Seating Arrangement Schematic and Seat Stop Locations
Figure 4 (Sheet 3)
# FAA APPROVED

## Airplane Flight Manual Supplement

**FOR**

<table>
<thead>
<tr>
<th>MODELS</th>
<th>SERIALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>T303</td>
<td>T30300001 thru T30300315</td>
</tr>
<tr>
<td>310</td>
<td>310R1501 thru 310R2140</td>
</tr>
<tr>
<td>335</td>
<td>335-0001 thru 335-0065</td>
</tr>
<tr>
<td>340</td>
<td>340A0601 thru 340A1817</td>
</tr>
<tr>
<td>401</td>
<td>401-0001 thru 401B0221</td>
</tr>
<tr>
<td>402</td>
<td>402-0001 thru 402C1020</td>
</tr>
<tr>
<td>404</td>
<td>404-0001 thru 404-0859</td>
</tr>
<tr>
<td>411</td>
<td>411-0001 thru 411A0300</td>
</tr>
<tr>
<td>414</td>
<td>414-0001 thru 414A1212</td>
</tr>
<tr>
<td>421</td>
<td>421-0001 thru 421C1807</td>
</tr>
</tbody>
</table>

**Serial No.**

**Registration No.**

This supplement must be attached to the FAA Approved Airplane Flight Manual or Pilot’s Operating Handbook/FAA Approved Airplane Flight Manual when the Auxiliary Fuel Pump Switching System is installed in accordance with Cessna Multi-Engine Service Bulletin MEB88-3.

The information contained herein supplements or supersedes the information of the basic Airplane Flight Manual or Pilot’s Operating Handbook/FAA Approved Airplane Flight Manual and all Checklists. For limitations, procedures, and performance information not contained in this supplement, consult the basic Airplane Flight Manual or Pilot’s Operating Handbook/FAA Approved Airplane Flight Manual.

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**CESSNA AIRCRAFT COMPANY**

**WICHITA, KANSAS USA**

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Member of GAMA  
D1625-1-13-RPC-6000-2/89

Original Issue - 20 December 1988

Revision 1 - 10 February 1988
SECTION 1
GENERAL

AUXILIARY FUEL PUMP SWITCHING SYSTEM

To improve the reliability of the auxiliary fuel pump systems in Cessna conventional twin-engine airplanes (except Model 310 airplanes prior to Model 310C which are not affected by this change), the automatic fuel pressure sensing switch and auxiliary fuel pump switch for each engine have been removed and replaced with new three-position, lever lock, toggle-type auxiliary fuel pump switches and circuitry. This modification provides direct pilot control of the output pressure of the two auxiliary fuel pumps. The switches are labeled AUX PUMP, L (left engine) and R (right engine) and switch positions are LOW, OFF, and HIGH. The LOW position operates the auxiliary pumps at low speed and can be used, when required, to provide supplementary fuel pressure for all normal operations. The switches are OFF in the middle position. The HIGH position is reserved for emergency operation, and operates the pumps at high speed. The HIGH position supplies sufficient fuel flow to sustain partial engine power in the event of an engine-driven fuel pump failure. The switches are locked out of the HIGH position and the switch toggle must be pulled out to clear a detent before it can be moved to the HIGH setting. The toggle need not be pulled to return the switch to OFF.

In Models 340A, 414, 421, 421A and 421B, additional fuel tank selector logic is added to activate the auxiliary fuel tank system in-line fuel pumps when the auxiliary fuel tanks are selected, thereby making the auxiliary tank in-line pump operation independent of the auxiliary fuel pump switches.

SWITCH OPERATION

Operation of the new switching system is simple and straightforward. The new LOW position of the auxiliary fuel pump switches should be used whenever an original manual/handbook or checklist procedure specifies either LOW (PRIME in early 310 or 320 airplanes) or ON. The LOW position is also used anytime there are indications of vapor, as evidenced by a "nervous" fuel flow needle. Auxiliary fuel pumps, if needed, are to be operated on LOW in all conditions except when an engine-driven fuel pump fails.

The new HIGH position supplies sufficient fuel flow to sustain partial engine power and should be used solely to sustain the operation of an engine in the event its engine-driven fuel pump fails. Failure of an engine-driven fuel pump will be evidenced by a sudden reduction in the fuel flow indication immediately prior to a loss of power while operating from a fuel tank containing adequate fuel. In an emergency where loss of an engine-driven fuel pump is involved, pull out on the applicable auxiliary fuel pump switch to clear the detent and select the HIGH position. Then adjust the throttle and mixture controls to obtain sat-
isfactory operation. At high manifold pressure and RPM, auxiliary fuel pump output may not be sufficient for normal engine operation. In this case, reduce manifold pressure to a level compatible with the indicated fuel flow. At low powers, the mixture may have to be leaned as necessary for smooth engine operation. If HIGH auxiliary pump output does not restore adequate fuel flow, a fuel leak may exist and the auxiliary pump should be shut off, the engine secured and propeller feathered, and the flight terminated on the remaining engine.

On rare occasions, such as during engine starting in cold weather, the HIGH position (instead of LOW) may be needed for a few seconds to ensure a good ground start or restart in flight.

⚠️ CAUTION ⚠️

If the auxiliary fuel pump switches are placed in the HIGH position with the engine-driven fuel pump(s) operating normally, total loss of engine power may occur.

When performing training in single-engine operations, the auxiliary fuel pump of the engine to be shutdown should be turned OFF (if it was on LOW) prior to any simulated engine failure or prior to any intentional engine shutdown to preclude fuel accumulation in the engine intake system.

The following limitations and procedures apply only to the operational changes of the auxiliary fuel pump switches and not the entire procedure.

SECTION 2
LIMITATIONS

The following new placard is provided to identify that the airplane has been modified and show the proper switch positions for normal operation. It is located on the left cabin sidewall near the auxiliary fuel pump switches and must be installed when the airplane is modified in accordance with Cessna Multi-Engine Service Bulletin MEB88-3.

![The Auxiliary Fuel Pump Systems in This Airplane Have Been Modified by Service Bulletin MEB88-3.](image)

Original Issue
The following additional placard is provided to overlay an existing placard (if installed) near the fuel selector.

TAKEOFF AND LAND WITH AUXILIARY FUEL PUMPS LOW

SECTION 3
EMERGENCY PROCEDURES

ENGINE FAILURE DURING FLIGHT
BEFORE SECURING INOPERATIVE ENGINE
    Fuel Flow - CHECK. If deficient, position auxiliary fuel pump to HIGH.
IF ENGINE DOES NOT START
    Operative Engine - Auxiliary Fuel Pump LOW.

ENGINE INOPERATIVE LANDING
    Operative Engine - Auxiliary Fuel Pump LOW.

ENGINE-DRIVEN FUEL PUMP FAILURE
    Auxiliary Fuel Pump - HIGH.

AIRSTART
    Auxiliary Fuel Pump - CHECK OFF. If on LOW or HIGH, purge engine.

Original Issue
SECTION 4
NORMAL PROCEDURES

BEFORE TAKEOFF
Auxiliary Fuel Pumps - LOW.

AFTER TAKEOFF, CLIMB OR LOW ALTITUDE CRUISE
Auxiliary Fuel Pumps - OFF (LOW if necessary to suppress vapor).

CRUISE (Above 12,000 Feet)
Auxiliary Fuel Pumps - LOW for 5 minutes after leveling off to suppress vapor tendencies.

DESCENT
Auxiliary Fuel Pumps - LOW.

BEFORE LANDING
Auxiliary Fuel Pumps - LOW.

AFTER LANDING
Auxiliary Fuel Pumps - OFF (LOW if necessary to suppress vapor).

PRACTICE SINGLE ENGINE PROCEDURES
Auxiliary Fuel Pumps - OFF.

SWITCHING FUEL TANKS
Auxiliary Fuel Pumps - LOW.

Original Issue
SECTION 5
PERFORMANCE

There is no change in airplane performance with the auxiliary fuel pump switching system modification.
and

FAA APPROVED AIRPLANE FLIGHT MANUAL

CESSNA AIRCRAFT COMPANY

1981 MODEL 421C

Serial Number 421C1115
Registration Number N2652Y

FAA APPROVED IN NORMAL CATEGORY BASED ON CAR
PART 3 THIS DOCUMENT MUST
BE CARRIED IN THE AIRPLANE
AT ALL TIMES.

THIS HANDBOOK INCLUDES THE MATERIAL REQUIRED
TO BE FURNISHED TO THE PILOT BY CAR PART 2 AND
CONSTITUTES THE FAA APPROVED AIRPLANE FLIGHT MANUAL

CESSNA AIRCRAFT COMPANY
Wallace Division
Wichita, Kansas

Member of GAMA

3 NOVEMBER 1980
THIS MANUAL WAS PROVIDED FOR THE AIRPLANE IDENTIFIED ON THE TITLE PAGE ON 10-05-81.
SUBSEQUENT REVISIONS SUPPLIED BY CESSNA AIRCRAFT COMPANY MUST BE PROPERLY INSERTED.

By:

CESSNA AIRCRAFT COMPANY, PAWNEE DIVISION
CONGRATULATIONS

Welcome to the ranks of Cessna owners! Your Cessna has been designed and constructed to give you the most in performance, economy, and comfort. It is our desire that you will find flying it, either for business or pleasure, a pleasant and profitable experience.

This Pilot Operating Handbook and FAA Approved Flight Manual has been prepared as a guide to help you get the most pleasure and utility from your airplane. It contains information about your Cessna’s equipment, operating procedures and performance; and suggestions for its servicing and care. We urge you to read it from cover to cover, and to refer to it frequently.

Our interest in your flying pleasure has not ceased with your purchase of a Cessna. Worldwide, the Cessna Dealer Organization backed by Cessna Customer Services Department stands ready to serve you. The following services are offered by most Cessna Dealers:

- **THE CESSNA WARRANTY**, which provides coverage for parts and labor, is available at Cessna Dealers worldwide. Specific benefits and provisions of warranty, plus other important benefits for you, are contained in your Customer Care Handbook supplied with your airplane. Warranty service is available to you at authorized Cessna Dealers throughout the world upon presentation of your Customer Care Card which establishes your eligibility under the warranty.

- **FACTORY TRAINED PERSONNEL** to provide you with courteous expert service.

- **FACTORY APPROVED SERVICE EQUIPMENT** to provide you efficient and accurate workmanship.

- **A STOCK OF GENUINE CESSNA SERVICE PARTS** on hand when you need them.

- **THE LATEST AUTHORITATIVE INFORMATION FOR SERVICING CESSNA AIRPLANES**. Cessna Dealers have all of the Service Manuals and Parts Catalogs, and are kept current by Service Information Letters published by Cessna Aircraft Company.

We urge all Cessna owners to use the Cessna Dealer Organization to the fullest.

A current Worldwide Customer Care Directory accompanies your new airplane. The Directory is revised frequently, and a current copy can be obtained from your Cessna Dealer. Make your Directory one of your cross-country flight planning aids; a warm welcome awaits you at every Cessna Dealer.

3 November 1980
**MAXIMUM WEIGHT:**

- **Range:** 7500 Pounds
- **Takeoff:** 7450 Pounds
- **Landing:** 7200 Pounds
- **Zero Fuel:** 6750 Pounds

**USEFUL GROSS WEIGHT:**

- **Maritime - 20,000 feet:** 2046 KIAS
- **Maximum Recommended Cruise:**
  - 72.5: Power at 20,000 Feet = 2046 KIAS
  - 73: Power at 25,000 Feet = 2415 KIAS

**MAXIMUM RANGE:**

- **10,000 feet (1250 Pounds Usable Fuel):**
  - 1107 Nautical Miles
  - 7.19 Hours and 181 KIAS
- **10,000 feet (1404 Pounds Usable Fuel):**
  - 1385 Nautical Miles
  - 9.73 Hours and 181 KIAS
- **25,000 feet (1404 Pounds Usable Fuel):**
  - 1264 Nautical Miles
  - 6.75 Hours and 191 KIAS
- **25,000 feet (1705 Pounds Usable Fuel):**
  - 1463 Nautical Miles
  - 7.78 Hours and 192 KIAS

**RATING OF CLIMB AT SEA LEVEL:**

- **411 Engines:**
  - Single-Engine: 1943 Feet Per Minute
  - Single-Engine: 555 Feet Per Minute
- **411 Engines:**
  - Single-Engine: 30,200 Feet

**TAKOFF PERFORMANCE:**

- **(000 KIAS, 0° Wing Flaps and 1400 Pounds Weight):**
  - **Ground Roll:** 1786 Feet
  - **Total Distance Over 50-Foot Obstacle:** 2323 Feet
- **LANDING PERFORMANCE:**
  - **(000 KIAS, 0° Wing Flaps and 1200 Pounds Weight):**
    - **Ground Roll:** 720 Feet
    - **Total Distance Over 50-Foot Obstacle:** 2323 Feet

**STANDARD EMPTY WEIGHTS:** (Approximate)

- Golden Eagle 4231: 4490 Pounds
- Golden Eagle 421C: 4407 Pounds
- Golden Eagle 430C: 5003 Pounds

**BAGGAGE ALLOWANCE:**

- 1500 Pounds

**WING LOADING:**

- 34.5 Pounds Per Square Foot

**POWER LANDING:**

- 9.9 Pounds Per Horsepower

**FUEL CAPACITY:**

- **Standard (105 Gallons Usable):** 215.4 Gallons
- **With One Wing Locker Tank (224 Gallons Usable):** 241.8 Gallons
- **With Two Wing Locker Tanks (262 Gallons Usable):** 270.2 Gallons

**OIL CAPACITY:**

- 20 Quarts

**ENGINES:**

- Six-Cylinder, Gear, Turbocharged, Fuel-Injected Engines
- 375 Rated Horsepower at 2300 Propeller RPM and 39.0 Inches Hg

**Maftrapped Pressure To 20,000 Feet**

- Constant Speed, Full Feathering, Three-Bladed 7'6" Diameter

*Range data includes allowances for start, taxi, takeoff, climb, descent and 45-minute reserve at the particular cruise power. Speeds based on Estimated Mid-Cruise Weight.

The above performance figures are based on the indicated weights, standard atmospheric conditions, level hard-surface dry runways and no wind. They are calculated values derived from flight tests conducted by the Cessna Aircraft Company under carefully documented conditions and will vary with individual airplanes and numerous factors affecting flight performance.

3 November 1980
The Pilot's Operating Handbook and FAA Approved Airplane Flight Manual in the airplane at the time of delivery from Cessna Aircraft Company contains information applicable to the 1981 Model 421C airplane designated by the serial number and registration number shown on the Title Page of this handbook.

REVISIONS

Changes and/or additions to this handbook will be covered by revisions published by Cessna Aircraft Company. These revisions are distributed to all Cessna Dealers and to owners of U.S. Registered airplanes according to FAA records at the time of revision issuance.

Revisions should be examined immediately upon receipt and incorporated in this handbook.

NOTE

It is the responsibility of the owner to maintain this handbook in a current status when it is being used for operational purposes.

Owners should contact their Cessna Dealer whenever the revision status of their handbook is in question.

A revision bar will extend the full length of new or revised text and/or illustrations added on new or presently existing pages. This bar will be located adjacent to the applicable revised area on the outer margin of the page.

All revised pages will carry the revision number and date on the applicable page.

The following Log of Effective Pages provides the dates of issue for original and revised pages, and a listing of all pages in the handbook. Pages affected by the current revision are indicated by an asterisk (*) preceding the pages listed.

LOG OF EFFECTIVE PAGES

<table>
<thead>
<tr>
<th>Dates of issue for original and revised pages are:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original . . 0 . . . 3 Nov 1980</td>
</tr>
<tr>
<td>Revision . . 1 . . . 2 Apr 1982</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Page</th>
<th>Date</th>
<th>Page</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>3 Nov 80</td>
<td>*1-6</td>
<td>2 Apr 82</td>
</tr>
<tr>
<td>Assignment Record</td>
<td>3 Nov 80</td>
<td>1-7 thru 1-10</td>
<td>3 Nov 80</td>
</tr>
<tr>
<td>i thru ii</td>
<td>3 Nov 80</td>
<td>2-1 thru 2-3</td>
<td>3 Nov 80</td>
</tr>
<tr>
<td>*iii thru iv</td>
<td>2 Apr 82</td>
<td>*2-4</td>
<td>2 Apr 82</td>
</tr>
<tr>
<td>Contents</td>
<td>3 Nov 80</td>
<td>2-5 thru 2-16</td>
<td>3 Nov 80</td>
</tr>
<tr>
<td>1-1 thru 1-3</td>
<td>3 Nov 80</td>
<td>2-17 thru 2-18</td>
<td>3 Nov 80</td>
</tr>
<tr>
<td>*1-4</td>
<td>2 Apr 82</td>
<td>*3-1</td>
<td>2 Apr 82</td>
</tr>
<tr>
<td>1-5</td>
<td>3 Nov 80</td>
<td>3-2 thru 3-10</td>
<td>3 Nov 80</td>
</tr>
</tbody>
</table>

3 November 1980
Revision 1 - 2 Apr 1982
<table>
<thead>
<tr>
<th>Page</th>
<th>Date</th>
<th>Page</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>#3-11</td>
<td>2 Apr 82</td>
<td>7-3 thru 7-21</td>
<td>3 Nov 80</td>
</tr>
<tr>
<td>#3-12</td>
<td>3 Nov 80</td>
<td>#7-22</td>
<td>2 Apr 82</td>
</tr>
<tr>
<td>#3-13/3-14</td>
<td>2 Apr 82</td>
<td>#7-23</td>
<td>3 Nov 80</td>
</tr>
<tr>
<td>#3-15 thru 3-16</td>
<td>3 Nov 80</td>
<td>#7-24 thru 7-25</td>
<td>2 Apr 82</td>
</tr>
<tr>
<td>#3-17</td>
<td>2 Apr 82</td>
<td>#7-26 thru 7-27</td>
<td>3 Nov 80</td>
</tr>
<tr>
<td>#3-18</td>
<td>3 Nov 80</td>
<td>#7-28</td>
<td>2 Apr 82</td>
</tr>
<tr>
<td>#3-19</td>
<td>2 Apr 82</td>
<td>7-29 thru 7-35</td>
<td>3 Nov 80</td>
</tr>
<tr>
<td>#3-20 thru 3-31</td>
<td>3 Nov 80</td>
<td>#7-36 thru 7-37</td>
<td>2 Apr 82</td>
</tr>
<tr>
<td>#3-32</td>
<td>2 Apr 82</td>
<td>7-38 thru 7-45</td>
<td>3 Nov 80</td>
</tr>
<tr>
<td>#3-33 thru 3-34</td>
<td>3 Nov 80</td>
<td>#7-46</td>
<td>2 Apr 82</td>
</tr>
<tr>
<td>#3-35/3-36</td>
<td>2 Apr 82</td>
<td>7-47</td>
<td>3 Nov 80</td>
</tr>
<tr>
<td>4-1</td>
<td>3 Nov 80</td>
<td>#7-48</td>
<td>2 Apr 82</td>
</tr>
<tr>
<td>#4-2</td>
<td>2 Apr 82</td>
<td>7-49 thru 7-60</td>
<td>3 Nov 80</td>
</tr>
<tr>
<td>#4-3/4-4</td>
<td>2 Apr 82</td>
<td>#7-61/7-62</td>
<td>2 Apr 82</td>
</tr>
<tr>
<td>4-5 thru 4-9</td>
<td>3 Nov 80</td>
<td>#8-1</td>
<td>2 Apr 82</td>
</tr>
<tr>
<td>#4-10 thru 4-13</td>
<td>2 Apr 82</td>
<td>8-2 thru 8-6</td>
<td>3 Nov 80</td>
</tr>
<tr>
<td>#4-14 thru 4-21</td>
<td>3 Nov 80</td>
<td>#8-7 thru 8-9</td>
<td>2 Apr 82</td>
</tr>
<tr>
<td>#4-22 thru 4-23</td>
<td>2 Apr 82</td>
<td>8-10 thru 8-11</td>
<td>3 Nov 80</td>
</tr>
<tr>
<td>4-24</td>
<td>3 Nov 80</td>
<td>#8-12</td>
<td>2 Apr 82</td>
</tr>
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<td>#4-25</td>
<td>2 Apr 82</td>
<td>8-13 thru 8-14</td>
<td>3 Nov 80</td>
</tr>
<tr>
<td>#4-26 thru 4-27</td>
<td>3 Nov 80</td>
<td>#8-15 thru 8-18</td>
<td>2 Apr 82</td>
</tr>
<tr>
<td>#4-28</td>
<td>2 Apr 82</td>
<td>#9-1 thru 9-2</td>
<td>2 Apr 82</td>
</tr>
<tr>
<td>#4-29 thru 4-34</td>
<td>3 Nov 80</td>
<td>*Index-1 thru Index-6</td>
<td>2 Apr 82</td>
</tr>
<tr>
<td>#4-35/4-36</td>
<td>3 Nov 80</td>
<td>*Index-7/Index-8</td>
<td>2 Apr 82</td>
</tr>
<tr>
<td>5-1 thru 5-40</td>
<td>3 Nov 80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-1 thru 6-9</td>
<td>3 Nov 80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#6-10 thru 6-12</td>
<td>2 Apr 82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-13 thru 6-26</td>
<td>3 Nov 80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-27/6-29</td>
<td>3 Nov 80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-29/6-30</td>
<td>3 Nov 80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#7-1 thru 7-2</td>
<td>2 Apr 82</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE
Refer to Section 9, Table of Contents, for supplements applicable to optional systems.

PILOT'S OPERATING HANDBOOK
AND FAA APPROVED AIRPLANE
FLIGHT MANUAL PART NUMBER
D1595-1-13PH-RPC-300-6/82

3 November 1980
Revision 1 - 2 Apr 1982
<table>
<thead>
<tr>
<th>SECTION</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 GENERAL</td>
<td>1-1</td>
</tr>
<tr>
<td>2 LIMITATIONS</td>
<td>2-1</td>
</tr>
<tr>
<td>3 EMERGENCY PROCEDURES</td>
<td>3-1</td>
</tr>
<tr>
<td>4 NORMAL PROCEDURES</td>
<td>4-1</td>
</tr>
<tr>
<td>5 PERFORMANCE</td>
<td>5-1</td>
</tr>
<tr>
<td>6 WEIGHT &amp; BALANCE/EQUIPMENT LIST</td>
<td>6-1</td>
</tr>
<tr>
<td>7 AIRPLANE &amp; SYSTEMS DESCRIPTIONS</td>
<td>7-1</td>
</tr>
<tr>
<td>8 AIRPLANE HANDLING, SERVICE &amp; MAINTENANCE</td>
<td>8-1</td>
</tr>
<tr>
<td>9 SUPPLEMENTS</td>
<td>9-1</td>
</tr>
<tr>
<td>ALPHABETICAL INDEX</td>
<td>Index-1</td>
</tr>
</tbody>
</table>
# SECTION 1
## GENERAL
### TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>1-1</td>
</tr>
<tr>
<td>ENGINES</td>
<td>1-2</td>
</tr>
<tr>
<td>THREE-VIEW DRAWING</td>
<td>1-3</td>
</tr>
<tr>
<td>PROPELLERS</td>
<td>1-3</td>
</tr>
<tr>
<td>FUEL</td>
<td>1-3</td>
</tr>
<tr>
<td>OIL</td>
<td>1-4</td>
</tr>
<tr>
<td>MAXIMUM CERTIFICATED WEIGHTS</td>
<td>1-5</td>
</tr>
<tr>
<td>CABIN, BAGGAGE AND ENTRY</td>
<td>1-5</td>
</tr>
<tr>
<td>DIMENSIONS</td>
<td>1-6</td>
</tr>
<tr>
<td>STANDARD AIRPLANE WEIGHTS</td>
<td>1-6</td>
</tr>
<tr>
<td>SPECIFIC LOADINGS</td>
<td>1-6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYMBOLS, ABBREVIATIONS AND TERMINOLOGY</td>
<td>1-6</td>
</tr>
<tr>
<td>General Airspeed Terminology and Symbols</td>
<td>1-6</td>
</tr>
<tr>
<td>Meteorological Terminology</td>
<td>1-7</td>
</tr>
<tr>
<td>Power Terminology</td>
<td>1-8</td>
</tr>
<tr>
<td>Airplane Performance and Flight Planning</td>
<td>1-8</td>
</tr>
<tr>
<td>Terminology</td>
<td>1-9</td>
</tr>
</tbody>
</table>

## INTRODUCTION

This handbook consists of 9 sections and an alphabetical index as shown on the Contents page. This handbook includes the material required to be furnished to the pilot by CAR Part 3. It also contains supplemental data supplied by Cessna Aircraft Company. Specific information can be rapidly found by referring to the Contents page for the appropriate section, then referring to the Table of Contents on the first page of an appropriate section, or by the use of the Alphabetical Index.

Section 1 of this handbook presents basic airplane data and general information which will be of value to the pilot.

## ENGINES

Number of Engines: 2

Manufacturer: Teledyne Continental Motors

Engine Model Number: GTS10-520-N

Engine Type: Turbocharged, fuel-injected, gear driven, air cooled, horizontally opposed, six-cylinder, 520 cubic-inch displacement.

Horsepower: 375 rated horsepower at 2235 propeller RPM and 39.0 inches Hg. manifold pressure to the critical altitude of 20,000 feet.

3 November 1980
1. Normal propeller tip to ground clearance is 71 inches.
2. Total wing area, including nacelles and fuselage within the wing planform, is 215.02 square feet.
3. Minimum turning distance is 56.51 feet. See Figure 7.11 for additional information.
Number of Propellers: 2
Manufacturer: McCauley Accessory Division, Cessna Aircraft Company
Propeller Part Number: 0850334-27
Number of Blades: 3
Propeller Diameter: 7'6.0"
Propeller Type: Constant speed, full feathering, nonreversible hydraulically actuated
Blade Range: (At 30-Inch Station)
a. Low Pitch 16.6% ±0.20
b. Feather 84.6% ±0.30

FUEL (Approved Fuel Grades And Colors)*
PRIMARY - 100 (formerly 100/130) Grade Aviation Fuel (Green)
ALTERNATE - 100LL Grade Aviation Fuel (Blue)

*Isopropyl alcohol or ethylene glycol monomethyl ether may be added to the fuel supply. Additive concentrations shall not exceed 1% for isopropyl alcohol or .15% for ethylene glycol monomethyl ether. Refer to Section 6 for additional information.

Total and Usable: See Figure 1-2

| FUEL TABLE |
|---|---|---|
| System | Total Fuel Capacity (U.S. Gallons) | Usable Fuel (U.S. Gallons) |
| Standard System | 213.4 | 206.0 |
| Standard System with One Optional Wing Locker Tank | 241.8 | 234.0 |
| Standard System with Two Optional Wing Locker Tanks | 270.2 | 262.0 |

Figure 1-2

OIL
Grade: Aviation grade engine oil. Refer to Section 8 for additional information.

3 November 1980
STANDARD AIRPLANE WEIGHTS

- Standard Empty Weight: 4640 pounds (4837 pounds for 421C II) (5048 pounds for 421C III)
- Maximum Useful Load: 2860 pounds (2663 pounds for 421C II) (2452 pounds for 421C III)

SPECIFIC LOADINGS

- Wing Loading: 34.7 pounds per square foot
- Power Loading: 9.9 pounds per horsepower

SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

GENERAL AIRSPEED TERMINOLOGY AND SYMBOLS

CAS: Calibrated Airspeed is the indicated speed corrected for position and instrument error. Calibrated airspeed is equal to true airspeed in standard atmosphere at sea level.

G: g is acceleration due to gravity.

IAS: Indicated Airspeed is the speed as shown on the airspeed indicator when corrected for instrument error. IAS values published in this handbook assume zero instrument error.

KCAS: Calibrated Airspeed expressed in knots.

KIAS: Indicated Airspeed expressed in knots.

KTAS: True Airspeed expressed in knots.

TAS: True Airspeed is the airspeed relative to undisturbed air which is the CAS corrected for altitude, temperature and compressibility.

V_A: Maneuvering Speed is the maximum speed at which application of full available aerodynamic control will not overstress the airplane.

V_FE: Maximum Flap Extended Speed is the highest speed permissible with wing flaps in a prescribed extended position.

V_LE: Maximum Landing Gear Extended Speed is the maximum speed at which an airplane can be safely flown with the landing gear extended.

V_LD: Maximum Landing Gear Operating Speed is the maximum speed at which the landing gear can be safely extended or retracted.

3 November 1980
Revision 1 - 2 Apr 1982
Air Minimum Control Speed is the minimum flight speed at which the airplane is directionally controllable as determined in accordance with Federal Aviation Regulations. Airplane certification conditions include one engine becoming inoperative and windmilling; not more than a 5° bank towards the operative engine; takeoff power on operative engine; landing gear up; flaps in takeoff position; and most rearward CG.

Never Exceed Speed is the speed limit that may not be exceeded at any time.

Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air and then only with caution.

Intentional One Engine Inoperative Speed is a minimum speed selected by the manufacturer for intentionally rendering one engine inoperative in flight for pilot training.

Best Angle-of-Climb Speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.

Best Rate-of-Climb Speed is the airspeed which delivers the greatest gain in altitude in the shortest possible time.

**METEOROLOGICAL TERMINOLOGY**

°C Temperature in degrees Celsius.

°F Temperature in degrees Fahrenheit.

ISA International Standard Atmosphere in which:
(1) The air is a dry perfect gas;
(2) The temperature at sea level is 15°C Celsius (59°F 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 -56.5°C (-69.7°F) is -1.0°F (-3.6°F) per 1000 feet.

OAT Outside Air Temperature is the free air static temperature, obtained either from inflight temperature indications adjusted for instrument error and compressibility effects or ground meteorological sources.

Pressure Altitude Altitude measured from standard sea-level pressure (29.92 inches 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.

3 November 1980
Viscosity:

<table>
<thead>
<tr>
<th>SAE Rating</th>
<th>Ambient Temperature - °C (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>Above 4.4 (40)</td>
</tr>
<tr>
<td>30</td>
<td>Below 4.4 (40)</td>
</tr>
<tr>
<td>Multiviscosity</td>
<td>Unrestricted - After 100 Hours</td>
</tr>
</tbody>
</table>

Total Sump Capacity: 13 quarts per engine

Drain and Refill Quantity: 14 quarts per engine including one quart for oil filter.

Oil Quantity Operating Range: Do not operate engine on less than 9-quart indication. To minimize loss of oil through breather, fill to 10-quart level for normal flights of less than 3 hours. For extended flight, fill to capacity.

**NOTE**

Dip stick indicates the quantity of oil in the engine and does not account for the 1 quart of oil in the oil filter.

**MAXIMUM CERTIFICATED WEIGHTS**

<table>
<thead>
<tr>
<th>Maximum Ramp Weight:</th>
<th>7500 pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Takeoff Weight:</td>
<td>7450 pounds</td>
</tr>
<tr>
<td>Maximum Landing Weight:</td>
<td>7200 pounds</td>
</tr>
<tr>
<td>Maximum Zero Fuel Weight:</td>
<td>6733 pounds</td>
</tr>
</tbody>
</table>

Maximum Weights in Baggage Compartments:

a. Left and Right Wing Lockers - 200 pounds each. When optional wing locker fuel is installed, the applicable wing locker baggage capacity is reduced to 40 pounds.

b. Avionics Bay - 250 pounds less installed optional equipment. Refer to the loading placard in the airplane avionics baggage bay.

c. Nose Bay - 350 pounds less installed optional equipment. Refer to the loading placard in the airplane nose baggage bay.

d. Aft Cabin (Bay A) See Figure 1-3 - 400 pounds (200 Pounds Per Side).

e. Aft Cabin (Bay B) See Figure 1-3 - 100 pounds (50 Pounds Per Side).

1-4

3 November 1980
Revision 1 - 2 Apr 1982
CABIN, BAGGAGE AND ENTRY DIMENSIONS
GOLDEN EAGLE

AVIONICS SHELF

UPPER AND LOWER SHELF

NOSE BAGGAGE

AVIONICS BAY

WHEEL WELL

BAY BA

A

B

AVIONICS COMPARTMENT VOLUME - CUBIC FEET

<table>
<thead>
<tr>
<th>Compartment</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVIONICS BAY</td>
<td>11.0</td>
</tr>
<tr>
<td>NOSE</td>
<td>25.0</td>
</tr>
<tr>
<td>WING LOCKER EACH (STD)</td>
<td>7.7</td>
</tr>
<tr>
<td>AFT CABIN (BAY A AND B)</td>
<td>30.6</td>
</tr>
</tbody>
</table>

Figure 1-3

3 November 1980
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.

**POWER TERMINOLOGY**

- **BHP**
  Brake horsepower means the power delivered at the propeller shaft of an airplane engine.

- **Critical Altitude**
  The maximum altitude at which in standard temperature it is possible to maintain a specified power.

- **Maximum Continuous Power**
  The power developed in a standard atmosphere from sea level to the critical altitude at the maximum RPM and manifold pressure approved for use during periods of unrestricted duration.

- **RPM**
  The revolutions per minute (RPM) of an engine refers to the rotational speed of the propeller shaft, as shown on a tachometer.

**AIRPLANE PERFORMANCE AND FLIGHT PLANNING TERMINOLOGY**

- **Accelerate-Go Distance**
  The distance required to accelerate an airplane to a specified speed and, assuming failure of an engine at that speed after liftoff and with gear in transit, continue takeoff on the remaining engine to a height of 50 feet.

- **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.

- **Aerobatic Maneuver**
  An intentional maneuver involving an abrupt change of an airplane’s attitude, an abnormal attitude, or abnormal acceleration, not necessary for normal flight.

- **Balked Landing**
  A balked landing is an aborted landing (i.e., all engines go-around in the landing configuration).

- **Balked Landing Transition Speed**
  The minimum speed at which a transition to a balked landing climb should be attempted from 50-foot obstacle height.

- **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. The value shown is not considered to be limiting. This value is not an aerodynamic limit for the airplane.

- **Maneuvering Fuel**
  Maneuvering fuel is the usable fuel as shown in Section 2 for all airplane configurations, provided the maximum side slip duration is not exceeded.

- **Maximum Effective Braking**
  The maximum amount of braking pressure that can be applied to the toe brakes without locking the wheels.

---

3 November 1980
MODEL 7210

WEIGHT AND BALANCE TERMINOLOGY

Arm: The horizontal distance from the reference datum to the center of gravity (C.G.) of an item.

Basic Empty Weight: Standard empty weight plus installed optional equipment.

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.

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.

Jack Point: One of the three points on the airplane designed to rest on a jack.

MAC: The mean aerodynamic chord of a wing is the chord of an imaginary airfoil which throughout the flight range will have the same force vectors as those of the wing.

Maximum Landing Weight: Maximum weight approved for the landing touchdown.

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 Zero Fuel Weight: Maximum weight exclusive of usable fuel.

Moment: The product of the weight of an item multiplied by its arm. (Moment divided by a constant is used to simplify balance calculations by reducing the number of digits.)

Payload: Weight of occupants, cargo and baggage.

Reference Datum: An imaginary vertical plane from which all horizontal distances are measured for balance purposes.

Residual Fuel: The undrainable fuel remaining when the airplane is defueled in a specific attitude by the normal means and procedures specified for draining the tanks.

Standard Empty Weight: Weight of a standard airplane including unusable fuel, full operating fluids and full oil.

Station: A location along the airplane fuselage given in terms of distance from the reference datum.

3 November 1980
<table>
<thead>
<tr>
<th><strong>GENERAL</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tare</strong></td>
</tr>
<tr>
<td>Tare is the weight of chocks, blocks, stands, etc. used when weighing an airplane, and is included in the scale readings. Tare is deducted from the scale reading to obtain the actual (net) airplane weight.</td>
</tr>
<tr>
<td><strong>Unusable Fuel</strong></td>
</tr>
<tr>
<td>Fuel remaining after fuel runout tests have been completed in accordance with governmental regulations.</td>
</tr>
<tr>
<td><strong>Usable Fuel</strong></td>
</tr>
<tr>
<td>Fuel available for flight planning.</td>
</tr>
</tbody>
</table>
SECTION 2
LIMITATIONS

TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Page</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>2-1</td>
</tr>
<tr>
<td>AIRSPEED LIMITATIONS</td>
<td>2-2</td>
</tr>
<tr>
<td>ENGINE LIMITATIONS</td>
<td>2-3</td>
</tr>
<tr>
<td>MISCELLANEOUS INSTRUMENT MARKINGS</td>
<td>2-6</td>
</tr>
<tr>
<td>WEIGHT LIMITS</td>
<td>2-6</td>
</tr>
<tr>
<td>MANEUVER LIMITS</td>
<td>2-7</td>
</tr>
<tr>
<td>FLIGHT LOAD FACTOR LIMITS</td>
<td>2-7</td>
</tr>
</tbody>
</table>

INTRODUCTION

Section 2 of this handbook presents the operating limitations, the significance of such limitations, instrument markings, color coding and basic placards necessary for the safe operation of the airplane, its power plants, standard systems and standard equipment. The limitations included in this section and Section 9 have been approved by the Federal Aviation Administration. Observance of these operating limitations is required by law.

Operation in countries other than the United States may require observance of other limitations, procedures or performance data in applicable supplements.

NOTE

Refer to Section 9 of this handbook for amended operating limitations, operating procedures, performance data and other necessary information for airplanes equipped with specific options.

3 November 1980
## AIRSPEED LIMITATIONS

### AIRSPEED LIMITATIONS TABLE

<table>
<thead>
<tr>
<th>SPEED</th>
<th>KIAS</th>
<th>KCAS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maneuvering Speed ( V_A ) (Knots)</td>
<td>151</td>
<td>150</td>
<td>Do not make abrupt control movements above this speed.</td>
</tr>
<tr>
<td>Maximum Flap Extended Speed ( V_{FE} ) (Knots)</td>
<td>176</td>
<td>175</td>
<td>Do not exceed this speed with the given flap setting.</td>
</tr>
<tr>
<td>Maximum Gear Operating Speed ( V_{LO} ) (Knots)</td>
<td>176</td>
<td>175</td>
<td>Do not extend landing gear above this speed.</td>
</tr>
<tr>
<td>Maximum Gear Extended Speed ( V_{LE} ) (Knots)</td>
<td>176</td>
<td>175</td>
<td>Do not extend or retract landing gear above this speed.</td>
</tr>
<tr>
<td>Air Minimum Control Speed - ( V_{MCA} ) (Knots)</td>
<td>80</td>
<td>82</td>
<td>This is the minimum flight speed at which the airplane is controllable with one engine inoperative and a 50(^\circ) bank towards the operative engine.</td>
</tr>
<tr>
<td>One Engine Inoperative Best Rate-of-Climb Speed ( V_Y ) (Knots)</td>
<td>111</td>
<td>111</td>
<td>This speed delivers the greatest gain in altitude in the shortest possible time with one engine inoperative at sea level, standard day conditions and 7450 pounds weight.</td>
</tr>
<tr>
<td>Never Exceed Speed ( V_{NE} ) (Knots)</td>
<td>240</td>
<td>238</td>
<td>Do not exceed this speed in any operation.</td>
</tr>
<tr>
<td>Maximum Structural Cruising Speed ( V_{NO} ) (Knots)</td>
<td>201</td>
<td>200</td>
<td>Do not exceed this speed except in smooth air and then only with caution.</td>
</tr>
</tbody>
</table>

Figure 2-1
Airspeed Indicator Markings: See Figure 2-2

### AIRSPEED INDICATOR TABLE

<table>
<thead>
<tr>
<th>MARKING</th>
<th>KIAS VALUE OR RANGE</th>
<th>SIGNIFICANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red Radial</td>
<td>80</td>
<td>Air minimum control speed.</td>
</tr>
<tr>
<td>White Arc</td>
<td>77 to 146</td>
<td>Operating speed range with 45° wing flaps. Lower limit is maximum weight stalling speed in landing configuration. Upper limit is maximum speed permissible with wing flaps extended 45°.</td>
</tr>
<tr>
<td>Green Arc</td>
<td>80 to 201</td>
<td>Normal operating range. Lower limit is maximum weight stalling speed with flaps and landing gear retracted. Upper limit is maximum structural cruising speed.</td>
</tr>
<tr>
<td>Blue Radial</td>
<td>111</td>
<td>One engine inoperative best rate-of-climb speed at sea level standard day conditions and 7450 pounds weight.</td>
</tr>
<tr>
<td>Yellow Arc</td>
<td>201 to 240</td>
<td>Caution range. Operations must be conducted with caution and only in smooth air.</td>
</tr>
<tr>
<td>Red Radial</td>
<td>240</td>
<td>Maximum speed for all operations.</td>
</tr>
</tbody>
</table>

Figure 2-2

### ENGINE LIMITATIONS

Number of Engines: 2

Engine Manufacturer: Teledyne Continental Motors

Engine Model Number: GTSIO-520-N

Engine Operating Limits for Takeoff and Continuous Operation

<table>
<thead>
<tr>
<th>Altitude - Feet</th>
<th>Allowable Manifold Pressure - Inches Hg.</th>
<th>Engine RPM</th>
<th>Rated Horsepower</th>
<th>Time</th>
<th>Max. Head Temp. Of</th>
<th>Max. Oil Temp. Of</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.L. to 20,000</td>
<td>39.0</td>
<td>2235</td>
<td>375</td>
<td>Continuous</td>
<td>460</td>
<td>240</td>
</tr>
<tr>
<td>22,000</td>
<td>36.5</td>
<td>2235</td>
<td>338</td>
<td>Continuous</td>
<td>460</td>
<td>240</td>
</tr>
<tr>
<td>24,000</td>
<td>34.0</td>
<td>2235</td>
<td>312</td>
<td>Continuous</td>
<td>460</td>
<td>240</td>
</tr>
<tr>
<td>26,000</td>
<td>31.0</td>
<td>2235</td>
<td>283</td>
<td>Continuous</td>
<td>460</td>
<td>240</td>
</tr>
<tr>
<td>28,000</td>
<td>28.0</td>
<td>2235</td>
<td>253</td>
<td>Continuous</td>
<td>460</td>
<td>240</td>
</tr>
<tr>
<td>30,000</td>
<td>25.0</td>
<td>2235</td>
<td>225</td>
<td>Continuous</td>
<td>460</td>
<td>240</td>
</tr>
</tbody>
</table>

3 November 1980
LIMITATIONS

Oil Pressure:
  a. Minimum: 10 PSI (Idle Power)
  b. Maximum: 100 PSI

Oil Viscosity:

<table>
<thead>
<tr>
<th>SAE Rating</th>
<th>Ambient Temperature - °C (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>Above 4.4 (40)</td>
</tr>
<tr>
<td>30</td>
<td>Below 4.4 (40)</td>
</tr>
<tr>
<td>Multiviscosity</td>
<td>Unrestricted - After 100 Hours</td>
</tr>
</tbody>
</table>

Propellers:
  a. Number of Propellers: 2
  b. Manufacturer: McCauley Accessory Division, Cessna Aircraft Company
  c. Part Number: 0850334-27
  d. Number of Blades: 3
  e. Diameter: 7'6.0" maximum, 7'4.0" minimum
  f. Blade Range: (At 30-Inch Station)
     (1) Low Pitch 16.6° ±0.2°
     (2) Feather 84.6° ±0.3°
  g. Operating Limits: 2235 RPM maximum speed

Engine Instrument Markings:
  a. Tachometer (Propeller Speed):
     (1) Normal Operating 1600 to 1900 RPM (Green Arc)
     (2) 1900 to 2185 (Yellow Arc)
     (3) Takeoff and Climb 2185 to 2235 RPM (Green Arc)
     (4) Maximum 2235 RPM (Red Radial)
     (5) On Face of Indicator: "RPM x 100" "AVOID CONTINUOUS OPERATION IN YELLOW ARC"

3 November 1980
Revision 1 - 2 Apr 1982
b. Manifold Pressure:

(1) Normal Operating 17.0 to 32.5 Inches Hg. Manifold Pressure (Green Arc)

(2) Maximum At Indicated Altitudes (Blue Arc)

<table>
<thead>
<tr>
<th>&quot;ALT. FT x 1000&quot;</th>
<th>&quot;MAX MP&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL</td>
<td>39.0</td>
</tr>
<tr>
<td>20</td>
<td>39.0</td>
</tr>
<tr>
<td>22</td>
<td>36.5</td>
</tr>
<tr>
<td>24</td>
<td>34.0</td>
</tr>
<tr>
<td>26</td>
<td>31.0</td>
</tr>
<tr>
<td>28</td>
<td>28.0</td>
</tr>
<tr>
<td>30</td>
<td>25.0</td>
</tr>
</tbody>
</table>

(3) Maximum (20,000 Feet And Below) 39.0 Inches Hg. Manifold Pressure (Red Radial)

c. Oil Temperature:

(1) Normal Operating 75 to 240°F (Green Arc)

(2) Maximum 240°F (Red Radial)

d. Oil Pressure:

(1) Minimum Operating 10 PSI (Red Radial)

(2) Normal Operating 30 to 60 PSI (Green Arc)

(3) Maximum 100 PSI (Red Radial)

e. Cylinder Head Temperature:

(1) Normal Operating 200 to 460°F (Green Arc)

(2) Maximum 460°F (Red Radial)

f. Fuel Flow:

(1) Normal Operating 0 Pounds per hour (3.4 PSI) (Red Radial)

(2) Normal Operating 20.0 Pounds per hour (3.9 PSI) to 275.0 Pounds per hour (16.7 PSI) (Green Arc)

(a) Green Dots

45% Power - 82.8 Pounds per hour (5.5 PSI)
55% Power - 98.8 Pounds per hour (6.1 PSI)
65% Power - 114.5 Pounds per hour (6.9 PSI)
75% Power - 131.0 Pounds per hour (7.7 PSI)

(b) Blue Arc - Takeoff and Climb

28,000 Feet - 161.0 Pounds per hour (9.4 PSI)
26,000 Feet - 185.0 Pounds per hour (11.1 PSI)
24,000 Feet - 206.0 Pounds per hour (12.6 PSI)
22,000 Feet - 224.0 Pounds per hour (14.1 PSI)
20,000 Feet - 240.0 Pounds per hour (15.5 PSI)

3 November 1980
(c) Blue Triangle (75% Power) - 143.0 Pounds per hour (8.3 PSI) (Cruise Climb and Best Power)

(d) White Arc - Takeoff and Climb Power to 16,000 Feet 255.0 Pounds per hour (16.8 PSI) to 275.0 Pounds per hour (18.7 PSI)

(3) Maximum Operating 280.0 Pounds per hour (19.2 PSI) (Red Radial)

(4) On face of Indicator: "FUEL FLOW LBS/HR" "T.O." "CLIMB"
"75% CLIMB" "CRUISE POWER"

MISCELLANEOUS INSTRUMENT MARKINGS

Instrument Vacuum:

a. Red Line: 4.75 Inches Hg.
b. Green Arc: 4.75 to 5.25 Inches Hg.

Oxygen Pressure:

a. Yellow Arc: 0 to 300 PSI
b. Green Arc: 1550 to 1650 PSI
c. Red Line: 2000 PSI
d. The Cubic Foot Capacity Of The Bottle Installed Will Be Indicated On The Face Of The Gage.

WEIGHT LIMITS

Maximum Ramp Weight: 7500 pounds
Maximum Takeoff Weight: 7450 Pounds
Maximum Landing Weight: 7200 Pounds
Maximum Zero Fuel Weight: 6733 Pounds

Maximum Weights in Baggage Compartments:

a. Left and Right Wing Lockers - 200 pounds each.

(1) If optional wing locker tank(s) are installed, change item "a" on the appropriate side(s) to 40 pounds each.

b. Avionics Bay - 250 pounds less installed optional equipment.
c. Nose Bay - 350 pounds less installed optional equipment.
d. Aft Cabin (Bay A) - 400 pounds (200 Pounds Per Side).
e. Aft Cabin (Bay B) - 100 pounds (50 Pounds Per Side).
Center of Gravity Limits (Gear Extended):

a. Aft Limit: 157.95 inches aft of reference datum (29.58% MAC) at 7450 pounds or less.

b. Forward Limit: 152.59 inches aft of reference datum (21.15% MAC) at 7450 pounds or less and 147.14 inches aft of reference datum (32.56% MAC) at 6200 pounds or less with straight line variation between these points.

c. See Weight and Balance Data in Section 6 for loading schedule. The reference datum is 100 inches forward of the forward face of the fuselage bulkhead forward of the rudder pedals. The mean aerodynamic chord (MAC) is 63.64 inches in length. The leading edge of the MAC is 139.13 inches aft of the reference datum.

MANEUVER LIMITS

This is a normal category airplane. Aerobatic maneuvers, including spins, are prohibited.

FLIGHT LOAD FACTOR LIMITS

The design load factors are 150% of the following, and in all cases the structure exceeds design loads.

At Design Takeoff Weight of 7450 Pounds:

a. Landing gear up, wing flaps 0° +3.66 to -1.44G

b. Landing gear down, wing flaps 45° +2.0G

FLIGHT CREW LIMITS

Minimum Flight Crew for FAR 91 operations is one pilot.

OPERATION LIMITS

The standard airplane is approved for day and night operation under VFR conditions. With the proper optional equipment installed, the airplane is approved for day and night IFR operations and flight into icing conditions as defined by the FAA.

FUEL LIMITATIONS (See Figure 2-3)

Fuel Pressure:

a. Minimum: 3.4 PSI (0 Pounds Per Hour)

b. Maximum: 19.2 PSI (280.0 Pounds Per Hour)
Fuel Quantity:

a. Minimum fuel for takeoff is 20 gallons in each main tank.

Maneuvering Fuel:

a. Due to possible fuel starvation, maximum side slip duration time is 30 seconds. The airplane is considered in a side slip anytime the turn and bank "ball" is more than one half ball out of the center (coordinated flight) position.

Fuel (Approved Fuel Grades And Colors):

- PRIMARY - 100 (Formerly 100/130) Grade Aviation Fuel (Green).
- ALTERNATE - 100LL Grade Aviation Fuel (Blue).

<table>
<thead>
<tr>
<th>System</th>
<th>Total Fuel Capacity (U.S. Gallons)</th>
<th>Usable Fuel (U.S. Gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard System</td>
<td>213.4</td>
<td>206.0</td>
</tr>
<tr>
<td>Standard System with One Optional Wing Locker Tank</td>
<td>241.8</td>
<td>234.0</td>
</tr>
<tr>
<td>Standard System with Two Optional Wing Locker Tanks</td>
<td>270.2</td>
<td>262.0</td>
</tr>
</tbody>
</table>

Figure 2-3

MAXIMUM OPERATING ALTITUDE LIMIT

Without Oxygen Equipment: 25,000 Feet
With Oxygen Equipment: 30,000 Feet

CABIN PRESSURIZATION LIMIT

Maximum: 5.3 PSI
Normal: 0.0 to 5.0 PSI

Cabin Shall Be Depressurized During:

a. Takeoff.
b. Landing.
c. In flight when both engines are operating on hot alternate air.
d. All ground operations.

2-8 3 November 1980
REQUIRED PLACARDS

On Emergency Exit Window Trim:

EMERGENCY EXIT
1. TURN HANDLE → OPEN
2. PULL DOOR IN & DOWN

On Emergency Exit Window Trim (with Optional Right Aft Facing Seat):

EMERGENCY EXIT
1. TURN HANDLE → OPEN
2. PULL DOOR IN & DOWN
AFT FACING SEAT MUST BE
FULL TWO WITH BACK ERECT
FOR TAKEOFF & LANDING

On Executive Table Top And Writing Desk Top:

TABLE MUST BE STOWED
DURING TAKE-OFF AND
Landing

On Wall Opposite Emergency Exit Window:

AFT FACING SEAT BACK MUST BE
ERECT FOR TAKEOFF & LANDING

3 November 1980
LIMITATIONS

On Left Engine Fuel Selector:  

On Right Engine Fuel Selector:

Depress button for Left Eng Off

103 GAL
103 GAL

LEFT MAIN
RIGHT MAIN

Depress button for Right Eng Off

103 GAL
103 GAL

LEFT MAIN
RIGHT MAIN

On Floor Forward of Fuel Selectors:

Standard Configuration

Optional Wing Locker Tanks

Set fuel selector valves to left main for left engine and right main for right engine for takeoff, descent, landing, and all normal operations.

Takeoff and land with auxiliary fuel pumps on.

Emergency crossfeed shutoff valve must be open for all normal operations.

100 grade aviation fuel minimum.

2-10

3 November 1980
On Floor Forward of Fuel Emergency Crossfeed Shutoff Valve:

**EMERGENCY CROSSFEED SHUTOFF VALVE**
PULL TO SHUT OFF

In Recess on Fuel Emergency Crossfeed Shutoff Valve Bezel (Visible When Lever is Up):

**LEVER UP**
CROSSFEED OFF

On Pilot’s Sun Visor:

**OPERATIONAL LIMITS**
The markings and placards installed in this airplane contain operating limitations which must be complied with when operating this airplane in the normal category. Other operating limitations which must be complied with when operating this airplane in the normal category are contained in the “PILOT’S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL.”

- No acrobatic maneuvers, including spins, approved.
- Minimum control speed: 80 KIAS
- Maximum gear extended speed: 176 KIAS
- Maximum flap extended speed, 15° flap: 176 KIAS
- Maximum flap extended speed, 45° flap: 140 KIAS
- Maximum maneuvering speed: 151 KIAS

Landing with cabin pressurized prohibited. This airplane is approved for day-night VFR conditions. It is approved for day-night IFR conditions and flights into icing conditions if the proper equipment is installed and operational.

3 November 1980
Near Heater and Pressurization Heat Exchanger Controls:

- Open one control minimum for heater operation

Near Pressurization Controls:
- Pressurize + cabin
- Depressurize

Near Fuel Transfer Switches (if installed):
- LH on
- RH off
- Fuel transfer

If Optional Unfeathering Accumulators Are Installed:
- Prop unfeathering accumulators are installed on this airplane

Near Engine Induction Alternate Air Controls:
- LH +
- RH +
- Alt air pull to open

2-12
3 November 1980
Induction Air Controls (Optional EL Panel Installed):

- ALT AIR
- LEFT
- PULL
- RIGHT

Around Landing Gear Selector Switches:

- MAX OPER & EXTD SPEED
- 176 KIAS
- GEAR
- UP
- +
- DN
- GEAR

Around Landing Gear Selector Switches (Optional EL Panel Installed):

- EMER, GEAR CONTROL
- 1. GEAR SELECT—DOWN
- 2. GEAR HYD C/B—PULL
- 3. "T"—HANDLE—PULL

On Landing Gear Indicator Lights:

- GEAR UNLOCKED
- NOSE
- LH
- RH

3 November 1980
LIMITATIONS

Adjacent to Wing Flap Position Switch:

Near Propeller Synchrophaser Switch, if optional Propeller Synchrophaser is installed:

On Engine Control Pedestal:
T.O. Range on Elevator Trim Tab Indicator
2° Nose Up to 8° Nose Up:

Rudder Trim Indicator:

Aileron Trim Indicator:

2-14

3 November 1980
LIMITATIONS

Adjacent to Static Source in Pilot's Compartment:

**PARKING BRAKE**
TO APPLY BRAKES, DEPRESS RUDDER PEDALS, THEN PULL KNOB.
TO RELEASE PULL IN KNOB. DO NOT DEPRESS RUDDER PEDALS.

**STATIC PRESSURE ALTERNATE SOURCE**

On Pilot's Compartment Right Sidewall:

**STATIC SOURCE DRAIN**
DO NOT OPEN WHILE PRESSURIZED

On Horizontal Part of First Baggage Step (Station 257):

**MAXIMUM BAGGAGE ALLOWANCE**
400 POUNDS (200 POUNDS/SIDE)
FOR AIRPLANE LOADING SEE WEIGHT & BALANCE DATA IN THE PILOT'S OPERATING HANDBOOK.

On Horizontal Part of Second Baggage Step (Station 276):

**MAXIMUM BAGGAGE ALLOWANCE**
100 POUNDS (50 POUNDS/SIDE)
FOR AIRPLANE LOADING SEE WEIGHT & BALANCE DATA IN THE PILOT'S OPERATING HANDBOOK.

3 November 1980
Near Upper Cabin Door Latch Mechanism:

External:

Internal:

Near Main Tank Filler Cap:

Near Wing Locker Fuel Filler Caps (If Installed):

On Wing Locker Doors:

Standard Configuration:  If Optional Wing Locker Tanks Are Installed:

MAX BAGGAGE
200 LBS

MAX BAGGAGE
40 LBS

2-16

3 November 1980
Inside Nose Baggage Doors:

**MAXIMUM BAGGAGE**
MAX CAPACITY 350 LBS, LESS
OPTIONAL EQUIP

Inside Left Nose Baggage Door:

**EXTERNAL HYD. RESERVOIR FILL**
MIL-H-5606

On Hydraulic Reservoir:

**MAX FULL —**
ADD —

On Avionics Bay Door Forward Partition:

**MAXIMUM BAGGAGE**
MAX CAPACITY 250 LBS, LESS
OPTIONAL EQUIP

3 November 1980
# SECTION 3
## EMERGENCY PROCEDURES
### TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>3-1</td>
</tr>
<tr>
<td>EMERGENCY PROCEDURES</td>
<td></td>
</tr>
<tr>
<td>AMPLIFIED EMERGENCY PROCEDURES</td>
<td>3-15</td>
</tr>
<tr>
<td>Engine Inoperative Airspeeds</td>
<td>3-15</td>
</tr>
<tr>
<td>For Safe Operation</td>
<td>3-16</td>
</tr>
<tr>
<td>Procedures</td>
<td>3-15</td>
</tr>
<tr>
<td>Maximum Glide</td>
<td>3-16</td>
</tr>
<tr>
<td>Fire Procedures</td>
<td>3-22</td>
</tr>
<tr>
<td>Emergency Descent</td>
<td>3-23</td>
</tr>
<tr>
<td>Procedures</td>
<td>3-25</td>
</tr>
<tr>
<td>Emergency Landing</td>
<td>3-26</td>
</tr>
<tr>
<td>Procedures</td>
<td></td>
</tr>
<tr>
<td>Fuel System Emergency</td>
<td>3-30</td>
</tr>
<tr>
<td>Procedures</td>
<td></td>
</tr>
<tr>
<td>Electrical System Emergency Procedures</td>
<td>3-31</td>
</tr>
<tr>
<td>Avionics Bus Failure</td>
<td>3-31</td>
</tr>
<tr>
<td>Landing Gear Emergency</td>
<td>3-32</td>
</tr>
<tr>
<td>Procedures</td>
<td></td>
</tr>
<tr>
<td>Flight Instruments</td>
<td></td>
</tr>
<tr>
<td>Emergency Procedures</td>
<td></td>
</tr>
<tr>
<td>Procedures</td>
<td></td>
</tr>
<tr>
<td>Obstruction or Icing of Air Inlet Emergency</td>
<td></td>
</tr>
<tr>
<td>Procedures</td>
<td>3-33</td>
</tr>
<tr>
<td>Pressurization System</td>
<td></td>
</tr>
<tr>
<td>Emergency Procedures</td>
<td>3-34</td>
</tr>
<tr>
<td>Propeller</td>
<td></td>
</tr>
<tr>
<td>Synchrophaser</td>
<td></td>
</tr>
<tr>
<td>Emergency Exit</td>
<td></td>
</tr>
<tr>
<td>Window Removal</td>
<td>3-35</td>
</tr>
<tr>
<td>Spins</td>
<td>3-36</td>
</tr>
</tbody>
</table>

## INTRODUCTION

Section 3 of this handbook describes the recommended procedures for emergency situations. The first part of this section provides emergency procedural action required in an abbreviated checklist form. Amplification of the abbreviated checklist is presented in the second part of this section.

### NOTE

Refer to Section 9 of this handbook for amended operating limitations, operating procedures, performance data and other necessary information for airplanes equipped with specific options.

3 November 1980
Revision 1 - 2 Apr 1982

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3-1
EMERGENCY PROCEDURES
ABBREVIATED CHECKLIST

NOTE
This Abbreviated Emergency Procedures Checklist is included as a supplement to the Amplified Emergency Procedures Checklist. Use of the Abbreviated Emergency Procedures Checklist should not be used until the flight crew has become familiar with the airplane and systems. All amplified emergency procedure items must be accomplished regardless of which checklist is used.

Procedures in the Abbreviated Checklist portion of this section outlined in black are immediate-action items and should be committed to memory.

SINGLE-ENGINE AIRSPEEDS FOR SAFE OPERATION

<table>
<thead>
<tr>
<th>Conditions:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Landing Weight 7200 Pounds</td>
<td></td>
</tr>
</tbody>
</table>

| (1) Air Minimum Control Speed |   | 80 KIAS |
| (2) Intentional One Engine Inoperative Speed |   | 100 KIAS |
| (3) One Engine Inoperative Best Angle-of-Climb Speed |   | 105 KIAS |
| (4) One Engine Inoperative Best Rate-of-Climb Speed (Wing Flaps UP) |   | 111 KIAS |

Figure 3-1

ENGINE INOPERATIVE PROCEDURES

ENGINE SECURING PROCEDURE

1. Throttle - CLOSE.
2. Mixture - IDLE CUT-OFF.
3. Propeller - FEATHER.
4. Fuel Selector - OFF (Fuel) For Detent.
5. Auxiliary Fuel Pump - OFF.
6. Magneto Switches - OFF.
8. Alternator - OFF.

ENGINE FAILURE DURING TAKEOFF (Speed Below 100 KIAS Or Gear Down)

1. Throttle - CLOSE IMMEDIATELY.
2. Brake or Land and Brake - AS REQUIRED.
ENGINE FAILURE AFTER TAKEOFF (Speed Above 100 KIAS With Gear Up Or In Transit)

1. Mixtures - FULL RICH.
2. Propellers - FULL FORWARD.
3. Throttles - FULL FORWARD (39.0 Inches Hg.).
4. Landing Gear - CHECK UP.
5. Inoperative Engine:
   a. Throttle - CLOSE.
   b. Mixture - IDLE CUT-OFF.
   c. Propeller - FEATHER.

7. Climb To Clear 50-Foot Obstacle - 100 KIAS.
8. Climb At One Engine Inoperative Best Rate-of-Climb Speed - 111 KIAS.
9. Trim Tabs - ADJUST 5° bank toward operative engine with approximately 1/2 ball slip indicated on the turn and bank indicator.
10. Inoperative Engine - SECURE as follows:
    a. Fuel Selector - OFF (Feel For Detent).
    b. Auxiliary Fuel Pump - OFF.
    c. Magneto Switches - OFF.
    d. Alternator - OFF.
11. As Soon As Practical - LAND.

SUDDEN ENGINE ROUGHNESS

1. Power - REDUCE IMMEDIATELY (Both Engines).
   a. Manifold Pressure - 32.5 Inches Hg. maximum.
   b. RPM - 1800 MAXIMUM.
2. Propeller Synchrophasor - OFF (Optional System).
3. Rough Engine - DETERMINE.
4. Problem - ANALYZE.
5. Rough Engine - SECURE if roughness cannot be cleared.

6. Operative Engine - ADJUST.
7. Trim Tabs - ADJUST 5° bank toward operative engine with approximately 1/2 ball slip indicated on the turn and bank indicator.
8. As Soon As Practical - LAND.

ENGINE FAILURE DURING FLIGHT (Speed Above $V_{MC_A}$)

1. Inoperative Engine - DETERMINE.
2. Operative Engine - ADJUST as required.

Before Securing Inoperative Engine:
3. Fuel Flow - CHECK. If deficient, position auxiliary fuel pump to ON.
4. Fuel Selectors - MAIN TANKS (Feel For Detent).
5. Fuel Quantity - CHECK.
6. Oil Pressure and Oil Temperature - CHECK.
7. Magneto Switches - CHECK ON.
8. Mixture - ADJUST. Lean until manifold pressure begins to increase, then enrichen as power increases.

3 November 1980
If Engine Does Not Start, Secure As Follows:

9. Inoperative Engine - SECURE.
   a. Throttle - CLOSE.
   b. Mixture - IDLE CUTOFF.
   c. Propeller - FEATHER.
   d. Fuel Selector - OFF (Feet for Detent).
   e. Auxiliary Fuel Pump - OFF.
   f. Magneto Switches - OFF.
   g. Propeller Synchrophaser - OFF (Optional System).
   h. Alternator - OFF.

10. Operative Engine - ADJUST.
    a. Power - AS REQUIRED.
    b. Mixture - ADJUST for power.
    c. Fuel Selector - MAIN TANK (Feet for Detent).
    d. Auxiliary Fuel Pump - ON.

11. Trim Tabs - ADJUST 5° bank toward operative engine with approximately 1/2 ball slip indicated on the turn and bank indicator.

12. Electrical Load - DECREASE to minimum required.

13. As Soon As Practical - LAND.

ENGINE FAILURE DURING FLIGHT (Speed Below V_{MC}_{A})

1. Rudder - APPLY towards operative engine.
2. Power - REDUCE to stop turn.
3. Pitch Attitude - LOWER NOSE to accelerate above V_{MC}_{A}.

4. Inoperative Engine Propeller - FEATHER.

5. Operative Engine - INCREASE POWER as airspeed increases above V_{MC}_{A}.

6. Inoperative Engine - SECURE.

7. Trim Tabs - ADJUST 5° bank toward operative engine with approximately 1/2 ball slip indicated on the turn and bank indicator.

ENGINE INOPERATIVE LANDING

1. Fuel Selector - MAIN TANK (Feet for Detent).
3. Alternate Air Control - IN.
4. Mixture - FULL RICH or lean as required for smooth operation.
5. Propeller Synchrophaser - OFF (Optional System).
6. Propeller - FULL FORWARD.
7. Approach - 111 KIAS with excessive altitude.
8. Landing Gear - DOWN within gliding distance of field.
9. Wing Flaps - DOWN when landing is assured.
10. Speed - DECREASE below 111 KIAS only if landing is assured.
11. Air Minimum Control Speed - 80 KIAS.

ENGINE INOPERATIVE GO-AROUND (Speed Above 111 KIAS)

1. Throttle - FULL FORWARD (39.0 Inches Hg.).
2. Wing Flaps - UP (If Extended).
3. Positive Rate-of-Climb - ESTABLISH.
4. Landing Gear - UP.
5. Climb at One Engine Inoperative Best Rate-of-Climb Speed - 111 KIAS.
6. Trim Tabs - ADJUST 5° bank toward operative engine with approximately 1/2 ball slip indicated on the turn and bank indicator.
AIRSTART

Airplane Without Optional Propeller Unfeathering System:
1. Auxiliary Fuel Pump - CHECK OFF. If ON or LOW, purge engine by turning OFF auxiliary fuel pump, mixture to IDLE CUT-OFF, throttle full open, magneto switches OFF, and rotating engine 15 revolutions with starter.
2. Magneto Switches - ON.
3. Fuel Selector - MAIN TANK (Feel For Detent).
4. Throttle - FORWARD approximately one and one-half inches.
5. Mixture - FULL RICH then retard approximately two inches.
7. Starter Button - PRESS.
8. Primer Switch - ACTIVATE.
10. Auxiliary Fuel Pump - LOW.
12. Power - INCREASE after cylinder head temperature reaches 200°F with gradual mixture enrichment as power increases.
13. Alternator - ON.

Airplane With Optional Propeller Unfeathering System:
1. Auxiliary Fuel Pump - CHECK OFF. If ON or LOW, purge engine by turning OFF auxiliary fuel pump, mixture to IDLE CUT-OFF, throttle full open, magneto switches OFF, and rotating engine 15 revolutions with starter.
2. Magneto Switches - ON.
3. Fuel Selector - MAIN TANK (Feel For Detent).
4. Throttle - FORWARD approximately one and one-half inches.
5. Mixture - FULL RICH then retard approximately two inches.
6. Propeller - FULL FORWARD.
7. Propeller - RETARD to detent when propeller reaches 1000 RPM.
8. Auxiliary Fuel Pump - LOW.
10. Power - INCREASE after cylinder head temperature reaches 200°F with gradual mixture enrichment as power increases.
11. Alternator - ON.

BOTH ENGINES FAILURE DURING CRUISE FLIGHT

1. Wing Flaps - UP.
2. Landing Gear - UP.
3. Propellers - FEATHER.
4. Airspeed - 122 KIAS (See Figure 3-3).
5. Landing - Refer to FORCED LANDING (Complete Power Loss) in this section.

3 November 1980
### FIRE PROCEDURES

**FIRE ON THE GROUND (Engine Start, Taxi And Takeoff With Sufficient Distance Remaining To Stop)**

1. Throttles - CLOSE.
2. Brakes - AS REQUIRED.
3. Mixtures - IDLE CUT-OFF.
6. Evacuate airplane as soon as practical.

**INFLIGHT WING OR ENGINE FIRE**

1. Both Auxiliary Fuel Pumps - OFF.
2. Operative Engine Fuel Selector - MAIN TANK (Feel For Detent).
4. Appropriate Engine - SECURE.
   a. Throttle - CLOSE.
   b. Mixture - IDLE CUT-OFF.
   c. Propeller - FEATHER.
   d. Fuel Selector - OFF (Feel For Detent).
   e. Magneto - OFF.
   f. Propeller Synchronizer - OFF (Optional System).
   g. Alternator - OFF.
5. Cabin Heater - OFF.
6. Land and evacuate airplane as soon as practical.

**INFLIGHT CABIN ELECTRICAL FIRE OR SMOKE**

1. Electrical Load - REDUCE to minimum required.
2. Fuel Selectors - MAIN TANK (Feel For Detent).
4. Attempt to isolate the source of fire or smoke.
5. Cabin Air Controls - OPEN all vents including windshield defrost. CLOSE if intensity of smoke increases.
6. Pressurization Air Contamination Procedure - INITIATE if required.
7. Land and evacuate airplane as soon as practical.

### EMERGENCY DESCENT PROCEDURES

**PREFERRED PROCEDURE**

1. Throttles - IDLE.
2. Propellers - FULL FORWARD.
4. Wing Flaps - UP.
5. Landing Gear - UP.
6. Moderate Bank - INITIATE.
7. Airspeed - 240 KIAS.

**IN TURBULENT ATMOSPHERIC CONDITIONS**

1. Throttles - IDLE.
2. Propellers - FULL FORWARD.
4. Wing Flaps - DOWN 45°.
5. Landing Gear - DOWN.
6. Moderate Bank - INITIATE.
7. Airspeed - 146 KIAS.
EMERGENCY LANDING PROCEDURES

FORCED LANDING (With Power)
1. Landing Site - CHECK. Overfly site at 105 KIAS and 15° wing flaps.
2. Landing Gear - DOWN if surface is smooth and hard.
   a. Normal Landing - INITIATE. Keep nosewheel off ground as long as practical.
3. Landing Gear - UP if surface is rough or soft.
   b. Pressurization Air Controls - PULL.
   c. All Switches Except Magnetos - OFF.
   d. Mixtures - IDLE CUT-OFF.
   e. Magneto Switches - OFF.
   f. Fuel Selectors - OFF (Feel For Detent).
   g. Emergency Crossfeed Shutoff - OFF (Pull Up).
   h. Landing Attitude - NOSE HIGH.

FORCED LANDING (Complete Power Loss)
1. Mixtures - IDLE CUT-OFF.
2. Propellers - FEATHER.
3. Fuel Selectors - OFF (Feel For Detent).
5. All Switches Except Battery - OFF.
6. Approach - 122 KIAS.
7. If Smooth and Hard Surface:
   a. Landing Gear - DOWN within gliding distance of field.
      (1) Landing Gear Switch - DOWN.
      (2) GEAR HYD Circuit Breaker - PULL.
      (3) Emergency Gear Extension T-Handle - PULL.
      (4) Gear Down Lights - ON; Unlocked Light - OFF.
      (5) Gear Warning Horn - CHECK.
   b. Wing Flaps - AS REQUIRED.
   c. Approach - 105 KIAS.
   d. Battery Switch - OFF.
   e. Normal Landing - INITIATE. Keep nosewheel off ground as long as practical.
8. If Rough or Soft Surface:
   a. Landing Gear - UP.
   b. Wing Flaps - DOWN 15°.
   c. Approach - 105 KIAS.
   d. Battery Switch - OFF.
   e. Landing Attitude - NOSE HIGH.

3 November 1980
LANDING WITH FLAT MAIN GEAR TIRE

1. Landing Gear - Leave DOWN.
2. Fuel Selectors - SELECT main tank on same side as defective tire; feel for detent.
3. Fuel Selectors - MAIN TANKS (Feel for Detent) before landing.
4. Wind should be headwind or crosswind opposite the defective tire.
5. Wing Flaps - DOWN 45°.
6. In approach, align airplane with edge of runway opposite the defective tire, allowing room for a mild turn in the landing roll.
7. Land slightly wing low on the side of the inflated tire and lower the nosewheel to the ground immediately for positive steering.
8. Use full aileron in landing roll to lighten the load on the defective tire.
9. Apply brakes only on the inflated tire to minimize landing roll and maintain directional control.
10. Stop airplane to avoid further damage unless active runway must be cleared for other traffic.

LANDING WITH DEFECTIVE MAIN GEAR

1. Fuel Selectors - SELECT main tank on the same side as defective gear; feel for detent.
2. Fuel Selectors - MAIN TANKS (Feel for Detent) before landing.
4. Wind - HEADWIND or crosswind opposite defective gear.
5. Landing Gear - DOWN.
6. Wing Flaps - DOWN 45°.
7. Approach - ALIGN AIRPLANE with the edge of runway opposite the defective landing gear.
8. Battery Switch - OFF.
9. Land wing low toward operative landing gear. Lower nosewheel immediately for positive steering.
10. Ground Loop - INITIATE into defective landing gear.
11. Mixtures - IDLE CUT-OFF.
12. Use full aileron in landing roll to lighten the load on the defective gear.
13. Apply brakes only on the operative landing gear to hold desired rate of turn and shorten landing roll.
14. Fuel Selectors - OFF (Feel for Detent).
15. Airplane - EVACUATE.

LANDING WITH FLAT NOSE GEAR TIRE

1. Landing Gear - Leave DOWN.
2. Passengers and Baggage - MOVE AFT.
3. Approach - 111 KIAS with 15° wing flaps.
4. Landing Attitude - NOSE HIGH.
5. Nose - HOLD OFF during landing roll.
7. Throttles - RETARD in landing roll.
8. Control Wheel - FULL AFT until airplane stops.
9. Minimize additional taxiing to prevent further damage.
ELECTRICAL SYSTEM EMERGENCY PROCEDURES

ALTERNATOR FAILURE (Single)

1. Electrical Load - REDUCE.
2. If Circuit Breaker is tripped:
   a. Turn off affected alternator.
   b. Reset affected alternator circuit breaker.
   c. Turn on affected alternator switch.
   d. If circuit breaker reopens, turn off alternator.
3. If Circuit Breaker does not trip:
   a. Select affected alternator on voltmeter and monitor output.
   b. If output is normal and failure light remains on, disregard
      fail indication and have indicator checked after landing.
   c. If output is insufficient, turn off alternator and reduce
      electrical load to one alternator capacity.
   d. If complete loss of alternator output occurs, check field fuse
      and replace if necessary.
   e. If an intermittent light indication accompanied by voltmeter
      fluctuation is observed, turn off affected alternator and
      reduce load to one alternator capacity.
   f. Restrict load on remaining alternator to 80% of the rated load.

ALTERNATOR FAILURE (Dual)

1. Electrical Load - REDUCE.
2. If Circuit Breakers are tripped:
   a. Turn off alternators.
   b. Reset circuit breakers.
   c. Turn on left alternator and monitor output on voltmeter.
   d. If alternator is charging, leave it on. Disregard failure light if still illuminated.
   e. If still inoperative, turn off left alternator.
   f. Repeat steps c through e for right alternator.
   g. If circuit breakers reopen, prepare to terminate flight.
3. If Circuit Breakers have not tripped:
   a. Turn off alternators.
   b. Check field fuses and replace as required.
   c. Turn on left alternator and monitor output on voltmeter.
   d. If alternator is charging, leave it on. Disregard failure light if still illuminated.
   e. If still inoperative, turn off left alternator.
   f. Repeat steps c through e for right alternator.
   g. If both still inoperative, turn off alternators and turn on
      emergency power alternator field switch.
   h. Repeat steps c through e for each alternator.
   i. If still inoperative, turn off alternators, nonessential elec-
      trical items and prepare to terminate flight.

AVIONICS BUS FAILURE

1. Avionics Bus Switch - OFF.
2. Emergency Power Avionics Bus Switch - ON.

3-10 3 November 1980
LANDING GEAR EMERGENCY PROCEDURES

HYD PRESS LIGHT ILLUMINATED AFTER GEAR CYCLE

1. Landing Gear Switch - RAPIDLY RECYCLE.
2. If HYD PRESS light still illuminated:
   a. Landing Gear - DOWN.
   b. GEAR HYD Circuit Breaker - PULL.
   c. If HYD PRESS light remains illuminated - LAND as soon as practi- 
      cal.

LANDING GEAR DOWN AND LOCKED LIGHT ILLUMINATED WITH GEAR HANDLE UP AND HYD PRESS LIGHT OUT

Perform "LANDING GEAR WILL NOT EXTEND HYDRAULICALLY" Checklist.

LANDING GEAR WILL NOT EXTEND HYDRAULICALLY

1. Airspeed - 130 KIAS or less.
2. Landing Gear Switch - DOWN.
3. GEAR HYD Circuit Breaker - PULL.
4. Emergency Gear Extension T-Handle - PULL.
5. Gear Down Lights - ON; Unlocked Light - OFF.
6. If Main Gear Does Not Lock Down - YAW AIRPLANE. Airloads will lock 
   main gear down if up locks have 
   released.
7. Gear Warning Horn - CHECK.
8. As Soon As Practical - LAND.

LANDING GEAR WILL NOT RETRACT HYDRAULICALLY

1. Landing Gear Switch - DOWN.
2. Gear Down Lights - ON; Unlocked Light - OFF.
3. Gear Warning Horn - CHECK.
4. As Soon As Practical - LAND.

FLIGHT INSTRUMENTS EMERGENCY PROCEDURES

VACUUM PUMP FAILURE (Attitude And Directional Gyros)

1. Failure indicated by left or right red failure button exposed on vacuum gage.
2. Automatic valve will select operative source.
3. Vacuum Pressure - CHECK proper vacuum from operative source.

OBSTRUCTION OR Icing OF STATIC SOURCE

1. Static Source - ALTERNATE.
2. Excess Altitude and Airspeed - MAINTAIN to compensate for change in 
   calibration (See Figures 5-2 and 
   5-4).

3 November 1980
Revision 1 - 2 Apr 1982

3-11
SECTION 3
EMERGENCY PROCEDURES

OBSTRUCTION OR ICING OF AIR INLET EMERGENCY PROCEDURES

1. Alternate Air Control(s) – PULL OUT after loss of 3 inches Hg. manifold pressure.
2. Propeller(s) – INCREASE RPM (Avoid Continuous Operation In The Yellow Arc).
3. Mixture(s) – LEAN as required.
4. Pressurization Air Control(s) – PULL LH and/or RH as necessary.
   a. With Both Pressurization Air Sources Dumped:
      (1) Cabin Vent Control – PULL.
      (2) Cabin Pressurization Switch – DEPRESSURIZE.
   b. Above 10,000 Feet with both pressurization air sources dumped:
      (1) If Supplementary Oxygen is Not Available – EMERGENCY DESCENT TO 10,000 FEET.
      (2) If Supplementary Oxygen is Available:
          (a) Oxygen Knob – PULL ON.
          (b) Assure each occupant is using oxygen.
          (c) Descend as soon as practical to 10,000 Feet.

PRESSURIZATION SYSTEM EMERGENCY PROCEDURES

IMPENDING SKIN PANEL OR WINDOW FAILURE

1. Cabin Pressurization Switch – DEPRESSURIZE.
2. Cabin Vent Control – PULL.
3. Pressurization Air Controls – PULL.
4. If Above 10,000 Feet and Supplementary Oxygen is Not Available – EMERGENCY DESCENT TO 10,000 FEET.
5. If Above 10,000 Feet and Supplementary Oxygen is Available:
   a. Oxygen Knob – PULL ON.
   b. Assure each occupant is using oxygen.
   c. Descend as soon as practical to 10,000 Feet.

CABIN OVERPRESSURE (Over 5.3 PSI)

1. Pressurization Air Controls – PULL.
2. If Above 10,000 Feet and Supplementary Oxygen is Not Available – EMERGENCY DESCENT TO 10,000 FEET.
3. If Above 10,000 Feet and Supplementary Oxygen is Available:
   a. Oxygen Knob – PULL ON.
   b. Assure each occupant is using oxygen.
   c. Descend as soon as practical to 10,000 Feet.

LOSS OF PRESSURIZATION ABOVE 10,000 FEET

1. Without Supplementary Oxygen – EMERGENCY DESCENT TO 10,000 FEET.
2. With Supplementary Oxygen:
   a. Oxygen Knob – PULL ON.
   b. Assure each occupant is using oxygen.
   c. Descend as soon as practical to 10,000 Feet.

3-12
3 November 1980
PRESSURIZATION AIR CONTAMINATION

1. Pressurization Air Control(s) - PULL LH and/or RH as necessary.
   a. With Both Air Sources Dumped:
      (1) Cabin Vent Control - PULL.
      (2) Cabin Pressurization Switch - DEPRESSURIZE.
   b. Above 10,000 Feet With Both Air Sources Dumped:
      a. If Supplementary Oxygen is Not Available - EMERGENCY DESCENT TO 10,000 FEET.
      b. If Supplementary Oxygen is Available:
         (1) Oxygen Knob - PULL ON.
         (2) Assure each occupant is using oxygen.
         (3) Descend as soon as practical to 10,000 Feet.

PROPELLER SYNCHROPHASER

ENGINE INOPERATIVE PROCEDURES

1. Propeller Synchrophaser - OFF (Optional System).

SYNCHROPHASER FAILURE

1. Propeller Synchrophaser - OFF (Optional System).
2. Propeller Synchrophaser Circuit Breaker - PULL (Optional System).

EMERGENCY EXIT WINDOW REMOVAL

1. Emergency Release Handle Plastic Cover - PULL OFF.
2. Release Handle - TURN COUNTERCLOCKWISE.
3. Emergency Exit Window - PULL IN and DOWN.

SPINS

1. Throttles - CLOSE IMMEDIATELY.
2. Ailerons - NEUTRALIZE.
3. Rudder - HOLD FULL RUDDER opposite the direction of rotation.
4. Control Wheel - FORWARD BRISKLY, 1/2 turn after applying full rudder.
5. Inboard Engine - INCREASE POWER to slow rotation. (If Necessary).

After rotation has stopped:
6. Rudder - NEUTRALIZE.
7. Inboard Engine (if used) - DECREASE POWER to equalize engines.
8. Control Wheel - PULL to recover from resultant dive. Apply smooth steady control pressure.

3 November 1980
Revision 1 - 2 Apr 1982
AMPLIFIED EMERGENCY PROCEDURES

NOTE

A complete knowledge of the procedures set forth in this section will enable the pilot to cope with various emergencies that can be encountered; however, this does not diminish the fact that the primary responsibility of the pilot is to maintain control at all times. Good judgment and precise action are essential and can only be developed through frequent practice of emergency and simulated engine inoperative procedures. The pilot must have a thorough knowledge of all emergency procedures so that in the event of an emergency, reaction will be precise and done with confidence. This is required so the pilot can cope with the demands of an emergency situation.

ENGINE INOPERATIVE AIRSPEEDS FOR SAFE OPERATION

The most critical time for an engine failure condition in a multi-engine airplane is during a two or three second period late in the takeoff run while the airplane is accelerating to a safe engine failure speed. A detailed knowledge of recommended engine inoperative airspeeds is essential for safe operation of the airplane.

The airspeed indicator is marked with a red radial at the air minimum control speed and a blue radial at the one engine inoperative best rate-of-climb speed to facilitate instant recognition. The following paragraphs present a detailed discussion of the problems associated with engine failures during takeoff.

AIR MINIMUM CONTROL SPEED

The multi-engine airplane must reach the air minimum control speed (80 KIAS) before full control deflections can counteract the adverse rolling and yawing tendencies associated with one engine inoperative and full power operation on the other engine. This speed is indicated by a red radial or the airspeed indicator.

INTENTIONAL ONE ENGINE INOPERATIVE SPEED

Although the airplane is controllable at the air minimum control speed, the airplane performance is so far below optimum that continued flight near the ground is improbable. A more suitable intentional one engine inoperative speed is 100 KIAS. At this speed, altitude can be maintained more easily while the landing gear is being retracted and the propeller is being feathered.

ONE ENGINE INOPERATIVE BEST ANGLE-OF-CLimb SPEED

The one engine inoperative best angle-of-climb speed becomes important when there are obstacles ahead on takeoff. Once the one engine inoperative best angle-of-climb speed is reached, altitude becomes more important than airspeed until the obstacle is cleared. The one engine inoperative best angle-of-climb speed is approximately 105 KIAS with wing flaps and landing gear up.

3 November 1980
ONE ENGINE INOPERATIVE BEST RATE-OF-CLIMB SPEED

The one engine inoperative best rate-of-climb speed becomes important when there are no obstacles ahead on takeoff, or when it is difficult to maintain or gain altitude in single-engine emergencies. The one engine inoperative best rate-of-climb speed is 111 KIAS with wing flaps and landing gear up. The speed is indicated by a blue radial on the airspeed indicator.

The variations of wing flaps up one engine inoperative best rate-of-climb speed with altitude are shown in Section 5. For one engine inoperative best climb performance, the wings should be banked 5° toward the operative engine.

Procedures in the Amplified Checklist portion of this section outlined in black are immediate-action items and should be committed to memory.

ENGINE INOPERATIVE PROCEDURES

ENGINE SECURING PROCEDURE

1. Throttle - CLOSE.
2. Mixture - IDLE CUT-OFF.
3. Propeller - FEATHER.
4. Fuel Selector - OFF (Fuel For Detent).
5. Auxiliary Fuel Pump - OFF.
6. Magneto Switches - OFF.
7. Propeller Synchrophaser - OFF (Optional System).
8. Alternator - OFF.

ENGINE FAILURE DURING TAKEOFF
(Speed Below 100 KIAS Or Gear Down)

1. Throttles - CLOSE IMMEDIATELY.
2. Brake or Land and Brake - AS REQUIRED.

NOTE

The distance required for the airplane to be accelerated from a standing start to 100 KIAS on the ground, and to decelerate to a stop with heavy braking, is presented in the Accelerate Stop Distance Chart in Section 5 for various combinations of conditions.

ENGINE FAILURE AFTER TAKEOFF (Speed Above 100 KIAS With Gear Up Or In Transit)

1. Mixtures - FULL RICH.
2. Propellers - FULL FORWARD.
3. Throttles - FULL FORWARD (39.0 Inches Hg.).
4. Landing Gear - CHECK UP.
5. Inoperative Engine:
   a. Throttle - CLOSE.
   b. Mixture - IDLE CUT-OFF.
   c. Propeller - FEATHER.
7. Climb to Clear 50-Foot Obstacle - 100 KIAS.
8. Climb at One Engine Inoperative Best Rate-of-Climb Speed - 111 KIAS.
9. Trim Tabs - ADJUST 5° bank toward operative engine with approximately 1/2 ball slip indicated on the turn and bank indicator.
10. Inoperative Engine - SECURE as follows:
   a. Fuel Selector - OFF (Feel For Detent).
   b. Auxiliary Fuel Pump - OFF.
   c. Magneto Switches - OFF.
   d. Alternator Switch - OFF.
11. As Soon as Practical - LAND.

Upon engine failure after reaching 100 KIAS on takeoff, the multi-engine pilot has a significant advantage over a single-engine pilot, for he has a choice of stopping or continuing the takeoff. This would be similar to the choice facing a single-engine pilot who has suddenly lost slightly more than half of his takeoff power. In this situation, the single-engine pilot would be extremely reluctant to continue the takeoff if he had to climb over obstructions. However, if the failure occurred at an altitude as high or higher than surrounding obstructions, he would feel free to maneuver for a landing back at the airport.

Fortunately, the airplane accelerates through this "area of decision" in just a few seconds. However, to make an intelligent decision in this type of emergency, one must consider the field length, obstruction height, field elevation, air temperature, headwind, and takeoff weight. The flight paths illustrated in Figure 3-2 indicate that the "go no-go area of decision" is bounded by: (1) the point at which 100 KIAS is reached and (2) the point where the obstruction altitude is reached. An engine failure in this area requires an immediate decision. Beyond this area, the airplane, within the limitations of single-engine climb performance shown in Section 5, may be maneuvered to a landing back at the airport.

ENGINE FAILURE DURING TAKEOFF
GO NO-GO DECISION

![Diagram of engine failure during takeoff](image)

Figure 3-2

3 November 1980
Revision 1 - 2 Apr 1982
At sea level standard day, with zero wind and 7450 pounds weight, the distance to accelerate to 100 KIAS and stop is 3630 feet, while the total unobstructed distance required to takeoff and climb over a 50-foot obstacle after an engine failure at 100 KIAS is 4960 feet. This total distance over an obstacle can be reduced slightly under more favorable conditions of weight, headwind, or obstruction height. However, it is recommended that in most cases it would be better to discontinue the takeoff, since any slight mismanagement of single-engine procedures would more than offset the small distance advantage offered by continuing the takeoff. Still higher field elevations will cause the engine failure takeoff distance to lengthen disproportionately until the altitude is reached where a successful takeoff is improbable unless the airspeed and height above the runway at engine failure are great enough to allow a slight deceleration and altitude loss while the airplane is being prepared for an engine inoperative climb.

During engine inoperative takeoff procedures over an obstacle, only one condition presents any appreciable advantage; this is headwind. A decrease of approximately 6% in ground distance required to clear a 50-foot obstacle can be gained for each 10 knots of headwind. Excessive speed above one engine inoperative best rate-of-climb speed at engine failure is not nearly as advantageous as one might expect since deceleration is rapid and ground distance is used up quickly at higher speeds while the airplane is being cleaned up for climb. However, the extra speed is important for controllability.

The following facts should be used as a guide at the time of engine failure during takeoff: (1) discontinuing a takeoff upon engine failure is advisable under most circumstances; (2) altitude is more valuable to safety after takeoff than is airspeed in excess of the one engine inoperative best rate-of-climb speed since excess airspeed is lost much more rapidly than is altitude; (3) climb or continued level flight at moderate altitude is improbable with the landing gear extended and the propeller windmilling; (4) in no case should the airspeed be allowed to fall below the intentional one engine inoperative speed, even though altitude is lost, since this speed will always provide a better chance of climb, or a smaller altitude loss, than any lesser speed; and (5) if the requirement for an immediate climb is not present, allow the airplane to accelerate to the one engine inoperative best rate-of-climb speed as this is the optimum climb speed and will always provide the best chance of climb or least altitude loss.

**WARNING**

The propeller on the inoperative engine must be feathered, landing gear retracted and wing flaps up or continued flight may be impossible.
ENGINE OVERSPEED

Should an overspeed condition occur, the pilot should reduce airspeed as quickly as possible by closing both throttles. On reaching an airspeed below 120 KIAS and above the one engine inoperative best rate-of-climb speed (Blue Radial), set the propeller control on the overspeeding engine for feather. If propeller will not feather, the power on the normally operating engine should be advanced to maximum, and the power on the overspeeding engine should be advanced to 50 RPM below the maximum allowable RPM (Red Line). Maintain the one engine inoperative best rate-of-climb speed (Blue Radial) and land as soon as practical. This will provide more than zero thrust at altitudes up to approximately 10,000 feet. During landing, the application of partial throttle on the malfunctioning engine (within limits of the tachometer red line) will minimize asymmetrical thrust.

SUDDEN ENGINE ROUGHNESS

1. Power - REDUCE IMMEDIATELY (Both Engines).
   a. Manifold Pressure - 32.5 inches Hg, maximum.
   b. RPM - 1800 MAXIMUM.
2. Propeller Synchrophaser - OFF (Optional System).
3. Rough Engine - DETERMINE.
4. Problem - ANALYZE.
5. Rough Engine - SECURE if roughness cannot be cleared.
6. Operative Engine - ADJUST.
7. Trim Tabs - ADJUST 5° bank toward operative engine with approximately 1/2 ball slip indicated on the turn and bank indicator.
8. As Soon As Practical - LAND.

The purpose of the tachometer yellow arc and associated placard is to minimize the possibility of operation with a rough or malfunctioning engine at these RPM's. The GTSIO-520 engine has no restrictions or critical vibration characteristics when operating normally (e.g., all cylinders firing equally); however, certain malfunctions within the engine cause torsional vibrations to be excited in the crankshaft and drive system. These vibrations, when forced at certain levels and frequencies, become destructive to numerous components of the engine and possibly the propeller and its attachment.

Specific items which show early damage from these torsional vibrations are: the magneto rubbers, alternator drives, starter adapter gears, tachometer drive shaft and quill shaft.

If it is necessary to keep a rough engine in operation, the speed of least destructive resonance is 1800 RPM; however, it is recommended that a rough engine be shut down whenever possible. Any rough engine operation calls for a magneto rubber and propeller nut torque inspection as described in Section 7 of the Airplane Service Manual.

3 November 1980
Revision 1 - 2 Apr 1982
ENGINE FAILURE DURING FLIGHT (Speed Above Air Minimum Control Speed)

1. Inoperative Engine - DETERMINE. Idle engine same side as Idle foot.
2. Operative Engine - ADJUST as required.

Before Securing Inoperative Engine:
3. Fuel Flow - CHECK. If deficient, position auxiliary fuel pump switch to ON.
4. Fuel Selectors - MAIN TANKS (Feel For Detent).
5. Fuel Quantity - CHECK. Switch to opposite MAIN TANK if necessary.
6. Oil Pressure and Oil Temperature - CHECK. Shutdown engine if oil pressure is low.
7. Magneto Switches - CHECK ON.
8. Mixture - ADJUST. Lean until manifold pressure begins to increase, then enrichen as power increases.

If Engine Does Not Start, Secure As Follows:
9. Inoperative Engine - SECURE.
  a. Throttle - CLOSE.
  b. Mixture - IDLE CUT-OFF.
  c. Propeller - FEATHER.
  d. Fuel Selector - OFF (Feel For Detent).
  e. Auxiliary Fuel Pump - OFF.
  f. Magneto Switches - OFF.
  g. Propeller Synchrophaser - OFF (Optional System).
  h. Alternator Switch - OFF.
10. Operative Engine - ADJUST.
  a. Power - AS REQUIRED.
  b. Mixture - ADJUST for power.
  c. Fuel Selector - MAIN TANK (Feel For Detent).
  d. Auxiliary Fuel Pump - ON.
11. Trim Tabs - ADJUST 5° bank toward operative engine with approximately 1/2 ball slip indicated on the turn and bank indicator.
12. Electrical Load - DECREASE to minimum required.
13. As Soon As Practical - LAND.

NOTE
Schedule fuel use such that an adequate amount of fuel is available in the operative engine main tank for landing. Crossfeed as required to maintain lateral balance within 120 pounds per side. When crossfeeding, maintain level flight, maintain altitude greater than 1000 feet AGL and position inoperative engine auxiliary fuel pump to LOW.

ENGINE FAILURE DURING FLIGHT (Speed Below Air Minimum Control Speed)

1. Rudder - APPLY towards operative engine.
2. Power - REDUCE to stop turn.
3. Pitch Attitude - LOWER NOSE to accelerate above air minimum control speed.
4. Inoperative Engine Propeller - FEATHER.
5. Operative Engine - INCREASE POWER as airspeed increases above air minimum control speed.
6. Inoperative Engine - SECURE.
7. Trim Tabs - ADJUST 5° bank toward operative engine with approximately 1/2 ball slip indicated on the turn and bank indicator.

3-20 3 November 1980
ENGINE INOPERATIVE LANDING

1. Fuel Selector - MAIN TANK (Feel For Detent).
3. Alternate Air Control - IN.
4. Mixture - FULL RICH or lean as required for smooth operation.
5. Propeller Synchrophaser - OFF (Optional System).
6. Propeller - FULL FORWARD.
7. Approach at 111 KIAS with excessive altitude.
8. Landing Gear - DOWN within gliding distance of field.
9. Wing Flaps - DOWN when landing is assured.
10. Decrease speed below 111 KIAS only if landing is assured.
11. Air Minimum Control Speed - 80 KIAS.

ENGINE INOPERATIVE GO-AROUND

**WARNING**

Level flight may not be possible for certain combinations of weight, temperature and altitude. In any event, do not attempt an engine inoperative go-around after wing flaps have been extended beyond 15°.

1. If absolutely necessary and speed is above 111 KIAS, increase engine speed to 2235 RPM and apply full throttle.
2. Wing Flaps - UP (If Extended).
3. Positive Rate-of-Climb - ESTABLISH.
4. Landing Gear - UP.
5. Climb at 111 KIAS (105 KIAS With Obstacles Directly Ahead).
6. Trim Tabs - ADJUST 5° bank toward operative engine with approximately 1/2 ball slip indicated on the turn and bank indicator.

AIRSTART (After Feathering)

Airplane Without Optional Propeller Unfeathering System:

1. Auxiliary Fuel Pump - CHECK OFF. If ON or LOW, purge engine by turning OFF auxiliary fuel pump, mixture to IDLE CUT-OFF, throttle full open, magneto switches OFF, and rotating engine 15 revolutions with starter.
2. Magneto Switches - ON.
3. Fuel Selector - MAIN TANK (Feel For Detent).
4. Throttle - FORWARD approximately one and one-half inches.
5. Mixture - FULL RICH then retard approximately two inches.
7. Starter Button - PRESS.
8. Primer Switch - ACTIVATE.
10. Auxiliary Fuel Pump - LOW.
12. Power - INCREASE after cylinder head temperature reaches 200°F with gradual mixture enrichment as power increases.
13. Alternator - ON.
Airplane With Optional Propeller Unfeathering System:

1. Auxiliary Fuel Pump - CHECK OFF. If ON or LOW, purge engine by turning OFF auxiliary fuel pump, mixture to IDLE CUT-OFF, throttle full open, magneto switches OFF, and rotating engine 15 revolutions with starter.

2. Magneto Switches - ON.
3. Fuel Selector - MAIN TANK (Feel For Detent).
4. Throttle - FORWARD approximately one and one-half inches.
5. Mixture - FULL RICH then retard approximately two inches.
6. Propeller - FULL FORWARD.

**NOTE**
The propeller will automatically windmill when the propeller lever is moved out of the FEATHER position.

7. Propeller - RETARD to detent when propeller reaches 1000 RPM.
8. Auxiliary Fuel Pump - LOW.
10. Power - INCREASE after cylinder head temperature reaches 200°F with gradual mixture enrichment as power increases.
11. Alternator - ON.

**BOTH ENGINES FAILURE DURING CRUISE FLIGHT**

1. Wing Flaps - UP.
2. Landing Gear - UP.
3. Propellers - FEATHER.
4. Airspeed - 122 KIAS (See Figure 3-3).

**NOTE**
Vacuum instruments will be inoperative. Electrical power available will be limited to the amount of energy contained in the battery.

5. Landing - Refer to FORCED LANDING (Complete Power Loss) in this section.

**MAXIMUM GLIDE**

In the event of an all engines failure condition, maximum gliding distance can be obtained by feathering both propellers, and maintaining approximately 122 KIAS with landing gear and wing flaps up. The speed which provides the "absolute maximum" glide distance varies with weight as shown in Figure 3-3.
MAXIMUM GLIDE

CONDITIONS:
1. Landing Gear - UP.
2. Wind Flaps - UP.
3. Propellers - FEATHERED.
4. Best Glide Speed.
5. Zero Wind.

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<td>111</td>
</tr>
<tr>
<td>5600</td>
<td>105</td>
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</table>

Figure 3-3

FIRE PROCEDURES

Refer to Section 9 if Fire Detection and Extinguishing System is installed.

FIRE ON THE GROUND (Engine Start, Taxi And Takeoff With Sufficient Distance Remaining To Stop)

1. Throttles - CLOSE.
2. Brakes - AS REQUIRED.
3. Mixtures - IDLE CUT-OFF.
5. Magnetos - OFF (Use Gang Bar).
6. Evacuate airplane as soon as practical.

INFLIGHT WING OR ENGINE FIRE

1. Both Auxiliary Fuel Pumps - OFF.
2. Operative Engine Fuel Selector - MAIN TANK (Feel For Detent).
4. Appropriate Engine - SECURE.
   a. Throttle - CLOSE.
   b. Mixture - IDLE CUT-OFF.
   c. Propeller - FEATHER.
   d. Fuel Selector - OFF (Feel For Detent).

3 November 1980
EMERGENCY PROCEDURES (AMPLIFIED PROCEDURES)

e. Magneto - OFF.
f. Propeller Synchrophaser - OFF (Optional System).
g. Alternator - OFF.
5. Cabin Heater - OFF.
6. Land and evacuate airplane as soon as practical.

INFLIGHT CABIN ELECTRICAL FIRE OR SMOKE

1. Electrical Load - REDUCE to minimum required.
2. Fuel Selectors - MAIN TANK (Feel For Detent).
4. Attempt to isolate the source of fire or smoke.
5. Cabin Air Controls - OPEN all vents including windshield defroster. CLOSE if intensity of smoke increases.
6. Pressurization Air Contamination Procedure - INITIATE if required.

---

**CAUTION**

Opening the foul weather windows or emergency exit window will create a draft in the cabin and may intensify a fire.

7. Land and evacuate airplane as soon as practical.

SUPPLEMENTARY INFORMATION CONCERNING AIRPLANE FIRES

With the use of modern installation techniques and material, the probability of an airplane fire occurring in your airplane is extremely remote. However, in the event a fire is encountered, the following information will be helpful in dealing with the emergency as quickly and safely as possible.

The preflight checklist is provided to aid the pilot in detecting conditions which could contribute to an airplane fire. As a fire requires both fuel and an ignition source, close preflight inspection should be given to the engine compartment and wing leading edge and lower surfaces. Leaks in the fuel system, oil system, or exhaust system can lead to a ground or inflight fire.

---

**NOTE**

Flight should not be attempted with known fuel, oil or exhaust leaks. The presence of fuel, unusual oil or exhaust stains may be an indication of system leaks and should be corrected prior to flight.
If an airplane fire is discovered on the ground or during takeoff, but prior to committed flight, the airplane is to be landed and/or stopped and the passengers and crew evacuated as soon as practical.

Fires originating in flight must be controlled as quickly as possible in an attempt to prevent major structural damage. Both auxiliary fuel pumps should be turned off and the emergency crossfeed shutoff pulled up to reduce pressure on the total fuel system (each auxiliary pump pressurizes a crossfeed line to the opposite fuel selector). The engine on the wing in which the fire exists should be shut down and its fuel selector positioned to OFF even though the fire may not have originated in the fuel system. The cabin heater draws fuel from the crossfeed system and should also be turned off. Descent for landing should be initiated immediately.

An open emergency exit or foul weather window produces a low pressure in the cabin. To avoid drawing the fire into the cabin, the emergency exit and foul weather window should be kept closed. This condition is aggravated with the landing gear and flaps extended. Therefore, the pilot should lower the gear as late in the landing approach as possible. A no-flap landing should also be attempted if practical.

A fire or smoke in the cabin should be controlled by identifying and shutting down the faulty system. Smoke may be removed by opening the cabin air controls. If the smoke increases in intensity when the air controls are opened, they should be closed as this indicates a possible fire in the heater or nose compartment. Normally the pressurization air system will remove smoke from the cabin; however, if the smoke is intense, it may be necessary to initiate the pressurization air contamination procedure presented in this section. When the smoke is intense, the pilot may choose to expel the smoke through the foul weather windows. The foul weather windows should be closed immediately if the fire becomes more intense when the windows are opened.

EMERGENCY DESCENT PROCEDURES
PREFERRED PROCEDURE

1. Throttles - IDLE.
2. Propellers - FULL FORWARD.
4. Wing Flaps - UP.
5. Landing Gear - UP.
6. Moderate Bank - INITIATE until descent attitude has been established.
7. Airspeed - 240 KIAS.

IN TURBULENT ATMOSPHERIC CONDITIONS

1. Throttles - IDLE.
2. Propellers - FULL FORWARD.
4. Wing Flaps - DOWN 45°.
5. Landing Gear - DOWN.
6. Moderate Bank - INITIATE until descent attitude has been established.
7. Airspeed - 146 KIAS.

3 November 1980
EMERGENCY LANDING PROCEDURES

FORCED LANDING (With Power)
1. Drag over selected field with 15° wing flaps and 105 KIAS noting type of terrain and obstructions.
2. Plan a wheels-down landing if surface is smooth and hard.
   a. Execute a normal landing, keeping nosewheel off ground until speed is decreased.
3. If terrain is rough or soft, plan a wheels-up landing as follows:
   a. Approach at 105 KIAS with 15° wing flaps.
   b. Pressurization Air Controls - PULL.
   c. All Switches Except Magneto Switches - OFF.
   d. Mixtures - IDLE CUT-OFF.
   e. Magneto Switches - OFF.
   f. Fuel Selectors - OFF (Feel For Detent).
   g. Emergency Crossfeed Shut-off - OFF (Pull Up).
   h. Land in a slightly nose-high attitude.

NOTE
On smooth sod with landing gear retracted, the airplane will slide straight ahead about 800 feet with very little damage.

FORCED LANDING (Complete Power Loss)
1. Mixtures - IDLE CUT-OFF.
2. Propellers - WINDMILLING (If Practical).
3. Fuel Selectors - OFF (Feel For Detent).
5. All Switches Except Battery Switch - OFF.
6. Approach - 122 KIAS.
7. If field is smooth and hard, plan a landing as follows:
   a. Landing Gear - DOWN within gliding distance of field.
   b. Gear Down Lights - ON; Unlocked Light - OFF.
   c. If gear down lights do not illuminate:
      (1) GEAR HYD Circuit Breaker - PULL.
      (2) Emergency Gear Extension T-Handle - PULL.
      (3) Gear Down Lights - ON; Unlocked Light - OFF.
      (4) Gear Warning Horn - CHECK.
   d. Wing Flaps - EXTEND as necessary within gliding distance of field.
   e. Approach - 105 KIAS.
   f. Battery Switch - OFF.
   g. Make a normal landing, keeping nosewheel off the ground as long as practical.
8. If field is rough or soft, plan a wheels-up landing as follows:
   a. Landing Gear - UP.
   b. Approach at 105 KIAS with 15° wing flaps.
   c. Battery Switch - OFF.
   d. Land in a slightly nose-high attitude.

   NOTE
   On smooth sod with landing gear retracted, the airplane will slide straight ahead about 800 feet with very little damage.

LANDING WITH FLAT MAIN GEAR TIRE

If a blowout occurs during takeoff, proceed as follows:
1. Landing Gear - Leave DOWN.

   NOTE
   Do not attempt to retract the landing gear if a main gear tire blowout occurs. The main gear tire may be distorted enough to bind the main gear strut within the wheel well and prevent later extension.

2. Fuel Selectors - Turn to main tank on same side as defective tire and feel for detent.

   NOTE
   Fuel should be used from this tank first, to lighten the load on the wing, prior to attempting a landing if inflight time permits. However, an adequate supply of fuel should be left in this tank so that it may be used during landing.

3. Fuel Selectors - Left Engine - LEFT MAIN (Feel For Detent).
   Right Engine - RIGHT MAIN (Feel For Detent).
4. Select a runway with a crosswind from the side opposite the defective tire, if a crosswind landing is required.
5. Wing Flaps - DOWN 45°.
6. In approach, align airplane with edge of runway opposite the defective tire, allowing room for a mild turn in the landing roll.
7. Land slightly wing-low on the side of inflated tire and lower nosewheel to ground immediately for positive steering.
8. Use full aileron in landing roll to lighten load on defective tire.
9. Apply brakes only on the inflated tire, to minimize landing roll and maintain directional control.
10. Stop airplane to avoid further damage, unless active runway must be cleared for other traffic.

3 November 1980
LANDING WITH DEFECTIVE MAIN GEAR

1. Fuel Selectors - Turn to main tank on same side as defective gear and feel for detent. Proceed to destination to reduce fuel load.

   NOTE

   Fuel should be used from this tank first, to lighten the load on the wing, prior to attempting a landing if in-flight time permits. However, an adequate supply of fuel should be left in this tank so that it may be used during landing.

2. Fuel Selectors - Left Engine - LEFT MAIN (Feet For Detent).
   Right Engine - RIGHT MAIN (Feet For Detent).
4. Select a wide, hard surface runway, or if necessary, a wide sod runway. Select a runway with crosswind from the side opposite the defective landing gear, if a crosswind landing is necessary.
5. Landing Gear - DOWN.
6. Wing Flaps - DOWN 45°.
7. In approach, align airplane with edge of runway opposite the defective landing gear, allowing room for a ground-loop in landing roll.
8. Battery Switch - OFF.
9. Land slightly wing-low toward the operative landing gear and lower the nosewheel immediately for positive steering.
10. Start moderate ground-loop into defective landing gear until airplane stops.
11. Mixtures - IDLE CUT-OFF.
12. Use full aileron in landing roll to lighten the load on the defective landing gear.
13. Apply brakes only on the operative landing gear to maintain desired rate of turn and minimize the landing roll.
14. Fuel Selectors - OFF (Feet For Detent).
15. Evacuate the airplane as soon as it stops.

LANDING WITH FLAT NOSE GEAR TIRE

If a blowout occurred on the nose gear tire during takeoff, proceed as follows:

1. Landing Gear - Leave DOWN.

   NOTE

   Do not attempt to retract the landing gear if a nose gear tire blowout occurs. The nose gear tire may be distorted enough to bind the nosewheel strut within the wheel well and prevent later extension.

2. Move disposable load to baggage area and passengers to available rear seat space.
3. Approach at 111 KIAS with 15° wing flaps.

3-28 3 November 1980
4. Land in a nose-high attitude with or without power.
5. Maintain back pressure on control wheel to hold nosewheel off the ground in landing roll.
6. Use minimum braking in landing roll.
7. Throttles - RETARD in landing roll.
8. As landing roll speed diminishes, hold control wheel fully aft until airplane is stopped.
9. Avoid further damage by holding additional taxi to a minimum.

**LANDING WITH DEFECTIVE NOSE GEAR**

1. If Smooth and Hard Surface:
   a. Move disposable load to baggage area and passengers to available rear seat space.
   b. Landing Gear - DOWN.
   c. Approach at 111 KIAS with 15° wing flaps.
   d. All Switches Except Magneto Switches - OFF.
   e. Land in a slightly nose-high attitude.
   f. Mixtures - IDLE CUT-OFF.
   g. Magneto Switches - OFF.
   h. Hold nose off throughout ground roll. Lower gently as speed dissipates.

2. If Rough or Sod Surface:

   --- NOTE ---

   This procedure will produce a minimum amount of airplane damage on smooth runways. This procedure is also recommended for short, rough or uncertain field conditions where passenger safety, rather than minimum airplane damage is the prime consideration.

   a. Landing Gear - UP.
   b. Approach at 111 KIAS with 15° wing flaps.
   c. All Switches Except Magneto Switches - OFF.
   d. Land in a slightly nose-high attitude.
   e. Mixtures - IDLE CUT-OFF.
   f. Magneto Switches - OFF.
   g. Fuel Selectors - OFF (Feel For Detent).
   h. Emergency Crossfeed Shut-off - OFF (Pull Up).

**LANDING WITHOUT FLAPS (0° Extension)**

1. Mixtures - FULL RICH or lean as required for smooth operation.
2. Propellers - FULL FORWARD.
3. Fuel Selectors - MAIN TANKS (Feel For Detent).
4. Minimum Approach Speed - 112 KIAS (See Figure 5-25).
5. Landing Gear - DOWN.

3 November 1980
DITCHING

1. Landing Gear - UP.
2. Plan approach into wind if winds are high and seas are heavy. With heavy swells and light wind, land parallel to swells, being careful not to allow wing tips to hit first.
3. Wing Flaps - DOWN 45°.
4. Carry sufficient power to maintain approximately 300 feet per minute rate-of-descent.
5. Airspeed - 105 KIAS minimum at 5500 pounds weight. Reduce airplane weight by fuel burn-off as much as practical.
6. Maintain a continuous descent until touchdown to avoid flaring and touching down tail-first, pitching forward sharply, and decelerating rapidly. Strive for initial contact at fuselage area below rear cabin section (point of maximum longitudinal curvature of fuselage).

**NOTE**

The airplane has not been flight tested in actual ditchings, thus the above recommended procedure is based entirely on the best judgment of Cessna Aircraft Company.

FUEL SYSTEM EMERGENCY PROCEDURES

ENGINE-DRIVEN FUEL PUMP FAILURE

1. Fuel Selector - MAIN TANK (Feet For Detent).
2. Auxiliary Fuel Pump - ON.
3. Mixture - FULL RICH. Adjust fuel flow to coincide with power setting.
4. As Soon as Practical - LAND.
5. Fuel in opposite main tank is unusable if other engine is operating.

**NOTE**

If both an engine-driven fuel pump and an auxiliary fuel pump fail on the same side of the airplane, the failing engine cannot be supplied with fuel from the opposite main tank since that auxiliary fuel pump will operate on the low pressure setting as long as the corresponding engine-driven fuel pump is operative.
ELECTRICAL SYSTEM EMERGENCY PROCEDURES

ALTERNATOR FAILURE (Single)

Indicated By Illumination Of Failure Light
1. Electrical Load - REDUCE.
2. If Circuit Breaker is tripped:
   a. Turn off affected alternator.
   b. Reset affected alternator circuit breaker.
   c. Turn on affected alternator switch.
   d. If circuit breaker reopening, turn off alternator.
3. If Circuit Breaker does not trip:
   a. Select affected alternator on voltmeter and monitor output.
   b. If output is normal and failure light remains on, disregard fail indication and have indicator checked after landing.
   c. If output is insufficient, turn off alternator and reduce electrical load to one alternator capacity.
   d. If complete loss of alternator output occurs, check field fuse and replace if necessary. Spare fuses are located on the left side console forward of the field fuses.
   e. If an intermittent light indication accompanied by voltmeter fluctuation is observed, turn off affected alternator and reduce load to one alternator capacity.
   f. Restrict load on remaining alternator to 80% of the rated load.

ALTERNATOR FAILURE (Dual)

Indicated By Illumination Of Failure Lights
1. Electrical Load - REDUCE.
2. If Circuit Breakers are tripped:
   a. Turn off alternators.
   b. Reset circuit breakers.
   c. Turn on left alternator and monitor output on voltmeter.
   d. If alternator is charging, leave it on. Disregard failure light if still illuminated.
   e. If still inoperative, turn off left alternator.
   f. Repeat steps c through e for right alternator.
   g. If circuit breakers reopen, prepare to terminate flight.
3. If Circuit Breakers have not tripped:
   a. Turn off alternators.
   b. Check field fuses and replace if necessary. Spare fuses are located on the left side console forward of the field fuses.
   c. Turn on left alternator and monitor output on voltmeter.
   d. If alternator is charging, leave it on. Disregard failure light if still illuminated.
   e. If still inoperative, turn off left alternator.
   f. Repeat steps c through e for right alternator.
   g. If both alternators are still inoperative, turn off alternators and turn on emergency power alternator field switch.
   h. Repeat steps c through e for each alternator.
   i. If still inoperative, turn off alternator, nonessential electrical items and prepare to terminate flight.

AVIONICS BUS FAILURE

1. Avionics Bus Switch - OFF.
2. Emergency Power Avionics Bus Switch - ON.

3 November 1980
LANDING GEAR EMERGENCY PROCEDURES

HYD PRESS LIGHT ILLUMINATED AFTER GEAR CYCLE

1. Landing Gear Switch - RAPIDLY RECYCLE.
2. If HYD PRESS light still illuminated:
   a. Landing Gear - DOWN.
   b. GEAR HYD Circuit Breaker - PULL.
   c. If HYD PRESS light remains illuminated - LAND as soon as practical.

   NOTE
   Insure the GEAR HYD circuit breaker is reset before further extension or retraction of the landing gear is attempted.

LANDING GEAR DOWN AND LOCKED LIGHT ILLUMINATED WITH GEAR HANDLE UP AND HYD PRESS LIGHT OUT

Perform "LANDING GEAR WILL NOT EXTEND HYDRAULICALLY" Checklist.

NOTE
Failure of any one of the three down lock switches in the down position may result in that gear not locking down during a gear down cycle if the other two gear lock down first. The down and locked light for the affected gear may remain on continually regardless of actual gear position.

LANDING GEAR WILL NOT EXTEND HYDRAULICALLY

1. Airspeed - 130 KIAS or less.

   NOTE
   As low an airspeed as practical is recommended as a lower airspeed will decrease the airloads on the nose gear during extension, thereby insuring the greatest probability of gear extension.

2. Landing Gear Switch - DOWN.
3. GEAR HYD Circuit Breaker - PULL.
4. Emergency Gear Extension T-Handle - PULL.
5. Gear Down Lights - ON; Unlocked Light - OFF.
6. If Main Gear Does Not Lock Down - YAW AIRPLANE. Airloads will lock main gear down if up locks have released.
7. Gear Warning Horn - CHECK.
8. As Soon As Practical - LAND.

   CAUTION
   The landing gear cannot be retracted inflight, once the emergency gear extension T-handle has been pulled. Ground servicing is required.

3 November 1980
Revision 1 - 2 Apr 1982
LANDING GEAR WILL NOT RETRACT HYDRAULICALLY
1. Landing Gear Switch - DOWN.
2. Gear Down Lights - ON; Unlocked Light - OFF.
3. Gear Warning Horn - CHECK.
4. As Soon as Practical - LAND.

FLIGHT INSTRUMENTS EMERGENCY PROCEDURES

VACUUM PUMP FAILURE (Attitude And Directional Gyros)
1. Failure indicated by left or right red failure button exposed or vacuum gage.
2. Automatic valve will select operative source.
3. Vacuum Pressure - CHECK proper vacuum from operative source.

OBSTRUCTION OR ICING OF STATIC SOURCE
1. Static Source - ALTERNATE. Alternate static source is for pilot's instruments only when dual static system is installed.
2. Excess Altitude and Airspeed - MAINTAIN to compensate for change in calibration.

NOTE
See Figures 5-2 and 5-4 for airspeed and altimeter corrections with static source to ALTERNATE.

OBSTRUCTION OR ICING OF AIR INLET EMERGENCY PROCEDURES

NOTE
The cold alternate air inlet will automatically open if the primary air inlet or air filter becomes blocked.

When more than approximately three inches Hg. manifold pressure is lost and the cold alternate air door(s) have not opened, proceed as follows:
1. Alternate Air Control(s) - PULL OUT.
2. Propeller(s) - INCREASE (Avert Continuous Operation In The Yellow Arc).
3. Mixture(s) - LEAN as required.
4. Pressurization Air Control(s) - PULL LH and/or RH as necessary.
   a. With Both Pressurization Air Sources Dumped:
      (1) Cabin Vent Control - PULL
      (2) Cabin Pressurization Switch - DEPRESSURIZE.
   b. Above 10,000 Ft. with both pressurization air sources dumped:
      (1) If Supplementary Oxygen Is Not Available - EMERGENCY DESCENT TO 10,000 FEET
      (2) If Supplementary Oxygen Is Available:
         (a) Oxygen Knob - PULL ON
         (b) Assure each occupant is using oxygen
         (c) Descend as soon as practical to 10,000 Feet.

3 November 1980
PRESSURIZATION SYSTEM EMERGENCY PROCEDURES

IMPENDING SKIN PANEL OR WINDOW FAILURE
1. Cabin Pressurization Switch - DEPRESSURIZE.
2. Cabin Vent Control - PULL.
3. Pressurization Air Controls - PULL.
4. If Above 10,000 Feet and Supplementary Oxygen is Not Available - EMERGENCY DESCENT TO 10,000 FEET.
5. If Above 10,000 Feet and Supplementary Oxygen is Available:
   a. Oxygen Knob - PULL ON.
   b. Assure each occupant is using oxygen.
   c. Descend as soon as practical to 10,000 Feet.

CABIN OVERPRESSURE (Over 5.3 PSI)
1. Pressurization Air Controls - PULL.
2. If Above 10,000 Feet and Supplementary Oxygen is Not Available - EMERGENCY DESCENT TO 10,000 FEET.
3. If Above 10,000 Feet and Supplementary Oxygen is Available:
   a. Oxygen Knob - PULL ON.
   b. Assure each occupant is using oxygen.
   c. Descend as soon as practical to 10,000 Feet.

LOSS OF PRESSURIZATION ABOVE 10,000 FEET
1. Without Supplementary Oxygen - EMERGENCY DESCENT TO 10,000 FEET.
2. With Supplementary Oxygen:
   a. Oxygen Knob - PULL ON.
   b. Assure each occupant is using oxygen.
   c. Descend as soon as practical to 10,000 Feet.

PRESSURIZATION AIR CONTAMINATION
1. Pressurization Air Control(s) - PULL LH and/or RH as necessary.
   a. With Both Air Sources Dumped:
      (1) Cabin Vent Control - PULL.
      (2) Cabin Pressurization Switch - DEPRESSURIZE.
   b. Above 10,000 Feet with Both Air Sources Dumped:
      a. If Supplementary Oxygen is Not Available - EMERGENCY DESCENT TO 10,000 FEET.
      b. If Supplementary Oxygen is Available:
         (1) Oxygen Knob - PULL ON.
         (2) Assure each occupant is using oxygen.
         (3) Descend as soon as practical to 10,000 Feet.

PROPELLER SYNCHROPHASER
ENGINE INOPERATIVE PROCEDURES
1. Propeller Synchrophaser - OFF (Optional System).

SYNCHROPHASER FAILURE
1. Propeller Synchrophaser - OFF (Optional System).
2. Propeller Synchrophaser Circuit Breaker - PULL (Optional System).

3-34 3 November 1980
## TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INTRODUCTION</strong></td>
<td>*</td>
</tr>
<tr>
<td>Preflight Inspection</td>
<td>4-1</td>
</tr>
<tr>
<td>NORMAL PROCEDURES</td>
<td>*</td>
</tr>
<tr>
<td>ABBREVIATED CHECKLIST</td>
<td>4-2</td>
</tr>
<tr>
<td>Airspeeds For Safe Operation</td>
<td>4-5</td>
</tr>
<tr>
<td>Before Starting Engines</td>
<td>4-6</td>
</tr>
<tr>
<td>Before Taxiing</td>
<td>4-7</td>
</tr>
<tr>
<td>Taxiing</td>
<td>4-8</td>
</tr>
<tr>
<td>Before Takeoff</td>
<td>4-9</td>
</tr>
<tr>
<td>Takeoff</td>
<td>4-10</td>
</tr>
<tr>
<td>After Takeoff</td>
<td>4-11</td>
</tr>
<tr>
<td>Climb</td>
<td>4-12</td>
</tr>
<tr>
<td>Cruise</td>
<td>4-13</td>
</tr>
<tr>
<td>Descent</td>
<td>4-14</td>
</tr>
<tr>
<td>Before Landing</td>
<td>4-15</td>
</tr>
<tr>
<td>After Landing</td>
<td>4-16</td>
</tr>
<tr>
<td>Balded Landing</td>
<td>4-17</td>
</tr>
<tr>
<td>After Landing</td>
<td>4-18</td>
</tr>
<tr>
<td>Shutdown</td>
<td>4-19</td>
</tr>
<tr>
<td>Stall</td>
<td>4-20</td>
</tr>
<tr>
<td>Maneuvering Flight</td>
<td>4-21</td>
</tr>
<tr>
<td>Procedures For Practice</td>
<td>4-22</td>
</tr>
<tr>
<td>Demonstration Of $V_{MC}$</td>
<td>4-23</td>
</tr>
<tr>
<td>Night Flying</td>
<td>4-24</td>
</tr>
<tr>
<td>Cold Weather Operation</td>
<td>4-25</td>
</tr>
<tr>
<td>Alternate Induction Air</td>
<td>4-26</td>
</tr>
<tr>
<td>Noise Abatement</td>
<td>4-27</td>
</tr>
<tr>
<td>Oxygen Use And The Pressurized Airplane</td>
<td>4-28</td>
</tr>
<tr>
<td>AMPLIFIED NORMAL PROCEDURES</td>
<td>4-29</td>
</tr>
<tr>
<td>Preflight Inspection</td>
<td>4-30</td>
</tr>
<tr>
<td>Before Starting Engines</td>
<td>4-31</td>
</tr>
<tr>
<td>Starting Engines</td>
<td>4-32</td>
</tr>
</tbody>
</table>

## INTRODUCTION

Section 4 of this handbook describes the recommended procedures for normal operations. The first part of this section provides normal procedural action required in an abbreviated checklist form. Amplification of the abbreviated checklist is presented in the second part of this section.

### NOTE

Refer to Section 9 of this handbook for amended operating limitations, operating procedures, performance data and other necessary information for airplanes equipped with specific options.

3 November 1980
PREFLIGHT INSPECTION

- Visually check inspection plates and general airplane condition during walk-around inspection. If night flight is planned, check operation of all lights and make sure a flashlight is available.
- Refer to Section 8 for quantities, materials and specifications of frequently used service items.

1. a. Central Lanes - REMOVE and stow.
   b. Parking Brake - SET.
   c. Static Source Selector - NORMAL.
   d. All switches - OFF.
   e. All Circuit Breakers - IN.
   f. Voltmeter Selector - BAT.
   g. Oxygen - DN: Quantity, Masks and Hoses - CHECK; Oxygen - OFF.
   h. Landing Gear Switch - DOWN.
   i. Throttle Controls (2) - SET for takeoff.
   j. Left Fuel Selector - LEFT MAIN (Fuel for Detent).
   k. Right Fuel Selector - RIGHT MAIN (Fuel for Detent).
   m. Battery Switch - ON.
   n. Fuel Gyot - CHECK quantity and operation.
   o. Fuel Selector - SET.
   p. Wing Flaps - DOWN 15°.
   q. Anti-Collision Lights - CHECK operation.
   r. Electric Windshield - CHECK operation by observing discharge on voltmeter if inflight use is anticipated. Ensure system is turned off after operational check.
   s. Pitot, Static and Vent Test Switch(es) - ON 20 seconds then OFF. Ensure pitot tube covers are removed before actuating pitot test switches.
   t. Navigation Lights - ON.
   u. Windshield and Windows - CHECK for cracks and general condition.
   v. Cabin Fire Extinguisher - CHECK SECURITY.

2. a. Battery Compartment Cover - SECURE.
   b. Wing Locker Baggage Door - SECURE.
   c. Wing Flap - CHECK security and attachment.
   d. Control Surface Lock - REMOVE, IF Installed.
   e. Alleran and Tab - CHECK condition, freedom of movement and tab position.
   g. Landing Light Flattener - CHECK condition.
   h. Stall Warning horn - CHECK freedom of movement, audible warning and horn.
   i. Main Tank Fuel Vent - CLEAR.
   j. Bottom Outboard Wing - CHECK for fuel leaks or stains.
   k. Main Tank Fuel Quantity - CHECK, Cap - SECURE.
   l. Painted Clevis Root - CHECK condition and security.
   m. Main Tank Fuel Strainer - DRAIN (2 Drains).
   n. Fuel Strainer - DRAIN.

3. a. Engine Compartment General Condition - CHECK for fuel, oil, hydraulic fluid and exhaust leaks or stains.
   b. Induction System Intercooler Outlet - CLEAR.
   c. Oil Level - CHECK minimum 6 quarts.
   d. Propeller and Spinner - EXAMINE for nicks, security and oil leaks.
   e. Engine Openings - CLEAR.
   f. Intake Air Opening - CLEAR.
   g. Inboard Retract Hook - CHECK condition and security.
   h. Main Gear, Strut, Door, Tire and Wheel Well - CHECK.
   i. Wing Tie Down - REMOVE.
   j. Wing Locking Tank Fuel Filter Cap Vent - CLEAR.
   k. Wing Locking Tank Fuel Sump - DRAIN.
   l. Wing Locking Tank Fuel Vent - CLEAR and WARP.
   m. Cretefused Line - DRAIN.
   n. Lower Fuselage, Naca and Center Section - CHECK for fuel and oil leaks or stains and antenna security.
   o. Heat Exchanger Openings - CLEAR.
   p. Engine Fire Extinguisher Bottle Pressure - CHECK.
   q. Wing Locking Tank Fuel Quantity - CHECK, Cap - SECURE, Cover - INSTALLED.

Figure 4-1 (Sheet 1 of 2)  
3 November 1980
Revision 1 - 2 Apr 1982
PREFLIGHT INSPECTION

1. **Hydraulic Fluid Reservoir Level - CHECK.**
2. **Emergency Landing Gear Blow Down Bottle Pressure - CHECK.** In the green arc. Check that red ring is not showing on the control ring. If red ring is visible, refer to the Airplane Service Manual before flight.
3. **Note Baggage Door - SECURE.**
4. **Arrestor Gear - SECURE.**
5. **Main Gear, Strut, Step Block, Door, Tire and Wheel Well - CHECK.**
6. **Tie Down - REMOVE.**
7. **Pitot Cover - REMOVED, Pitot Tube - CLEAR and WARM.**
8. **Air Inlet - CLEAR.**
9. **Air Inlet - CLEAR.**
10. **Engine Inlet and Outlet - CLEAR.**
11. **Baggage Door - SECURE.**

5. **Heat Exchanger Opening - CLEAR.**
6. **Wing Tip - CHECK condition and security.**
7. **Lever - Fuselage, Nose and Center Section - CHECK for fuel and oil leaks or stains and system security.**
8. **Main Gear, Strut, Door, Tire and Wheel - CHECK.**
9. **Wing Tie Down - REMOVE.**
10. **Wing Locker Tank Fuel Supply - DRAIN.**
11. **Wing Locker Tank Fuel Vent - CLEAR and WARM.**
12. **Crossfire Line - DRAIN.**
13. **Engine Fire Extinguisher Bottle Pressure - CHECK.**
14. **Air Conditioning Outlet Air Opening - CLEAR.**
15. **Intake Air Opening - CLEAR.**
16. **Induction System Intercooler Outlet - CLEAR.**
17. **Oil Level - CHECK minimum 8 quarts.**
18. **Propeller and Spinner - REMOVED for nicks, security and oil leaks.**
19. **Engine Openings - CLEAR.**

5. **Air Conditioning Outlet Value - CHECK.**
6. **Air Conditioning Outlet Air Opening - CHECK DOOR CLOSED.**
7. **Wing Tip - CHECK condition and security.**
8. **Wing Locker Tank Fuel Quantity - CHECK, Cap - SECURE, Cover - INSTALLED.**
9. **Engine Compartment General Condition - CHECK for fuel, oil, hydraulic fluid and exhaust leaks or stains.**
10. **Fuel Strainers - DRAIN.**
11. **Main Tank Fuel Supply - DRAIN (if draining).**
12. **Wing Locker Tank Fuel Vent - CLEAR and WARM.**
13. **Crossfire Line - DRAIN.**
14. **Engine Fire Extinguisher Bottle Pressure - CHECK.**
15. **Air Conditioning Outlet Air Opening - CLEAR.**
16. **Intake Air Opening - CLEAR.**
17. **Induction System Intercooler Outlet - CLEAR.**
18. **Oil Level - CHECK minimum 8 quarts.**
19. **Propeller and Spinner - REMOVED for nicks, security and oil leaks.**
20. **Engine Openings - CLEAR.**

7. **Static Port(s) - CLEAR.** Do not blow into static ports.
8. **Telephone Drain Holes - CHECK clear of obstructions.**
9. **Wing Tip - CHECK condition and security.**
10. **Crossfire Line - DRAIN (if draining).**
11. **Engine Fire Extinguisher Bottle Pressure - CHECK.**
12. **Air Conditioning Outlet Air Opening - CLEAR.**
13. **Intake Air Opening - CLEAR.**
14. **Induction System Intercooler Outlet - CLEAR.**
15. **Oil Level - CHECK minimum 8 quarts.**
16. **Propeller and Spinner - REMOVED for nicks, security and oil leaks.**
17. **Engine Openings - CLEAR.**

*Denotes items to be checked if the applicable optional equipment is installed on your airplane.*

3 November 1980
Revision 1 - 2 Apr 1982
4-3/4-4
NORMAL PROCEDURES
ABBREVIATED CHECKLIST

NOTE
This Abbreviated Normal Procedures Checklist is included as a supplement to the Amplified Normal Procedures Checklist. Use of the Abbreviated Normal Procedures Checklist should not be used until the flight crew has become familiar with the airplane and systems. All amplified normal procedure items must be accomplished regardless of which checklist is used.

AIRSPEEDS FOR SAFE OPERATION

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Takeoff Weight 7450 Pounds</td>
<td>3. Sea Level, Standard</td>
</tr>
<tr>
<td>2. Landing Weight 7200 Pounds</td>
<td>Day</td>
</tr>
</tbody>
</table>

<p>| | | | | | | | | | | | |</p>
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<td>(1) Air Minimum Control Speed</td>
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<tr>
<td>(2) Takeoff and Climb to 50 Feet (0° Wing Flaps)</td>
<td>100 KIAS</td>
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</tr>
<tr>
<td>(3) All Engines Best Angle-of-Climb Speed</td>
<td>88 KIAS</td>
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<tr>
<td>(4) All Engines Best Rate-of-Climb Speed</td>
<td>111 KIAS</td>
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<td></td>
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<tr>
<td>(0° Wing Flaps)</td>
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<td>(5) All Engines Landing/Approach Speed</td>
<td>100 KIAS</td>
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<td>(6) Maneuvering Speed</td>
<td>151 KIAS</td>
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<td>(7) Structural Cruise Speed</td>
<td>201 KIAS</td>
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<td>(8) Never Exceed Speed</td>
<td>240 KIAS</td>
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<td>(9) Speed for Transition to Balking Landing</td>
<td>100 KIAS</td>
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<tr>
<td>10. Maximum Demonstrated Crosswind Velocity</td>
<td>17 KNOTS</td>
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Figure 4-2

BEFORE STARTING ENGINES

1. Preflight - COMPLETE.
2. Cabin Door - LATCHED and SECURE.
3. Control Locks - REMOVE.
4. Seat, Seat Belts and Shoulder Harness - ADJUST and SECURE.
5. Fuel Selectors - MAIN TANKS.
6. Landing Gear Switch - DOWN.
7. Mixtures, Propellers and Throttles - SET.
8. All Switches and Circuit Breakers - SET.
9. Battery and Alternators - ON.
10. Landing Gear Position Indicator Lights - Check green lights ON.
11. Annunciator Panel - PRESS-TO-TEST.
12. Lights - AS REQUIRED.

3 November 1980
STARTING ENGINES

1. Propellers - CLEAR.
2. Magneto Switches - OK.
3. Engines - START.
4. Engine Instruments - CHECK.

BEFORE TAXIING

1. Avionics - SET.

TAXIING

1. Brakes - CHECK.
2. Flight Instruments - CHECK.

BEFORE TAKEOFF

1. Engine Runup - COMPLETE.
   a. Throttles - 1500 RPM.
   b. L and R HYD FLOW Lights - OFF.
   c. Alternators - CHECK.
   d. Vacuum System - CHECK.
   e. Magneto - CHECK.
   f. Propellers - CHECK.
   g. Engine Instruments - CHECK.
   h. Throttles - 500 RPM.
2. Fuel Quantity - CHECK.
3. Fuel Selectors - MAIN TANKS.
5. Trim Tabs - SET.
6. Wing Flaps - UP.
7. Flight Instruments and Avionics - SET.
8. Lights - AS REQUIRED.
9. All Cabin Doors and Windows - CLOSED.
10. Pressurization - SET.
11. Annunciator Panel - CLEAR.
12. Auxiliary Fuel Pumps - ON.
13. Flight Controls - CHECK.
14. Ice Protection - AS REQUIRED.
15. Seat Belts and Shoulder Harness - SECURE.

TAKEOFF

1. Power - SET FOR TAKEOFF.
2. Mixtures - CHECK fuel flows in the white arc.
3. Engine Instruments - CHECK.
4. Air Minimum Control Speed - 80 KIAS.
5. Takeoff and Climb to 50 Feet - 100 KIAS at 7450 pounds. Refer to Section 5 for speeds at reduced weights.

4-6 3 November 1980
AFTER TAKEOFF

1. Landing Gear - RETRACT.
2. Best Angle-of-Climb Speed - 88 KIAS at sea level to 92 KIAS at 20,000 feet with obstacle.
3. Best Rate-of-Climb Speed With Wing Flaps Up - 111 KIAS at sea level and 7450 pounds. Refer to Section 5 for speed at reduced weight.

CLIMB

1. Power - SET.
2. Mixtures - ADJUST.
3. Pressurization - SET.

CRUISE

1. Cruise Power - SET.
2. Auxiliary Fuel Pumps - OFF (LOW only if required).
3. Mixtures - LEAN.
4. Propellers - SYNCHRONIZE.
5. Propeller Synchrophasor - AS REQUIRED.
6. Fuel Selectors - MAIN TANKS.
7. Cabin Altitude and Delta Pressure - CHECK.
8. Trim Tabs - ADJUST.

DESCENT

1. Fuel Selectors - MAIN TANKS.
2. Auxiliary Fuel Pumps - ON.
3. Pressurization - SET.
4. Power - AS REQUIRED.
5. Mixtures - ADJUST.
6. Altimeter - SET.

BEFORE LANDING

1. Seat Belts and Shoulder Harness - SECURE.
3. Wing Flaps - AS REQUIRED.
4. Landing Gear - DOWN.
5. Mixtures - ADJUST.
6. Propellers - FULL FORWARD.
7. Approach Speed - 100 KIAS at 7200 pounds. Refer to Section 5 for speeds at reduced weights.

AFTER LANDING

1. Auxiliary Fuel Pumps - OFF.
2. Wing Flaps - UP.

3 November 1980
SHUTDOWN

1. Parking Brake - SET if brakes are cool.
2. Accessory Switches - OFF.
3. Auxiliary Fuel Pumps - OFF.
4. Engines - SHUT DOWN.
5. Battery, Alternator And Magneto Switches - OFF.
PREFLIGHT INSPECTION

The Preflight Inspection, described in Figure 4-1, is recommended for the first flight of the day. Inspection procedures for subsequent flights are normally limited to brief checks of the tail surface hinges, fuel and oil quantity and security of fuel and oil filler caps. If the airplane has been in extended storage, has had recent major maintenance or has been operated from marginal airports, a more extensive exterior inspection is recommended.

After major maintenance has been performed, the flight and trim tab controls should be double-checked for free and correct movement and security. The security of all inspection plates on the airplane should be checked following periodic inspections. Since avionics and heater maintenance requires the mechanic to work in the nose compartments, the nose compartment doors are opened for access to equipment. Therefore, it is important after such maintenance to double-check the security of these doors. If the airplane has been waxed or polished, check the external static pressure source holes for stoppage.

If the airplane has been exposed to much ground handling in a crowded hangar, it should be checked for dents and scratches on wings, main tanks, fuselage and tail surfaces, as well as damage to navigation, anti-collision and landing lights, deice boots and avionics antennas. Outside storage for long periods may result in water and obstructions in airspeed system lines, condensation in fuel tanks, and dust and dirt on the intake air filters and engine cooling fins. Outside storage in windy or gusty areas, or adjacent to taxiing airplanes, calls for special attention to control surface stops, hinges and brackets to detect presence of wind damage.

If the airplane has been operated from muddy fields or in snow or slush, check the main gear and nose gear wheel wells for obstructions and cleanliness. Operation from a gravel or cinder field will require extra attention to propeller tips and abrasion on leading edges of the horizontal tail. Stone damage to the propeller can seriously reduce the fatigue life of the blades.

Airplanes that are operated from rough fields, especially at high altitudes, are subjected to abnormal landing gear abuse. Check frequently all components of the landing gear retracting mechanisms, shock struts, tires and brakes. Undue landing and taxi loads will be subjected on the airplane structure when the shock struts are insufficiently extended. A completely collapsed (zero extension) shock strut could cause a malfunction in the landing gear retraction system.

To prevent loss of fuel in flight, make sure the main and optional wing locker fuel tank filler caps are tightly sealed. The fuel tank vents on the lower surface of the tanks should also be inspected for obstructions, ice or water, especially after operation in cold, wet weather.

The interior inspection will vary according to the planned flight and the optional equipment installed. Prior to high-altitude flights, it is important to check the condition and quantity of oxygen face masks and hose assemblies. The oxygen supply system should be functionally checked to

3 November 1980
insure that it is in working order. The oxygen pressure gage should indicate 300 to 1800 PSI (11.0 cubic foot system) or 300 to 1850 PSI (114.9 cubic foot system) depending upon the anticipated requirements.

While operating in the pressurized mode, an immediate depressurization would cause extreme passenger discomfort. For this reason, it is important to inspect the cabin door seal for condition. Also, the emergency exit, windows and windshields must be free of cracks and deep scratches.

Satisfactory operation of the pitot tube(s), stall warning transmitter and optional wing locker fuel tank vent heating elements is determined by observing a discharge on the voltmeter when the pitot and stall heat switches are turned ON. The effectiveness of these heating elements may be verified by cautiously feeling the heat of these devices while the switches are ON.

If the emergency landing gear extension T-handle was noticed to be partly extended during the cockpit preflight inspection, the emergency landing gear extension blowdown valve assembly should be reset at the blowdown bottle in the left nose compartment. Check the valve assembly position. If the red band is visible, the blowdown bottle must be serviced in accordance with the airplane Service Manual before flight. If the red band is not showing, push the cable towards the valve assembly, then check the bottle pressure gage for normal pressure.

Flights at night and in cold weather involve a careful check of other specific areas which will be discussed later in this section.

**BEFORE STARTING ENGINES**

1. Preflight Inspection - COMPLETE (See Figure 4-1).
2. Cabin Door - LATCHED and SECURE.
3. Control Locks - REMOVE.
4. Seat, Seat Belts and Shoulder Harness - ADJUST and SECURE.
5. Brakes - SET.
6. Fuel Selectors - Left Engine - LEFT MAIN (Feel For Dent), Right Engine - RIGHT MAIN (Feel For Dent).
7. Landing Gear Switch - DOWN.
8. Mixtures - GND START.
9. Propellers - FULL FORWARD.
10. Throttles - OPEN HALF LEVER WIDTH (At the quadrant).
11. All Switches - OFF.
12. Circuit Breakers - IN.
13. Emergency Power Alternator Field Switch - OFF.
14. Emergency Power Avionics Bus Switch - OFF.
15. Avionics Bus Switch - OFF.
16. Auxiliary Fuel Pump Switches - OFF.
17. Battery and Alternators - OFF.
18. Master Light Dimming Switch - AS REQUIRED.
19. Landing Gear Position Indicator Lights - Check green lights ON.
20. Annunciator Light Panel - PRESS-TO-TEST.
21. Attitude and Clock - SET.
22. Fuel Quantity - CHECK.
23. Fuel Totalizer - SET (Optional System).
   a. Counter Switch - ACTUATE until totalizer reads equal to the amount of fuel in the tanks if a fuel remaining reading is desired.
b. DIM/CLR Switch - CLR if a fuel consumed reading is desired.

**NOTE**

If fuel is added before a flight, ensure that the totalizer is adjusted to reflect the additional fuel.

24. Cabin Air Controls - AS REQUIRED.
25. Alternate Air Controls - IN.
26. External Lights - AS REQUIRED.

**NOTE**

Ground operation of the high intensity anti-collision lights can be of considerable annoyance to ground personnel and other pilots.

**STARTING ENGINES (Left Engine First Without External Power)**

1. Propeller - CLEAR.
2. Magneto Switches - ON.
3. Engine - START.

**CAUTION**

- If the primer is activated for excessive periods of time with the engine inoperative on the ground or during flight, damage may be incurred to the engine and/or airplane due to fuel accumulation in the induction system. Similar conditions may develop when the engine is shutdown with the auxiliary fuel pump ON.
- Should fuel priming or auxiliary fuel pump operation periods in excess of 60 seconds occur, the engine manifold must be purged by one of the following procedures:
  a. With auxiliary fuel pump OFF, allow manifold to drain at least 5 minutes or until fuel ceases to flow out of the drain under the nacelle.
  b. If circumstances do not allow natural draining periods recommended above, with the auxiliary fuel pump OFF, magnetos OFF, mixture IDLE CUT-OFF and throttle FULL OPEN, turn engine with starter or by hand a minimum of 15 revolutions.

a. Primer Switch - Left Engine - LEFT and HOLD.
   - Right Engine - RIGHT and HOLD.

**NOTE**

For a hot engine the primer switch and starter button should be pressed simultaneously. For a warm to cold engine hold the primer 4 to 8 seconds prior to pressing the starter button.
b. Starter Button - PRESS until engine starts. As the engine starts, release the starter but continue to hold the primer switch.

c. Throttle - ADJUST if necessary to obtain 700 to 800 RPM.

d. Mixture Lever - FORWARD slowly while continuing to hold the primer switch.

e. Primer Switch - RELEASE as engine stabilizes.

**NOTE**

Release the primer switch as soon as the engine stabilizes. Holding the switch on for excessive periods of time at idle may result in flooding and engine stoppage. Premature release of the primer switch, before the engine stabilizes, may result in some momentary engine surging due to fuel vapors in the metered fuel line.

4. Throttle - 750 to 900 RPM.

5. Oil Pressure - 10 PSI minimum in 30 seconds in normal weather, or 60 seconds in cold weather. If no indication appears, shutdown engine and investigate.

6. Right Engine - START. Repeat steps 1 through 5.

7. Alternators - CHECK.

**STARTING ENGINES (Left Engine First With External Power)**

1. Battery Switch - ON.

2. Alternator Switches - OFF.

3. External Power Source - ATTACH.

**NOTE**

For complete external power source operation refer to Section 7.

4. Propeller - CLEAR.

5. Magneto Switches - ON.

6. Engine - START.

**CAUTION**

- If the primer is activated for excessive periods of time with the engine inoperative on the ground or during flight, damage may be incurred to the engine and/or airplane due to fuel accumulation in the induction system. Similar conditions may develop when the engine is shutdown with the auxiliary fuel pump ON.

- Should fuel priming or auxiliary fuel pump operation periods in excess of 60 seconds occur, the engine manifold must be purged by one of the following procedures:
  a. With auxiliary fuel pump OFF, allow manifold to drain at least 5 minutes or until fuel ceases to flow out of the drain under the nacelle.
  b. If circumstances do not allow natural draining periods recommended above, with the auxiliary fuel pump OFF, magnetos OFF, mixture IDLE CUT-OFF and throttle FULL OPEN, turn engine with starter or by hand a minimum of 15 revolutions.

3 November 1980
Revision 1 - 2 Apr 1982
a. Primer Switch - Left Engine - LEFT and HOLD.
   - Right Engine - RIGHT and HOLD.

   **NOTE**

   For a hot engine the primer switch and starter button should be pressed simultaneously. For a warm to cold engine hold the primer 4 to 8 seconds prior to pressing the starter button.

b. Starter Button - PRESS until engine starts. As the engine starts, release the starter but continue to hold the primer switch.

c. Throttle - ADJUST if necessary to obtain 700 to 800 RPM.

d. Mixture Lever - FORWARD slowly while continuing to hold the primer switch.

e. Primer Switch - RELEASE as engine stabilizes.

   **NOTE**

   Release the primer switch as soon as the engine stabilizes. Holding the switch on for excessive periods of time at idle may result in flooding and engine stoppage. Premature release of the primer switch, before the engine stabilizes, may result in some momentary engine surging due to fuel vapors in the metered fuel line.

7. Throttle - 750 to 900 RPM.
8. Oil Pressure - 10 PSI minimum in 30 seconds in normal weather, or 60 seconds in cold weather. If no indication appears, shutdown engine and investigate.
9. Right Engine - START. Repeat steps 4 through 8.
10. External Power Source - REMOVE.
11. Alternator Switches - ON.
12. Alternators - CHECK.

The left engine is normally started first because the cable from the battery to this engine is much shorter permitting more electrical power to be delivered to the starter. If battery is low, the left engine should start more readily.

When using an external power source, it is recommended that the airplane be started with alternator switches OFF.

   **NOTE**

   Release starter button as soon as engine fires or engine will not accelerate and flooding can result.

3 November 1980
Revision 1 - 2 Apr 1982

4-13
The engine priming system will start spraying fuel into the air induction manifold through a start nozzle as soon as the primer switch is activated when the mixture lever is in the GND START, (Idle Cut-Off), position. The metered fuel is cut off by the mixture lever at the metering unit; therefore there will be no flow indication on the fuel flow indicator. If the primer switch is activated for an excessive period of time with the engine stopped, liquid fuel will collect temporarily in the cylinder intake ports. The quantity of fuel deposited will depend on the length of time the primer switch has been activated. If this happens, it is advisable to wait a few minutes until the fuel drains away, then with mixtures at GND START, crank the propeller through 15 complete revolutions without prime. This is done to prevent the possibility of engine damage due to hydrostatic lock.

Engine mis-starts, characterized by weak intermittent explosions followed by black puffs of smoke from the exhaust, are the result of flooding or overpriming. This situation is more apt to develop when the engines are hot if the primer is actuated prior to pressing the starter. Check the throttle for proper position (1/2 lever width forward) and attempt to start the engine pressing the starter button prior to the primer.

If cranking longer than 30 seconds is required, allow starter-motor to cool five minutes before cranking again since excessive heat may damage the armature windings.

If the engine primer system will not function due to the start nozzle solenoid being failed closed, the engine may be started as follows:

**ALTERNATE STARTING PROCEDURE**

1. Throttle - OPEN ONE INCH.
2. Mixture - FULL RICH.
3. Propeller - CLEAR.
4. Magneto Switches - ON.
5. Engine - START.
   a. Starter Button - PRESS.
   b. Primer Switch - Left Engine - LEFT.
   - Right Engine - RIGHT.
6. Throttles - ADJUST 750 to 900 RPM.
7. Oil Pressure - CHECK.
8. Alternator - CHECK.

**BEFORE TAXIING**

1. Avionics Bus Switch - ON.
2. Avionics - SET.
3. Lights - AS REQUIRED.
4. Cabin Temperature - AS REQUIRED.
   a. If heating and defrosting is required:
      (1) Cabin Vent Control - PUSH IN.
      (2) Pressurization Air Temperature Controls - FULL CLOCKWISE.
      (3) Forward and Aft Cabin Air Knobs - PULL OUT.
      (4) Defrost Knob - AS REQUIRED.
      (5) Cabin Heat Knob - AS REQUIRED.
      (6) Cabin Heat Switch - ON.
      (7) Heat Registers - AS REQUIRED.

4-14 3 November 1980
If ventilation is required:
(1) Cabin Vent Control - PULL OUT.
(2) Pressurization Air Temperature Controls - FULL COUNTER-CLOCKWISE.
(3) Forward and Aft Cabin Air Knobs - PULL OUT.
(4) Cabin Fan Switch - NORMAL or HIGH.
(5) Heat Registers - AS REQUIRED.

5. Brakes - RELEASE. Pushing in the parking brake knob releases the trapped brake fluid, allowing the brakes to be released.

TAXIING

1. Throttles - AS REQUIRED.
2. Brakes - CHECK.
3. Flight Instruments - CHECK.

A steerable nosewheel, interconnected with the rudder system, provides positive control up to 18° left or right, and free turning from 18° to 52° for sharp turns during taxiing. Normal steering may be aided through use of differential power and differential braking on the main wheels. These aids are listed in the preferred order of use. Do not use excessive brake on the inboard side to effect a turning radius as decreased tire life will result.

NOTE

If the airplane is parked with the nosewheel castered in either direction, initial taxiing should be done with caution. To straighten the nosewheel, use full opposite rudder and differential power instead of differential braking. After a few feet of forward travel, the nosewheel will steer normally.

When taxiing near buildings or other stationary objects, observe the minimum turning distance limits as stated in Figure 7-11. No abnormal precautions are required when taxiing in conditions of high winds.

At some time early in the taxi run, the brakes should be checked for any unusual reaction, such as uneven braking. The operation of the turn-and-bank indicator and directional gyro should also be checked during taxiing. When turning right, the turn-and-bank needle should deflect right while the ball goes left and directional gyro heading increases in numerical value. In a left turn the converse is true. At this time the artificial horizon should be up to speed and indicating a level attitude.

Most of the engine warm-up should be done during taxiing, with just enough power to keep the airplane moving. Engine speed should not exceed 1000 RPM while the oil is cold.

Do not operate engines at high RPM when taxiing over gravel or loose material that may cause damage to the propeller blades.

3 November 1980
BEFORE TAKEOFF

1. Brakes - SET.
2. Engine Runup:
   a. Throttles - 1500 RPM.
   b. L and R HYD FLOW lights - OFF.
   c. Alternators - CHECK.
   d. Vacuum System - CHECK 4.75 to 5.25 inches Hg.
   e. Magnetos - CHECK 100 RPM maximum drop with a maximum differential of 50 RPM. Do not check magnetos above 1900 RPM in the yellow arc.
   f. Propellers - CHECK feathering to 1000 RPM; return to high RPM (Full Forward Position).

   **CAUTION**

   During propeller feathering checks, do not allow the propeller RPM to fall below 1000 RPM as this may damage the hub mechanism.

   g. Engine Instruments - CHECK green arc.
   h. Throttles - 900 RPM.

   **NOTE**

   It is important that the engine oil temperature be within the normal operating range prior to applying takeoff power. Even cautious power applications with cool oil may result in momentarily exceeding the 39.0 inches Hg, manifold pressure limit. Refer to Section 7 if momentary overboost of manifold pressure occurs.

3. Fuel Quantity - CHECK.
4. Fuel Selectors - RECHECK - Left Engine - LEFT MAIN (Feel For Detent).
   Right Engine - RIGHT MAIN (Feel For Detent).
6. Alternate Air Controls - IN.
7. Trim Tabs - SET elevator, aileron and rudder tabs in the TAKEOFF range.
8. Wing Flaps - UP.
10. Flight Instruments and Avionics - SET.
11. Lights - AS REQUIRED.
12. All Cabin Doors and Windows - CLOSED.
13. Pressurization Air Controls - PUSH IN and LOCK.
14. Cabin Pressurization Switch - PRESSURIZE.
15. Cabin Rate - ARROW UP (Optional System).
16. Cabin Altitude - SET 500 feet above field pressure altitude (Optional System).
17. Alternate Air Controls - IN.
18. Cabin Vent Control - PUSH IN.
19. Annunciator Panel - CLEAR.
20. Auxiliary Fuel Pumps - ON.
22. Ice Protection Equipment - AS REQUIRED.
23. Seat Belts and Shoulder Harness - SECURE.

Full throttle checks on the ground are not recommended unless there is good reason to suspect that the engines are not operating properly. Do not run up the engines over loose gravel or cinders because of possible stone damage or abrasion to the propeller tips.

If the ignition system produces an engine speed drop in excess of 100 RPM, or if the drop in RPM between the left and right magneto differs by more than 50 RPM, continue warm-up a minute or two longer before rechecking the system. If there is doubt concerning operation of the ignition system, checks at higher engine speed will usually confirm if a deficiency exists. In general, a drop in excess of 100 RPM is not considered acceptable. Magneto checks should not be made in the yellow arc. The most effective RPM range for detecting magneto roughness is between 1100 and 1500 RPM.

A careful check should be made of the vacuum system. The minimum and maximum allowable suction are 4.75 and 5.25 inches Hg., respectively, on the instrument. Good alternator condition is also important for instrument flight since satisfactory operation of all avionics equipment and electrical instruments is essential. The alternators are checked during engine runup (1500 RPM) by positioning the selector switch in the L ALT and R ALT position and observing the charging rate on the voltmeter.

A simple last minute recheck of important items should include a quick glance to see if all switches are ON, the mixture and propeller controls are forward, all flight controls have free and correct movement and the fuel selectors are properly positioned.

NOTE

Make sure that weight does not exceed 7450 pounds before attempting takeoff.

A mental review of all single-engine speeds, procedures and field length requirements should be made prior to takeoff.

3 November 1980
SECTION 4
NORMAL PROCEDURES
(AMPLIFIED PROCEDURES)

TAKEOFF

1. Power - 2235 RPM and FULL THROTTLE.

NOTE
Apply full throttle smoothly to avoid propeller surging and excessive manifold pressures. Refer to Section 7 if momentary overboost of manifold pressure occurs.

2. Mixtures - CHECK fuel flows in the white arc.
3. Engine Instruments - CHECK.
4. Air Minimum Control Speed - 80 KIAS.
5. Elevator Control - Raise nosewheel at 95 KIAS.
6. Lift-Off - 100 KIAS.

Before initiating the takeoff roll, a go, no-go decision should have been made in the event an engine failure should occur. Review the anticipated performance presented in the Accelerate-Stop Distance, Accelerate-Go Distance and Engine Inoperative Rate-of-Climb charts in Section 5. In addition, review the applicable procedures and speeds associated with single-engine operation so that the transition (in the event of an engine failure) will be smooth, positive and safe. If the anticipated performance exceeds the runway length available or obstacle clearance requirements cannot be achieved, it is recommended to takeoff on a more favorable runway, off-load the airplane until the anticipated performance is consistent with existing conditions or delay the takeoff until more favorable atmospheric conditions exist.

Since the use of full throttle is not recommended in the static runup, closely observe full-power engine operation early in the takeoff run. The maximum allowable manifold pressure of 39.0 inches Hg. manifold pressure should not be exceeded. Throttle action should be smooth and slow in order that the waste gate can becomeoperative as early as possible. Signs of rough engine operation, unequal power between engines, or sluggish engine acceleration are good cause for discontinuing the takeoff. If this occurs, make a thorough full throttle static runup before another takeoff is attempted.

Full throttle operation is recommended on takeoff since it is important that a speed well above air minimum control speed (80 KIAS) be obtained as rapidly as possible. It is desirable to accelerate the airplane to 100 KIAS (intentional one engine inoperative speed) before lift-off for additional safety in case of an engine failure. This safety may have to be compromised slightly where short and rough fields prohibit such high speed before takeoff.

For crosswind takeoffs, additional power may be carried on the upwind engine until the rudder becomes effective. The airplane is accelerated to a slightly higher than normal takeoff speed, and then is pulled off abruptly to prevent possible settling back to the runway while drifting. When clear of the ground, a coordinated turn is made into the wind to correct for drift.

A takeoff with one main tank full and the opposite tank low on fuel creates a lateral unbalance. This is not recommended since gusty air or premature lift-off could create a serious control problem.
After takeoff, it is important to maintain the intentional one engine inoperative speed (100 KIAS) to 50 feet. As the airplane accelerates still further to all engines best rate-of-climb speed (111 KIAS), it is good practice to climb rapidly to an altitude at which the airplane is capable of circling the field on one engine.

AFTER TAKEOFF

1. Brakes - APPLY momentarily.
2. Landing Gear - RETRACT. Check gear unlocked and HYD PRESS lights off.
3. Best Angle-of-Climb Speed (Sea Level) - 88 KIAS after reaching 50 feet if immediate obstacle clearance is a consideration.
4. Best Rate-of-Climb Speed - 111 KIAS at sea level and 7450 pounds. Refer to Section 5 for climb speed at altitude and reduced weight.
5. Auxiliary Fuel Pumps - CHECK ON.

To establish climb configuration, retract the landing gear, set climb power, check auxiliary fuel pumps on and adjust the mixture for the selected power setting.

Before retracting the landing gear, apply the brakes momentarily to stop the rotation of the main wheels. Centrifugal force caused by the rapidly rotating wheels expands the diameter of the tires, and if ice or mud has accumulated in the wheel wells, the rotating wheels may rub as they enter.

On long runways, the landing gear should be retracted at the point over the runway where a wheels-down forced landing on that runway would become impractical. However, on short runways it may be preferable to retract the landing gear after the airplane is safely airborne.

Power reduction will vary according to the requirements of the traffic pattern or surrounding terrain, weight, field elevation, temperature, environmental considerations and engine condition. However, a normal after takeoff power setting is 1900 RPM and 32.5 inches Hg. manifold pressure. In any case, avoid continuous operation in the yellow arc (1900 to 2185 RPM).

CLimb

CRUISE CLimb

1. Power - 1900 RPM and 32.5 inches Hg. Avoid continuous operation in the yellow arc.
2. Airspeed - 115 to 140 KIAS.
3. Mixtures - ADJUST to climb fuel flow (Blue Triangle).
4. Cabin Altitude Control - SET SLOWLY after cabin pressure has stabilized. Reset cabin altitude control to destination field pressure altitude plus 500 feet (outer scale), or cruise altitude plus 500 feet (inner scale) whichever gives the highest cabin altitude (Optional System).
5. Cabin Rate Control - SET to reach selected cabin altitude at approximately the same time the airplane reaches cruise altitude (Optional System).

3 November 1980
MAXIMUM CLimb

1. Power - 2235 RPM and FULL THROTTLE below 20,000 feet. Placed manifold pressure above 20,000 feet.
2. Airspeed - 111 KIAS.
3. Mixtures - FULL RICH below 18,000 feet (White Arc). LEAN as required above 18,000 feet (Blue Arc).
4. Cabin Altitude Control - SET SLOWLY after cabin pressure has stabilized. Reset cabin altitude control to destination field pressure altitude plus 500 feet (outer scale), or cruise altitude plus 500 feet (inner scale) whichever gives the highest cabin altitude (Optional System).
5. Cabin Rate Control - SET to reach selected cabin altitude at approximately the same time the airplane reaches cruise altitude (Optional System).

Power settings for climb must be limited to 2235 RPM and 39.0 inches Hg. manifold pressure below 20,000 feet and placed manifold pressures above 20,000 feet.

Normal cruising climb is recommended where practical and should be conducted at 115 to 140 KIAS, using approximately 75% power [1900 RPM and 32.5 inches Hg. manifold pressure]. The mixture should be leaned in this type of climb to give the desired fuel flow in the climb dial range (blue triangle) which is approximately best power mixture.

If it is necessary to climb rapidly to clear mountains or reach favorable winds at high altitudes, the all engines best rate-of-climb speed of 111 KIAS should be used with maximum power. During maximum performance climbs, the mixture should remain in the takeoff power range (white arc) up to the engine critical altitude and at the appropriate climb power range (blue arc) above critical altitude. It is recommended that the auxiliary fuel pumps be ON, and the mixture remain at the climb mixture setting for approximately 5 minutes after establishing cruising flight before leaning is initiated. This procedure will eliminate fuel vaporization problems likely to occur from rapid altitude changes.

If an obstruction ahead requires a steep climb angle, the airplane should be flown at the all engines best angle-of-climb speed with wing flaps up and maximum power. This speed varies from 88 KIAS at sea level to 92 KIAS at 20,000 feet.

If the optional pressurization system is installed, adjust the cabin altitude and cabin rate controls as follows. After the cabin pressure has stabilized, slowly reset the cabin altitude control to the destination field pressure altitude plus 500 feet on the outer scale or cruise altitude plus 500 feet on the inner scale. Make the selection which will provide the highest cabin altitude. When a cabin altitude change is required, adjust the cabin rate control as the climb progresses such that the selected cabin altitude is reached at approximately the same time the airplane reaches cruising altitude. This will permit a high airplane rate-of-climb to be used and still provide a comfortable environment for the passengers.

4-20

3 November 1980
During cruise climbs, positioning the propeller synchrophaser to PHASE will eliminate the unpleasant audio beat accompanying unsynchronized operation. The propeller synchrophaser can also provide a significant reduction in cabin vibration.

With the propellers slightly out of synchronization so that an audio beat is obtained approximately once each 5 seconds, it should be noted that the vibration level of the cabin and instrument panel will increase and decrease at a rate of approximately once every 20 seconds. Optimum operation will be obtained by manually synchronizing the propellers and positioning the synchrophaser switch to PHASE. Best propeller synchronizing is obtained by making the final adjustment of the propeller controls in a DECREASE RPM direction. For best operation, securely tighten the quadrant friction lock to prevent the slaved propeller control from creeping.

CRUISE

1. Cruise Power - 1600 to 1900 RPM and 17.0 to 32.5 inches Hg.

   NOTE
   Maintain sufficient power for pressurization requirements.

2. Auxiliary Fuel Pumps:
   a. Main Tanks - OFF (LOW only if required).
   b. Crossfeeding - LOW.

3. Mixtures - LEAN for desired cruise fuel flow as determined from your power computer. Recheck mixtures if power, altitude or OAT changes.

4. Propellers - SYNCHRONIZE manually.

5. Propeller Synchrophaser - AS REQUIRED (Optional System).

6. Fuel Selectors - Left Engine - LEFT MAIN (Feet For Detent), Right Engine - RIGHT MAIN (Feet For Detent).
   a. If wing locker tank(s) are installed, transfer wing locker fuel when main tank fuel quantity is less than 400 pounds. Begin wing locker transfer before main tank quantity decreases below 200 pounds.

   NOTE
   Turn auxiliary fuel pumps to LOW and mixtures to FULL RICH when switching tanks.

   b. If wing locker tank(s) are installed, crossfeed as required to maintain fuel balance after wing locker tank fuel transfer

7. Cabin Altitude Control - SET SLOWLY if cruising altitude changes. Reset cabin altitude control to destination field pressure altitude plus 500 feet (outer scale), or cruise altitude plus 50 feet (inner scale) whichever gives the highest cabin altitude (Optional System).

8. Cabin Rate Control - ARROW UP.

3 November 1980

4-2
9. If Cabin Altitude Light Illuminates (cabin altitude above 10,000 feet) - DESCEND or use supplementary oxygen as follows:
   a. Mask - Connect mask and hose assembly and put mask on.

   **WARNING**

   Permit no smoking when using oxygen. Oil, grease, soap, lipstick, lip balm, and other fatty materials constitute a serious fire hazard when in contact with oxygen. Be sure hands and clothing are oil-free before handling oxygen equipment.

   b. Hose Coupling - Plug into oxygen outlet inside access door in outboard armrest.
   d. Disconnect hose coupling when not in use.

10. Trim Tabs - ADJUST.

Normal cruising requires between 50% and 70% power. The manifold pressure and RPM settings required to obtain these powers at various altitudes and outside air temperatures can be determined with your cruise computer. A maximum cruising power of approximately 75% (32.5 inches Hg, manifold pressure and 1900 RPM) may be used if desired. Various percent powers can be obtained with a number of combinations of manifold pressure, engine speed, altitude and outside air temperature. For a given throttle setting, select the lowest engine speed in the green arc range that will give smooth engine operation without evidence of laboring.

The use of lower power settings and the selection of cruise altitude on the basis of the most favorable wind conditions are significant factors that should be considered on every trip to reduce fuel consumption. Additional range can be achieved when operating at select power combinations, see Figure 5-21, by leaning to peak exhaust gas temperature (EGT) for Best Economy mixture. This setting results in an airspeed loss of 4 KTAS and range increase of 8% compared to the Recommended Lean mixture. Do not lean to the extent that engine roughness or excessive speed loss occurs.

   **CAUTION**

Operation at Best Economy mixture is not recommended until oil consumption stabilizes or during the first 50 hours of operation. The purpose of this interval of operation at higher power levels (65% to 75% power) is to insure proper seating of the rings and is applicable to new engines, and engines in service following cylinder replacement or top overhaul of one or more cylinders.

When leaning, accomplish the procedure as precisely as possible. A little extra effort in setting the mixtures will yield significant dividends.
For normal cruise conditions, your cruise computer should be utilized to set the fuel flows. The cruise computer is based on indicated OAT; therefore, the ram rise does not have to be subtracted. The cruise computer is marked with two fuel flow scales. These scales are provided to insure that you can obtain the maximum performance and utilization from your airplane. The inner fuel flow scale (marked Recommended Lean) should be utilized for all normal cruise performance. Data shown in Section 5 are based on Recommended Lean mixture. The outer fuel flow scale (marked Best Power) will provide maximum speed for a given power setting. The speed will be approximately two knots greater than the speed with Recommended Lean mixture.

Manually synchronize the propellers as closely as possible. With the propellers slightly out of synchronization so that an audio beat is obtained approximately once each 5 seconds, it should be noted that the vibration level of the cabin and instrument panel will increase and decrease at a rate of approximately once each 20 seconds. Optimum operation will be obtained by manually synchronizing the propellers and switching the synchrophaser switch to PHASE. Best propeller synchronizing is obtained by making the final adjustment of the propeller controls in a DECREASE RPM direction. For best operation, securely tighten the friction lock to prevent the slaved propeller control from creeping.

If wing locker fuel is to be used, use the main tank fuel until 400 pounds or less remains in the main tank(s) which will receive the wing locker fuel; this will prevent overflowing of the main tank(s) when transferring the wing locker fuel. Begin wing locker fuel transfer before the main tank quantity decreases below 200 pounds to prevent depleting the engine fuel supply before the wing locker fuel has been transferred.

There are no separate fuel selector controls for the wing locker fuel tanks. The wing locker fuel is pumped directly into the main tanks with a fuel transfer pump. Indicator lights mounted on the annunciator panel are illuminated by pressure switches to indicate fuel has been transferred. Fuel should be cross-fed as required to maintain fuel balance after wing locker fuel has been transferred.

NOTE

Wing locker transfer pump switches provided on the instrument panel, energize the wing locker fuel transfer pumps for transferring fuel. These switches should be turned ON only to transfer fuel and turned OFF when the indicator lights come on indicating fuel has been transferred.

If the optional pressurization system is installed, the cabin rate-of-climb control should be positioned with the arrow straight up to provide the proper cabin rate-of-climb as small altitude changes occur.

Normal operations may be conducted without supplemental oxygen for extended periods up to a cabin altitude of approximately 10,000 feet. An oxygen system is required when the cabin altitude exceeds 10,000 feet. An altitude warning light will illuminate when the cabin altitude is higher than 10,000 feet, at which time oxygen should be used by all occupants.

For flight in an icing environment, refer to the Alternate Induction Air paragraphs in this section and other sections dealing with flight in an icing environment.

3 November 1980
Revision 1 - 2 Apr 1982
DESCENT

1. Fuel Selectors - Left Engine - LEFT MAIN (Feet For Detent).
   Right Engine - RIGHT MAIN (Feet For Detent).
2. Auxiliary Fuel Pumps - ON.
   a. Cabin Altitude - SET SLOWLY. During the initial portion of the
      descent, set the cabin altitude control to
      field pressure altitude plus 500 feet (outer
      scale) (Optional System).
   b. Cabin Rate Control - SET to reach selected cabin altitude (zero
      cabin pressure) at approximately the same
      time the airplane reaches field pressure
      altitude plus 500 feet (Optional System).
4. Power - AS REQUIRED to maintain engine temperatures in the green.
   
   NOTE
   Maintain sufficient power for pressurization
   requirements (manifold pressure in the green arc).
5. Mixtures - ADJUST for smooth operation with gradual enrichment as
   altitude is lost.
7. Altimeter - SET.

Power should be reduced slowly to a manifold pressure and RPM which will
provide the desired airspeed and rate-of-descent. Sufficient power should
be maintained, however, to keep cylinder head temperatures in the green arc
and maintain cabin pressurization. The optimum engine speed in a descent
is usually the lowest one in the RPM green arc range that will allow cylin-
der head temperature to remain in the recommended operating range.

The combination of high pressure altitudes and above-standard tempera-
tures has a significant effect on engine operation. Power output at any
manifold pressure or power setting will be lower at high ambient tempera-
tures than under standard atmospheric conditions. As temperatures
increase, a constant fuel flow rate will result in a progressively richer
mixture.

When operating at high altitudes and/or high ambient temperatures,
careful attention should be paid to proper leaning of the mixture for both
fuel economy and engine performance. This is especially important during
prolonged low-power or idle-power operation. Overly rich mixtures during a
long idle-power descent from cruising altitude could result in loss of
power. During low-power operations, mixtures should always be leaned for
smooth operation.

If the optional pressurization system is installed, the cabin altitude
control should be set to give a cabin altitude equal to field pressure
altitude plus 500 feet. The cabin altitude control should be set as early
as practical in the descent in order to allow the lowest cabin rate-of-
descent.

4-24
3 November 1980
As the descent continues, the cabin rate-of-climb control is adjusted to reach the selected cabin altitude (zero cabin pressure differential) at the same time the airplane reaches field pressure altitude plus 500 feet. This system permits high rates of airplane descent while maintaining a comfortable environment for passengers.

**NOTE**

To obtain the approximate field pressure altitude, add 100 feet to the field elevation for each .1 inch Hg. the altimeter is below 29.92 inches Hg. or subtract 100 feet from the field elevation for each .1 inch Hg. the altimeter is above 29.92 inches Hg.

During descents with progressive power reductions into rough air, the propeller synchronizer may be positioned to ON. The synchronizer should be positioned to OFF for large power changes.

Upon completion of any large power changes, the synchronizer may be reengaged for the remainder of the descent. Manually synchronize the propellers, then select the PHASE position of the synchronizer.

To prevent confusion in interpreting which 10,000-foot segment of altitude is being displayed on the altimeter, a striped warning segment is exposed on the face of the altimeter at all altitudes below 10,000 feet.

If fuel has been consumed at uneven rates between the two tanks because of prolonged single-engine flight, it is desirable to balance the fuel load by operating both engines from the fullest tank. However, if there is sufficient fuel in both tanks, even though they may have unequal quantities, it is important to switch the left and right fuel selectors to the left and right tanks, respectively; feel for detent; and check the auxiliary fuel pumps ON for the landing. This will provide an adequate fuel flow to each engine if a balked landing is necessary.

**NOTE**

Make sure weight does not exceed 7200 pounds before attempting landing.

**BEFORE LANDING**

1. Seat Belts and Shoulder Harness - Secure.
3. Alternate Air Controls - CHECK IN.
4. Wing Flaps - DOWN 15° below 176 KIAS.
5. Landing Gear - DOWN below 176 KIAS.
6. Landing Gear Position Indicator Lights - Check down lights ON Unlocked Light - OFF
7. Cabin Differential Pressure - ZERO DIFFERENTIAL.
8. Mixtures - FULL RICH or lean as required for smooth operation.
9. Propellers - FULL FORWARD.
10. Wing Flaps - DOWN 45° below 146 KIAS.
11. Minimum Multi-Engine Approach Speed - 100 KIAS at 7200 pounds Refer to Section 5 for speed at reduced weights.

3 November 1980
Revision 1 - 2 Apr 1982

MODEL 421C

BALKED LANDING

1. Increase propeller speed to 2235 RPM and apply full throttle if necessary.
2. Balked Landing Transition Speed - 100 KIAS.
3. Landing Gear - RETRACT during IFR go-around or simulated IFR go-around after establishing a positive rate of climb.

NOTE

- Experience indicates that retracting the landing gear during an operational VFR go-around, when an immediate landing is contemplated, has been conducive to gear up landings.
- Always follow the Before Landing Checklist.

5. Trim airplane for climb.
6. Wing Flaps - UP as soon as all obstacles are cleared and a safe altitude and airspeed are obtained.

AFTER LANDING

1. Auxiliary Fuel Pumps - OFF during landing roll.
2. Wing Flaps - UP.

Maximum braking effectiveness is obtained by applying full even pressure to the toe brakes without locking the wheels and applying full back pressure to the control column. This procedure is recommended only for emergency stops as excessive brake pad and tire wear will occur. Maximum brake wear occurs at high speed. This brake wear can be reduced using aerodynamic braking supplemented with the use of wheel brakes. Maximum aerodynamic braking occurs with the wing flaps fully extended and control wheels held aft to keep the nose off the runway as long as possible.

After leaving the active runway, the wing flaps should be retracted. I assure the wing flaps switch is identified before placing it in the UP position. The auxiliary fuel pump switches are turned to LOW during the landing roll.

SHUTDOWN

1. Parking Brake - SET if brakes are cool.
2. Avionics Bus Switch - OFF.
3. All Switches Except Battery, Alternator and Magneto Switches - OFF.
4. Auxiliary Fuel Pumps - OFF.

NOTE

The fuel pumps must be turned OFF prior to stopping engines.

3 November 1980
SECTION 4
NORMAL PROCEDURES

5. Throttles - IDLE.
6. Mixtures - IDLE CUT-OFF.
7. Battery and Alternators - OFF.
9. Control Locks - INSTALL.
10. Fuel Selectors - OFF if a long period of inactivity is anticipated
    (Feel for Detent).
11. Cabin Door - CLOSE after checking internal upper door handle is
    stowed in the lock plate.

With the mixture levers in IDLE CUT-OFF, the fuel flow is effectively
blocked at the fuel metering unit. Thus, it is unnecessary to place
the fuel selectors in the OFF position if the airplane is receiving normal
usage. However, if a long period of inactivity is anticipated, the fuel
selectors should be turned OFF to preclude any possible fuel seepage that
might develop through the metering valve.

To preclude battery discharge when the airplane is temporarily inactive,
refer to FLYABLE STORAGE Section 8 for applicable servicing instructions.

STALL

The stall characteristics of the airplane are conventional. Aural
warning is provided by the stall warning horn between 5 and 10 KIAS above
the stall in all configurations. The stall is also preceded by a mild
aerodynamic buffet which increases in intensity as the stall is approached.
The power-on stall occurs at a very steep pitch angle with or without
flaps. It is difficult to inadvertently stall the airplane during normal
maneuvering.

MANEUVERING FLIGHT

No aerobatic maneuvers, including spins, are approved in this airplane;
however, the airplane is conventional in all respects through the maneuver-
ing range encountered in normal flight.

PROCEDURES FOR PRACTICE DEMONSTRATION OF VMCA

Single-engine procedures should be practiced in anticipation of an
emergency. This practice should be conducted at a safe altitude, with full
power operation on both engines, and should be started at a safe speed of
at least 115 KIAS. As recovery ability is gained with practice, the starting
speed may be lowered in small increments until the feel of the airplane
in emergency conditions is well known. It should be noted that as the
speed is reduced, directional control becomes more difficult. Emphasis
should be placed on stopping the initial large yaw angles by the IMMEDIATE
application of rudder supplemented by banking slightly away from the yaw.
Practice should be continued until: (1) an instinctive corrective reaction
is developed and the corrective procedure is automatic and, (2) airspeed,
altitude, and heading can be maintained easily while the airplane is being
prepared for a climb. In order to simulate an engine failure, set both
engines at full power operation; then at a chosen speed, pull the throttle
control of one engine to idle, and proceed with single-engine emergency
procedures. Simulated single-engine flight characteristics can be prac-
ticed by setting propeller RPM to simulate a critical engine inoperative
condition as shown in Figure 4-3.

3 November 1980

Revision 1 - 2 Apr 1982
RPM TO SIMULATE CRITICAL (LEFT) ENGINE INOPERATIVE AND FEATHERED

CONDITIONS:
1. Propellers in Low Pitch (Full Forward Position).
2. Manifold Pressure Adjusted to Obtain Proper RPM.

CAUTION
(TACHOMETER YELLOW ARC - 1900 TO 2185 RPM)
MANIFOLD PRESSURE SHOULD NOT EXCEED 18 INCHES HG, AND SMOOTH ENGINE OPERATION IS REQUIRED WHEN OPERATING WITHIN THE YELLOW ARC.

Figure 4-3
1. Wing Flaps - UP.
2. Landing Gear - UP.
3. Airspeed - Vsse (100 KIAS) or above.
4. Inoperative Engine - IDLE POWER.
5. Operative Engine - 2235 RPM and FULL THROTTLE.
6. Airspeed - DECREASE at approximately 1 knot per second until VMCA (red radial) or stall warning, whichever occurs first, is obtained.

Vsse is used in training and is not a limitation. It is recommended, however, that except for training, demonstrations, takeoffs and landings, this airplane should not be flown at a speed slower than Vsse.

Under no circumstances should VMCA demonstration be attempted at a speed slower than the red radial on the airspeed indicator.

NIGHT FLYING

Before starting the engines for a night flight, position the master panel lighting switch to NIGHT and adjust the rheostats to provide enough illumination to check all switches, controls, etc.

Operation of the anti-collision lights should be checked by observing the reflections on the ground and on the wing tips. After starting the engines, the retractable landing lights (the right landing light is optional equipment) may be extended and checked momentarily. Returning the landing light switches to OFF turns the lights off, but leaves them extended ready for instant use.

Before taxi, the interior lighting intensity is normally decreased to the minimum at which all the controls and switches are visible. The taxi light should be turned on prior to taxiing at night. The landing lights, if used during taxiing, should be used intermittently to avoid excessive drain on the battery. In the engine runups, special attention should be directed to alternator operation by individually turning the voltmeter selector switch to L ALT, R ALT and BATT and noting response on the voltmeter.

Night takeoffs are conventional, although the gear retraction operation is usually delayed slightly to insure that the airplane is well clear of the runway.

In cruising flight, the interior lighting intensity should be decreased to the minimum which will provide adequate instrument legibility.
COLD WEATHER OPERATION

Whenever possible, external preheat should be utilized in cold weather. The use of preheat materially reduces the severity of conditions imposed on both engines and electrical systems. It is the preferred or best method of starting engines in extremely cold weather. Preheat will thaw the oil trapped in the oil coolers and oil filters, which will probably be congealed prior to starting in very cold weather. Refer to the Airplane Service Manual for additional information when operating in extremely cold weather.

When the oil pressure gage is extremely slow in indicating pressure, it may be advisable to fill the pressure line to the gage with kerosene or JP-4.

NOTE
During cold weather operation it is advisable to rotate propellers through four complete revolutions, by hand, before starting engines.

If preheat is not available, external power should be used for starting because of the higher cranking power required and the decreased battery output at low temperatures. The starting procedure is normal.

Manual pressurization air temperature controls have been provided to increase passenger comfort and heating system efficiency during cold weather operation. These manual controls, see Figure 4-4, are located on the instrument panel.

During cold weather operation, it is suggested that the right or both the right and left pressurization air temperature controls be rotated fully clockwise. This will allow higher pressurization air temperatures, eliminating cold air drafts and decreasing cabin heater requirements.

Figure 4-4 can be used as a guide in positioning the pressurization control temperature controls. If the position of the right or both temperature controls is questionable due to the temperature at ground level, it is suggested that the colder temperature be assumed. If it then becomes too warm in the cabin, the manual control(s) may be rotated counterclockwise to emit cooling air. This procedure is recommended as it allows a more rapid cabin temperature adjustment.

NOTE
When necessary to position only one control fully clockwise, rotate the right control as this will allow the left heat exchanger to provide cool air through the upper cabin air outlets, when desired.

3 November 1980
### Pressurization Air Temperature Controls

<table>
<thead>
<tr>
<th>Outside Air Temperature at Ground Level</th>
<th>Manual Shutoff Control Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above 21.1°C (70°F)</td>
<td>Both Controls – Full Counterclockwise</td>
</tr>
<tr>
<td>17°C to 21.1°C (35°F to 70°F)</td>
<td>Right Control Only – Full Clockwise</td>
</tr>
<tr>
<td>Below 17°C (35°F)</td>
<td>Both Controls – Full Clockwise</td>
</tr>
</tbody>
</table>

Figure 4-4

After a suitable warm-up period (2 to 5 minutes at 900 RPM, if preheat is not used) accelerate the engines several times to higher RPM. The propellers should be operated through several complete cycles to warm the governors and propeller hubs. If the engines accelerate smoothly and the oil pressure remains normal and steady, the airplane is ready for takeoff.

**WARNING**

The wings and tail surfaces must be clear of ice, snow and frost prior to takeoff as flight characteristics can be adversely affected.

**NOTE**

The waste gate actuators will not operate satisfactorily with engine oil temperatures below the lower limit of the operating range 23.9°C (75°F). With oil temperatures near the bottom of the operating range, the throttle motions should be very slow and care exercised to prevent exceeding the 39.0 inches Hg. manifold pressure limit.

During operation in cold wet weather, the possibility of brake freezing exists; therefore, special precautions should be taken. If ice is found on the brakes during preflight inspection, heat the brakes with a ground heater until the ice melts and all traces of moisture are removed. If a ground heater is not available, spray or pour isopropyl alcohol (MIL-F-5566) on the brakes to remove the ice.

**CAUTION**

If brakes are defied using alcohol, insure alcohol has evaporated from the ramp prior to starting engines as a fire could result.

4-32 3 November 1980
If neither heat nor alcohol are available, frozen brakes can sometimes be freed by cycling the brakes asymmetrically while applying engine power. Caution should be exercised if the airplane is sitting on ice or in close proximity to other parked airplanes.

After takeoff from slush-covered runways or taxiways, leave landing gear down for a short period, allowing wheels to spin. This will allow centrifugal force to throw off any accumulated slush which should preclude frozen brakes on landing. Insure wheels are stopped before retracting wheels to prevent buildup of ice or slush in the wheel wells.

During cruise, the propellers should be exercised at half-hour intervals to flush the cold oil from the governors and propeller hubs. Electrical equipment should be managed to assure adequate alternator charging throughout the flight, since cold weather adversely affects battery capacity.

During letdown, watch engine temperatures closely and carry sufficient power to maintain them above operating minimums.

The pitot heat and stall warning heater switches should be turned ON at least 5 minutes before entering potential icing conditions (2 minutes if on ground) so that these units will be warm enough to prevent formation of ice. Preventing ice is preferable to attempting its removal once it has formed.

**ALTERNATE INDUCTION AIR**

The induction system employed on these engines is considered to be non-icing. However, two alternate induction air systems are incorporated to assure satisfactory operation. Should the induction air inlet, or the induction system air filter become obstructed, magnetically held auxiliary air doors in the engine compartment will automatically open. The opening of these alternate air doors will provide the engine with cool unfiltered air. If a decrease in manifold pressure is again experienced, it is an indication of SEVERE icing conditions and that the alternate air inlet source has iceed up. Under these circumstances, the alternate air controls should be pulled full open which will admit warm unfiltered air to the engines. Both systems will provide continued satisfactory engine operation.

Since the higher intake air temperature, when using the manual (hot) alternate induction air system, results in a decrease in engine power and turbocharger capability, it is recommended that this system should not be utilized until indications of alternate air inlet source icing, (decreased manifold pressure) are actually observed.

3 November 1980
Should additional power be required, the following procedures may be employed:

1. Increase RPM as required. Avoid continuous operation in the yellow arc.
2. Move throttles forward to maintain desired manifold pressure.
3. Readjust mixture controls for smooth engine operation.

**WARNING**

Should it become necessary to use heated alternate air, the pressurization air controls must be pulled out to prevent nacelle fumes from entering the cabin. The cabin vent control should also be pulled out and the cabin pressurization switch positioned to DEPRESSURIZE to provide cabin ventilation. Placing the controls in the DUMP position will result in the cabin being depressurized. Therefore, if the flight altitude is above 10,000 feet, all occupants should use oxygen or initiate Emergency Descent Procedures.

During ground operation, the alternate air doors should be closed to prevent engine damage caused by ingesting debris through unfiltered air ducts.

**NOISE ABATEMENT**

Increased emphasis on improving the quality of our environment requires renewed effort on the part of all pilots to minimize the effect of airplane noise on the public.

We, as pilots, can demonstrate our concern for environmental improvement by application of the following suggested procedures, and thereby tend to build public support for aviation:

1. Pilots operating airplanes under VFR over outdoor assemblies of persons, recreational and park areas, and other noise-sensitive areas should make every effort to fly not less than 2000 feet above the surface, weather permitting, even though flight at a lower level may be consistent with the provisions of government regulations.
2. During departure from or approach to an airport, climb after take-off and descent for landing should be made so as to avoid prolonged flight at low altitude near noise-sensitive areas. Avoidance of noise-sensitive areas, if practical, is preferable to overflight at relatively low altitudes.

**NOTE**

The preceding recommended procedures do not apply where they would conflict with Air Traffic Control, clearances or instructions, or where, in the pilot's judgment, an altitude of less than 2000 feet is necessary to adequately exercise his duty to see and avoid other airplanes.
The flyover noise level established in compliance with FAR 36, at maximum continuous power is 76.7 dBA.

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

**OXYGEN USE AND THE PRESSURIZED AIRPLANE**

Although this airplane exceeds the safety requirements for operation of pressurized airplanes at high altitude, it is felt that some words of caution are desirable in order to avoid unnecessary hazards. Normal operations may be conducted without supplemental oxygen for extended periods up to a cabin altitude of approximately 10,000 feet. Although the cabin altitude will not exceed 11,950 feet for operation up to the maximum altitude of 30,000 feet, it should be pointed out that the expected time that a person will remain conscious in the event the cabin must be depressurized is less than one minute if supplementary oxygen is not used.

An altitude warning light is provided which indicates when the cabin altitude is higher than 10,000 feet. This indication is controlled by a barometric switch which senses cabin altitudes and is functional when the battery switch is ON.

An oxygen system is required when the cabin altitude exceeds 10,000 feet. It is recommended that oxygen be used by all occupants when the cabin altitude warning light illuminates.

**WARNING**

Permit no smoking when using oxygen. Oil, grease, soap, lipstick, lip balm, and other fatty materials constitute a serious fire hazard when in contact with oxygen. Be sure hands and clothing are oil-free before handling oxygen equipment.
## SECTION 5
### PERFORMANCE

#### TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Page</th>
<th>Normal Takeoff Distance</th>
<th>5-22</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-1</td>
<td>Normal Takeoff Distance</td>
<td>5-22</td>
</tr>
<tr>
<td>5-2</td>
<td>Accelerate Stop Distance</td>
<td>5-24</td>
</tr>
<tr>
<td>5-24</td>
<td>Accelerate Go Distance</td>
<td>5-25</td>
</tr>
<tr>
<td>5-26</td>
<td>Rate-of-Climb Maximum Climb</td>
<td>5-26</td>
</tr>
<tr>
<td>5-27</td>
<td>Cruise Climb</td>
<td>5-27</td>
</tr>
<tr>
<td>5-28</td>
<td>One Engine Inoperative</td>
<td>5-28</td>
</tr>
<tr>
<td>5-29</td>
<td>Balked Landing Climb Rate-of-Climb</td>
<td>5-29</td>
</tr>
<tr>
<td>5-30</td>
<td>Engine Inoperative Service Ceiling</td>
<td>5-30</td>
</tr>
<tr>
<td>5-31</td>
<td>Time, Fuel and Distance to Climb Maximum Climb</td>
<td>5-31</td>
</tr>
<tr>
<td>5-32</td>
<td>Cruise Climb</td>
<td>5-32</td>
</tr>
<tr>
<td>5-33</td>
<td>Cruise Performance Sea Level</td>
<td>5-33</td>
</tr>
<tr>
<td>5-34</td>
<td>5000 Feet</td>
<td>5-34</td>
</tr>
<tr>
<td>5-35</td>
<td>10,000 Feet</td>
<td>5-35</td>
</tr>
<tr>
<td>5-36</td>
<td>15,000 Feet</td>
<td>5-36</td>
</tr>
<tr>
<td>5-37</td>
<td>20,000 Feet</td>
<td>5-37</td>
</tr>
<tr>
<td>5-38</td>
<td>25,000 Feet</td>
<td>5-38</td>
</tr>
<tr>
<td>5-39</td>
<td>Range Profile Endurance Profile</td>
<td>5-39</td>
</tr>
<tr>
<td>5-40</td>
<td>Holding Time</td>
<td>5-40</td>
</tr>
<tr>
<td>5-41</td>
<td>Time, Fuel and Distance to Descend</td>
<td>5-41</td>
</tr>
<tr>
<td>5-42</td>
<td>Normal Landing Distance</td>
<td>5-42</td>
</tr>
<tr>
<td>5-43</td>
<td>Normal Takeoff Distance</td>
<td>5-43</td>
</tr>
</tbody>
</table>

### INTRODUCTION

Section 5 of this handbook contains all the performance information required to operate the airplane safely and to help you plan your flights in detail with reasonable accuracy. Safe and precise operation of the airplane requires the pilot to be thoroughly familiar with and understand the data and calculations of this section.

The data on these graphical and tabular charts have been compiled from actual flight tests, with the airplane and engines in good condition, using average pilot techniques. Note that the cruise performance data makes no allowance for wind and/or navigational errors. Allowances for start, tax, takeoff, climb, descent and 10 minutes reserve fuel at the particular cruise power are provided in the range profile chart.

To determine pressure altitude at origin and destination airports, add 100 feet to field elevation for each .1 inch Hg. below 29.92 or subtract 100 feet from field elevation for each .1 inch Hg. above 29.92.

3 November 1980
DEMONSTRATED OPERATING TEMPERATURE

Satisfactory engine cooling has been demonstrated for this airplane with an outside air temperature 23°C (41°F) above standard. This is not to be considered as an operating limitation. Reference should be made to Section 2 for engine operating limitations.

INTRODUCTION TO TABULATED PERFORMANCE

The performance tables are presented in increments of temperature, altitude and any other variables involved. Performance for a given set of conditions can be approximated as follows:

(1) Takeoff, Accelerate Stop, Accelerate Go, Landing - Enter tables at the next higher increment of weight, altitude and temperature.
(2) Cruise - Enter tables at next lower increment of temperature and altitude.

To obtain exact performance values from the tables, it is necessary to interpolate between the increment values. The following is an example of approximation and interpolation, using an excerpt from the Normal Takeoff Distance Chart.

EXAMPLE

<table>
<thead>
<tr>
<th>Given:</th>
<th>Find:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>7100 Pounds</td>
</tr>
<tr>
<td>Temperature</td>
<td>(10°C) 50°F</td>
</tr>
<tr>
<td>Pressure Altitude</td>
<td>2400 Feet</td>
</tr>
<tr>
<td>Headwind</td>
<td>19 Knots</td>
</tr>
</tbody>
</table>

Takeoff Speed  __ KIAS
Ground Roll  __ Feet
Total Distance to Clear 50-Foot Obstacle  __ Feet


<table>
<thead>
<tr>
<th>Weight Pounds</th>
<th>Takeoff and Climb Speed KIAS</th>
<th>Pressure Altitude Feet</th>
<th>Total Distance to Clear 50-Ft Feet</th>
<th>Total Distance to Clear 50-Ft Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>7450</td>
<td>100</td>
<td>2000</td>
<td>1930</td>
<td>2490</td>
</tr>
<tr>
<td></td>
<td>3000</td>
<td>2050</td>
<td>2650</td>
<td>2270</td>
</tr>
<tr>
<td></td>
<td>3000</td>
<td>1650</td>
<td>2090</td>
<td>1810</td>
</tr>
<tr>
<td>6800</td>
<td>96</td>
<td>2000</td>
<td>1550</td>
<td>1970</td>
</tr>
<tr>
<td></td>
<td>3000</td>
<td>1650</td>
<td>2090</td>
<td>1810</td>
</tr>
</tbody>
</table>

Approximation Method

Extract from the chart the next increment of weight, altitude and temperature which is more conservative than the actual conditions (i.e.: 7450 pounds, 3000 feet and 20°C (68°F)).

Takeoff and Climb Speed  __ 100 KIAS
Ground Roll  __ 2270 Feet
Total Distance to Clear 50-Foot Obstacle  __ 3000 Feet

5-2
3 November 1980
Interpolation Method

If the approximation method yields a value larger than can be tolerated, a more exact value should be determined using the interpolation method.

The example weight (7100 pounds) is 6800 pounds plus 300/650 or .46 times the difference between 6800 pounds and 7450 pounds [i.e.: 6800-pound value + .46 (7450-pound value - 6800-pound value)].

The example pressure altitude (2400 feet) is 2000 feet plus 400/1000 or .4 times the difference between 2000 feet and 3000 feet [i.e.: 2000-foot value + .4 (3000-foot value - 2000-foot value)].

The example temperature of 160°C (610°F) is 10°C plus 6/10 or .6 times the difference between 10°C and 20°C [i.e.: 10°C value + .6 (20°C value - 10°C value)].

Interpolating Values for Normal Takeoff Distance:

Takeoff and Climb Speed

= 6800-pound value + [.46 (7450-pound value - 6800-pound value)]
= 96 KIAS + [.46 (100 KIAS - 96 KIAS)]
= 96 KIAS + [1.8 KIAS]

Ground Roll (7 interpolations required)

Altitude Interpolation at 10°C (50°F) and 7450 pounds

= 2000-foot value + [.4 (3000-foot value - 2000-foot value)]
= 1930 feet + [.4 (2050 feet - 1930 feet)]
= 1930 feet + [48 feet]
= 1978 feet

Altitude Interpolation at 20°C (68°F) and 7450 pounds

= 2000-foot value + [.4 (3000-foot value - 2000-foot value)]
= 2130 feet + [.4 (2270 feet - 2130 feet)]
= 2130 feet + [56 feet]
= 2186 feet

Altitude Interpolation at 10°C (50°F) and 6800 pounds

= 2000-foot value + [.4 (3000-foot value - 2000-foot value)]
= 1550 feet + [.4 (1650 feet - 1550 feet)]
= 1550 feet + [40 feet]
= 1590 feet

3 November 1980
SECTION 5
PERFORMANCE

Altitude interpolation at 20°C (68°F) and 6800 pounds

\[
= 2000\text{-foot value} + [0.4 (3000\text{-foot value} - 2000\text{-foot value})]
\]

\[
= 1700\text{ feet} + [0.4 (1810\text{ feet} - 1700\text{ feet})]
\]

\[
= 1700\text{ feet} + [44\text{ feet}]
\]

\[
= 1744\text{ feet}
\]

The Normal Takeoff Distance chart, with altitude interpolation, looks as follows:

<table>
<thead>
<tr>
<th>Weight Pounds</th>
<th>Takeoff and Climb Speed KIAS</th>
<th>Pressure Altitude Feet</th>
<th>10°C (50°F)</th>
<th>20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7450</td>
<td>100</td>
<td>2400</td>
<td>1978</td>
<td>2186</td>
</tr>
<tr>
<td>6800</td>
<td>96</td>
<td>2400</td>
<td>1530</td>
<td>1744</td>
</tr>
</tbody>
</table>

Weight interpolation at 10°C (50°F) and 2400 feet

\[
= 6800\text{-pound value} + [0.46 (7450\text{-pound value} - 6800\text{-pound value})]
\]

\[
= 1590\text{ feet} + [0.46 (1978\text{ feet} - 1590\text{ feet})]
\]

\[
= 1590\text{ feet} + [178\text{ feet}]
\]

\[
= 1768\text{ feet}
\]

Weight interpolation at 20°C (68°F) and 2400 feet

\[
= 6800\text{-pound value} + [0.46 (7450\text{-pound value} - 6800\text{-pound value})]
\]

\[
= 1744\text{ feet} + [0.46 (2186\text{ feet} - 1744\text{ feet})]
\]

\[
= 1744\text{ feet} + [203\text{ feet}]
\]

\[
= 1947\text{ feet}
\]

The Normal Takeoff Distance chart, with altitude and weight interpolation, looks as follows:

<table>
<thead>
<tr>
<th>Weight Pounds</th>
<th>Takeoff and Climb Speed KIAS</th>
<th>Pressure Altitude Feet</th>
<th>10°C (50°F)</th>
<th>20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7100</td>
<td>98</td>
<td>2400</td>
<td>1768</td>
<td>1947</td>
</tr>
</tbody>
</table>

5-4
3 November 1980
Temperature interpolation at 2400 feet and 7100 pounds

\[ \text{Temperature at 2400 feet} = 10^\circ C (50^\circ F) \times 0.6 + 1768 \text{ feet} \]
\[ \text{Temperature at 7100 pounds} = 10^\circ C (50^\circ F) \times 0.5 + 1768 \text{ feet} \]
\[ = 1768 \text{ feet} + 1768 \text{ feet} (= 3536 \text{ feet}) \]
\[ = 1768 \text{ feet} + 107 \text{ feet} \]
\[ = 1875 \text{ feet} \]

The Normal Takeoff Distance chart, with altitude, weight and temperature, looks as follows:

<table>
<thead>
<tr>
<th>Weight Pounds</th>
<th>Takeoff and Climb Speed&lt;br&gt;KIAS</th>
<th>Pressure Altitude Feet&lt;br&gt;</th>
<th>16°C (61°F) Ground Roll Feet&lt;br&gt;</th>
<th>Total Distance to Clear 50-Ft Feet&lt;br&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>7100</td>
<td>98</td>
<td>2400</td>
<td>1875</td>
<td>----</td>
</tr>
</tbody>
</table>

Ground Roll with 19-knot headwind

\[ = 1875 \text{ feet} - (19 \text{ knots headwind}) \times 7\% \]
\[ = 1875 \text{ feet} - 249 \text{ feet} \]
\[ = 1626 \text{ feet} \]

Total Distance to Clear 50-Foot Obstacle (7 interpolations required)

The interpolations required are identical to the ground roll interpolations, except "total distance to clear 50-foot obstacle" values are substituted for the "ground roll" values.

The interpolated value for the total distance to clear 50-foot obstacle is 2432 feet (no wind) and 2109 feet (19-knot headwind).

**SAMPLE FLIGHT**

The following is an example of a typical flight using the performance data contained in Figures 5-9 through 5-25. The approximation method is used in tabular performance except where noted.

**AIRPLANE CONFIGURATION**

<table>
<thead>
<tr>
<th>Airplane Weight</th>
<th>7100 Pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usable Fuel Load</td>
<td>1236 Pounds</td>
</tr>
</tbody>
</table>

**TAKEOFF AIRPORT CONDITIONS**

<table>
<thead>
<tr>
<th>Field Length</th>
<th>6000 Feet (Runway 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>10°C (50°F)</td>
</tr>
<tr>
<td>Field Pressure Altitude</td>
<td>2400 Ft</td>
</tr>
<tr>
<td>Wind</td>
<td>270° at 25 Knots</td>
</tr>
<tr>
<td>Obstacles</td>
<td>No</td>
</tr>
</tbody>
</table>

3 November 1980
SECTION 5
PERFORMANCE

CRUISE CONDITIONS

<table>
<thead>
<tr>
<th>Distance</th>
<th>600 Nautical Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cruise Altitude</td>
<td>17,500 Feet</td>
</tr>
<tr>
<td>Temperature</td>
<td>-10°C (14°F)</td>
</tr>
<tr>
<td>Wind</td>
<td>Maximum Recommended Cruise Power at Recommended Lean Mixture</td>
</tr>
<tr>
<td>Field Length</td>
<td>3500 Feet (Runway 19)</td>
</tr>
<tr>
<td>Temperature</td>
<td>70°C (48°F)</td>
</tr>
<tr>
<td>Field Pressure Altitude</td>
<td>1700 Feet</td>
</tr>
<tr>
<td>Wind</td>
<td>210° At 17 Knots</td>
</tr>
<tr>
<td>Landing Weight</td>
<td>To be Calculated</td>
</tr>
<tr>
<td>Obstacles</td>
<td>50-Foot Trees</td>
</tr>
</tbody>
</table>

LANDING AIRPORT CONDITIONS

SAMPLE CALCULATIONS

Wind Component Chart (Figure 5-9)

1. The angle between the runway and the prevailing wind is 40°.
2. Enter Figure 5-9 on the 40° wind line and proceed out to the intersection with the 25-knot arc.
3. Read horizontally left from this intersection; the headwind component is 19 knots.

Normal Takeoff Distance (Figure 5-10)

1. Enter Figure 5-10 at 7450 pounds weight; the takeoff and climb speed is 100 KIAS.
2. Proceed horizontally right from 3000-foot pressure altitude to the vertical columns for 20°C (68°F). The takeoff ground run is 2270 feet and the total distance required to clear a 50-foot obstacle is 3000 feet without wind correction. With a 19-knot headwind component, the corrected takeoff ground run is 1968 feet and the corrected total distance required is 2601 feet.

\[
\text{19 Knots Headwind (7%)} = 13.3\%
\]

\[
\begin{align*}
\text{Corrected Takeoff} & = 2270 \text{ feet} - [13.3\% (2270 \text{ feet})] \\
& = 2270 \text{ feet} - [302 \text{ feet}] \\
& = 1968 \text{ feet} \\
\text{Corrected Total Distance Required} & = 3000 \text{ feet} - [13.3\% (3000 \text{ feet})] \\
& = 3000 \text{ feet} - [399 \text{ feet}] \\
& = 2601 \text{ feet}
\end{align*}
\]

Accelerate Stop Distance (Figure 5-11)

1. Enter Figure 5-11 at 7450 pounds weight; engine failure speed is 100 KIAS.

5-6

3 November 1980
Proceed horizontally right from 3000-foot pressure altitude to the vertical columns for 20°C (68°F). The distance required to accelerate to 100 KIAS and stop is 4350 feet without wind correction. With a 19-knot headwind component, the accelerate stop distance can be reduced by:

\[
\frac{19 \text{ Knots Headwind}}{4 \text{ Knots Headwind}} = 14.25\%
\]

Corrected Accelerate = 4350 feet - (14.25% (4350 feet))
Stop Distance = 4350 feet - (620 feet)
= 3730 feet

**Accelerate Go Distance (Figure 5-12)**

1. Enter Figure 5-12 at 7450 pounds weight; engine failure speed is 100 KIAS.
2. Proceed horizontally right from 3000-foot pressure altitude to the vertical columns for 20°C (68°F). The distance required to clear a 50-foot obstacle, after losing an engine at 100 KIAS, is 13,540 feet without wind correction. With a 19-knot headwind component, the distance can be reduced by:

\[
\frac{19 \text{ Knots Headwind}}{10 \text{ Knots Headwind}} = 11.44\%
\]

Corrected Accelerate = 13,540 feet - (11.44% (13,540 feet))
Go Distance = 13,540 feet - (1544 feet)
= 11,996 feet

**NOTE**

- The distance required to accelerate go using the approximation method is so great, in view of the 6000-foot runway available, that a more exact value should be obtained using the interpolation method.
- The interpolation method gives an accelerate go distance of 6025 feet without wind or 5338 feet with 19 knots of headwind.

**Rate-Of-Climb — Maximum Climb (Figure 5-13)**

1. Enter Figure 5-13 at 16°C (61°F).
2. Proceed vertically up to the 2400-foot pressure altitude line.
3. Proceed horizontally right to the reference line. Follow the slope of the adjacent rate-of-climb lines until intersecting the vertical 7100-pound line.
4. Proceed horizontally right to obtain rate-of-climb. (1925 Feet per minute)
5. Enter the climb speed data to determine the climb speed corrected for 7100 pounds and 2400 feet. (108 KIAS)

3 November 1980
Rate-Of-Climb - Cruise Climb (Figure 5-14)

(1) Enter Figure 5-14 at 160°C (61°F).
(2) Proceed vertically up to the 2400-foot pressure altitude line.
(3) Proceed horizontally right to the reference line. Follow the
slope of the adjacent rate-of-climb lines until intersecting the
vertical 7100-pound line.
(4) Proceed horizontally right to obtain rate-of-climb. (1260 Feet
per minute)
(5) Climb speed is 120 KIAS for all conditions.

Rate-Of-Climb - Single Engine (Figure 5-15)

(1) Enter Figure 5-15 at 160°C (61°F).
(2) Proceed vertically up to the 2400-foot pressure altitude line.
(3) Proceed horizontally right to the reference line. Follow the
slope of the adjacent rate-of-climb lines until intersecting the
vertical 7100-pound line.
(4) Proceed horizontally right to obtain rate-of-climb. (335 Feet
Feet per minute)
(5) Enter the climb speed data to determine the climb speed cor-
rected for 7100 pounds and 2400 feet. (109 KIAS)

Time, Fuel And Distance To Climb - Cruise Climb (Figure 5-19)

Time, fuel and distance to climb are determined by finding the dif-
ference between the airport and the cruise conditions; thus, two
calculations are required, one for the airport condition and the
second for the cruise condition.

Airport Condition:
(1) Enter Figure 5-19 at 160°C (61°F).
(2) Proceed vertically up to 2400-foot pressure altitude line.
(3) Proceed horizontally right to the 7100-pound line.
(4) Proceed vertically down to obtain time to climb (2.2 minutes),
fuel to climb (11 pounds) and distance to climb (5 nautical
miles).

Cruise Condition:
(5) Enter Figure 5-19 at -10°C (14°F).
(6) Proceed vertically up to 17,500-foot pressure altitude line.
(7) Proceed horizontally right to the 7100-pound line.
(8) Proceed vertically down to obtain time to climb (17.4 minutes),
fuel to climb (61 pounds) and distance to climb (40 nautical
miles).

Final Calculations:
Time to Climb = Cruise time to climb - Airport time to
climb
= 17.4 minutes - 2.2 minutes
= 15.2 minutes
Fuel to Climb
= Cruise fuel to climb - Airport fuel to climb
  = 81 pounds - 11 Pounds
  = 70 pounds (add 46 pounds for start, taxi and runup) (116 pounds total)

Distance to Climb
= Cruise distance to climb - Airport distance to climb
  = 40 nautical miles - 5 nautical miles
  = 35 nautical miles

Adjusted for wind (use 60% of the wind at altitude for climb wind),
  = 35 nautical miles + wind contribution
  = 35 + [15.2 minutes x 0.6 x 15 knots]
  = 35 nautical miles + 2.3 nautical miles
  = 37.3 nautical miles

Time, Fuel And Distance To Descend (Figure 5-24)

Time, fuel and distance to descend are determined by finding the difference between the cruise and the landing airport conditions; thus two calculations are required, one for the cruise condition and the second for the landing airport condition.

Cruise Condition:
(1) Enter Figure 5-24 at the cruise altitude of 17,500 feet.
(2) Proceed horizontally right to the guideline.
(3) Proceed vertically down to obtain time to descend (16.3 minutes), fuel to descend (92 pounds) and distance to descend (55.5 nautical miles).

Landing Airport Condition:
(4) Enter Figure 5-24 at the airport altitude of 1700 feet.
(5) Proceed horizontally right to the guideline.
(6) Proceed vertically down to obtain time to descend (2.1 minutes), fuel to descend (6 pounds) and distance to descend (6.5 nautical miles).

Final Calculations:
Time to Descend = Cruise time to descend - Airport time to descend
  = 16.3 minutes - 2.1 minutes
  = 14.2 minutes

3 November 1980
Cruise Performance With Recommended Lean Mixture (Figure 5-20)

Maximum recommended cruise can be obtained with 1900 RPM and 32.5 Inches Hg. manifold pressure.

The approximation method for extracting data from the cruise tables is to select the next lower temperature and altitude values, which are generally conservative with respect to fuel economy.

(1) Enter the 15,000-foot data at 1900 RPM and 32.5 Inches Hg. manifold pressure.
(2) Use -15°C (5°F) data for a power of 73.5%, airspeed of 214 KTAS and a total fuel flow of 257 pounds per hour.
(3) Correcting for a weight of 7100 pounds, the airspeed increases to:

\[ 214 \text{ KTAS} + \frac{(7450 \text{ pounds} - 7100 \text{ pounds})}{1000 \text{ pounds}} (6 \text{ KTAS}) = 214 \text{ KTAS} + 2.1 \text{ KTAS} = 216 \text{ KTAS} \]

Using the interpolation method, interpolating altitude, temperature and weight, the actual performance is 71.2% power, 221 KTAS and total fuel flow of 250 pounds per hour.

In the above calculations, for convenience, the weight was assumed to be equal to the takeoff weight of 7100 pounds. More realistic data can be determined if the average cruise weight is used. This average cruise weight is determined as follows:
Cruise Fuel

\[
\text{Cruise Fuel} = \frac{\text{Total distance climb distance descent distance}}{\text{True airspeed + wind correction}} \times [\text{Total fuel flow per hour}]
\]

\[
\begin{align*}
600 & \text{ Nautical Miles} \\
37.3 & \text{ Nautical Miles} \\
50.4 & \text{ Nautical Miles}
\end{align*}
\]

\[
= \frac{600 + 37.3 + 50.4}{221 \text{ KTAS} + 15 \text{ knot tailwind}} \times 250 \text{ pounds per hour}
\]

\[
= \frac{512.3 \text{ Nautical miles}}{238} \times 250 \text{ pounds per hour}
\]

\[
= 543 \text{ pounds}
\]

Average Cruise Weight

\[
\begin{align*}
\text{Average Cruise Weight} & = \text{Takeoff weight} - \text{start, taxi and climb fuel} - \frac{\text{Cruise Fuel}}{2} \\
& = 7100 \text{ pounds} - 116 \text{ pounds} - 543 \text{ pounds}
\end{align*}
\]

\[
= 6713 \text{ pounds}
\]

Average Cruise Speed

\[
\begin{align*}
\text{Average Cruise Speed} & = 221 \text{ KTAS} + 6 \left( \frac{387}{1000} \right) \\
& = 223 \text{ KTAS}
\end{align*}
\]

Average Ground Speed

\[
\begin{align*}
\text{Average Ground Speed} & = 223 \text{ KTAS} + 15 \text{ knots} \\
& = 238 \text{ knots}
\end{align*}
\]

Distance During Cruise

\[
\begin{align*}
\text{Distance During Cruise} & = \text{Total distance - Climb distance - Descent distance} \\
& = 600 - 37.3 - 50.4
\end{align*}
\]

\[
= 512.3 \text{ Nautical Miles}
\]

Time During Cruise

\[
\begin{align*}
\text{Time During Cruise} & = \frac{\text{Cruise distance}}{\text{ground speed}} \\
& = \frac{512.3}{238}
\end{align*}
\]

\[
= 2.17 \text{ hours}
\]

Normal Landing Distance (Figure 5-25)

\[
\text{Landing Weight} = \text{Takeoff weight - climb fuel - cruise fuel - descent fuel}
\]

\[
= 7100 \text{ pounds} - 116 \text{ pounds} - 543 \text{ pounds} - 46 \text{ pounds}
\]

\[
= 6395 \text{ pounds}
\]

3 November 1980
Wind = 210° at 17 knots. Determine headwind component from Figure 5-9. (16 knots headwind)

Enter Figure 5-25 at 6600 pounds; the approach speed is 96 KIAS. Proceed horizontally right from 2000-foot pressure altitude to the vertical column for 10°C (50°F). The landing distance ground roll is 630 feet and the total distance required to clear a 50-foot obstacle is 2210 feet without wind correction. With a 16-knot headwind component, the corrected ground roll distance is 554 feet and the corrected total distance required is 1945 feet.

16 Knots Headwind
4 Knots Headwind

Corrected Landing = 630 feet - [12% (630)]
Ground Roll = 630 feet - 76 feet
= 554 feet

Corrected Total Distance Required = 2210 - [12% (2210)]
= 2210 feet - 265 feet
= 1945 feet

Rate-Of-Climb — Balked Landing Climb (Figure 5-16)

(1) Enter Figure 5-16 at 7°C (45°F).
(2) Proceed vertically up to the 1700-foot pressure altitude line.
(3) Proceed horizontally right to the weight reference line. Follow the guidelines up to the right until intersecting the vertical 6395-pound weight line.
(4) Proceed horizontally right to determine the rate-of-climb. (1490 Feet per minute)

Total Fuel Required = Start, taxi and climb fuel + cruise fuel + descent fuel
= 116 pounds + 543 pounds + 46 pounds = 705 pounds (Without Holding Fuel)
or 705 pounds + 125 pounds = 830 pounds (With 45 Minutes Holding Fuel)

Holding Time (Figure 5-23)

To determine holding time, the fuel available for holding must be determined.

Fuel Available for Holding = Initial fuel - (start, taxi and climb fuel + cruise fuel + descent fuel)
= 1236 pounds - (116 pounds + 543 pounds + 46 pounds)
= 531 pounds

(1) Enter Figure 5-23 at 531 pounds of fuel available.
(2) Proceed vertically up to the intersection with the guideline.
(3) Proceed horizontally left to obtain holding time available. (3.2 hours)
NOTE:
1. Indicated airspeed assumes zero instrument error.
2. The following calibrations are not valid in the preshock buffet.
3. The following calibrations are valid for the pilot's and copilot's airspeed indicators when the standard or optional dual static system is installed.

<table>
<thead>
<tr>
<th>Gear Up Flaps 0°</th>
<th>Gear Down Flaps 15°</th>
<th>Gear Down Flaps 45°</th>
</tr>
</thead>
<tbody>
<tr>
<td>KIAS</td>
<td>KCAS</td>
<td>KIAS</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>70</td>
</tr>
<tr>
<td>80</td>
<td>82</td>
<td>82</td>
</tr>
<tr>
<td>90</td>
<td>91</td>
<td>92</td>
</tr>
<tr>
<td>100</td>
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</tr>
<tr>
<td>110</td>
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<tr>
<td>120</td>
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<td>120</td>
</tr>
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<td>130</td>
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</tr>
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<td>140</td>
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<td>170</td>
<td>170</td>
</tr>
<tr>
<td>180</td>
<td>180</td>
<td>180</td>
</tr>
</tbody>
</table>

*Recommended Minimum All Engines Approach Speed At 7200 Pounds With 45° Wing Flaps.

Figure 5-1

3 November 1980
NOTE:
1. Indicated airspeed assumes zero instrument error.
2. The following calibrations are not valid in the prestall buffet.
3. The following calibrations are valid for pilot's and copilot's airspeed indicators when the standard static system is installed.
4. An alternate static source is not available for copilot's instruments when optional dual static system is installed.

<table>
<thead>
<tr>
<th>Gear Up Flaps 0°</th>
<th>Gear Down Flaps 15°</th>
<th>Gear Down Flaps 45°</th>
</tr>
</thead>
<tbody>
<tr>
<td>KIAS</td>
<td>KIAS</td>
<td>KIAS</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>70</td>
</tr>
<tr>
<td>80</td>
<td>89</td>
<td>80</td>
</tr>
<tr>
<td>90</td>
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<td>90</td>
</tr>
<tr>
<td>100</td>
<td>108</td>
<td>100</td>
</tr>
<tr>
<td>110</td>
<td>117</td>
<td>110</td>
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<tr>
<td>120</td>
<td>126</td>
<td>120</td>
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<td>140</td>
<td>144</td>
<td>130</td>
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<td>160</td>
<td>163</td>
<td>140</td>
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<tr>
<td>180</td>
<td>181</td>
<td>150</td>
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<td>200</td>
<td>199</td>
<td>160</td>
</tr>
<tr>
<td>220</td>
<td>218</td>
<td>180</td>
</tr>
<tr>
<td>240</td>
<td>236</td>
<td>---</td>
</tr>
</tbody>
</table>

*Recommended Minimum All Engines Approach Speed At 7200 Pounds With 45° Wing Flaps.

Figure 5-2

5-14 3 November 1980
NOTE:
1. Add correction to indicated altimeter reading.
2. The following calibrations are valid for the pilot's and copilot's altimeters when the standard or optional dual static system is installed.

<table>
<thead>
<tr>
<th>Altitude</th>
<th>Sea Level</th>
<th>10,000 Feet</th>
<th>20,000 Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gear</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Up  Down  Down</td>
<td>Up  Down  Down</td>
<td>Up  Down  Down</td>
</tr>
<tr>
<td>Flaps</td>
<td>0°  15°  45°</td>
<td>0°  15°  45°</td>
<td>0°  15°  45°</td>
</tr>
<tr>
<td>KIAS</td>
<td>Feet Feet Feet</td>
<td>Feet Feet Feet</td>
<td>Feet Feet Feet</td>
</tr>
<tr>
<td>80</td>
<td>14  16   6</td>
<td>19  22    9</td>
<td>27  31   12</td>
</tr>
<tr>
<td>90</td>
<td>10  10   7</td>
<td>13  14    10</td>
<td>18  20   14</td>
</tr>
<tr>
<td>100 *</td>
<td>9   9    0</td>
<td>12  12    0</td>
<td>17  17   0</td>
</tr>
<tr>
<td>120</td>
<td>-3   -6  0</td>
<td>-4   0    -9</td>
<td>-6   0   -12</td>
</tr>
<tr>
<td>180</td>
<td>-20   --- -27</td>
<td>---   --- -37   --- ---</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>-33   --- -45</td>
<td>---   --- -63   --- ---</td>
<td></td>
</tr>
<tr>
<td>220</td>
<td>-39   --- -53</td>
<td>---   --- -73   --- ---</td>
<td></td>
</tr>
<tr>
<td>240</td>
<td>-43   --- -58</td>
<td>---   --- -80   --- ---</td>
<td></td>
</tr>
</tbody>
</table>

*Recommended Minimum All Engines Approach Speed At 7200 Pounds With 45° Wing Flaps.

**ALTIMETER CORRECTION PROCEDURE**

\[
\begin{bmatrix}
\text{INDICATED ALTITUDE} \\
\text{TO FLY}
\end{bmatrix} = \begin{bmatrix}
\text{DESIRED ALTITUDE} \\
\text{MSL}
\end{bmatrix} - \begin{bmatrix}
\text{ALTIMETER} \\
\text{CORRECTION}
\end{bmatrix}
\]

Figure 5-3

3 November 1980

5-1
# Altimeter Correction Alternate Static Source

**NOTE:**

1. Add correction to indicated altimeter reading.

2. The following calibrations are valid for pilot's and copilot's altimeters when the standard static system is installed.

3. An alternate static source is not available for copilot's instruments when the optional dual static system is installed.

<table>
<thead>
<tr>
<th>Altitude</th>
<th>Sea Level</th>
<th>10,000 Feet</th>
<th>20,000 Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gear</td>
<td>Up</td>
<td>Down</td>
<td>Up</td>
</tr>
<tr>
<td>Flaps</td>
<td>0° 15° 45°</td>
<td>0° 15° 45°</td>
<td>0° 15° 45°</td>
</tr>
<tr>
<td>KIAS</td>
<td>Feet</td>
<td>Feet</td>
<td>Feet</td>
</tr>
<tr>
<td></td>
<td>80</td>
<td>64</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>66</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>100 *</td>
<td>68</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>120</td>
<td>63</td>
<td>-11</td>
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<tr>
<td></td>
<td>140</td>
<td>51</td>
<td>-48</td>
</tr>
<tr>
<td></td>
<td>160</td>
<td>36</td>
<td>-102</td>
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<td>12</td>
<td>-174</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>-13</td>
<td>-----</td>
</tr>
<tr>
<td></td>
<td>220</td>
<td>-51</td>
<td>-----</td>
</tr>
<tr>
<td></td>
<td>240</td>
<td>-90</td>
<td>-----</td>
</tr>
</tbody>
</table>

*Recommended Minimum All Engines Approach Speed At 7200 Pounds With 45° Wing Flaps.*

**Altitude Correction Procedure**

\[
\text{Indicated Altitude To Fly} = \left[ \text{Desired Altitude (MSL)} \right] - \left[ \text{Altimeter Correction} \right]
\]

*Figure 5-4*

---

5-16

3 November 1980
TEMPERATURE RISE DUE TO RAM RECOVERY

RECOVERY FACTOR \((K) = 0.90\)

NOTE:
1. Subtract temperature rise from indicated outside air temperature to obtain true outside air temperature

Figure 5-5
TEMPERATURE CONVERSION FROM FAHRENHEIT TO CELSIUS

Figure 5-6
## STALL SPEEDS

**CONDITIONS:**

Throttles - IDLE

**NOTE:**

1. Maximum altitude lost during a conventional stall is 800 feet.
2. Maximum altitude loss during an engine inoperative stall is 550 feet with a maximum pitch below the horizon of 25°.

<table>
<thead>
<tr>
<th>WEIGHT Pounds</th>
<th>Configuration</th>
<th>ANGLE OF BANK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0°</td>
</tr>
<tr>
<td></td>
<td>Flaps</td>
<td>KIAS</td>
</tr>
<tr>
<td>7450</td>
<td>0° Up</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td>15° Down</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td>45° Down</td>
<td>77</td>
</tr>
<tr>
<td>6800</td>
<td>0° Up</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td>15° Down</td>
<td>78</td>
</tr>
<tr>
<td></td>
<td>45° Down</td>
<td>74</td>
</tr>
<tr>
<td>6200</td>
<td>0° Up</td>
<td>78</td>
</tr>
<tr>
<td></td>
<td>15° Down</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>45° Down</td>
<td>71</td>
</tr>
<tr>
<td>5600</td>
<td>0° Up</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>15° Down</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>45° Down</td>
<td>67</td>
</tr>
</tbody>
</table>

Figure 5-8
Figure 5-9

3 November 1980
### Normal Takeoff Distance

**Conditions:**
1. 2300 RPM and 39.0 Inches Hg. Manifold Pressure before brake release.
2. Mixture - Check fuel flow in the white arc.
3. Wing Flaps - UP.
4. Level, Hard Surface, Dry Runway.

**Notes:**
1. If full power is applied without brakes set, distances apply from point where full power is applied.
2. Decrease distance 7' for each 10 knots headwind.
3. Increase distance 4' for each 2 knots tailwind.

<table>
<thead>
<tr>
<th>WEIGHT/PUNCH</th>
<th>PRESSURE ALTITUDE</th>
<th>TAKEOFF TO 50'-FOOT ROLL</th>
<th>TOTAL DISTANCE TO CLEAR 50 FEET</th>
<th>TAKEOFF TO 50'-FOOT ROLL</th>
<th>TOTAL DISTANCE TO CLEAR 50 FEET</th>
<th>TAKEOFF TO 50'-FOOT ROLL</th>
<th>TOTAL DISTANCE TO CLEAR 50 FEET</th>
<th>TAKEOFF TO 50'-FOOT ROLL</th>
<th>TOTAL DISTANCE TO CLEAR 50 FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea Level</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td>2100</td>
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<td>1900</td>
</tr>
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<td>1610</td>
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<td>1750</td>
<td>1550</td>
<td>1900</td>
<td>1700</td>
<td>2100</td>
<td>1900</td>
</tr>
<tr>
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<td>1700</td>
<td>2100</td>
<td>1900</td>
</tr>
<tr>
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<td>1610</td>
<td>1410</td>
<td>1750</td>
<td>1550</td>
<td>1900</td>
<td>1700</td>
<td>2100</td>
<td>1900</td>
</tr>
</tbody>
</table>

### Figure 5-10 (Sheet 1 of 2)

5-22  
3 November 1980
### Normal Takeoff Distance

**Conditions:**
1. 2036 RPM and 19.6 Inches Hg. Manifold Pressure Before Brake Release.
3. Wing Flaps - UP.
4. Level, Hard Surface, Dry Runway.

**Notes:**
1. If full power is applied without brakes set, distances apply from point where full power is applied.
2. Decrease distance 75% for each 10 knots headwind.
3. Increase distance 4% for each 2 knots tailwind.

<table>
<thead>
<tr>
<th>Weight-Pounds</th>
<th>Takeoff To 50-Foot Obstacle</th>
<th>Pressure Altitude</th>
<th>20°F (68°F)</th>
<th>30°F (87°F)</th>
<th>45°F (113°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Feet</td>
<td>Feet</td>
<td>Roll - To Clear</td>
<td>Roll - To Clear</td>
<td>Roll - To Clear</td>
</tr>
<tr>
<td>Sea Level</td>
<td>1000</td>
<td>1060</td>
<td>2470</td>
<td>2000</td>
<td>2300</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>2000</td>
<td>2530</td>
<td>2110</td>
<td>2440</td>
</tr>
<tr>
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<td></td>
<td>4000</td>
<td>2420</td>
<td>2660</td>
<td>2850</td>
<td>3400</td>
</tr>
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<td>3460</td>
<td>3160</td>
<td>4570</td>
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<td>3380</td>
<td>4080</td>
</tr>
<tr>
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<td>7000</td>
<td>2940</td>
<td>3900</td>
<td>3660</td>
<td>4350</td>
</tr>
<tr>
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<td>3150</td>
<td>4330</td>
<td>3960</td>
<td>4790</td>
</tr>
<tr>
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<td>9000</td>
<td>3370</td>
<td>4710</td>
<td>4350</td>
<td>5290</td>
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<tr>
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<td>10,000</td>
<td>3610</td>
<td>5160</td>
<td>4820</td>
<td>5730</td>
</tr>
</tbody>
</table>

| Sea Level     | 6000                        | 1510              | 1940         | 1680         | 1840         | 2460         |
|               | 1000                        | 1600              | 2060         | 1770         | 1950         | 2630         |
|               | 2000                        | 1700              | 2150         | 1860         | 2140         | 2830         |
|               | 3000                        | 1800              | 2240         | 1950         | 2370         | 3150         |
|               | 4000                        | 1900              | 2340         | 2040         | 2610         | 3480         |
|               | 5000                        | 2000              | 2460         | 2130         | 2840         | 3790         |
|               | 6000                        | 2100              | 2590         | 2270         | 3100         | 4130         |
|               | 7000                        | 2200              | 2720         | 2400         | 3350         | 4420         |
|               | 8000                        | 2300              | 2860         | 2530         | 3580         | 4710         |
|               | 9000                        | 2400              | 3000         | 2650         | 3830         | 4980         |
|               | 10,000                      | 2500              | 3150         | 2770         | 4080         | 5250         |

| Sea Level     | 5000                        | 1180              | 1520         | 1300         | 1690         | 2190         |
|               | 1000                        | 1280              | 1640         | 1410         | 1620         | 2040         |
|               | 2000                        | 1380              | 1740         | 1500         | 1680         | 2170         |
|               | 3000                        | 1480              | 1840         | 1590         | 1760         | 2350         |
|               | 4000                        | 1580              | 1940         | 1690         | 1840         | 2490         |
|               | 5000                        | 1680              | 2080         | 1810         | 2040         | 2790         |
|               | 6000                        | 1770              | 2220         | 1930         | 2120         | 2840         |
|               | 7000                        | 1860              | 2370         | 2060         | 2280         | 3050         |
|               | 8000                        | 1960              | 2530         | 2190         | 2420         | 3250         |
|               | 9000                        | 2100              | 2700         | 2350         | 2610         | 3550         |
|               | 10,000                      | 2200              | 2890         | 2490         | 2790         | 3840         |

| Sea Level     | 1500                        | 920               | 1180         | 1010         | 1110         | 1460         |
|               | 1000                        | 960               | 1360         | 1110         | 1350         | 1610         |
|               | 2000                        | 1040              | 1320         | 1140         | 1320         | 1670         |
|               | 3000                        | 1110              | 1420         | 1240         | 1370         | 1780         |
|               | 4000                        | 1170              | 1500         | 1320         | 1460         | 1890         |
|               | 5000                        | 1260              | 1620         | 1410         | 1560         | 2010         |
|               | 6000                        | 1360              | 1720         | 1500         | 1660         | 2150         |
|               | 7000                        | 1450              | 1830         | 1590         | 1770         | 2290         |
|               | 8000                        | 1550              | 1950         | 1670         | 1890         | 2440         |
|               | 9000                        | 1650              | 2070         | 1750         | 1990         | 2590         |
|               | 10,000                      | 1770              | 2190         | 1830         | 2150         | 2720         |

Figure 5-10 (Sheet 2 of 2)

3 November 1980
## ACCELERATE STOP DISTANCE

**Conditions:**
1. 2235 RPM and 39.0 Inches Hg. Manifold Pressure before Brake Release.
3. Wing Flaps - UP.
4. Level, Hard Surface, Dry Runway.
5. Engine Failure at Engine Failure Speed.

**Note:**
1. If full power is applied without brake set, distances apply from point where full power is applied.
2. Decrease distance 5% for each 4 knots headwind.
3. Increase distance 5% for each 2 knots tailwind.

<table>
<thead>
<tr>
<th>Weight, Pressure, Altitude</th>
<th>7400</th>
<th>6200</th>
<th>5600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea Level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10000</td>
<td>2902</td>
<td>2330</td>
<td>1890</td>
</tr>
<tr>
<td>2000</td>
<td>3130</td>
<td>2560</td>
<td>2180</td>
</tr>
<tr>
<td>3000</td>
<td>3360</td>
<td>2790</td>
<td>2320</td>
</tr>
<tr>
<td>4000</td>
<td>3590</td>
<td>2920</td>
<td>2450</td>
</tr>
<tr>
<td>5000</td>
<td>3820</td>
<td>3050</td>
<td>2580</td>
</tr>
<tr>
<td>6000</td>
<td>3940</td>
<td>3180</td>
<td>2610</td>
</tr>
<tr>
<td>7000</td>
<td>4060</td>
<td>3310</td>
<td>2740</td>
</tr>
<tr>
<td>8000</td>
<td>4180</td>
<td>3440</td>
<td>2870</td>
</tr>
<tr>
<td>9000</td>
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</tr>
<tr>
<td>10,000</td>
<td>4420</td>
<td>3700</td>
<td>3120</td>
</tr>
</tbody>
</table>

**Figure 5-11**

5-24

3 November 1990
### ACCELERATE GO DISTANCE

**CONDITIONS:**
1. 2235 RPM and 39.4 Inches Hg. Manifold Pressure before Brake Release.
3. Wing Flaps - UP.
4. Level Hard Surface Dry Runway.
5. Engine Failure At Engine Failure Speed.

**NOTE:**
1. If full power is applied without brakes set, distances apply from point where full power is applied.
2. Decrease distance 6% for each 10 knots headwind.
3. Increase distance 2% for each 1 knots of tailwind.
4. Distance in boxes represent rates of climb less than 50 ft/min.

<table>
<thead>
<tr>
<th>WEIGHT - SPEED - ALTITUDE</th>
<th>PRESSURE</th>
<th>TOTAL DISTANCE TO CLEAR 50-FOOT OBSTACLE - FEET</th>
</tr>
</thead>
<tbody>
<tr>
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### Figure 5-12

3 November 1980

5-25
RATE-OF-CLIMB - MAXIMUM CLIMB

CONDITIONS:
1. 2235 RPM and 39.0
   Inches Hg. to 20,000
   Feet. Use Placarded
   Manifold Pressure
   Above 20,000 Feet.
2. Landing Gear - UP.
3. Flaps - UP.
4. Mixture at Recom-
   mended Fuel Flow.

Figure 5-13
RATE-OF-CLimb - CRUISE CLimb

CONDITIONS:
1. 1900 RPM and 32.5 inches Hg.
2. Landing Gear - UP.
3. Wing Flaps - UP.
4. Airspeed - 120 KIAS.
ENGINE INOPERATIVE SERVICE CEILING

CONDITIONS:
1. Engine Inoperative Climb Configuration.

NOTE:
1. Engine inoperative service ceiling is the maximum altitude where the airplane has the capability of climbing 50 feet per minute with one engine inoperative and feathered.
2. Increase indicated service ceiling 100 feet for each 0.10 inches Hg. altimeter setting greater than 29.92.
3. Decrease indicated service ceiling 100 feet for each 0.10 inches Hg. altimeter setting less than 29.92.
4. This chart provides performance information to aid in route selection when operating under FAR 135.181 and 91.119 requirements.

Figure 5-17

5-30
3 November 1980
TIME, FUEL AND DISTANCE TO CLimb - MAXIMUM CLimb

CONDITIONS:
1. 2250 RPM and 39.0
   Inch Hg, to 20,000
   Feet. Use Placarded
   Maximum Pressure
   Above 20,000 Feet.
2. Landing Gear - UP.
3. Wing Flaps - 0°.
4. Mixture at Recom-
   mendnd Fuel Flow.

NOTE:
1. Time, fuel and dis-
   tance for the climb
   are determined by
   taking the differ-
   ence between the
   starting altitude and
   initial cruise
   altitude conditions.
2. For total fuel used,
   add 46 pounds for
   start, taxi and
takeoff.
### CRUISE PERFORMANCE WITH RECOMMENDED LEAN MIXTURE

**Note:**
1. At sea level, increase speed by 4 knots for each 1000 pounds below 7400 pounds.
2. At 6000 feet, increase speed by 4 knots for each 1000 pounds below 7400 pounds.
3. Operations at peak EGT are not permitted with power settings within the boxes if the aircraft is not equipped with the option for EGT system.

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**Figure 5-20 (Sheet 1 of 3)**

3 November 1980
### CRUISE PERFORMANCE
WITH RECOMMENDED LEAN MIXTURE

**NOTE:**
1. At 10,000 Feet, increase speed by 5 KIAS for each 1000 pounds below 7400 pounds.
2. At 15,000 Feet, increase speed by 6 KIAS for each 1000 pounds below 7400 pounds.

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<th>TOTAL</th>
<th>PERCENT &lt;br&gt;20°C</th>
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| 15,000 FEET | 100 | 38 | 78.0 | 214 | 73.5 | 214 | 69.9 | 215 |
| 110 | 39 | 74.3 | 200 | 70.0 | 199 | 65.7 | 199 |
| 120 | 39 | 68.0 | 194 | 64.6 | 194 | 60.6 | 195 |
| 130 | 39 | 63.0 | 187 | 59.3 | 187 | 55.5 | 188 |
| 140 | 39 | 57.1 | 180 | 53.1 | 180 | 50.1 | 181 |
| 150 | 39 | 52.5 | 175 | 48.9 | 175 | 46.6 | 176 |
| 160 | 39 | 47.4 | 165 | 44.7 | 165 | 42.0 | 165 |
| 170 | 39 | 42.0 | 155 | 40.2 | 155 | 38.7 | 155 |
| 180 | 38 | 36.7 | 145 | 35.7 | 145 | 34.2 | 145 |
| 190 | 38 | 31.9 | 135 | 30.9 | 135 | 29.4 | 135 |
| 200 | 38 | 27.3 | 125 | 26.3 | 125 | 24.8 | 125 |
| 210 | 38 | 22.8 | 115 | 21.8 | 115 | 20.3 | 115 |
| 220 | 38 | 18.5 | 105 | 17.5 | 105 | 16.0 | 105 |
| 230 | 38 | 14.3 | 95 | 13.3 | 95 | 11.8 | 95 |
| 240 | 38 | 10.2 | 85 | 9.2 | 85 | 7.7 | 85 |
| 250 | 37 | 6.4 | 75 | 5.4 | 75 | 3.9 | 75 |
| 260 | 37 | 2.8 | 60 | 1.8 | 60 | 0.3 | 60 |
| 270 | 37 | 2.0 | 50 | 1.0 | 50 | 0.0 | 50 |
| 280 | 37 | 2.0 | 40 | 1.0 | 40 | 0.0 | 40 |
| 290 | 37 | 2.0 | 30 | 1.0 | 30 | 0.0 | 30 |

**Figure 5-20 (Sheet 2 of 3)**

5-24

3 November 1980
CRUISE PERFORMANCE
WITH RECOMMENDED LEAN MIXTURE

NOTE:
1. At 20,000 Feet, increase speed by 6 KTAS for each 1000 pounds below 7450 pounds.
2. At 35,000 Feet, increase speed by 6 KTAS for each 1000 pounds below 7450 pounds.
3. Operations at peak EGT may be utilized with power settings within the boxes if the aircraft is equipped with the optional EGT system.

<table>
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<th>ALTITUDE</th>
<th>RPM</th>
<th>MP</th>
<th>-45ºC (140ºF)</th>
<th>-25ºC (50ºF)</th>
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Figure 5-20 (Sheet 3 of 3)

3 November 1980
SECTION 5
PERFORMANCE

RANGE PROFILE

CONDITIONS:
1. Takeoff Weight - 7450 Pounds.
2. Cruise Climb to Desired Altitude.
5. Standard Day.

NOTE:
1. Range computations include fuel required for start, taxi, takeoff, climb, cruise, descent and 45 minutes reserve fuel at the particular cruise power.
2. The distances shown are the sum of the distances to climb, cruise and descend.

Figure 5-21

5-36
3 November 1980
CONDITIONS:
1. Takeoff Weight - 7450 Pounds.
2. Cruise Climb to Desired Altitude.

NOTE:
1. Endurance computations include
   fuel required for start, taxi,
   takeoff, climb, cruise, descent
   and 45 minutes reserve fuel at
   the particular cruise power.
2. The endurance shown is the sum
   of the times to climb, cruise
   and descend.

Figure 5-22

3 November 1980
CONDITIONS:
1. 1000 RPM and 23 inches Hg.
   Manifold Pressure (42F Power).
2. Recommended Lean Fuel Flow
   (166 Pounds Per Hour Total).

Figure 5-23
CONDITIONS:
1. Power - 1800 RPM and 23 Inches Hg.
   Manifold Pressure (45% Power).
2. Fuel Flow - RECOMMENDED LEAN
   (Approximately 83.0
   Pounds Per Hour Per
   Engine).
3. Landing Gear - UP.
4. Wing Flaps - UP.
5. Airspeed - 180 KIAS.

Figure 5-24
## Normal Landing Distance

**Conditions:**
1. Thrusts - Idle at 50 feet above ground level.
2. Landing Gear - DOWN.
3. Wing Flaps - 40°.
4. Touchdown - Full Stall.
5. Level, Hard Surface Runway.

**Note:**
1. If necessary to land with wing flaps up, the approach speed should be increased above the normal approach speed by 12 knots. Expect total landing distance to increase by 35%.
2. Decrease total distances by 3% for each 4 knots headwind. For operations with tailwinds up to 10 knots, increase total distances by 6% for each 3 knots wind.

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<th>Weight Pounds</th>
<th>Pressure Altitude Feet</th>
<th>Total Distance to Clear Obstacles Feets</th>
<th>Ground Roll Feet</th>
<th>Total Distance to Clear Obstacles Feet</th>
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Figure 5-25 (Sheet 1 of 2)

3 November 1980
NORMAL LANDING DISTANCE

CONDITIONS:
1. Throttles - IDLE at 50 feet above ground level.
2. Landing Gear - DOWN.
3. Wing Flaps - 45°.
4. Touchdown - FULL STALL.
5. Level, Hard Surface Runway.

NOTE:
1. If necessary to land with wing flaps UP, the approach speed should be increased above the normal approach speed by 12 knots. Expect total landing distance to increase by 225.
2. Decrease total distances by 3% for each 4 knots headwind. For operations with tailwinds up to 10 knots, increase total distances by 5% for each 3 knots wind.

<p>| PRESSURE | TOTAL DISTANCE | TOTAL DISTANCE | TOTAL DISTANCE |</p>
<table>
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<tr>
<th>OBTACLE FEET</th>
<th>20°C (68°F)</th>
<th>30°C (86°F)</th>
<th>40°C (104°F)</th>
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<td>100</td>
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Figure 5-25 (Sheet 2 of 2)

3 November 1980
SECTION 6
WEIGHT & BALANCE/EQUIPMENT LIST

TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Page</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>6-1</td>
</tr>
<tr>
<td>AIRPLANE WEIGHING PROCEDURES</td>
<td>6-1</td>
</tr>
<tr>
<td>WEIGHT AND BALANCE DETERMINATION FOR FLIGHT</td>
<td>6-4</td>
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INTRODUCTION

Section 6 of this handbook provides procedures for establishing the airplane’s basic empty weight and moment and procedures for determining the weight and balance for flight. This section also describes all items on the Weight and Balance Data sheet which was provided with the airplane (located in the back of this handbook in a plastic envelope) as delivered from Cessna Aircraft Company. An equipment list, provided at the end of this section, provides names and weights of all equipment available for installation on the airplane.

AIRPLANE WEIGHING PROCEDURES

To Establish Basic Empty Weight

The airplane must be weighed in the following configuration.

1. Wing flaps shall be fully retracted and all other control surfaces shall be in neutral.
2. Service engine oil and landing gear hydraulic fluid reservoir as required to obtain a normal full indication.
3. Check landing gear down and parking brake released.
4. Remove all equipment and items not to be included in basic empty weight.
5. Adjust all seats to the normal operating position.
6. Close all baggage doors, main cabin door and emergency exit window.
7. Clean the airplane inside and out.
8. Remove all snow, ice or water which may be on the airplane.
9. Weigh the airplane in a closed hangar to avoid errors caused by air currents.
10. Defuel the airplane in accordance with the following steps.

WARNING

Conduct all defueling operations at a safe distance from other airplanes and buildings. Fire fighting equipment must be readily available. Attach two ground wires from different points on the airplane to separate approved grounding stakes. The use of two ground wires will prevent ungrounding of the airplane due to accidental disconnecting of either wire.

3 November 1980
a. Turn off all electrical power.
b. Turn fuel selectors off.
c. Remove engine cowling.
d. Disconnect inlet fuel supply hose at the inlet side of the engine-driven fuel pump.
e. Connect defueling hose to inlet fuel supply hose.
f. Turn fuel selectors ON and defuel wing until all possible fuel is removed.
g. Drain the remaining fuel through the drain valves into an appropriate container.
   (1) The main tanks are drained by opening the drain valve on the bottom of each tank sump. The main tank fuel lines are drained by removing a fuel sump drain valve located at the wing gap fairings, inboard of the respective engine nacelle. The right and left fuel filters are drained aft of the main spar inboard of each main fuel tank.
   (2) The wing locker fuel tanks are drained by opening a drain valve located on the lower surface of the nacelle aft of each wing locker tank.
   (3) Each drain should remain open until the defueling rate slows to approximately 1 drop per second.
(4) Drain fuel selector valves and fuel crossfeed lines.
h. The fuel remaining on-board after defueling is residual fuel and is included in the basic empty weight.
i. Drainable unusable fuel must be added after the weighing to obtain basic empty weight. Figure 6-1 includes the weight and arms necessary to add the drainable unusable fuel.

11. The airplane must be level when weighed.
   a. For longitudinal leveling, two bolts are located on the right side of the fuselage at stations 214 and 238. Unscrew these two bolts approximately 1/4 inch so a spirit level can be placed on them.
   b. For lateral leveling, use a spirit level on the underside of the fuselage at station 154.0.

12. When weighing on the wheels or jack points with mechanical scales, insure the scales are in calibration and used per the applicable manufacturer's recommendations. When weighing on the wheels, deflate or inflate the gear struts and/or tires until the airplane is level.

--- CAUTION ---

- Keep the airplane level while jacking to prevent the airplane from slipping off the jacks and damaging the airplane.
- Jack pads, provided with the airplane, must be installed in each jack point prior to jacking the airplane.

13. When weighing on the jack points with electronic weighing scales, attach the electronic weighing cells to the proper mounting adapters to prevent slipping.
a. Prepare the electronic weighing kit for use by following the manufacturer's instructions provided with the weighing kit. Adjust all jacks simultaneously until the cells are in contact with the jack points. Continue jacking, keeping the airplane level, until the airplane is supported at the jack points only.

6-2 3 November 1980
Figure 6-1

3 November 1980
14. Determine scale reading, scale drift and tare from all three scales.
15. Lower the airplane and clear the weighing cells as soon as the readings are obtained.
16. Computations (see Figure 6-1).
   a. Enter the scale reading, scale drift and tare from all three scales in the columns in the Airplane As Weighed table. Compute and enter values for the Net Weight and Airplane Total As Weighed columns.
   b. Determine the CG arm of the airplane using the formula presented in Figure 6-1, if the jack points are used for weighing. If the airplane is weighed on the wheels, use the following formula.

\[
CG \text{ Arm of Airplane As } = 171.77 - \frac{125.11 \times W_N}{W_T} \text{ Inches Aft of Datum Weighed}
\]

where \( W_N \) = net weight on nosewheel and \( W_T \) = total net weight on all three wheels.

c. Enter the total Net Weight and CG Arm in the Basic Empty Weight and Center of Gravity Table columns. Multiply the Weight (Lbs) entry times the CG Arm (In) entry to determine Moment (In-Lbs/200) entry. Delete printed weight, arm and moments listed for fuel tank configurations not installed in the airplane. Total each of the three columns to determine basic empty weight, CG arm and moment.

\[\text{NOTE}\]
An attempt should be made to verify the results of each weighing, when data for comparison is available.

d. Enter Basic Empty Weight, CG arm and moment in the Weight and Balance Record, see Figure 6-4.

**WEIGHT AND BALANCE DETERMINATION FOR FLIGHT**

The following is a sample weight and balance determination. For an actual determination for your airplane, refer to the equivalent illustrations on the Weight and Balance Data sheet provided in your airplane.

To compute the weight and balance for your airplane, use Figures 6-2 through 6-4 as follows:

Take the Basic Empty Weight and Moment/100 from the latest entry shown on the Weight and Balance Data sheet or in Figure 6-4 and enter them in Item 1 (Basic Empty Weight) of Figure 6-3. For this sample, assume a weight of 4729 pounds and moment/100 of 7310.

\[\text{NOTE}\]
A blank Weight and Balance Form is provided, for the operator's convenience, at the end of this section.

6-4 3 November 1980
Determine arm, weight and Moment/100 of the crew, passengers, baggage or cargo and cabinet contents from Figure 6-2 and enter them under Payload Computations in Figure 6-3. The crew and passenger loading table is applicable only when the CG of the occupant is at the location specified.

If the seats are in any other position than stated in Figure 6-2, the moment must be computed by multiplying occupant weight times the arm in inches. A point 9 inches forward of the intersection of the seat bottom and seat back with seat cushions compressed can be assumed to be the occupant CG. For a reference in determining the arm, the forward face of the cabin doorway structure is fuselage station 212.87.

See Figure 6-3. Total the Payload Computations items and enter the resulting Weight and Moment/100 in item 2.

See Figure 6-3. Total items 1 (Basic Empty Weight) and 2 (Payload) to determine appropriate entries for item 3 (Zero Fuel Weight).

See Figure 6-3. Item 4 (Fuel Loading) is determined from the applicable columns of Figure 6-2.

Total items 3 and 4 to determine item 5 (Ramp Weight).

See Figure 6-3. Subtract item 6 (Less Fuel For Taxiing) from item 5 (Ramp Weight) to determine item 7 (Takeoff Weight). Enter item 7 in Figure 6-2 to determine if the loading is within allowable limits. If the point falls outside of the envelope, it will be necessary to redistribute the load.

Refer to Section 5 for estimated fuel used during the flight. After determining the fuel used, obtain the appropriate weights and Moment/100 from Figure 6-2. Enter the total of these weights and Moment/100 in item 8 (Less Fuel To Destination).

Item 9 (Landing Weight) is determined by subtracting item 8 from item 7. Enter item 9 in Figure 6-2 to determine if the loading is within allowable limits. If the point falls within the envelope, the loading is approved. If the point falls outside the envelope, it will be necessary to redistribute the load.

WEIGHT AND BALANCE RECORD

The Weight and Balance Record, see Figure 6-4, provides a record to reflect the continuous history of changes in airplane structure and/or equipment which will affect the weight and balance of the airplane.

The Basic Empty Weight of your airplane is entered at the appropriate location on the Weight and Balance Data sheet as delivered from the factory. Changes to the structure or equipment should be entered on the Weight and Balance Record when any modifications are made to the airplane. It is the responsibility of the airplane owner to assure this record is up to date, as all loadings will be based on the latest entry.

3 November 1980
Figure 6-2 (Sheet 1 of 2)

3 November 1980
Figure 6-2 (Sheet 2 of 2)
### SAMPLE WEIGHT AND BALANCE FORM

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<th>WEIGHT</th>
<th>MOMENT/100</th>
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<td>2. PAYLOAD</td>
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<td>3. ZERO FUEL WEIGHT</td>
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<td>zero fuel weight</td>
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<td>of 6733 pounds)</td>
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<td>takeoff weight of 7450</td>
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<tr>
<td>pounds)</td>
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</tr>
</tbody>
</table>

Totals must be within approved weight and C.G. limits. It is the responsibility of the operator to ensure that the airplane is loaded properly. The Basic Empty Weight C.G. is noted on the Airplane Weighing Form. If the airplane has been altered, refer to the Weight and Balance Record for this information.

Figure 6-3

---

6-B

3 November 1980
WEIGHT AND BALANCE RECORD
(CONTINUOUS HISTORY OF CHANGES IN STRUCTURE OR EQUIPMENT
AFFECTING WEIGHT AND BALANCE)

<table>
<thead>
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<th>DATE</th>
<th>ITEM</th>
<th>DESCRIPTION OF ARTICLE OR MODIFICATION</th>
<th>WEIGHT CHANGE</th>
<th>BASIC EMPTY WEIGHT</th>
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<td></td>
<td></td>
<td></td>
<td>ADDED (+)</td>
<td>REMOVED (-)</td>
</tr>
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</table>

Figure 6-4

EQUIPMENT LIST

The following pages of this handbook contain a comprehensive listing of all equipment available from the factory for the airplane. This equipment list is divided into two sections, the first of which (Section A) lists equipment required to be installed. The second section (Section B) lists the remaining standard equipment and all available optional equipment.

NOTE

If additional equipment is to be installed, it must be done in accordance with the reference drawing, accessory or service kit instructions, or a separate FAA approval.

A "Mark If Installed" column has been provided after each item in the equipment list. If desired, the operator may check each appropriate item which is installed in his particular airplane. Columns showing weight in pounds and arm in inches provide the weight and center of gravity location for the equipment.

A customized equipment list, detailing only the equipment installed in your airplane as delivered from the factory, is provided with your airplane papers. This list is presented in the same order and format as the comprehensive listing.

3 November 1980
EQUIPMENT LIST

The following is a complete list of equipment which can be installed in the airplane when delivered by Cessna Aircraft Company. Refer to the equipment list in the airplane for a list of equipment actually installed when delivered by Cessna Aircraft Company.

Datum station 0.0 is 100.0 inches forward of the aft face of the fuselage bulkhead just forward of the rudder pedals.

Positive arms are distances aft of Datum station 0.0.

An asterisk (*) indicates weights are exchange weights.

Installation approval of equipment included in this list is maintained either by the manufacturer's supplementary type certificate with the approval number noted with equipment or in the manufacturer's type design file in accordance with delegation option authorization CE-3.

SECTION A
REQUIRED EQUIPMENT

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<th>FACTORY KIT</th>
<th>ITEM</th>
<th>PART NUMBER</th>
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<tr>
<td>BAY B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CABINET CONTENTS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAYLOAD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. BASIC EMPTY WEIGHT
2. PAYLOAD
3. ZERO FUEL WEIGHT (sub-total) (Do not exceed maximum zero fuel weight of 6733 pounds)
4. FUEL LOADING
   (WING)
   (WING LOCKERS)
5. RAMP WEIGHT (sub-total) (Do not exceed maximum ramp weight of 7500 pounds)
6. LESS FUEL FOR TAXING
7. TAKEDOFF WEIGHT (Do not exceed maximum takeoff weight of 7450 pounds)
8. LESS FUEL TO DESTINATION
   (WING)
   (WING LOCKERS)
9. LANDING WEIGHT (Do not exceed maximum landing weight of 7200 pounds)

Totals must be within approved weight and C.G. limits. It is the responsibility of the operator to insure that the airplane is loaded properly. Basic Empty Weight C.G. is noted on the Airplane Weighing Form. If the airplane has been altered, refer to the Weight and Balance Record for information.

3 November 1980
# SECTION 7
AIRPLANE & SYSTEMS DESCRIPTIONS

## TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>7-3</td>
</tr>
<tr>
<td>AIRFRAME</td>
<td>7-3</td>
</tr>
<tr>
<td>INSTRUMENT PANEL</td>
<td>7-3</td>
</tr>
<tr>
<td>Overhead Console</td>
<td>7-5</td>
</tr>
<tr>
<td>Annunciator Panel</td>
<td>7-5</td>
</tr>
<tr>
<td>FLIGHT CONTROLS SYSTEM</td>
<td>7-7</td>
</tr>
<tr>
<td>Alleron System</td>
<td>7-8</td>
</tr>
<tr>
<td>Elevator System</td>
<td>7-9</td>
</tr>
<tr>
<td>Elevator Trim System</td>
<td>7-10</td>
</tr>
<tr>
<td>Rudder System</td>
<td>7-11</td>
</tr>
<tr>
<td>Rudder Trim System</td>
<td>7-12</td>
</tr>
<tr>
<td>NOSEWHEEL STEERING SYSTEM</td>
<td>7-13</td>
</tr>
<tr>
<td>WING FLAPS SYSTEM</td>
<td>7-14</td>
</tr>
<tr>
<td>LANDING GEAR SYSTEM</td>
<td>7-15</td>
</tr>
<tr>
<td>Landing Gear Hydraulic System</td>
<td>7-17</td>
</tr>
<tr>
<td>Landing Gear Position Lights</td>
<td>7-19</td>
</tr>
<tr>
<td>Landing Gear Warning Horn Extension System</td>
<td>7-20</td>
</tr>
<tr>
<td>Landing Gear Emergency System</td>
<td>7-20</td>
</tr>
<tr>
<td>Landing Gear Shock Struts</td>
<td>7-21</td>
</tr>
<tr>
<td>FUEL SYSTEM</td>
<td>7-21</td>
</tr>
<tr>
<td>Main Tanks</td>
<td>7-21</td>
</tr>
<tr>
<td>Wing Locker Tanks</td>
<td>7-21</td>
</tr>
<tr>
<td>Fuel Selectors</td>
<td>7-21</td>
</tr>
<tr>
<td>Emergency Crossfeed Shutoff Lever</td>
<td>7-23</td>
</tr>
<tr>
<td>Auxiliary Fuel Pump Switches</td>
<td>7-23</td>
</tr>
<tr>
<td>Fuel Drain Valves</td>
<td>7-23</td>
</tr>
<tr>
<td>Electronic Fuel Flow Indicating System</td>
<td>7-24</td>
</tr>
<tr>
<td>Fuel Quantity Gage</td>
<td>7-24</td>
</tr>
<tr>
<td>Fuel Low Level Warning Lights</td>
<td>7-24</td>
</tr>
<tr>
<td>OIL Heated Fuel Manifold Valve Engine-Driven Fuel Pumps</td>
<td>7-24</td>
</tr>
<tr>
<td>BRAKE SYSTEM</td>
<td>7-24</td>
</tr>
<tr>
<td>ELECTRICAL SYSTEM</td>
<td>7-25</td>
</tr>
<tr>
<td>Battery and Alternator Switches</td>
<td>7-25</td>
</tr>
<tr>
<td>Emergency Power Alternator Field Switch</td>
<td>7-25</td>
</tr>
<tr>
<td>Overvoltage Relays Voltmeter Circuit Breakers and Switch Breakers External Power Receptacle</td>
<td>7-28</td>
</tr>
<tr>
<td>LIGHTING SYSTEM</td>
<td>7-29</td>
</tr>
<tr>
<td>External Lighting Internal Lighting</td>
<td>7-30</td>
</tr>
<tr>
<td>PITOT PRESSURE SYSTEM</td>
<td>7-31</td>
</tr>
<tr>
<td>STATIC PRESSURE SYSTEM</td>
<td>7-31</td>
</tr>
<tr>
<td>VACUUM SYSTEM</td>
<td>7-31</td>
</tr>
<tr>
<td>FLIGHT INSTRUMENTS</td>
<td>7-34</td>
</tr>
<tr>
<td>STALL WARNING SYSTEM</td>
<td>7-36</td>
</tr>
<tr>
<td>AVIONICS</td>
<td>7-36</td>
</tr>
<tr>
<td>Avionics Interference</td>
<td>7-36</td>
</tr>
<tr>
<td>Avionics Master Switches</td>
<td>7-36</td>
</tr>
<tr>
<td>ENGINES</td>
<td>7-37</td>
</tr>
<tr>
<td>Engine Controls Engine Oil System Ignition System Fuel Injection System Starting System Engine Instruments Engine Masts</td>
<td>7-37</td>
</tr>
<tr>
<td>Engine Break-In Procedures</td>
<td>7-37</td>
</tr>
<tr>
<td>Turbo-Sysytem</td>
<td>7-37</td>
</tr>
<tr>
<td>CABIN AIR SYSTEM</td>
<td>7-38</td>
</tr>
<tr>
<td>Heating and Defrosting Cabin Heat Switch Breaker Cabin Fan Switch Cabin Air Temperature</td>
<td>7-38</td>
</tr>
<tr>
<td>Control Knob Forward Cabin Air Knob Aft Cabin Air Knob</td>
<td>7-38</td>
</tr>
<tr>
<td>Defrost Knob</td>
<td>7-38</td>
</tr>
<tr>
<td>Heater Overheat Warning Light</td>
<td>7-38</td>
</tr>
<tr>
<td>Heater Operation for Heating and Defrosting Heater Used for</td>
<td>7-38</td>
</tr>
<tr>
<td>Ventilation CABIN PRESSURIZATION SYSTEM Operating Details</td>
<td>7-38</td>
</tr>
<tr>
<td>Standard Pressurization System</td>
<td>7-38</td>
</tr>
</tbody>
</table>

3 November 1980
Revision 1 - 2 Apr 1982
### TABLE OF CONTENTS (CONTINUED)

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optional Pressurization System</td>
<td>7-50</td>
</tr>
<tr>
<td>OXYGEN SYSTEM</td>
<td>7-52</td>
</tr>
<tr>
<td>PASSENGER LOADING</td>
<td>7-56</td>
</tr>
<tr>
<td>BAGGAGE COMPARTMENTS</td>
<td>7-56</td>
</tr>
<tr>
<td>AIRPLANE TIE-DOWN PROVISIONS</td>
<td>7-57</td>
</tr>
<tr>
<td>AND JACK POINTS</td>
<td>7-57</td>
</tr>
<tr>
<td>SEATS, SEAT BELTS AND SHOULDER HARNESSES</td>
<td>7-57</td>
</tr>
<tr>
<td>Pilot and Copilot Provisions</td>
<td>7-57</td>
</tr>
<tr>
<td>Passenger Provisions</td>
<td>7-57</td>
</tr>
<tr>
<td>DOORS, WINDOWS AND EXITS</td>
<td>7-58</td>
</tr>
<tr>
<td>Cabin Door</td>
<td>7-58</td>
</tr>
<tr>
<td>Windows</td>
<td>7-59</td>
</tr>
<tr>
<td>Emergency Exit Window</td>
<td>7-59</td>
</tr>
<tr>
<td>CONTROL LOCKS</td>
<td>7-59</td>
</tr>
<tr>
<td>PROPELLERS</td>
<td>7-59</td>
</tr>
<tr>
<td>PROPELLER SYNCHROPHASER</td>
<td>7-60</td>
</tr>
<tr>
<td>CABIN FEATURES</td>
<td>7-61/7-62</td>
</tr>
</tbody>
</table>
421C

SECTION

AIRPLANE & SYSTEMS DESCRIPTION

INTRODUCTION

Section 7 of this handbook provides a description and operation of the airplane and its systems.

NOTE

Operational procedures for optional systems and equipment are presented in Section 9.

AIRFRAME

The 421 Golden Eagle is a 6- to 8-place, all-metal, low-wing, pressurized airplane. The fuselage and empennage are of semimonocoque construction. The cabin area is sealed and structurally reinforced for pressurization. The wing, horizontal and vertical tail surfaces are of conventional aluminum construction. The wing uses 2 main spars which attach to the carry-thru spars. The retractable landing gear is a tricycle design using air-over-oil shock struts.

The 421 Golden Eagle II and 421 Golden Eagle III are identical to the 421 Golden Eagle except a selection of popular optional equipment has been included as standard equipment.

INSTRUMENT PANEL

The instrument panel, see Figure 7-1, contains the instruments and controls necessary for safe flight. The instrument panel presented is typical, as it contains all standard items and a good selection of popular optional equipment. The function and operation of the instrument panel features not described here have been explained in this section or Section 9 under the applicable system.

3 November 1980
INSTRUMENT PANEL

1. ANNUNCIATOR PANEL
2. FLIGHT INSTRUMENT GROUP
3. FLIGHT DIRECTOR HSI (OPTIONAL)
4. FLIGHT DIRECTOR FDI (OPTIONAL)
5. MARKER BEACON LIGHTS (OPTIONAL)
6. MARKER BEACON TEST SWITCH (OPTIONAL)
7. AVIONICS CONTROL PANEL
8. FLIGHT DIRECTOR MODE SELECTOR (OPTIONAL)
9. ENGINE INSTRUMENT GROUP
10. PROPELLER SYNCHROPHASER SWITCH
11. FUEL FLOW GAGE
12. ECONOMY MIXTURE INDICATOR (OPTIONAL)
13. FUEL QUANTITY GAGE
14. RIGHT FLIGHT INSTRUMENT GROUP (OPTIONAL)
15. PRESSURIZATION AIR TEMPERATURE CONTROLS
16. HEATER AND CABIN AIR CONTROL PANEL
17. FLAP POSITION SWITCH
18. LIGHT DIMMING CONTROLS
19. QUADRANT FRICITION LOCK
20. MIXTURE CONTROLS
21. AUTOPILOT CONTROL HEAD (OPTIONAL)
22. RUDDER TRIM CONTROL
23. PROPELLER CONTROLS
24. AILERON TRIM CONTROL
25. ELEVATOR TRIM CONTROL
26. THROTTLE CONTROLS
27. EMERGENCY LANDING GEAR EXTENSION T-HANDLE
28. LANDING GEAR POSITION INDICATOR LIGHTS
29. LANDING GEAR SWITCH
30. ALTERNATE AIR CONTROLS
31. OXYGEN CONTROL
32. PRESSURIZATION AIR CONTROLS
33. PARKING BRAKE CONTROL
34. OXYGEN CYLINDER PRESSURE GAGE
35. CABIN PRESSURIZATION INDICATORS

Figure 7-1

7-4

3 November 1980
OVERHEAD CONSOLE

The overhead console, see Figure 7-2, includes the avionics speaker an
instrument panel floodlight and aisle courtesy lights with dimming contro
and pilot and copilot overhead directional air vents.

ANNUNCIATOR PANEL

The annunciator panel, see Figure 7-3, is located on the left side
the pilot’s instrument panel. The panel annunciates items of interest
the pilot in the applicable color of red, amber, green or white. No di
ming capability of the annunciator lights is provided.

When a hazardous condition exists, requiring immediate correcti
action, a red warning light will illuminate. When an impending possit
dangerous condition exists, requiring attention but not necessary in
mediate action, an amber light will illuminate. A green or white lig
will illuminate to indicate a safe or normal configuration, condition
performance, operation of essential equipment or to attract attention i
important information for routine action purposes.

A press-to-test button is provided to the left of the annunciator panel
When the button is pressed, all annunciator panel lights, landing ga
position and unlocked lights, propeller synchrophaser light and mor
beacon lights will be tested and should illuminate. If the throttles are
corrected or flaps are extended more than 15 degrees, the gear warning li
will sound when the button is pressed.

3 November 1980
ANNUNCIATOR PANEL

PRESS TO TEST

NOTE
THE NUMBERED ANNUNCIATOR PANEL LIGHTS CORRESPOND TO THE FOLLOWING NUMBERED DESCRIPTIVE TEXT ITEMS.

Figure 7-3

NOTE
A spare light lens is installed in each blank location of the annunciator panel when the optional system is not installed. These lenses can be replaced with the appropriate lens when additional optional equipment is installed.

The following numbered items, see Figure 7-3, describe the applicable system condition when the annunciator light is illuminated.

1. The red low voltage light advises that the airplane bus voltage is less than 28 volts.
2. The amber left alternator out light advises that the left alternator is not generating.
3. The amber cabin altitude light advises that cabin altitude is above 10,000 feet.
4. The amber left hydraulic flow light advises that insufficient flow exists at 1000 propeller RPM or above and that the cause may be a result of pump, lines, filter or bypass valve failure.
5. The amber left main tank fuel low light advises that approximately 60 pounds of fuel remains in the left main tank.
6. The amber left wing locker fuel transferred light indicates transfer of the optional left wing locker fuel to the left main tank is complete.
7. The white spare light is reserved for optional equipment.
8. The green air conditioning hydraulic pressure light advises that the optional air conditioning compressor is in operation.
9. The green electric windshield heater light advises that the heating elements in the optional electric windshield are operating.
10. The green turn-and-bank test light will only illuminate when the press-to-test button is pushed and power is being provided to the turn-and-bank electrical circuit.
11. The white courtesy light advises that the overhead flight deck flood light and main cabin door entry lights are illuminated.
12. The red door warning light advises that the main cabin door is not secured for flight.
13. The amber right alternator out light advises that the right alternator is not generating.
14. The amber hydraulic pressure light advises that hydraulic pressure is being applied to the landing gear retraction and extension system.
15. The amber right hydraulic flow light advises that insufficient flow exists at 1000 propeller RPM or above and that the cause may be a result of pump, lines, filter or bypass valve failure.
16. The amber right main tank fuel low light advises that approximately 60 pounds of fuel remains in the right main tank.
17. The amber right wing locker fuel transferred light indicates transfer of the optional right wing locker fuel to the right main tank is complete.
18. The amber deck course light advises that the optional navigational equipment is programmed for a back course approach.
19. The amber heater overheat light advises that the heater has reached an abnormal temperature and has been automatically deenergized. Once this light illuminates, the heater cannot be operated until resetting of the safety device has been completed.
20. The green surface deice light advises that the optional tail deice boots have reached full inflation pressure.
21. The white intercom light advises that the optional flight deck passenger compartment microphone switch is pressed and communication is possible.
22. The white spare light is reserved for optional equipment.

FLIGHT CONTROLS SYSTEM

The flight controls consist of the ailerons, elevators and rudder and their respective trim systems. All of these surfaces are constructed of aluminum and are statically mass balanced.

3 November 1980
AILERON SYSTEM

Each aileron, see Figure 7-4, is attached to the rear main wing spar at two points. The aileron is actuated by a bellcrank which is attached to a wheel in the wing. The wheel is actuated by cables attached to the pilot's control wheel. When the rudder is actuated, a spring assembly, interconnected to the aileron system, causes the ailerons to automatically assist the turn.

Figure 7-4
AILERON TRIM SYSTEM

AILERON trim, see Figure 7-5, is achieved by a trim tab attached to the left aileron with a full length piano-type hinge. The trim tab is actuated by a push-pull rod which is attached to a jack screw type actuator in the wing. The actuator is driven by cables attached to the trim control knob on the cockpit control pedestal.

AILERON TRIM SYSTEM

Figure 7-5

November 1980
ELEVATOR SYSTEM

The two elevator control surfaces, see Figure 7-6, are connected by a torque tube. The resulting elevator assembly is attached to the rear spar of the horizontal stabilizer at six points. The elevator assembly is actuated by a push-pull rod which is attached to a bell crank in the empennage. The bell crank is actuated by cables attached to the pilot's control wheel.

Figure 7-6
ELEVATOR TRIM SYSTEM

Elevator trim, see Figure 7-7, is achieved by an elevator trim tab attached to the right elevator with a full length piano-type hinge. The trim tab is actuated by a push-pull rod which is attached to a jack screw type actuator in the horizontal stabilizer. The actuator is driven by cables attached to the trim control wheel on the cockpit control pedestal.

Figure 7-7

3 November 1980
RUDDER SYSTEM

The rudder, see Figure 7-8, is attached to the vertical stabilizer rear main spar at three points. The rudder is actuated by a bell crank attached to the bottom of the rudder. The bell crank is actuated by cables attached to the cockpit rudder pedals. When the rudder is actuated, a cable and spring assembly that is connected to the aileron system causes the ailerons to automatically assist the turn.

RUDDER SYSTEM

Figure 7-8
RUDDER TRIM SYSTEM

Rudder trim, see Figure 7-9, is achieved by a trim tab attached to the lower half of the rudder with a full length piano-type hinge. The trim tab is actuated by a push-pull rod which is attached to a jack screw type actuator in the vertical stabilizer. The actuator is driven by cables attached to the rudder trim wheel on the cockpit control pedestal. The rudder trim tab also acts as a servo tab so that aerodynamic forces on the tab will move the rudder to the selected position, which reduces the force required to activate the rudder in flight.

Figure 7-9

3 November 1980
NOSEWHEEL STEERING SYSTEM

The nosewheel steering system, see Figure 7-10, consists of the rudder pedals, nose gear, bungee spring assembly and cables. During ground operation, the nose gear automatically engages the nosewheel steering system, allowing normal directional control.

Figure 7-10
The minimum turning distance is presented in Figure 7-11. Always use a large a radius of turn as is practical. Turning tighter than necessary requires excessive braking on the inboard wheel which decreases the tire life.

NOTE
Minimum turning distance is effected with inboard wheel brake locked, full rudder and differential power.

MINIMUM TURNING DISTANCE

Figure 7-11

WING FLAPS SYSTEM

The wing flaps, see Figure 7-12, are of the split flap design. Each wing flap (two per side) is attached to the rear wing main spar lower surface and is actuated by two push-pull rods attached to bell cranks in the wing. The bell cranks in each wing are ganged together with push-pull rods. Each inboard push-pull rod is attached to a cable which is actuated by an electric motor with reduction gear in the fuselage center section.

The electric flap motor is controlled by the wing flap position switch, see Figure 7-1, in the cockpit. This switch incorporates a preselect

3 November 1980
SECTION 7
AIRPLANE & SYSTEMS DESCRIPTIONS

A feature which allows the pilot to select the amount of flap extension desired. When the 0°, 15°, 30° or 45° position is selected, the flap motor is electrically actuated and drives the flaps toward the selected position. As the flaps move, an intermediate cable feeds position information back to the preselect assembly. When the actual flap position equals the selected position, a microswitch deenergizes the flap motor.

WING FLAPS SYSTEM

Figure 7-12
LANDING GEAR SYSTEM

The retractable tricycle landing gear, see Figure 7-13, is electrically controlled and hydraulically actuated. The individual landing gear actuators incorporate an internal lock to hold the landing gear in the extended position. The landing gear is held in the retracted position by mechanical uplocks that are released hydraulically during gear extension. During ground operation, accidental gear retraction, regardless of gear switch position, is prevented by a safety switch located on the left landing gear shock strut. The weight of the airplane compresses the shock strut, causing the safety switch to open, thus preventing electrical power from reaching the landing gear control valve.

The landing gear doors are mechanically linked to their respective landing gear, retracting and extending with each landing gear. The landing gear is operated by a switch, see Figure 7-16, which is identified by a wheel-shaped knob. The switch positions are UP and DOWN. To operate the landing gear, pull out the landing gear switch and move it to the desired position. This allows electrical power to energize the gear control valve and the hydraulic pressure to drive the landing gear towards the selected position. The hydraulic pressure light, located on the annunciator panel, see Figure 7-3, will remain on until the landing gear is locked into position. The system also incorporates a left and right hydraulic flow light which illuminates at low engine RPM or in the event of a hydraulic pump failure.
HYDRAULIC SYSTEM SCHEMATIC

SECTION 7
AIRPLANE & SYSTEMS DESCRIPTIONS

MODEL 421C

Figure 7-14

7-18
3 November 1980
LANDING GEAR HYDRAULIC SYSTEM

Hydraulic pressure at 1750 psi is supplied on demand by the hydraul pump which is mounted on each engine, see Figure 7-14. The hydraul reservoir, located in the nose baggage compartment, see Figure 7-15, incorporates a sight gage for checking the fluid level while the gear extended. An electrically actuated gear control valve controls the flow hydraulic fluid to the individual gear cylinders. The gear control valve receives power through the landing gear position switch. The landing gear completes the retraction cycle in approximately 4.5 seconds at max engine RPM. The actuation cycle time increases as engine RPM decreases with the loss of an engine-driven hydraulic pump.

HYDRAULIC RESERVOIR SIGHT GAGE AND EMERGENCY BLOW DOWN BOTTLE PRESSURE GAGE

Figure 7-15

LANDING GEAR POSITION LIGHTS

Four landing gear position indicator lights, see Figure 7-16, are contained in two modules located beneath the avionics control panel just of the center of the instrument panel. One module contains three of these lights (one for each gear) which are green and will illuminate when landing gear is fully extended and locked. The other light module is yellow and will illuminate when any or all the gears are unlocked (intermed position). When the gear unlocked light and gear down lights are illuminated, the landing gear is in the UP and locked position.
LANDING GEAR WARNING HORN

The landing gear warning horn is controlled by the throttles and the wing flap position. The warning horn will sound intermittently if either throttle is retarded below approximately 15.0 inches Hg. manifold pressure with the landing gear retracted or if the wing flaps are lowered past the 15° position with the landing gear in any position except extended and locked. The warning horn can be activated by either the wing flap position switch or by throttle position as each function independently of the other. The warning horn is also connected to the UP position of the landing gear position switch and will sound if the switch is placed in the UP position while the airplane is on the ground. The system can be checked by activating the PRESS-TO-TEST button, see Figure 7-3, located near the annunciator panel while retarding one throttle at a time. Also, lowering the wing flaps past the 15° position with the PRESS-TO-TEST button activated will cause the landing gear warning horn to sound.

LANDING GEAR EMERGENCY EXTENSION SYSTEM

The landing gear emergency extension system, see Figure 7-16, consists of a red emergency gear extension T-handle, a blowdown bottle, located in the nose baggage compartment, and associated plumbing. The procedure for emergency gear extension is given in Section 3. Pulling the emergency control releases dry nitrogen under pressure into the shuttle valve, caus-
ing the shuttle valve to move from the hydraulic to air position. The nitrogen then flows into the uplocks which releases the gear to the free-fall position, and then into the landing gear cylinders, which drives the landing gear into the down and locked position.

NOTE

The landing gear cannot be retracted after emergency gear extension until the system has been ground serviced.

LANDING GEAR SHOCK STRUTS

Shock absorption is provided on each gear by an air-over-oil shock strut. This strut is composed of two basic parts: an upper barrel assembly and a lower tube assembly which fits inside the upper barrel assembly. The lower barrel assembly contains an orifice and tapered metering pin which vary the resistance to shock according to severity transmitted to the upper barrel assembly.

FUEL SYSTEM

The fuel system, see Figure 7-17, consists of two main tanks, two optional wing locker tanks, two fuel selectors, emergency crossfeed shut valves and necessary components to complete the system.

MAIN TANKS

The main fuel tanks are an integral portion of the sealed wet wing. These tanks supply their respective engine with fuel for normal operation including takeoffs and landings. An auxiliary fuel pump, located outside the tank, provides fuel pressure for priming during engine start. In the event of an engine fuel pump failure, the auxiliary fuel pump will supply fuel to the engine if the auxiliary fuel pump switches are on. The main tank is vented to the atmosphere by a combination flush vent and a .50-inch diameter drain located on the lower surface of the wing. The flush mourn vent eliminates the need for heated vents. The fuel tanks are serviced through a flush filler located in the top surface of each wing.

WING LOCKER TANKS

An optional wing locker fuel tank is available for installation in the forward portion of each wing locker baggage area. These tanks are bladder type cells which supplement the main tank fuel quantity. This fuel can be fed directly to the engines; instead it is transferred to the main by wing locker fuel transfer pumps. The transfer pumps are manually controlled and should be energized as soon as adequate volume is available in the main tank to hold the wing locker fuel, to assure early recognition of possible failure of transfer. After the fuel is transferred, a pressure switch in each transfer line will sense a drop in pressure and illuminate the annunciator light, indicating fuel transfer is complete and the appropriate wing locker fuel transfer pump should be turned off. These pumps use for lubrication; therefore, operation after fuel transfer will shorten pump life. The wing locker fuel tanks are individually vented through lower surfaces of each wing. The fuel vent lines are deflected by heaters which are controlled by the stall and vent heat switch. These tanks are serviced through a flush filler located on the top of the engine nacelle.

FUEL SELECTORS

Two fuel selectors, one for each engine, are provided on the floor between the pilot and copilot seats. The selectors allow selection of fuel, crossfeed and off.
During normal flight operations, position the left fuel selector to LEFT MAIN and the right fuel selector to RIGHT MAIN. This allows fuel to flow from each main tank, through the fuel selector, to the respective engine-driven fuel pump. Fuel may be crossed from the left main tank to the right engine or from the right main tank to the left engine. Both engines will be supplied with fuel from the right main tank when both fuel selectors are positioned to RIGHT MAIN. Conversely, both engines will be supplied with fuel from the left main tank when both fuel selectors are positioned to LEFT MAIN. The crossfeed function is used for balancing asymmetric fuel loads and supplying the engine-driven fuel pump from the opposite main tank. The LEFT ENG OFF position or RIGHT ENG OFF position (the center button must be depressed as the selector valve is rotated to the off position) on the fuel selectors allows no fuel to flow to the engine-driven fuel pump.

The fuel selector handles form the pointers for the selectors. The ends of the handles are arrow-shaped and point to the position on the selector placard which corresponds to the position of the control valves.

EMERGENCY CROSSFEED SHUTOFF LEVER

A two position emergency crossfeed shutoff lever is located between the fuel selector handles. When the shutoff lever is pulled up, crossfeeding of main tank fuel and heater operation is stopped. This lever is for emergency crossfeed control only, since its function is to isolate the fuel crossfeed lines from the fuel tanks in the event of a nacelle, wing or center section fire or a wheels up landing.

AUXILIARY FUEL PUMP SWITCHES

A 3-position auxiliary fuel pump switch, see Figure 7-19, is provided for each main fuel tank pump providing 5.5 PSI pressure for vapor clearing and purging. In the LOW position, the auxiliary fuel pumps operate at 100 pressure. The ON position runs the auxiliary fuel pumps at low pressure, as long as the engine-driven pumps are functioning. With an engine-driven pump failure and the switch in the ON position, the auxiliary pump on the side will switch to high pressure automatically, providing sufficient fuel for all partial-power engine operations.

FUEL DRAIN VALVES

Fuel quick-drain valves are provided for each fuel tank, fuel filter crossfeed line. In addition, a quick-drain is provided in each wing fuel transfer line. The drains provide a location for removing moisture and sediment from the fuel system. The drains are located on the lower surface of the wing nacelle, and main tanks and are actuated by depressing the lower portion of the valve. A special screwdriver is provided with airplane which allows a 2-ounce sample to be drained and inspected with no fuel spillage.
SECTION 7
AIRPLANE & SYSTEMS DESCRIPTIONS

ELECTRONIC FUEL FLOW INDICATING SYSTEM

The electronic fuel flow indicating system consists of a dual needle indicator and a fuel flow transducer for each engine. The flow transducer generates electrical pulses, which represent a measure of fuel flow rate, and transmits these pulses to the indicator as input frequency. The indicator then converts the frequency signals into an analog output which is displayed by the indicator as fuel flow rate in pounds per hour. These gage markings are predicated on the use of 100 grade aviation fuel. Increase fuel flow 2% above markings when 100LL grade aviation fuel is used.

The indicator has takeoff, climb and cruise markings for various percentages of power. The takeoff range (white arc) presents the desired fuel flow (full rich schedule for proper engine cooling) for full power (2235 RPM and 39.0 Inches Hg manifold pressure) operation and all conditions up to 18,000 feet altitude. The climb range (blue arc) presents the desired fuel flow for maximum power above 18,000 feet, which corresponds to the manifold pressure schedule, with an enriched mixture for higher power settings to allow proper engine cooling during climb conditions. The cruise range presents the desired fuel flow for recommended lean mixture at the specified percent power.

FUEL QUANTITY GAGE

The dual indicating fuel quantity gage, see Figure 7-1, is calibrated in pounds and will accurately indicate the weight of fuel contained in the tanks regardless of whether 100 grade aviation or 100LL grade aviation fuel is used; however, fuel density varies with temperature, therefore, a full tank will weigh more on a cold day than on a warm day. This will be reflected by the weight shown on the gage. A gallons scale is provided in blue on the indicator for convenience in allowing the pilot to determine the approximate volume of fuel on board. The volume markings are predicated on the use of 100 aviation grade fuel. Reduce the indicated gallonage reading by 4% when 100LL grade aviation fuel is being used.

FUEL LOW LEVEL WARNING LIGHTS

The optional fuel low level warning lights, see Figure 7-3, provide a warning when the left and/or right main tanks contain approximately 60 pounds of fuel. The warning is provided by the L FUEL LOW and R FUEL LOW lights located on the annunciator panel. These lights are actuated by a float switch located in each main fuel tank. Each light operates independently from the fuel quantity indicating system.

OIL HEATED FUEL MANIFOLD VALVE

The fuel manifold valves are heated with engine oil to minimize the possibility of engine power loss induced by ice formation in the valve cavity. The manifold valve, located on the top of the engine case aft of the prop gear housing, regulates metered fuel distribution to the injector nozzles.

ENGINE-DRIVEN FUEL PUMPS

Each engine is equipped with a mechanically driven dual stage fuel pump which provides fuel to the metering unit. Should these pumps fail, the main tank auxiliary pumps can provide sufficient fuel flow for all partial-power engine operations. These auxiliary pumps, however, operate at a fixed pressure, consequently the mixture must be leaned when operating at a low power setting to prevent flooding in the engines. Conversely, if an
engine-driven pump failure should occur during high power operation, ade-
quate fuel flow may not be available to insure rated power and adequate
engine cooling. The dual stage engine driven pump minimizes any effects of
fuel vaporization during operations with the auxiliary boost pumps off.
Excess fuel return to the main tanks is provided by the metering unit.

BRAKE SYSTEM

The airplane is provided with an independent hydraulically actuated
brake system for each main wheel. A hydraulic master cylinder is attached
to each pilot’s rudder pedal. Hydraulic lines and hoses are routed from
each master cylinder to the wheel cylinder on each brake assembly. No
manual adjustment is necessary on these brakes. The brakes can be operated
from either pilot’s or copilot’s pedals. The parking brake system consists
of a manually operated handle assembly, see Figure 7-1, connected to the
parking brake valves located in each main brake line. When pressure is
applied to the brake system and the parking brake handle is pulled,
the valve holds pressure on the brake assemblies until released. To release
the parking brakes, push the parking brake handle in. It is not necessary
to depress the rudder pedals when releasing the parking brake.

ELECTRICAL SYSTEM

Electrical energy, see Figure 7-18, is supplied by a 28-volt, negative-
ground, direct current system powered by an alternator on each engine. The
electrical system has independent circuits for each side with each alter-
nator having its own regulator and overvoltage protection relay. The
voltage regulators are connected to provide proper load sharing. A 24-volt
battery is located in the left stub wing. Immediate detection of low
system voltage is provided by a LOW VOLT light on the annunciator panel,
see Figure 7-3. The light will illuminate when the airplane bus voltage
decreases below approximately 25 volts.

NOTE

Insure all circuit breakers are engaged and service-
able fuses are installed before all flights. Never
operate with any blown fuses or disengaged circuit
breakers without a thorough knowledge of the conse-
quences.

BATTERY AND ALTERNATOR SWITCHES

Separate battery and alternator switches, see Figure 7-19, are provided
as a means of checking for a malfunctioning alternator circuit and to
permit such a circuit to be turned off. If an alternator circuit fails or
malfunctions, or when one engine is not running, the switch for that alter-
nator should be turned off. Operation should be continued on the func-
tioning alternator, using only necessary electrical equipment. If both
alternator circuits should malfunction, equipment can be operated at short
intervals on the battery alone. In either case a landing should be made as
soon as practical to check and repair the circuits.

EMERGENCY POWER ALTERNATOR FIELD SWITCH

An emergency power alternator field switch, see Figure 7-19, is located
on the aft top side of the side console. The switch is used when the
alternators will not self-excite. Placing the switch in the ON positio
provides excitation from the battery even though the battery is considere
to have failed.

3 November 1980
Revision 1 - 2 Apr 1962
LEFT AND RIGHT SIDE CONSOLES

- Magneto Switches
- Starter Switches
- Primer Switch
- Auxiliary Fuel Pump Switches
- Voltmeter
- Voltmeter Selector Switch
- Systems Switch and Circuit Breakers
- Emergency Power Alternator Field Switch
- Emergency Power Avionics Bus Switch
- Alternator Circuit Breakers
- Alternator Field Fuses

Figure 7-19

3 November 1980
SECTION 7
AIRPLANE & SYSTEMS DESCRIPTIONS

OVERVOLTAGE RELAYS

Two overvoltage relays in the electrical system constantly monitor their respective alternator output. Should an alternator exceed the normal operating voltage, the overvoltage relay will trip, taking the affected alternator off the line. The overvoltage relay can be reset by cycling the applicable alternator switch.

VOLTAMMETER

A voltmeter, see Figure 7-19, located on the left side console is provided to monitor alternator current output, battery charge or discharge rate and bus voltage. A selector switch, see Figure 7-19, labeled L ALT, R ALT, BATT, and VOLTS is located to the left of the voltmeter. By positioning the switch to L ALT, R ALT, or BATT position, the respective alternator or battery amperage can be monitored. By positioning the switch to the VOLTS position, the electrical system bus voltage can be monitored.

CIRCUIT BREAKERS AND SWITCH BREAKERS

All electrical systems in the airplane are protected by push-to-reset type circuit breakers or switch breakers, see Figure 7-19. Should an overload occur in any circuit, the resulting heat rise will cause the controlling circuit breaker to "pop" out, opening the circuit or allowing the switch breaker to return to the OFF position. After allowing to cool for approximately three minutes, the circuit breaker may be pushed in (until a click is heard or felt) or the switch breaker may be returned to the ON position to reenergize the circuit. However, the circuit breaker should not be held in nor the switch breaker forced to remain in the ON position if it opens the circuit a second time as this indicates a short circuit.

EXTERNAL POWER RECEPTACLE

An optional external power receptacle may be installed in the left wing aft nacelle fairing. The receptacle accepts a standard external power source plug. The following precautions must be observed when starting an airplane using an external power source:

1. Avionics Master Switch - OFF.
2. Battery Switch - ON (The battery will tend to absorb transients that are present in some external power sources).
3. Alternator Switches - OFF.
4. Airplane Voltmeter - READ battery voltage.

**NOTE**

Set External Power Source Output Voltage to 28 volts.

5. External Power Source - TURN OFF before connecting to airplane.
6. External Power Source - ATTACH and TURN ON.
7. Airplane Voltmeter - READ VOLTAGE. (If external power source is properly connected, the reading will be greater than when reading battery voltage only.)

3 November 1980
Revision 1 - 2 Apr 1982
LIGHTING SYSTEM

EXTERNAL LIGHTING

The airplane is equipped with four navigation lights, two retractable landing lights (right light is optional), an optional taxi light, two anti-collision lights, two optional wing deice lights and two optional vertical tail floodlights.

Navigation Lights

The navigation lights are located in the tailcone stinger and in each wing tip assembly. These lights are energized with the navigation light switch breaker on the side console, see Figure 7-19. Proper operation can be checked by observing reflections on the ground below the tail light from objects surrounding the airplane.

Landing Lights

The retractable landing lights (right light is optional) are located at the lower surface of the wing tips. These lights are extended, retract and illuminated by the landing light switch breaker on the side console, see Figure 7-19. With the switch positioned to LDG, the landing light will extend and illuminate. In the off (center) position, the lights will remain extended but will not illuminate. In the RETRACT position, the lights will retract flush with the respective wing tip.

Taxi Lights

The optional taxi light, attached to the nose gear, provides adequate illumination for night taxiing. The taxi light is controlled by the taxi light switch breaker on the side console, see Figure 7-19.

Anti-Collision Lights

The anti-collision lights, with individual power supplies, are located in the wing tips. These lights are actuated by the anti-collision light switch breaker on the side console, see Figure 7-19.

NOTE

Do not operate the anti-collision lights in conditions of fog, clouds or haze as the reflection of the light beam can cause disorientation or vertigo.

Wing Deice Lights

The optional wing deice lights are installed in the outboard side of each engine nacelle and illuminate the outboard wing leading edge dihedral. The lights allow the pilot to check for ice accumulation on wing leading edges. The lights are actuated by the deice light switch breaker on the side console, see Figure 7-19.

All exterior lighting should be checked for proper operation before flight. Cockpit recognition of operational exterior lighting can be determined by looking for ground illumination or reflections on the glass from the various lights.

3 November 1980
INTERNAL LIGHTING

The airplane is equipped with lighting for baggage areas, cabin doorway, cockpit controls and indicators, cockpit illumination and cabin illumination.

Optional baggage area lights are provided for both wing lockers and the nose baggage areas. The lights are actuated when the applicable baggage door is opened and extinguish when the door is closed.

The cabin doorway and instrument panel floodlight provides adequate illumination for night boarding. These lights are controlled by a switch immediately inside the cabin doorway, see Figure 7-21, or by a switch on the instrument panel, see Figure 7-1. An optional timer is available which will automatically extinguish the cabin doorway and instrument panel floodlights 15 minutes after leaving the airplane if the lights were not switched off. The system operation is as follows:

1. The cabin doorway and instrument panel floodlights can be actuated by either of the two switches described above. Any time the lights come on, the timer begins to count down for 15 minutes.
2. With the cabin door closed, the lights will operate in a normal fashion (i.e., lights out, movement of either switch turns lights on; lights on, movement of either switch turns lights off), unless the timer has extinguished the lights, thus requiring cycling of either switch to turn the lights on again.

COCKPIT LIGHTING AND CONTROLS

![Diagram of cockpit lighting and controls]

Figure 7-20
3. Opening the door will turn the lights on unless the timer extinguished the lights, in which case, one movement of the door switch is also required in order to turn the lights on.

4. With the cabin door open, the lights will always be on unless the timer has turned them off. Movement of the door switch is required to reset the lights to on for an additional 15 minutes.

5. Closing the door will extinguish the lights only if the system was switched off. If the system is on, the timer must continue to run down to extinguish the lights.

Cockpit lighting is provided by the instrument panel floodlight, instrument postlights and overhead map lights. All cockpit lights are variable intensity and are controlled by rheostats on the top of the control pedestal and pilot's control wheel, see Figure 7-20.

NOTE

The master panel lighting switch must be positioned to DAY during daylight operations to assure maximum illumination of the annunciator panel lights.

Individual reading lights and controls, see Figure 7-21, are provided in the cabin for each passenger seat.

CABIN LIGHTING AND CONTROLS

![Diagram of cabin lighting and controls]

Figure 7-21

3 November 1980
PITOT PRESSURE SYSTEM

The standard pitot pressure system, see Figure 7-22, consists of an electrically heated pitot tube mounted on the left side at the bottom of the fuselage nose, suitable plumbing and an airspeed indicator.

When the pitot heat switch is placed in the ON position, the heating elements in the pitot tube are electrically heated to maintain proper operation of the system during icing conditions. Do not operate for prolonged periods while on the ground to prevent overheating of the heating elements.

When the optional copilot's instruments are installed, a second pitot system is used. This second pitot head is located on the right side at the bottom of the fuselage nose and is connected to the copilot's airspeed indicator. This dual system allows a completely independent second presentation of airspeed pitot pressure. Pitot heat for the additional head is controlled by an additional pitot heat switch located adjacent to the standard pitot heat switch.

STATIC PRESSURE SYSTEM

Static pressure for the pilot's airspeed, altimeter and rate-of-climb indicators, see Figure 7-22, is obtained by a normal external static source or an alternate internal static source should the external source fail.

A static source selector, installed in the static system directly below the parking brake handle, allows selection of the normal or alternate static source. When the selector is positioned to NORMAL, the pilot's instruments reference the static source located aft of the main cabin door. When the selector is positioned to ALTERNATE, the pilot's instruments reference the alternate static source in the nose compartment. Refer to Section 5 for airspeed and altimeter corrections when the static source selector is positioned to ALTERNATE. A drain valve is located behind the map pocket on the copilot's side.

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**CAUTION**

Do not open the drain valve while the cabin is pressurized as flight instrument damage will result.

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When the optional copilot's instruments are installed, a second set of static ports are installed aft of the main cabin door below the standard static ports. The added static ports are manifolded together and are used as a reference for the copilot's instruments only. This dual system allows a completely independent second static pressure source. No alternate static source is provided for the copilot's instruments. Optional static port heaters are controlled by the stall and vent heat switch.

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7-32

3 November 1980
PITOT STATIC SYSTEM SCHEMATIC

- PITOT HEAD
- AIRSPEED
- ALTIMETER
- ALTERNATE STATIC SOURCE
- RATE-OF-CLIMB
- CABIN DIFFERENTIAL PRESSURE INDICATOR
- STATIC SOURCE SELECTOR
- STATIC SYSTEM DRAIN VALVE
- NORMAL STATIC SOURCE

CODE
- PILOT'S PITOT SYSTEM
- PILOT'S STATIC SYSTEM
- COPILOT'S PITOT SYSTEM (OPTIONAL)
- COPILOT'S STATIC SYSTEM (OPTIONAL)

Figure 7-22

3 November 1980
SECTION 7
AIRPLANE & SYSTEMS DESCRIPTIONS

VACUUM SYSTEM

A vacuum system, see Figure 7-23, is installed to provide a source of vacuum for the vacuum instruments. The system consists of an engine-driven vacuum pump on each engine, pressure relief valve for each pump, a common vacuum manifold, vacuum air filter, suction gage and gyro instruments.

Each vacuum pump pulls a vacuum on the common manifold, exhausting the air overboard. The maximum amount of vacuum pulled on the manifold by each vacuum pump is controlled to a preset level by each pressure relief valve. Should either of the pumps fail, a check valve is provided in each end of the manifold to isolate the inoperative vacuum pump from the system.

The exhaust air side of each attitude gyro is connected to the vacuum manifold thus providing a smooth steady vacuum for the gyroes. The vacuum pressure being applied to the gyroes is constantly presented on the suction gage. This gage also provides failure indicators for the left and right vacuum pumps. These indicators are small red buttons located in the lower portion of the suction gage which are spring-loaded to the extended (failed) position. When normal vacuum is applied in the manifold, the failure buttons are pulled flush with the gage face. Should insufficient vacuum occur on either side, the respective red button will extend. No corrective action is required by the pilot, as the system will automatically isolate the failed vacuum source, allowing normal operation on the remaining operative vacuum pump.

The inlet air side of the attitude gyroes are connected to a common vacuum air filter which cleans the ambient nose compartment air before allowing it to enter the gyroes.

FLIGHT INSTRUMENTS

The basic flight instruments, see Figure 7-1, consist of airspeed, altimeter and rate-of-climb indicators, electric turn-and-bank and vacuum horizon and directional gyroes.

Operation of the airspeed, altimeter and rate-of-climb indicators can be determined by cross-checking the copilot's instruments, if installed. Also, when a climb or descent is initiated, these instruments should indicate the appropriate change. If no change is indicated, it is reasonable to assume static source blockage has occurred and the alternate static source should be selected. If the possibility of static source icing is present, actuation of the stall and vent heat switch might delce the static sources, allowing a return to the normal static source, if the optional heated static sources are installed. If only the airspeed indicator appears to be affected when the climb or descent is initiated, it is reasonable to assume a pitot system blockage has occurred. If the possibility of pitot source icing is present, actuation of the pitot heat switch will clear the ice blockage. Reference the optional copilot's instruments and optional angle-of-attack indicator for airspeed information until a reliable airspeed indication can be obtained. If neither optional system is installed, fly attitude and power references.

Operation of the turn-and-bank needle can be checked by initiating a standard rate turn and cross-checking the turn rate with the directional gyro. An indicated standard rate turn should show a turning rate of 3 degrees per second on the directional gyro. Pushing the PRESS-TO-TEST
VACUUM SYSTEM

STANDARD SYSTEM

PILOT'S DIRECTIONAL GYRO
PILOT'S HORIZON GYRO
SUCTION GAGE
VACUUM AIR FILTER
FROM PRESSURIZATION SYSTEM COMPONENTS
RELIEF VALVE
CHECK VALVE AND VACUUM MANIFOLD
LEFT VACUUM PUMP
OUTLET

OPTIONAL SYSTEM

PILOT'S DIRECTIONAL GYRO
PILOT'S HORIZON GYRO
SUCTION GAGE
VACUUM AIR FILTER
FROM PRESSURIZATION SYSTEM COMPONENTS
RELIEF VALVE
CHECK VALVE AND VACUUM MANIFOLD
LEFT VACUUM PUMP
OUTLET

Figure 7-23

3 November 1980
button adjacent to the annunciator panel will illuminate the T & B TEST annunciator light if power is being applied to the turn-and-bank indicator. After shutdown of the airplane on the ground, abnormal noise coming from the turn-and-bank can indicate a near failure condition. The ball part of the turn-and-bank is virtually failure proof. Inaccuracy can result only if the indicator is not level in the instrument panel. With the airplane on level ground, the ball should be centered in the race.

Operation of the directional and horizon gyro's can be checked during taxiing by watching for an abnormally slow erection rate and erratic operation. After shutdown of the airplane on the ground, abnormal noise coming from either gyro can indicate a near failure condition. Checking the suction gage for proper vacuum and no failure buttons exposed will assure proper gyro vacuum is available.

In flight, the directional gyro can be checked by flying a standard rate turn and observing the directional gyro for a turning rate of 3 degrees per second. Also the precession rate in straight and level flight should not exceed 5 degrees in 10 minutes. The horizon gyro operation can be checked by establishing a level flight attitude; the gyro should indicate wings level within 1 degree. Initiate a 20-degree bank for a 180-degree turn, then smoothly return to level flight; gyro should indicate wings level within 3 degrees. Establish level flight at 150 KIAS, gyro should indicate level airplane within 1 degree. Smoothly pitch airplane nose down 10 degrees, then return to level flight; gyro should indicate level flight within 1 degree.

STALL WARNING SYSTEM

A stall warning system is required equipment which consists of a stall warning transmitter vane located in the left wing tip leading edge, a flight deck warning horn and the necessary wiring to complete the system. The stall warning horn will sound 5 to 10 KIAS above the stall in all flight configurations. Proper operation of the warning system can be checked during preflight inspection by moving the stall warning vane; the horn should sound. Condition of the stall warning vane heater should also be checked during preflight by actuating the stall and vent heat switch and feeling the vane for heat.

AVIONICS

AVIONICS INTERFERENCE

NOTE

When tuned to a weak NAV signal, keying the COM transmitter may cause momentary interference within the NAV receiver causing a NAV flag to appear. Should circumstances warrant, ATC should be requested to assign another COM frequency.

AVIONICS MASTER SWITCHES

Two optional avionics master switches are provided with factory installed avionics. The master switch breaker labeled AVIONICS BUS is located on the top forward section of the side console, see Figure 7-19. This switch supplies power from the battery bus through a circuit breaker located forward of the battery box to the individual avionics circuit.
breakers and is used for all normal operations. An emergency power avionics bus switch breaker labeled EMER POWER AVIONICS BUS is located in the lower section of the side console and is protected by a red switch guard cover, see Figure 7-19. This switch supplies power from the alternator bus to the individual avionics circuit breakers. The emergency power avionics bus switch is recommended for use only when the avionics bus switch, associated wiring or battery circuits become inoperative.

ENGINES

The airplane is equipped with two, 6-cylinder, turbocharged, fuel-injected, gear-driven engines with provisions for cabin pressurization. Each engine is rated at 375 horsepower at 2235 RPM and 30.0 inches Hg. manifold pressure. Each engine is provided with an oil pump, fuel pump, vacuum pump, propeller governor, tachometer generator, starter and alternator.

ENGINE CONTROLS

The control pedestal contains all engine controls except the alternator controls. The three primary engine controls are in groups of two at the top of the pedestal; starting from left to right they are: (1) throttle, (2) propeller and (3) mixture.

Throttle Control

The throttle control lever, see Figure 7-1, is used to increase or decrease the engine power by moving the butterfly valve in the fuel-air control unit.

Propeller Control

The propeller control lever, see Figure 7-1, is used to change the propeller pitch to maintain or set a desired engine RPM.

Mixture Control

The mixture control lever, see Figure 7-1, is used to control the amount of fuel to be metered by the fuel-air control unit. A microswitch in the quadrant opens when the mixture lever is aft of the No. 6 position to allow power to be supplied to the start nozzle shut-off solenoid.

Quadrant Friction Lock

A quadrant friction lock, see Figure 7-1, is provided to prevent the three primary engine controls (six total levers) from creeping once they have been set. The locking knob (approximately one and one-half inches diameter) is located on the right side of the pedestal.

Alternate Air Control

An alternate air control is provided for each engine, see Figure 7-1. These mechanically actuated, two-position controls are located on the instrument panel below the pilot's control wheel. Normally the control is pushed in, providing cold filtered ram air to the engines. When the controls are pulled out, warm unfiltered air from inside the cowlings provided to the engines. A locking feature is provided for each control to prevent inadvertent alternate air control position change. Rotating the control clockwise engages the locking mechanism.
The primary alternate air system consists of magnetically held, automatically opening alternate air doors in the engine compartment. The opening of these alternate air doors will provide the engine with cool unfiltered air. A decrease in manifold pressure, indicating that induction system icing has occurred, followed by a return to normal manifold pressure, indicates that the automatic alternate air system is operating. If a decrease in manifold pressure is again experienced, it is an indication that the alternate air inlet source has iced up and the manual alternate air controls should be opened.

**Primer Switch**

The primer switch is a three position switch (Left, Off, Right) spring loaded to the off position. When the switch is pressed to the left (or right) the left (or right) boost pump is energized to the high position to provide fuel for priming and engine start. Actuation of the primer switch also opens the respective start nozzle shut-off solenoid (if mixture levers are at GND START) to supply fuel to the start nozzle.

**ENGINE OIL SYSTEM**

The engines installed in the airplane have a wet sump type, pressure lubricating system. Oil temperature is controlled by a thermally operated valve which either routes oil through the externally mounted cooler or bypasses the oil around the cooler. Oil is routed through internal passages to all moving parts of the engine which require lubrication.

In addition to providing lubrication and cooling for the engine, the oil is used for control of the propeller, actuating the turbocharger waste gate and for lubricating the turbocharger.

Oil pressures from both engines are routed into the fuselage, to the left and right engine gages, see Figure 7-1, where direct oil pressure readings are mechanically displayed. The oil temperatures of both engines are measured on the output side of the oil coolers. The measurements are electrically transmitted to the left and right engine gages where the oil temperatures are displayed.

**IGNITION SYSTEM**

Each engine is equipped with a dual ignition system. The ignition systems are entirely independent from each other such that a failure of any part of one system will have no effect on the other system. Each system consists of a magneto located on the rear engine accessory case, ignition harness to distribute the electrical energy and a spark plug in each engine cylinder. The left magneto fires the lower right and upper left spark plugs while the right magneto fires the upper right and lower left spark plugs. When the primary circuit of each magneto is electrically grounded by placing the magneto switch in the OFF position, the magneto will not produce a spark. With the magneto switch positioned to ON, the primary magneto circuit is ungrounded, allowing a high voltage spark to be produced to fire the spark plugs. During engine starting, a high voltage vibrator supplements the magneto spark to assure a fast start.
ENGINE STARTING SYSTEM

The starting system consists of a 24-volt lead acid battery, a direct drive starter mounted on each engine, a starter button for each engine and necessary wiring and components to complete the system.

The starter is engaged when the starter button, located on the six console, is pushed, see Figure 7-19. Pushing the button closes the starting contactor, allowing the starter to be energized. While the starter is energized, a starting vibrator provides a high-voltage current through the left magneto at a retarded position to assist the normal magneto ignition during the start.

ENGINE PRIMER SYSTEM

The start fuel nozzle is located in the top of the air induction manifold (forward of the intercooler). When the mixture lever is at GND STA (or within the first 1/3 of the lever travel forward of GND START) and the primer switch is actuated, fuel is supplied from the auxiliary fuel boost pump discharge port thru the dual stage fuel pump to the start fuel nozzle. This nozzle injects atomized fuel into the induction air to provide engine priming for starting. The system provides reliable engine starting at normal engine temperatures and atmospheric conditions, including cold engine starts. If the engine primer system will not function due to a failure of the start nozzle solenoid being failed closed or a faulty fuel nozzle, an alternate starting procedure is provided using the fuel injection system.

FUEL INJECTION SYSTEM

Fuel is supplied to the engine using a low-pressure injection system. The fuel is injected into the cylinder head adjacent to the intake valve for all cylinders. The continuous flow type injection system controls the fuel flow to match engine airflow. A manual mixture control and a flow gauge are provided for precise metering. See Figure 7-1, indicating fuel flow are provided for precise leaning any combination of altitude and power setting. There are no moving parts in this system except for the engine-driven fuel injection pump.

ENGINE INSTRUMENTS

Engine instrumentation for each engine, see Figure 7-1, consists of a mechanical oil pressure, electrical oil temperature, and electrical cylinder head temperature. The combination engine gage, a mechanical manifold pressure gage, electric tachometer and mechanical fuel flow gage. These gages are placarded as to their operational parameters.

ENGINE MOUNTS

The engine is mounted to the nacelle structure by four engine mounts. Each mount incorporates a rubber pad capable of sustaining operating loads and providing absorption for engine vibrations.

ENGINE BREAK-IN PROCEDURE

The engine underwent a run-in at the factory and is ready for the range of use. It is, however, recommended that cruising be accomplished at 65% to 75% power until a total of 50 hours has accumulated or oil consumption has stabilized.

3 November 1980
The purpose of operating at 65% to 75% power with Best Power or Recommended Lean mixture is to ensure proper seating of the rings and is applicable to new engines, and engines in service following cylinder replacement or top overhaul of one or more cylinders.

The airplane is delivered from the factory with corrosion preventive oil in the engine. This oil allows fast ring seating and should not be used any longer than 25 hours. If during the first 25 hours oil must be added, use only aviation grade straight mineral oil conforming to Specification MIL-L-6082. Refer to Section 8 for additional oil servicing information.

TURBO-SYSTEM

Each engine is equipped with a turbocharger and related components to allow rated power to 20,000 feet.

The engines work and act just like any normally aspirated engines; however, because the engines are turbocharged, some of the engine characteristics are different. The intent of this section is to point out some of the items that are affected by turbocharging, and outline the correct procedures to be followed.

For a better understanding of the Turbo-System, let us follow the induction air through the engine until it is expelled as exhaust gases. Reference should be made to the Turbo-System Schematic shown in Figure 7-24 when reading through the following steps.

1. Engine induction air is taken in through the ram air inlet (1), located in the inboard side of the engine nacelle, at which point it passes through a filter and then into the compressor (2).
2. The compressor compresses the induction air.
3. Most of the pressurized induction air from the compressor then passes through an intercooler (7), then into the cylinders through the induction manifold (3). A small portion of this pressurized air is routed to the cabin for pressurization.
4. The air and fuel are burned and the exhaust gases are then routed to the turbine through the exhaust manifold (4).
5. The exhaust gases drive the turbine (5) which, in turn, drives the compressor.
6. The turbine has enough power to allow the engine to operate in excess of the maximum 39.0 inches Hg. manifold pressure. Therefore, in order not to exceed 39.0 inches Hg. manifold pressure, a bypass or waste gate (6) is used so the excess exhaust gas will be expelled overboard instead of passing through the turbine.

It can be seen from studying steps (1) through (5) that anything that affects the flow of induction air into the compressor, or the flow of exhaust gases into the turbine, will increase or decrease the speed of the
turbocharger. This resultant change in flow will have no effect on the engine if the waste gate is still open, because the waste gate position will automatically change to hold compressor discharge pressure constant. The waste gate automatically maintains allowable compressor discharge pressure when below 20,000 feet with full throttle and full RPM. Above 20,000 feet, the throttles must be retarded to maintain the manifold pressure within the allowable limits. When the waste gate is closed, any change in the turbocharger speed will mean a change in engine operation. Anything that causes an increase or decrease in turbine speed will cause a increase or decrease in manifold pressure. If turbine speed increases, the manifold pressure increases; if the turbine speed decreases, the manifold pressure decreases. Any change in exhaust flow to the turbine or ram induction air pressure, whether it is an increase or decrease, will be magnified approximately 8 to 10 times by the compression ratio and the change in flow through the exhaust system.

**Manifold Pressure Variation With Altitude**

At full throttle, the turbocharger is capable of maintaining the maximum allowable 39.0 inches Hg. manifold pressure, well above 20,000 feet; however, engine operating limitations establish the maximum manifold pressure that may be used. From 20,000 feet to higher altitudes, the throttles must be retarded to maintain the manifold pressure within the allowable limits.
Manifold Pressure Variation With Airspeed

When the waste gate is open at low altitude, changes in airspeed have little or no effect on manifold pressure. However, at high altitudes when the waste gate is closed, manifold pressure will vary with variations in airspeed. This is because any change in pressure at the compressor inlet is magnified 8 to 10 times at the compressor outlet due to compression ratio and exhaust flow changes.

Fuel Flow Variations With Changes In Manifold Pressure

The engine-driven fuel pump output is regulated by engine speed and compressor discharge pressure. Engine fuel flow is regulated by fuel pump output and the metering effects of the throttle and mixture control. When the waste gate is open, fuel flow will vary directly with manifold pressure, engine speed, mixture or throttle position. In this case, manifold pressure is controlled by throttle position and the waste gate controller, while fuel flow varies with throttle movement and manifold pressure.

When the waste gate is closed and manifold pressure changes are due to turbocharger output, as discussed previously, fuel flow will follow manifold pressure even though the throttle position is unchanged. This means that fuel flow adjustments required by the pilot are minimalized to the following: (1) small initial adjustments on takeoff or climb-out for the proper rich climb setting, (2) lean-out in cruise to the recommended lean cruise setting, and (3) return to the full rich position for approach and landing.

Manifold Pressure Variations With Increasing Or Decreasing Fuel Flow

When the waste gate is open, movement of the mixture control has little or no effect on the manifold pressure of the turbocharged engine.

When the waste gate is closed, any change in fuel flow to the engine will have a corresponding change in manifold pressure. That is, increasing the fuel flow will increase the manifold pressure and decreasing the fuel flow will decrease the manifold pressure. This is because an increased fuel flow to the engine increases the mass flow of the exhaust. This turns the turbocharger faster, increasing the induction airflow and raising the manifold pressure.

Momentary Overboost Of Manifold Pressure

Under some circumstances (such as rapid throttle movement, especially with cold oil) it is possible that the engine can be overboosted above the maximum allowable 39.0 inches Hg. manifold pressure. This would most likely be experienced during the takeoff roll or during a change to full throttle operation in flight. Therefore, it is still necessary that the pilot observe and be prepared to control the manifold pressure.

Slight overboosting is not considered detrimental to the engine so long as it is momentary. Momentary overboost of 2 to 3 inches Hg. manifold pressure can usually be controlled by slower throttle movement and no corrective action is required when momentary overboost corrects itself and is followed by normal engine operation. However, if overboosting of this nature persists, or if the amount of overboost goes as high as 4 inches Hg. manifold pressure or more, the control system should be checked for necessary replacement or adjustment of components.
Altitude Operation

Turbocharged airplanes can maintain higher power settings and fuel flow to higher altitudes than are possible with normally aspirated airplanes. As a result, turbocharged airplanes climb faster and higher. Due to the higher fuel flows and the more rapid temperature and barometric pressure changes during these climbs, fuel vaporization in the fuel lines is more probable than with normally aspirated airplanes. Fuel vaporization is usually indicated by fuel flow fluctuations and can be eliminated by pressurizing the fuel system with the auxiliary fuel pumps. Refer to the Normal Procedures Checklist for recommended positioning of the auxiliary fuel pump switches.

High Altitude Engine Acceleration

The engines will accelerate normally from idle to full throttle with full rich mixture at any altitude below 18,000 feet. At higher altitudes it is usually necessary to lean the mixture to get smooth engine operation from idle to maximum power. At altitudes above 25,000 feet, and with temperatures above standard, it takes one to two minutes for the turbine to accelerate from idle to maximum RPM, although adequate power is available in 20 to 30 seconds. If fuel flow has been interrupted for any reason, the mixture should be leaned until the engine begins to accelerate as shown by an increase in manifold pressure (with throttle open). Thereafter, adjust the mixture control for smooth engine operation.

Engine Shutdown

After extended periods of ground engine operation above 1600 RPM or when the cylinder head temperature indicator shows values within the upper half of the green arc, reduce power to between 600 and 800 RPM for a period of not less than 2 to 3 minutes prior to engine shutdown. This procedure is intended to reduce internal turbocharger temperatures and preclude the possibility of premature accumulation of carbon on the turbine shaft seal.

CABIN AIR SYSTEM

The cabin air system provides for cabin heating, ventilating and defrosting. The system consists of an air inlet in the nose, a cabin fan, a gasoline combustion-type heater, pressurization air temperature control and heat outlets in the cabin. Two heat outlets are located at the base of the windshield for defrosting purposes. Passenger compartment heat is provided by two plenums with nonadjustable heat outlets, located on the left and right side of the cabin just above the floor. Two are located on the forward pressure bulkhead, see Figure 7-25 or 7-26.

Cabin heating and ventilating is accomplished by the cabin air DEFROST AFT and FWD controls, see Figure 7-25 or 7-26. The overhead directional vents also supply unheated ventilating air in the pressurized mode. For ventilation is obtained with the two-speed cabin fan which may be operated independently of the heater. When the heater is actuated, the fan automatically operates in low speed; if additional airflow is desired, the position may be selected.

HEATING AND DEFROSTING

Depressurized

Fresh air is picked up from the air inlet in the nose of the airplane, heated by the heater, and directed to the pilot and passenger compart
The heating and ventilating air is not recirculated, but exhausts overboard through the cabin pressure regulating valve.

The heating system can be used for ventilation by placing the cabin fan switch, see Figure 7-19, in either the NORMAL or HIGH position. The fan provides unheated fresh air to the cabin through the cabin heat outlets. In flight, ram air pressure can be used for ventilation by placing the cabin heat switch to the OFF position, pulling out the cabin air knobs and opening the heat outlets as desired.

Pressurized

Pressurization air is heated by the heater and ducted to the pilot and passenger compartments. To increase passenger comfort and heating system efficiency, the pressurization air temperature controls, see Figure 4-3, may be rotated fully clockwise. This will allow higher pressurization air temperatures, reducing cabin heater requirements. With the left pressurization air temperature control rotated fully clockwise, the overhead vents will supply warm air.

CABIN HEAT SWITCH BREAKER

The cabin heater is controlled by a two-position cabin heat switch breaker, see Figure 7-19. Switch positions are ON and OFF. Placing the switch breaker in the ON position starts and maintains heater operation and turns the cabin fan on low.

CABIN FAN SWITCH

The ventilating fan is controlled by a three-position cabin fan switch, see Figure 7-19. Switch positions are NORMAL, OFF and HIGH.

CABIN AIR TEMPERATURE CONTROL KNOB

The cabin air temperature is controlled by the cabin heat knob, see Figure 7-1. Clockwise rotation of this knob increases the desired temperature.

This knob adjusts a thermostat, which in turn controls heated air temperature in a duct located just aft of the heater. When the temperature of the heated air exceeds the setting of the thermostat, the thermostat automatically opens and shuts off the heater. When the heated air cools to the thermostat setting, the heater starts again. Thus the heater cycles on and off to maintain an even air temperature. Operation is identical for the pressurized and depressurized modes.

FORWARD CABIN AIR KNOB

The forward cabin air knob directs warm air to two outlets located on the forward pressure bulkhead. These direct outlets allow fast warm-up when the airplane is on the ground. Airflow through the direct outlets is completely shut off by pushing the knob all the way in. The knob may be set at any intermediate position to regulate the quantity of air to the pilot's compartment.
AFT CABIN AIR KNOB

The aft cabin air knob controls airflow to the passenger compartment when the knob is pulled out, the air flows to the heater plenums and th into the passengers' compartment. Airflow to the plenums is complete shutoff by pushing the knob all the way in. The knob may be set in an intermediate position to regulate the quantity of air to the cabin.

DEFROST KNOB

Windshield defrosting and defogging is controlled by the push-pull frost knob. When the knob is pulled out, air flows from the defrost outlets at the base of the windshield. When the knob is pushed all the way in, airflow to the defroster outlets is shut off. The knob may be set in any intermediate position to regulate the defroster airflow.

HEATER OVERHEAT WARNING LIGHT

An amber overheat warning light provided in the annunciator panel labeled HEATER OVHT, see Figure 7-3. When illuminated, the light indica that the heater overheat switch has been actuated and that the temperature of the air in the heater has exceeded 163°F (73°C). Once the heater overheat switch has been actuated, the heater turns off and cannot restarted until the overheat switch, located in the right forward compartment, has been reset. This switch is accessible from inside nose wheel well. Prior to resetting the overheat switch, the heater sho be thoroughly checked to determine the reason for the malfunction.

HEATER OPERATION FOR HEATING AND DEFROSTING

(1) Battery Switch - ON.
(2) Pressurization Air Controls - PUSH IN.
(3) Cabin Vent Control - PUSH IN.
(4) Cabin Air Knobs - PULL OUT.
(5) Defrost Knob - Adjust as desired (if defrosting is desired).
(6) Cabin Heat Knob - MAX or as desired.
(7) Pressurization Air Temperature Controls - CLOCKWISE.
(8) Cabin Heat Switch - ON.

NOTE

- If no warm air is coming out of the registers within one minute, turn cabin heat switch breaker OFF; and try another start. If heater still does not start, no further starting attempt should be made.
- During heater operation, defrost and/or cabin air knobs must be out.

3 November 1980
HEATER USED FOR VENTILATION

(1) Battery Switch - ON.
(2) Cabin Air Knobs - PULL OUT as desired.
(3) Cabin Fan Switch - NORMAL or HIGH as desired.

CABIN PRESSURIZATION SYSTEM.

OPERATING DETAILS

The airplane may be operated in either the pressurized mode or depressurized mode. The mode selection is made with the cabin pressurization switch and/or the cabin vent control, see Figure 7-27 or 7-29. Mode of operation should be selected prior to takeoff. If a mode selection must be made while airborne, the cabin vent control should be moved very slowly to minimize pressure transients which would cause discomfort to the passengers.

Pressurization air is supplied from each engine turbocharger through supersonic venturi (flow limiter), the heat exchanger and then into the cabin. Adequate flow to maintain pressurization is provided by either engine at normal power settings. Power changes should be made smoothly to prevent sudden changes in pressurization air inflow resulting in cabin pressure transients.

The pressurization controls and indicators of your airplane, see Figure 7-27 (standard system) or 7-29 (optional system), consist of right and left pressurization air controls, a cabin vent control, a cabin pressurization switch, a cabin rate-of-climb indicator and a combination cabin altitude and differential pressure indicator.

A warning light, which illuminates at approximately 10,000 feet cabin altitude indicating a need for oxygen, is located in the annunciator panel.

To optimize normal operation in the pressurized mode, position the pressurization controls as follows:
(1) Pressurization Air Controls - PUSH IN for all flight operations except ground operation when additional ground ventilation is desired.

(2) Cabin Vent Control - PUSH IN for all flight operations and normal ground operation.
- PULL OUT for additional ground ventilation

(3) Cabin Pressurization Switch - PRESSURIZE.

To optimize normal operation in the depressurized mode, position the pressurization controls as follows:
(1) Pressurization Air Controls - PUSH IN if heater operation or additional ground ventilation is desired.
- PULL OUT if heater operation is not desired.

(2) Cabin Vent Control - PUSH IN if in-flight heater operation is desired.
- PULL OUT if additional ground ventilation is desired.

(3) Cabin Pressurization Switch - DEPRESSURIZE.

3 November 1980
SECTION 7
AIRPLANE & SYSTEMS DESCRIPTIONS

CABIN AIR SYSTEM SCHEMATIC
PRESSURIZED MODE, HEATER ON

DEFROST AIR
FORWARD CABIN HEATING OUTLETS
AFT CABIN AIR
OVERHEAD DIRECTIONAL AIR VENTS
CABIN PRESSURE REGULATING VALVE
CABIN PRESSURE DUMP VALVE-CLOSED

CODE
- WARM PRESSURIZATION AIR
- HEAT AND VENT AIR
- MECHANICAL ACTUATION
- ELECTRICAL ACTUATION

Figure 7-26

3 November 1980
Revision 1 - 2 Apr 1982
STANDARD PRESSURIZATION SYSTEM

The PRESSURIZE position of the cabin pressurization switch, see Figure 7-26, provides for cabin pressurization at altitudes above 8000 feet. The cabin altitude is maintained at 8000 feet at all airplane altitudes between 8000 and 23,120 feet. From 23,120 feet to the operating ceiling of 30,000 feet, 5.0 PSI differential is maintained between cabin and atmosphere.

Until reaching 8000 feet, the cabin rate-of-climb, see Figure 7-27, will be equal to the airplane rate-of-climb. At 8000 feet, the cabin rate-of-climb will drop to zero as pressurization begins. The cabin rate-of-climb will remain approximately at this indication until the airplane has reached an altitude of 23,120 feet. Above this altitude, the cabin altitude will again begin to ascend as the airplane ascends, but at a lesser rate than the airplane rate-of-climb because of the difference in ambient air density and cabin air density. The cabin altitude reaches approximately 10,000 feet at an airplane altitude of 26,500 feet; at this time the altitude warning light on the annunciator panel will illuminate, indicating the need for oxygen.

STANDARD PRESSURIZATION CONTROLS AND INDICATORS

CABIN ALTITUDE AND DIFFERENTIAL INDICATOR  CABIN RATE-OF-CLIMB INDICATOR  CABIN VENT CONTROL

PRESSURIZATION AIR CONTROLS

Figure 7-27

The cabin differential pressure of 5.0 PSI is limited by the pressure regulator valve, see Figure 7-26, located in the aft portion of the cabin. This valve automatically permits air to leave the cabin to maintain the desired pressure. If the regulating valve should fail in the closed position, a dump valve, see Figure 7-26, also located in the aft portion of the cabin, operates as a safety valve to regulate maximum cabin differential pressure at 5.3 PSI. This is a dual function valve which functions as a cabin dump when the DEPRESSURIZE position is selected with the cabin pressurization switch.

The cabin altitude which is maintained at a given airplane altitude is shown in Figure 7-28.

3 November 1980
SECTION 7
AIRPLANE & SYSTEMS DESCRIPTIONS

STANDARD PRESSURIZATION SCHEDULE

<table>
<thead>
<tr>
<th>AIRPLANE ALTITUDE</th>
<th>CABIN ALTITUDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEA LEVEL TO 8000 FEET</td>
<td>SAME AS AIRPLANE ALTITUDE</td>
</tr>
<tr>
<td>8000 to 23,120 FEET</td>
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</tr>
<tr>
<td>24,790 FEET</td>
<td>8000 FEET</td>
</tr>
<tr>
<td>26,500 FEET</td>
<td>9000 FEET</td>
</tr>
<tr>
<td>28,260 FEET</td>
<td>10,000 FEET</td>
</tr>
<tr>
<td>30,000 FEET</td>
<td>11,000 FEET</td>
</tr>
</tbody>
</table>

Figure 7-28

The aft cabin dump valve is used during ground operation to assure the cabin pressure differential is zero. The dump valve is opened automatically by the landing gear safety switch when the weight of the airplane is on the landing gear or can be opened manually by selecting the DEPRESSURIZE position of the cabin pressurization switch. Normally, the cabin pressurization switch can be left in the PRESSURIZE position. However, should a malfunction occur or if a landing is attempted above 8000 feet pressure altitude, select the DEPRESSURIZE position. This airplane is not certified for landings with the cabin pressurized.

**NOTE**

The airplane cannot be pressurized on the ground as the landing gear safety switch circuit is interconnected with the aft cabin dump valve circuit.

In the event that an emergency should require immediate depressurization, place the cabin pressurization switch in the DEPRESSURIZE position, see Figure 7-25, and pull out the cabin vent control. These actions electrically open the aft cabin dump valve and mechanically open the ram air inlet butterfly valve located in the nose; however, pressurization air will still flow into the cabin.

OPTIONAL PRESSURIZATION SYSTEM

For the pressurization system to operate, the cabin pressurization switch must be in the PRESSURIZE position and the cabin vent control and pressurization air controls must be pushed in, see Figure 7-29. The desired cabin altitude can then be selected by the cabin altitude control and the desired cabin rate-of-climb can be selected by the cabin rate control, see Figure 7-29. The selected values can be maintained until a cabin altitude is reached which results in a 5.0 PSI differential between the cabin and atmosphere. To obtain the optimum benefit from the cabin altitude control and the cabin rate control, set in the cruise pressure altitude plus 500 feet on the inner AIRCRAFT ALT scale just prior to takeoff with the arrow on the cabin rate control positioned straight up. After takeoff, with the cabin pressure stabilized, slowly reset the cabin altitude control to cruise altitude plus 500 feet on the inner AIRCRAFT ALT scale or destination field pressure altitude plus 500 feet on the outer CABIN ALT scale. Make the selection which will provide the highest cabin altitude. For cruising altitudes below the inner scale values, always
select the destination field pressure altitude plus 500 feet on the scale. The selection should be made slowly to provide maximum comfort. Adjust the cabin rate control as the climb progresses such that the selected cabin altitude is reached at approximately the same time that the airplane reaches cruising altitude.

The above procedure is recommended because once the engines have been started and a source of vacuum is available, the pressure control system will begin to "climb" to the preset cabin altitude; thus, if cabin altitude required for cruise is selected too soon, the pressure control system will have climbed to an altitude approaching the desired cabin altitude before the airplane leaves the ground. Since the cabin pressure can never be less than outside ambient pressure, the cabin will be unpressurized until the airplane "catches up" with the pressure control system or the desired cabin altitude is reached, whichever occurs first. This will result in no cabin rate control being available as the cabin rate-of-climb will be equal to the airplane rate-of-climb.

The cabin differential pressure of 5.0 PSI is limited by the pressure regulator valve, see Figure 7-26, located in the aft portion of the cabin. This valve automatically permits air to leave the cabin to maintain the
desired pressure. If the regulating valve should fail in the closed position, a dump valve, see figure 7-26, also located in the aft portion of the cabin, operates as a safety valve to regulate maximum cabin differential pressure to 5.3 PSI. This is a dual function valve which also functions as a cabin dump when the DEPRESSURIZE position is selected with the cabin pressurization switch.

### OPTIONAL PRESSURIZATION SCHEDULE

<table>
<thead>
<tr>
<th>AIRPLANE ALTITUDE</th>
<th>CABIN ALTITUDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEA LEVEL TO 10,060 FEET</td>
<td>SEA LEVEL</td>
</tr>
<tr>
<td>13,910 FEET</td>
<td>2000 FEET</td>
</tr>
<tr>
<td>16,850 FEET</td>
<td>4000 FEET</td>
</tr>
<tr>
<td>19,920 FEET</td>
<td>6000 FEET</td>
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<td>23,120 FEET</td>
<td>8000 FEET</td>
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<td>30,000 FEET</td>
<td>11,950 FEET</td>
</tr>
</tbody>
</table>

**Figure 7-30**

The aft cabin dump valve is used during ground operation to assure the cabin pressure differential is zero. The dump valve is opened automatically by the landing gear safety switch when the weight of the airplane is on the landing gear or can be opened manually by selecting the DEPRESSURIZE position of the cabin pressurization switch. Normally, the cabin pressurization switch can be left in the PRESSURIZE position. However, should a malfunction occur or if the cabin altitude is inadvertently set at a lower altitude than field pressure altitude, select the DEPRESSURIZE position. It is important, therefore, to select a cabin altitude approximately 500 feet above field pressure altitude and check cabin pressure differential at zero prior to landing. This will prevent any cabin pressure transients on landing and provide maximum passenger comfort.

**NOTE**

The airplane cannot be pressurized on the ground as the landing gear safety switch circuit is interconnected with the aft cabin dump valve circuit.

The lowest cabin altitude which can be maintained at any given airplane altitude is shown in the chart in Figure 7-30.

### OXYGEN SYSTEM

The oxygen system provides individual service for the pilot, copilot and each passenger. The oxygen supply is stored in either an 11.0 or 14.9 cubic foot bottle located in the nose compartment. Cabin plumbing, including outlets for each occupant, is standard with each airplane and will vary with individual airplane seating configuration. The oxygen control, pressure gage (see Figure 7-1), bottle, regulator and nose compartment plumbing are optional.
The oxygen system is activated by pulling the oxygen control knob, see Figure 7-1, to the ON position, allowing oxygen to flow from the regulator to all cabin outlets. A normally closed valve in each oxygen outlet is opened by inserting the connector of the mask and hose assembly. After flights using oxygen, the pilot should insure that the oxygen system has been deactivated by unplugging all masks and pushing the oxygen control knob completely to the OFF position.

**NOTE**

If the oxygen control knob is left in an intermediate position between ON and OFF, it may allow low pressure oxygen to bleed through the regulator into the nose compartment of the airplane.

**COCKPIT OXYGEN OUTLETS**

PILOT'S SIDE SHOWN: IDENTICAL CONTROLS ARE PROVIDED FOR THE COPILOT.

Figure 7-31

3 November 1980
The oxygen system with optional 114.9 cubic foot oxygen bottle provides adequate oxygen flow rates up to 30,000 feet cabin altitude and is suitable for cruising at altitudes in excess of 25,000 feet for extended periods, see Figure 7-32. The oxygen outlets for the pilot and copilot are located inside the stowage compartment under the outboard armrests, see Figure 7-31. Oxygen outlets for passengers are located overhead of each seat position, see Figure 7-21. The pilot, copilot and passengers shall always use the blue hose assemblies.

OXYGEN DURATION CHART

114.9 CUBIC FOOT SYSTEM

\[
\text{Oxygen Duration in Hours} = \frac{\text{Total Hours Duration}}{\text{Number of Persons}}
\]

Figure 7-32
The oxygen system with optional 11.0 cubic foot bottle provides adequate oxygen flow rates up to 30,000 feet cabin altitude, see Figure 7-33. This system is designed solely to provide for emergency descents as described in Section 3. The system is calibrated for two different altitude ranges, which are: 14,000 to 22,000 feet cabin altitude and 22,000 to 30,000 foot cabin altitude. Selection of the desired altitude range is accomplished by appropriate selection of color-coded hose assemblies. The oxygen outlets for the pilot and copilot are located inside the stowage compartment under the outboard armrests, see Figure 7-31. Oxygen outlets for passengers are located overhead of each seat position, see Figure 7-21. The pilot shall always use the red hose assembly.

**NOTE**

Some airplanes are delivered with red oxygen hose mask connectors only. If your airplane is so equipped, disregard all information pertaining to orange oxygen hose mask connectors.

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**OXYGEN CONSUMPTION RATE CHART**

**11.0 CUBIC FOOT SYSTEM**

**OXYGEN DURATION CALCULATION:**

$$\text{TOTAL OXYGEN DURATION (HOURS) = OXYGEN PRESSURE INDICATOR READING} + \left[ \text{OXYGEN CONSUMPTION (PSI/HR)} \times \text{NUMBER OF PASSENGERS} + \text{PILOT CONSUMPTION RATE} \right]$$

<table>
<thead>
<tr>
<th>CABIN ALTITUDE RANGE, FEET</th>
<th>HOSE ASSEMBLY COLOR</th>
<th>CONSUMPTION PSI/HR</th>
</tr>
</thead>
<tbody>
<tr>
<td>14,000</td>
<td>ORANGE</td>
<td>965</td>
</tr>
<tr>
<td>22,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22,000</td>
<td>RED</td>
<td>1352</td>
</tr>
<tr>
<td>30,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Figure 7-33*

3 November 1980
SECTION 7
AIRPLANE & SYSTEMS DESCRIPTIONS

PASSenger LOADING

Due to the differences in installed optional equipment on the airplane, a wide CG range exists. Under certain passenger loading conditions, it is possible to exceed the aft CG limits, which can lead to tail tipping. To prevent this from occurring, owners and pilots should study their airplane's weight and balance information to become familiar with the airplane's capabilities and limitations. It is recommended that the loading of passengers be as follows:

(1) Load the baggage in the nose and avionics compartments prior to boarding of the crew and passengers.
(2) No baggage allowed in the aft cabin.
(3) When boarding people, have the pilot, or person who is to occupy the copilot seat, be the first to board with the remaining people filling the most forward seats first and the aft seats last. Arrange to have the heavier people occupy the most forward seats.
(4) When unloading the airplane, have one person remain in the copilot or pilot seat while the other flight deck occupant goes aft to open the door. Arrange to have the passengers in the aft seats be the first to deplane.

BAGGAGE COMPARTMENTS

Six baggage locations, see Figure 1-3, are available: two in the fuselage nose section, two in the aft cabin area and one location in the aft portion of each engine nacelle.

These baggage areas are intended primarily for low-density items such as luggage and briefcases. The floors of the wing locker baggage areas are primary structure. Therefore, care should be exercised during loading and unloading to prevent damage. When loading high-density objects, insure that adequate protection is available to prevent damage to any of the airplane’s primary structure. Without optional equipment installed, 200 pounds can be carried in each wing locker, 250 pounds in the avionics bay, 350 pounds in the nose baggage compartment, 400 pounds in the aft cabin Bay A and 100 pounds in the aft cabin Bay B. With optional equipment installed, refer to Section 2 or the loading placards in your airplane’s baggage compartments.

**WARNING**

- The transportation of hazardous materials is discouraged. However, if transport of this material is necessary, it shall be done in accordance with FAR 103 and any other applicable regulations.
- Under no circumstances, allow the loading of people or animals in the nose baggage area or wing lockers. These areas do not qualify for carriage of animate objects.
AIRPLANE TIE-DOWN PROVISIONS AND JACK POINT

A wing tie-down fitting is provided on the lower surface of each wing aft of each main gear. The fittings retract into the wing when not in use. The empennage is secured at the tail tie-down fitting located on the fuselage bottom, below the elevator hinge line. In addition, the nose can be secured with ropes attached to the nose gear assembly above the scissors linkage.

Three jack points are provided on the underside of the airplane. The main gear jack points are located inboard of and in-line with the wing fl hinge. The nose gear jack point is located aft of the left nose gear door hinge. Jack pads, which are provided with the airplane, are required to be installed in each jack point before the airplane can be jacked.

SEATS, SEAT BELTS AND SHOULDER HARNESS

PILOT AND COPILOT PROVISIONS

The pilot and copilot seats are secured to seat pan assemblies which are attached to the forward main spar carry-thru structure. The seats are adjustable fore and aft on seat rails by lifting the handle located on the forward face of the seat.

Seat belts are provided for both seats and are attached to the airplane structure on the floor. The shoulder harnesses attach aft and outboard of the pilot's and copilot's seats to overhead structure. The opposite end of each harness can be attached permanently to the outboard pilot's or copilot's seat belt. An adjustment is provided between the attach point with the optional shoulder harnesses. Inertia reels are bolted to the overhead structure aft and outboard of the pilot's and copilot's seats. The front end of the harnesses attach to the seat belt with a detachable fastener. The inertia reels allow normal fore and aft movement of the occupants until a violent movement occurs, at which time the reel will lock, restricting forward movement of the seat occupant.

PASSENGER PROVISIONS

The passenger seats are attached to continuous seat rails located on each side of the cabin area. The seats are adjustable fore and aft, within the limits of the seat stops, by raising the handle located on the front of each seat. If the optional adjustable seats are installed, a button is provided on the front of the inboard armrest which allows reclining of the seat back. Insure the seat stop pins are engaged with the holes in the seat rails before takeoff and landing. Each seat is equipped with a safety belt which is attached to the seat structure.
DOORS, WINDOWS AND EXITS

CABIN DOOR

The main cabin door is a two-section, outward opening, airstair door. The lower section folds down to provide two steps for ease in boarding and deplaning passengers, while the top portion folds up.

**CAUTION**
When entering or exiting airplane equipped with pneumatic lower door extender, ensure lower cabin door is fully extended before putting weight on steps.

The lower door handle is located such that the upper door must be open to gain access to it. In addition, the locking pin receptacles can be visually inspected for positive engagement, see Figure 7-34.

As an additional safety feature, a cabin door warning light is provided. This light is located in the annunciator panel, see Figure 7-3, and is illuminated when the cabin door is not securely latched.

Cabin door sealing is provided by a pneumatic tube door seal that is inflated by pressurization air from the left engine. With the left engine operating, and the cabin door closed and the locking pins fully engaged, the door seal is inflated to provide positive fuselage to door sealing. When the cabin door locking pins are disengaged, the door seal is depressurized to allow the door to be opened and closed easily.

**CABIN DOOR SAFETY AND LOCKING PINS**

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Figure 7-34

7-58

3 November 1980
SECTIONS
AIRPLANE & SYSTEMS DESCRIPTION

WINDOWS

Seven windows are provided on each side of the airplane. All windows are fixed except the foul weather windows located forward of the pilot and copilot's side windows. These foul weather windows can be open during all ground operations and in-flight operations with the cabin pressurized. Airspeed is not restricted with the foul weather windows open.

EMERGENCY EXIT WINDOW

The forward oval cabin window on the right side of the passenger compartment can be removed for emergency exit. Pull off the plastic cover over the emergency release handle under the window. Turn the release handle counterclockwise to release the window retainers, then pull the window in and down.

CONTROL LOCKS

A control column lock is provided to restrict control column movement. This restriction holds the ailerons in a neutral position and the elevators approximately 10° down, thus preventing damage to the control surfaces under gusty wind conditions.

The rudder is secured with the optional rudder gust lock. To engage this lock, center the rudder, ensure the elevator is fully down, then move the external rudder lock handle to the lock position. The rudder lock is engaged by rotating the external rudder lock handle to the unlock position. The rudder lock handle is located above the left horizontal stabilizer on the side of the fuselage. If the optional rudder lock is not installed, the rudder can be secured by placing an external control surface lock on the vertical stabilizer and rudder. If neither rudder lock is available, caster the nosewheel to the full left or right position. This action will deflect the rudder against its stop, thus restricting rudder movement.

WARNING

Insure all control locks are removed before starting the engines.

PROPELLERS

The airplane is equipped with all-metal, three-bladed, constant-speed, full-feathering, single-acting, governor-regulated propellers. Each propeller utilizes oil pressure which opposes the force of springs and counterweights to obtain correct pitch for engine load. Oil pressure from the propeller governor drives the blades toward low pitch (increasing RPM) while the springs and counterweights drive blades toward high pitch (decreasing RPM). The source of oil pressure for propeller operation is furnished by the engine oil system, boosted in pressure by the gearing pump, and supplied to the propeller hub through the engine crankshaft.

To feather the propeller blades, the propeller control levers on the control pedestals must be placed in the feather position. Unfeathering the propeller is accomplished by positioning the propeller control lever to increase RPM position. The optional unfeathering system uses accumulators and oil to force the propeller out of feather and into the low pitch condition.

3 November 1980
SECTION 7
AIRPLANE & SYSTEMS DESCRIPTIONS

PROPELLER SYNCHROPHASER

The optional propeller synchrophaser system (see Figure 7-35) senses the RPM of both engines, compares this data and makes required adjustments to control engine RPM exactly the same. The pilot, by varying the phase control knob, can select the most desirable propeller phase relationship for various flying conditions.

The synchrophaser system consists of two propeller governors incorporating magnetic transducers and electromagnetic control coils, electronic control box, on-off switch and indicator light and potentiometer to adjust phase settings. The transducers create one negative to positive pulse per revolution that is fed into the control box and is used to synchronize the engines by comparing the time of arrival between signals of the two governors. Any error in time between signal comparison causes the governor control coil to change fly weight positions, speeding up the RPM of the slower running engine to bring about synchronization. The pilot, by adjusting the potentiometer, varies propeller phase relationship by changing signal timing between governors.

When the system is initially turned on, only the slower turning propeller is adjusted to increase RPM. This feature keeps the system operating more closely to the manually selected RPM. Also, if an engine is feathered without shutting off the system, there will be no RPM loss by the operating engine below the manually selected RPM.

The on-off light is only an indicator that the system is on or off and in no way is it an indicator of system performance. If the bulb should happen to burn out or otherwise fail during operation, the system is still operative and the bulb may be replaced when convenient to do so.

PROPELLER SYNCHROPHASER

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Figure 7-35
For best operation, it is important to guard against propeller control creeping by setting the quadrant friction lock tightly. On extended flights, it may be necessary to periodically switch to the OFF position, reset propeller synchronization manually and reengage the synchromesh.

NOTE

Manually synchronize propellers within 25 RPM prior to turning system on. After system is operating, RPM adjustment may be made by moving both propeller control levers together. This should keep both governor settings close enough to remain in the synchromesh's operating range.

If the propellers should go out of synchronization, turn system off; manually synchronize the propellers and turn the system on.

This propeller synchromesh may be ON for all flight operations including takeoff and landing; however, normal RPM variations during takeoff roll may exceed the synchromesh capture range causing the synchromesh to break lock.

CABIN FEATURES

CABIN FIRE EXTINGUISHER (If Installed)

A portable 3/4 pound Halon 1211 fire extinguisher is provided in case of an inadvertent cabin fire. The fire extinguisher, located beneath the copilot's seat, should be checked prior to each flight to ensure that bottle pressure, as indicated by the gauge on the bottle, is within the green arc (approximately 125 PSI). To operate the bottle:

1. Loosen the retaining clamp and remove extinguisher from bracket.
2. Hold bottle upright, pull retaining pin, and press lever to discharge.

NOTE

• Begin discharge 5 feet from fire, at base of the flame, and sweep as required across the flame.
• Extinguisher should be recharged after each use.

3 November 1980
Revision 1 2 Apr 1982

7-61/7-6
INTRODUCTION

Section 8 of this handbook provides information on cleaning, inspection, servicing and maintenance of the airplane.

If your airplane is to retain the new plane performance and dependability, certain inspection and maintenance requirements must be followed. It is wise to follow a planned schedule of lubrication and preventive maintenance based on climatic and flying conditions encountered in your locality.

Keep in touch with your Cessna Dealer, and take advantage of his knowledge and experience. He knows your airplane and how to maintain it. He will remind you when lubrications and oil changes are necessary, and about other seasonal and periodic services.

All correspondence concerning your airplane should include the airplane model and serial number. This information may be obtained from the FAR-45 required identification plate located on the forward door post. Refer to the Airplane Service Manual for an illustration of the identification plate.

3 November 1980
Revision 1 - 2 Apr 1982
PUBLICATIONS

Various publications and flight operation aids are furnished in the airplane when delivered from the factory. These items are listed as follows:

CUSTOMER CARE HANDBOOK
PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL
PILOT'S CHECKLIST
CRUISE COMPUTER
WORLDWIDE CUSTOMER CARE DIRECTORY

The following additional publications, plus many other supplies that are applicable to your airplane, are available from your Cessna Dealer.

INFORMATION MANUAL (Contains Pilot's Operating Handbook and FAA Approved Airplane Flight Manual Information)
SERVICE MANUALS AND PARTS CATALOGS FOR YOUR AIRPLANE ENGINE AND ACCESSORIES AVIONICS

Your Cessna Dealer has a Customer Care Supplies Catalog covering all available items, many of which he keeps on hand. He will be happy to place an order for any item which is not in stock.

NOTE

A Pilot's Operating Handbook and FAA Approved Airplane Flight Manual which is lost or destroyed may be replaced by contacting your Cessna Dealer or writing directly to the Customer Services Department, Cessna Aircraft Company, Wichita, Kansas. An affidavit containing the owner's name, airplane serial number and registration number must be included in replacement requests since the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual is identified for specific airplanes only.

OWNER NOTIFICATION SYSTEM

As the owner of a Cessna, you will receive applicable Cessna Owner Advisories at no charge. These Owner Advisories will be mailed to the address that is provided to Cessna on the Warranty Registration Application Card which is included in your Customer Care Handbook. A subscription service for Propjet Service Information Letters is available directly from the Cessna Customer Services Department. Your Cessna Dealer will be glad to supply you with details concerning this subscription program, and stands ready, through his Service Department, to supply you with fast, efficient, low-cost service.

INSPECTION REQUIREMENTS

As required by Federal Aviation Regulations, all civil airplanes of U.S. registry must undergo a complete inspection (annual) each twelve calendar months. In addition to the required annual inspections, airplanes operated commercially (for hire) must have a complete inspection every 100 hours of operation.
In lieu of the above requirements, an airplane may be inspected in accordance with a progressive inspection schedule, which allows the workload to be divided into smaller operations that can be accomplished in shorter time periods.

The Cessna Progressive Care Program has been developed to provide a modern progressive inspection schedule that satisfies the complete airplane inspection requirements of both the 100-hour and annual inspections applicable to Cessna airplanes.

Additional inspections may be required by the FAA. These inspections are issued in the form of Airworthiness Directives and can apply to the airframe, engines and/or components of the airplane. It is the owner's responsibility to ensure compliance with these directives. In some cases, the Airworthiness Directives require repetitive compliance; therefore, the owner should ensure inadvertent noncompliance does not occur at future inspection intervals.

NOTE
Refer to FAR Parts 43 and 91 for properly certificated agency or personnel to accomplish the inspections. Contact your local Cessna Dealer for additional information.

CESSNA PROGRESSIVE CARE PROGRAM

The Cessna Progressive Care Program has been developed to provide a modern progressive inspection schedule that satisfies the complete airplane inspection requirements and to help you realize maximum utilization of your airplane at a minimum cost and down-time. Under this program, your airplane is inspected and maintained in four operations at 500-hour intervals during a 200-hour period. The operations are recycled each 200 hours and are recorded in a specially provided Aircraft Inspection Log as each operation is conducted.

The Cessna Aircraft Company recommends Progressive Care for airplanes that are flown 200 hours or more per year. The procedures for this Progressive Care Program have been carefully worked out by the factory and are followed by the Cessna Dealer Organization. The complete familiarization of Cessna 421 Dealers with Cessna equipment and factory-approved procedures provides the highest level of service possible at lower cost to Cessna owners.

CESSNA CUSTOMER CARE PROGRAM

Specific benefits and provisions of the Cessna Warranty plus other important benefits for you are contained in your Customer Care Handbook supplied with your airplane. You will want to thoroughly review this Handbook and keep it in your airplane at all times.

Coupons attached to the Customer Care Handbook entitle you to an initial inspection and either a Progressive Care Operation No. 1 or the first 100-hour inspection within the first 6 months of ownership at no charge to you. If you take delivery from your Dealer, the initial inspection will have been performed before delivery of the airplane to you. If you pick your airplane at the factory, plan to take it to your Dealer reasonably soon after you take delivery, so the initial inspection may be performed allowing the Dealer to make any minor adjustments which may be necessary.

3 November 1980
SECTION 8
HANDLING, SERVICE & MAINTENANCE

You will also want to return to your Dealer either at 50 hours for your first Progressive Care Operation, or at 100 hours for your first 100-hour inspection depending on which program you choose to establish for your airplane. While these important inspections will be performed for you by any Cessna Dealer, in most cases you will prefer to have the Dealer from whom you purchased the airplane accomplish this work.

SERVICING REQUIREMENTS

For quick and ready reference, quantities, materials, and specifications for frequently used service items (such as fuel, oil, etc.) are shown in this section.

In addition to the Preflight Inspection covered in Section 4, complete servicing, inspection, and test requirements for your airplane are detailed in the Airplane Service Manual. The Service Manual outlines all items which require attention at 50, 100, and 200 hour intervals plus those items which require servicing, inspection, and/or testing at special intervals.

Since Cessna Dealers conduct all service, inspection, and test procedures in accordance with applicable Service Manuals, it is recommended that you contact your Dealer concerning these requirements and begin scheduling your airplane for service at the recommended intervals.

Cessna Progressive Care insures that these requirements are accomplished at the required intervals to comply with the 100-hour or annual inspection as previously covered.

Depending on various flight operations, your local government aviation agency may require additional service, inspections, or tests. For these regulatory requirements, owners should check with local aviation officials where the airplane is being operated.

AIRPLANE FILE

There are miscellaneous data, information and licenses that are a part of the airplane file. The following is a checklist for that file. In addition, a periodic check should be made of the latest Federal Aviation Regulations to insure that all data requirements are met.

A. To be displayed in the airplane at all times:
   (1) Aircraft Airworthiness Certificate (FAA Form 8100-2).
   (2) Aircraft Registration Certificate (AC Form 8050-3).
   (3) Aircraft Radio Station License (Form FCC-566, if transmitter installed).
   (4) Radio Telephone Station License (Form FCC-401, if Flitefone III Radio Telephone is installed).

B. To be carried in the airplane at all times:
   (1) Weight and Balance, and associated papers (latest copy of the Repair and Alteration Form, Form 337, if applicable).
   (2) Airplane Equipment List.
   (4) Pilot's Checklist.

C. To be made available upon request:
   (1) Airplane Log Book.
   (2) Engine Log Books.

8-4

1 November 1979
Most of the items listed are required by the United States Federal Aviation Regulations. Since the regulations of other nations may require other documents and data, owners of airplanes not registered in the United States should check with their own aviation officials to determine their individual requirements.

Cessna recommends that these items, plus the power computer, Cu. m Care Handbook and Customer Care Card, be carried in the airplane at all times.

**PREVENTIVE MAINTENANCE**

Part 43 of the FAR's allows the holder of a pilot certificate, issued under Part 61, to perform preventive maintenance on any airplane owned or operated by him that is not used in air carrier service. Refer to FAR Part 43 for a list of preventive maintenance items the pilot is authorized to accomplish.

**NOTE**

- Prior to performance of preventive maintenance, review the applicable procedures in the Airplane Service Manual to insure the procedure is properly completed.
- All maintenance other than preventive maintenance must be accomplished by appropriately licensed personnel. Contact your Cessna Dealer for additional information.
- Pilots operating airplanes of other than United States registry should refer to the regulations of the country of certification for information on preventive maintenance that may be performed by pilots.

**ALTERATIONS OR REPAIRS TO THE AIRPLANE**

Alterations or repairs to the airplane must be accomplished by appropriately licensed personnel. If alterations are considered, the FAA should be consulted to insure that the airworthiness of the airplane is not violated.

**GROUND HANDLING**

**TOWING**

The airplane should be moved on the ground with the aid of the nose wheel towing bar provided with the airplane. The tow bar is designed to attach to the nose gear strut fork.

3 November 1980
1. Head airplane into the wind if possible.
2. Set parking brake and install control locks to restrict travel of all movable surfaces.

**CAUTION**
Do not set parking brake when the brakes are overheated or during cold weather when accumulated moisture may freeze the brakes.

3. If a rudder gust lock is not available, caster the nosewheel to the extreme left or right positions.
4. Install pitot tube cover(s) if available.
5. Set elevator, aileron and rudder trim tabs to neutral, so the trim tabs fair with the control surfaces.
6. Use ropes or chains of at least 700 pounds tensile strength. Secure the nose gear with a rope or chain attached above the nose gear torque link. The other end should be attached to a substantial ground anchor. The rope or chain angle to the ground should be 45 degrees. Attach a second rope or chain in a similar manner to the opposite side of the nose gear. Secure the tail tie-down fitting in a similar manner.

**JACKING AND LEVELING**

Three jack points are provided on the underside of the airplane. One jack point is located just aft of the nosewheel well, and one is located on the lower surface of each wing, inboard and in-line with the wing flaps. Jack pads, which are provided with the airplane, are required to be installed in each jack point before the airplane can be jacked.

**NOTE**

- To prevent the flight hour recorder from recording while the airplane is on jacks and battery switch is in the ON position, remove fuse located in the side console. Reinstall fuse when finished.
- Special two-ton jacks, ideally suited to the airplane, can be supplied by the Cessna Aircraft Company. Three jacks are required to lift the airplane.

To level the airplane longitudinally and laterally, use the three jack points provided on the airplane. Level longitudinally by backing out the two screws at "Level Point" on the right outside fuselage (opposite cabin door) at Stations 214.00 and 238.00 and place a spirit level on the screws, then level longitudinally. To level laterally, place a spirit level at Station 154.00 (aft of front spar) on the underside of fuselage. Refer to the Airplane Service Manual for additional information.

**FLYABLE STORAGE**

Flyable storage applies to all airplanes which will not be flown for an indefinite period but which are to be kept ready to fly with the least possible preparation. If the airplane is to be stored temporarily, indefinitely, refer to the Airplane Service Manual for proper storage procedures.

3 November 1980
Revision 1 - 2 Apr 1982
Airplanes which are not in daily flight should have the propellers rotated, by hand, six revolutions at least once each week. In damp climates and in storage areas where the daily temperature variation can cause condensation, propeller rotation should be accomplished more frequently. Rotating the propeller and stopping at 45° to 90° from its original position redistributes residual oil on the cylinder walls, crankshaft and gear surfaces and repositions the pistons in the cylinders, thus minimizing corrosion. Rotate propellers as follows:

1. Throttles - IDLE.
2. Mixtures - IDLE CUT-OFF.
3. Magneto Switches - OFF.
4. Propellers - ROTATE CLOCKWISE. Manually rotate propellers six revolutions, standing clear of arc of propeller blades. Stop the propeller at 45° to 90° from its original position.

Keep fuel tanks full to minimize condensation in the fuel tanks. Maintain battery at full charge to prevent electrolyte from freezing in cold weather. If the optional 1000 series avionics and/or optional fuel flow indicating system are installed, the battery will discharge continuously, regardless of battery switch position. This flow of current is required to maintain the memories of the referenced equipment. If the airplane is not in frequent use (inactive for longer than two days), battery discharge can be avoided by disconnecting the battery or disengaging the FREQ MEM circuit breaker for the avionics or CABIN LTS circuit breaker for the fuel flow indicating system.

**NOTE**

- A malfunctioning nose baggage or wing locker light will completely deplete the battery in approximately four days, depending on the degree of charge and condition of the battery.
- Airplanes inactive for long periods of time should have the battery serviced in accordance with BATTERY servicing, this section.

If the airplane is stored outside, tie-down airplane in anticipation of high winds. Secure airplane as follows:

1. Secure rudder with the optional rudder gust lock or with a control surface lock over the fin and rudder. If a lock is not available, use nosewheel to the full left or right position.
2. Install pitot tube cover(s) if available.
3. Set elevator, aileron and rudder trim tabs to neutral so the trim tabs fair with the control surfaces.
4. Install control column lock in pilot's control column, if available. If column lock is not available, tie the pilot's control wheel full aft with a seat belt.
5. Tie ropes or chains of at least 700 pounds tensile strength to the wing tie-down fittings located on the underside of each wing, aft of the main landing gear. Secure the opposite ends of the ropes or chains to ground anchors. Chock the main landing gear tires; do not set the parking brake if a long period of inactivity is anticipated as brake seizing can result.
6. Secure a rope (no chains or cables) to the upper nose gear trunnion and secure opposite end of rope to a ground anchor. Choc the nose landing gear tire.

7. Secure the middle of a rope or chain to the tail tie-down fitting. Pull each end of the rope or chain at a 45-degree angle and secure to ground anchors at each side of the tail.

8. At the end of 30 days, the airplane should be flown for 30 minute until oil and cylinder temperatures reach normal operating range. If the airplane is not flown at the end of 30 days, the airplane should be placed in temporary or indefinite storage.

SERVICING

NOTE

Refer to the Airplane Service Manual for complete servicing requirements.

FUEL (Approved Fuel Grades and Colors)

PRIMARY - 100 (formerly 100/130) Grade Aviation Fuel (Green)
ALTERNATE - 100LL Grade Aviation Fuel (Blue)

Service after each flight. Keep tanks full to retard condensation of the tanks. Tank capacities are:

Each Main Tank - 106.7 Gallons
Each Optional Wing Locker Tank - 28.4 Gallons

Isopropyl alcohol or ethylene glycol monomethyl ether may be added to the fuel supply in quantities not to exceed 1% or .15% by volume, respectively, of the total. Refer to Fuel Additive paragraphs in this section for additional information.

WARNING

- Do not operate any avionics or electrical equipment on the airplane during fueling. Do not allow open flame or smoking in the vicinity of the airplane while fueling.
- During all fueling operations, fire fighting equipment must be available. Two ground wires from different points on the airplane to separate approved grounding stakes shall be used.

Fuel Additive

Strict adherence to recommended preflight draining instructions called for in Section 4 will eliminate any free water accumulations in the tank sumps. While small amounts of water may still remain in solution in the gasoline, it will normally be consumed and go unnoticed in operation of the engine.
SECTION 8
HANDLING, SERVICE & MAINTENANCE

One exception to this can be encountered when operating under the combined effect of: 1) use of certain fuels, with 2) high humidity conditions on the ground 3) followed by flight at high altitude and low temperature (flight levels of 20,000 feet or above and temperatures of -28.9°C (-20°F) or below). Under these unusual conditions small amounts of water in solution can precipitate from the fuel stream and freeze in sufficient quantities to induce partial icing of the engine fuel injection system.

While these conditions are quite rare and will not normally pose a problem to owners and operators, they do exist in certain areas of the world and consequently must be dealt with, when encountered.

Therefore, to alleviate the possibility of fuel icing occurring under these unusual conditions it is permissible to add isopropyl alcohol or ethylene glycol monomethyl ether (EGME) compound to the fuel supply.

The introduction of alcohol or EGME compound into the fuel provides two distinct effects: 1) it absorbs the dissolved water from the gasoline and 2) alcohol has a freezing temperature depressant effect.

Alcohol, if used, is to be blended with the fuel in a concentration of 1% by volume. Concentrations greater than 1% are not recommended since they can be detrimental to fuel tank materials.

The manner in which the alcohol is added to the fuel is significant because alcohol is most effective when it is completely dissolved in the fuel. To insure proper mixing the following is recommended:

1. For best results the alcohol should be added during the fueling operation by pouring the alcohol directly on the fuel stream issuing from the fueling nozzle.
2. An alternate method that may be used is to premix the complete alcohol dosage with some fuel in a separate clean container (approximately 2-3 gallon capacity) and then transfer this mixture to the tank prior to the fuel operation.

Any high quality isopropyl alcohol may be used, such as:

Anti-icing fluid (MIL-F-5566) or Isopropyl alcohol (Federal Specification TT-I-735a).

Figure 8-1 provides alcohol-fuel ratio mixing information.

Ethylene glycol monomethyl ether (EGME) compound in compliance with MIL-F-27686 or Phillips PFA-53MB, if used, must be carefully mixed with the fuel in concentrations not to exceed 0.15% by volume.

**CAUTION**

Mixing of the EGME compound with the fuel is extremely important because concentration in excess of that recommended (0.15 percent by volume maximum) will result in detrimental affects to the fuel tanks, such as deterioration of protective primer and sealants and damage to O-rings and seals in the fuel system and engine components. Use only blending equipment that is recommended by the manufacturer to obtain proper proportioning.

8-10

3 November 1980
Do not allow the concentrated ESME compound to come in contact with the airplane finish or fuel cell as damage can result.

Prolonged storage of the airplane will result in a water buildup in the fuel which "leeches out" the additive. An indication of this is when an excessive amount of water accumulates in the fuel tank sumps. The concentration can be checked using a differential refractometer. It is imperative that the technical manual for the differential refractometer be followed explicitly when checking the additive concentration.

ALCOHOL - FUEL MIXING RATIO CHART

Figure 8-1

3 November 1980
SECTION 8
HANDLING, SERVICE & MAINTENANCE

OIL (Aviation Grade Engine Oil; SAE 50 Above 4.4°C (40°F), SAE 30 Below 4.4°C (40°F) or Multiviscosity Unrestricted Temperature Range - Filter Element 643227)

Multiviscosity oil is recommended for use after the first 100 hours of engine operation for improved starting and turbocharger controller operation in temperatures below 4.4°C (40°F). When operating temperatures overlap indicated ranges, use the lighter grade of oil. Ashless dispersant oil, conforming to the latest issue of Continental Motors Specification MHS-24, must be used. No oil additives are approved for use. Replace filters every 100 hours; change oil every 100 hours or 6 months, whichever occurs first, reduce intervals for prolonged operation in dusty areas, cold climates or when short flights and long idle periods result in sludging conditions.

NOTE
For faster ring seating and improved oil control, your Cessna was delivered from the factory with corrosion preventive oil conforming to MIL-L-6529, Type II. This break-in oil must be used only for the first 25 hours of operation; at that time it must be replaced with ashless dispersant oil. If oil must be added during this first 25 hours of operation, use straight mineral oil conforming to MIL-L-6082.

Check oil level before each flight. Do not operate on less than 9 quarts.

OXYGEN (Aviators Breathing Oxygen - Specification MIL-O-27210)

Check pressure gage for anticipated requirements before each flight. Refill whenever pressure drops below 300 PSI.

The small oxygen cylinder, when fully charged and allowed to stabilize at a temperature of 21.1°C (70°F), contains approximately 11.0 cubic feet of oxygen under a pressure of 1800 PSI. The large oxygen cylinder, when fully charged and allowed to stabilize at a temperature of 21.1°C (70°F), contains approximately 114.9 cubic feet of oxygen under a pressure of 1850 PSI. Filling pressures will vary, however, due to the ambient temperature in the filling area, and because of the temperature rise resulting from compression of the oxygen. Because of this, merely filling to 1800 or 1850 PSI will not result in a properly filled cylinder. Fill to the pressures indicated in Figure 8-2 for the ambient temperature.

WARNING
Oil, grease, or other lubricants in contact with oxygen create a serious fire hazard, and such contact must be avoided when handling oxygen equipment.

The 11.0 cubic foot capacity cylinder is serviced through a filler valve located on the forward face of the left nose baggage door jamb and the 114.9 cubic foot capacity cylinder is serviced through the right nose baggage door in a similar manner.

3 November 1980
8-12
Revision 1 - 2 Apr 1982
OXYGEN SERVICING CHART

<table>
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<th>AMBIENT TEMPERATURE °C</th>
<th>FILLING PRESSURE PSIG</th>
<th>AMBIENT TEMPERATURE °F</th>
<th>FILLING PRESSURE PSIG</th>
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</thead>
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<td>1600</td>
<td>21.1</td>
<td>1925</td>
</tr>
<tr>
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<td>26.7</td>
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<tr>
<td>19.6</td>
<td>1875</td>
<td>54.4</td>
<td>2200</td>
</tr>
</tbody>
</table>

The numbers shown above are applicable to 1800 PSI oxygen bottles. If an 1850 PSI oxygen bottle is installed, increase each filling pressure by 50 PSI.

Figure 8-2

AIR CONDITIONING RESERVOIR (Hydraulic Fluid MIL-H-5606)

Check reservoir fluid level above screen bottom. Reservoir capacity 2.75 quarts.

LANDING GEAR HYDRAULIC RESERVOIR (Hydraulic Fluid MIL-H-5606)

Check reservoir fluid level; fill as required to maintain fluid level between the ADD and MAX FULL marks. Reservoir capacity is approximately 1.2 quarts when landing gear is down and locked.

ALCOHOL WINDSHIELD DEICE RESERVOIR (Isopropyl Alcohol MIL-F-5566)

Check reservoir fluid level; fill as required. Reservoir capacity is 3.0 gallons.

BATTERY

Low electrolyte level, inadequate charging and long idle periods in a discharged condition can cause batteries to become sulfated and unserviceable. Airplanes intended to be idle for long periods of time should have the battery removed and placed on charge.

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NOTE

Water consumption will increase during warmer temperatures and should be checked regularly. Fifty (50) hour intervals are recommended, but may need to be reduced to maintain proper electrolyte level, depending on use and weather conditions.

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TIRES

Tire pressure should be maintained at 80 PSI for the main wheel tire and 35 PSI for the nosewheel tire.

3 November 1980
SECTION B
HANDLING, SERVICE & MAINTENANCE

FLUSH TOILET RESERVOIR

The optional flush toilet uses a reservoir tank that contains water and chemicals. The reservoir tank should be removed and serviced after excessive use or after 35 or 40 cycles of the system. Service the reservoir with a 2-quart solution of water and a 3-ounce package of Monogram G6-19 chemical.

NOTE

During cold weather operation, where cabin temperatures can fall below 0°C (32°F), an ethylene glycol base anti-freeze should be added to the reservoir tank to prevent freezing of the flush solution.

AIRPLANE CLEANING AND CARE

PAINTED SURFACES

The painted exterior surfaces of your new airplane require an initial curing period which may be as long as 90 days after the finish is applied. During this curing period some precautions should be taken to avoid damaging the finish or interfering with the curing process. The finish should be cleaned only by washing with clean water and mild soap, followed by a rinse water and drying with cloths or a chamois. Do not use polish or wax, which would exclude air from the surface, during this 90-day curing period. Do not rub or buff the finish and avoid flying through rain, hail or sleet.

Once the finish has cured completely, it may be waxed with a good automotive wax. A heavier coating of wax on the leading edges of the wings, tail, engine nose cap and propeller spinner will help reduce the abrasion encountered in these areas.

PROPELLER

Pre-flight inspection of propeller blades for nicks and wiping them occasionally with an oily cloth to clean off grass and bug stains will assure long, trouble-free service. It is vital that small nicks on the propeller, particularly near the tips and on the leading edges, are dressed out as soon as possible since these nicks produce stress concentrations, and if ignored, may result in cracks. Never use an alkaline cleaner on the blades; remove grease and dirt with Stoddard solvent.

LANDING GEAR

Cessna Dealer's mechanics have been trained in the proper adjustment and rigging of the landing gear system. To assure trouble-free gear operation, have your Cessna dealer check the gear regularly and make any necessary adjustments. Only properly trained mechanics should attempt to repair or adjust the landing gear components and system.
DEICE BOOTS

The optional deice boots have a special, electrically conductive coating to bleed-off static charges which cause radio interference and may perforate the boots. Fueling and other servicing operations should be done carefully, to avoid damaging this conductive coating or tearing the boots.

To prolong the life of surface and propeller deice boots, they should be washed and serviced on a regular basis. Keep the boots clean and free from oil, grease and other solvents which cause rubber to swell and deteriorate. Outlined below are recommended cleaning and servicing procedures.

**CAUTION**

Use only the following instructions when cleaning boots. Disregard instructions which recommend petroleum base liquids (Methyl-Ethyl-Ketone, non-leaded gasoline, etc.) which can harm the boot material.

Clean the boots with mild soap and water, then rinse thoroughly with clean water.

**NOTE**

Isopropyl alcohol can be used to remove grime which cannot be removed using soap. If isopropyl alcohol is used for cleaning, wash area with mild soap and water, then rinse thoroughly with clean water.

To possibly improve the service life of deice boots and to reduce ice adhesion of ice, it is recommended that the deice boots be treated with AGE MASTER No. 1 and I CEX.

AGE MASTER No. 1, used to protect the rubber against deterioration from ozone, sunlight, weathering, oxidation and pollution, and I CEX, used to help retard ice adhesion and for keeping deice boots looking new long are both products of and recommended by B. F. Goodrich.

The application of both AGE MASTER No. 1 and I CEX should be in accordance with the manufacturer’s recommended directions as outlined by the containers.

**CAUTION**

Protect adjacent areas, clothing, and use plastic or rubber gloves during applications, as AGE MASTER No. 1 stains and I CEX contains silicone which makes paint touchup almost impossible.

Ensure that the manufacturer’s warnings and cautions are adhered to when using AGE MASTER No. 1 and I CEX.

3 November 1980
Revision 1 - 2 Apr 1982
SECTION B
HANDLING, SERVICE & MAINTENANCE

1. Small tears and abrasions in surface dielectric boots can be repaired temporarily without removing the boots, and the conductive coating can be renewed. Your Cessna Dealer has the proper materials and know-how to do this correctly.

ENGINES

The engine compartments should be cleaned, using a suitable solvent. Most efficient cleaning is done using a spray-type cleaner. Before spray cleaning, ensure protection is afforded for components which might be adversely affected by the solvent. Refer to the Airplane Service Manual for proper lubrication of controls and components after engine cleaning.

INTERIOR CARE

To remove dust and loose dirt from the upholstery, headliner and carpet, clean the interior regularly with a vacuum cleaner.

Blot up any spilled liquid promptly with cleansing tissue or rags. Don't pat the spot; press the blotting material firmly and hold it for several seconds. Continue blotting until no more liquid is taken up. Scrape off sticky materials with a dull knife, then spot-clean the area.

Oily spots may be cleaned with household spot removers, used sparingly. Before using any solvent, read the instructions on the container and test it on an obscure place on the fabric to be cleaned. Never saturate the fabric with a volatile solvent; it may damage the padding and backing materials.

WARNING

- Use all cleaning agents in accordance with the manufacturer's recommendations.
- The use of toxic or inflammable cleaning agents is discouraged. If these cleaning agents are used, ensure adequate ventilation is provided to prevent harm to the user and/or damage to the airplane.

Soiled upholstery and carpet may be cleaned with foam-type detergent, used according to the manufacturer's instructions. To minimize wetting the fabric, keep the foam as dry as possible and remove it with a vacuum cleaner.

The plastic trim, instrument panel and control knobs need only be wiped with a damp cloth. Oil and grease on the control wheel and control knobs can be removed with a cloth moistened with kerosene. Volatile solvents, such as mentioned in paragraphs on care of the windshield, must never be used since they soften and craze the plastic.

WINDOWS AND WINDSHIELDS

The cabin windows and windshield panels are constructed of prestretched acrylic in lieu of the cast acrylic used on unpressurized airplanes. Stretched acrylic was chosen to provide the added safety offered by the ability to withstand higher stress concentration and improved resistance to

3 November 1980
8-16
Revision 1 - 2 Apr 1982
Crack propagation. The surface hardness of acrylic is approximately equal to that of copper or brass. Care must be exercised to avoid scratches and gouges which may be caused by dirty, hard or rough cloth used for cleaning. To prevent possible damage, items such as wrist watch, rings, etc. should be removed before cleaning windshield and windows. Do not use a canvas cover on the windshield unless freezing rain or sleet is anticipated. Canvas covers may scratch the plastic surface.

Proper window care and maintenance are particularly important in a pressurized airplane. If the airplane must be flown with a cracked window, DO NOT PRESSURIZE the cabin. When cleaning and waxing windshield and windows, use only the following prescribed methods and materials and those in the airplane service manual.

**CAUTION**

Do not use the following materials on acrylic plastic: gasoline, benzene, xylene, acetone, carbon tetrachloride, toluene, mek, fire extinguisher fluids, lacquer thinners or window glass cleaners because they will soften the plastic and/or cause crazing in the plastic.

Cleaning Windshield and Windows
(Except Electrical Windshield)

Plastic windshields and windows should be kept clean and waxed at all times. To prevent scratches and crazing, wash them carefully with a non abrasive soap or detergent and water, using the palm of the hand to feel and dislodge dirt and mud. A soft cloth, chamois or sponge may be used but only to carry water to the surface. Rinse thoroughly, then dry with clean, damp chamois or rymplecloth. Rubbing the surface of the plastic with a dry cloth builds up an electrostatic charge which attracts dust particles in the air. Wiping with a moist chamois will remove both dirt and this charge. Allphatic naphtha or kerosene may be used for removing grease and oil.

After removing dirt and grease, if the surface is not badly scratched it should be waxed with a good grade of commercial wax. The wax will fill in minor scratches and help prevent further scratching. Apply a thin, even coat of wax and bring it to a high polish by rubbing lightly with a clean dry, soft flannel cloth. Do not use a power buffer; the heat generated the buffing pad may soften the plastic.

Cleaning Electrical Windshield

**CAUTION**

Do not attempt to repair scratches in the electrical windshield. Any sanding or polishing will damage the anti-static wires due to their location near the windshield surface. Cleaning and waxing are the only approved maintenance procedures.

3 November 1980
Revision 1 - 2 Apr 1982
Spray a mist of alcohol solution (70% Isopropyl Alcohol; 30% Water) over the windshield and wipe with folded cotton or cheesecloth pads, applying a light pressure to remove dust and dirt particles. Repeat spray and wipe, increase pressure and refold pad to reduce chances of picking up any substance that will scratch the windshield surface.

After cleaning, the windshield should be waxed with "Turtle Wax" brand liquid automotive wax for protection. The wax coating improves appearance and makes cleaning easier.

OXYGEN MASKS

The pilot's mask is a permanent-type mask which contains a microphone for radio transmissions. The remaining masks are basically the same as the pilot's, except they do not have the microphone provision. All masks can be cleaned with alcohol. Additional masks and hoses are available from your Cessna Dealer.
### SECTION 9
**SUPPLEMENTS**

**TABLE OF CONTENTS**

<table>
<thead>
<tr>
<th>Supplement</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INTRODUCTION</strong></td>
<td>9-2</td>
</tr>
<tr>
<td><strong>SUPPLEMENTS - GENERAL</strong></td>
<td></td>
</tr>
<tr>
<td>1  Aft Cabin Divider and Sliding Door</td>
<td>1</td>
</tr>
<tr>
<td>2  Air Conditioning System</td>
<td>3</td>
</tr>
<tr>
<td>3  Alcohol Windshield Deice System</td>
<td>2</td>
</tr>
<tr>
<td>4  Angle-of-Attack System</td>
<td>2</td>
</tr>
<tr>
<td>5  Davtron 811 Digital Clock</td>
<td>2</td>
</tr>
<tr>
<td>6  Deice Boot System</td>
<td>4</td>
</tr>
<tr>
<td>7  Economy Mixture Indicator</td>
<td>2</td>
</tr>
<tr>
<td>8  Electrical Elevator Trim</td>
<td>1</td>
</tr>
<tr>
<td>9  Electrical Windshield Anti-ice System</td>
<td>2</td>
</tr>
<tr>
<td>10 Flight in Icing Conditions</td>
<td>4</td>
</tr>
<tr>
<td>12 Fire Detection and Extinguishing System</td>
<td>2</td>
</tr>
<tr>
<td>14 Fuel Flow Indicating System</td>
<td>1</td>
</tr>
<tr>
<td>15 Manually Adjustable Seat</td>
<td>2</td>
</tr>
<tr>
<td>17 Propeller Deice System</td>
<td>2</td>
</tr>
<tr>
<td>18 Yaw Damper</td>
<td>2</td>
</tr>
<tr>
<td><strong>SUPPLEMENTS - AVIONICS</strong></td>
<td></td>
</tr>
<tr>
<td>21 400 Encoding Altimeter (Type EA-401A)</td>
<td>3</td>
</tr>
<tr>
<td>22 800 Encoding Altimeter/Alerting/Preselect (Type EA-801 A)</td>
<td>6</td>
</tr>
<tr>
<td>23 400 Area Navigation System (Type RN-478A)</td>
<td>5</td>
</tr>
<tr>
<td>24 800 Area Navigation System (Type RN-878A)</td>
<td>6</td>
</tr>
<tr>
<td>26 800 Audio Control Panel</td>
<td>2</td>
</tr>
<tr>
<td>27 1000 Audio Control Panel</td>
<td>6</td>
</tr>
<tr>
<td>29 400 Automatic Direction Finder (Type R-446A)</td>
<td>4</td>
</tr>
<tr>
<td>**30 1000 Automatic Direction Finder (Type 1046B)</td>
<td>5</td>
</tr>
<tr>
<td>**31 400B Nav-O-Matic/autopilot System (Type AF-850A)</td>
<td>12</td>
</tr>
<tr>
<td>**32 CC-2024 B Checklist Display</td>
<td>3</td>
</tr>
<tr>
<td>**33 1000 Communication System (Type RT-1036A)</td>
<td>3</td>
</tr>
<tr>
<td>**34 400 DME (Type TRA-476A)</td>
<td>3</td>
</tr>
<tr>
<td>**35 800 DME (Type RTA-876A)</td>
<td>3</td>
</tr>
<tr>
<td>**36 400 and 1000 Glide Slope (Type R-4436 and Type R-5043A)</td>
<td>2</td>
</tr>
<tr>
<td>**37 400B Transceiver</td>
<td>2</td>
</tr>
<tr>
<td>**38 400B Integrated Flight Controls System (Type IF-550A)</td>
<td>17</td>
</tr>
<tr>
<td>**39 800B Integrated Flight Control System (Type IF-550A)</td>
<td>16</td>
</tr>
<tr>
<td>**40 Locator Beacon (DMELT-6 and -6C)</td>
<td>1</td>
</tr>
<tr>
<td>**41 400 Marker Beacon (Type R-402A)</td>
<td>2</td>
</tr>
<tr>
<td>**42 1000 Navigation System (Type 1048A)</td>
<td>4</td>
</tr>
<tr>
<td>**44 400 Nav/Com System (Type RT-485A)</td>
<td>6</td>
</tr>
<tr>
<td>**45 AA-100 Radio Altimeter</td>
<td>2</td>
</tr>
<tr>
<td>**46 AA-215 Radio Altimeter</td>
<td>2</td>
</tr>
<tr>
<td>**47 400 Radio Magnetic Indicator (Type IN-404A)</td>
<td>3</td>
</tr>
<tr>
<td>**48 1000 Radio Magnetic Indicator (Type IN-1004A)</td>
<td>3</td>
</tr>
<tr>
<td>**49 Radio Magnetic Indicator (7100 RMI)</td>
<td>3</td>
</tr>
<tr>
<td>**50 Flitefone III Radio Telephone</td>
<td>2</td>
</tr>
<tr>
<td>**51 400 Transponder (Type 459A)</td>
<td>4</td>
</tr>
<tr>
<td>**52 800 Transponder (Type 859A)</td>
<td>3</td>
</tr>
</tbody>
</table>

---

3 November 1980
Revision 1 - 2 Apr 1982
## TABLE OF CONTENTS (CONTINUED)

<table>
<thead>
<tr>
<th>Section</th>
<th>Supplement</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>53</td>
<td>Weather Radar RDR-150 and RDR-160</td>
<td>3 Pages</td>
</tr>
<tr>
<td>54</td>
<td>Weather Radar RDR-150 Color Display</td>
<td>4 Pages</td>
</tr>
<tr>
<td>55</td>
<td>Weather Radar Color Display Primus-200</td>
<td>4 Pages</td>
</tr>
</tbody>
</table>

## LOG OF REVISIONS

Supplement pages which have changed since the original issue of this manual are listed below.

<table>
<thead>
<tr>
<th>Supplement Number and Name</th>
<th>Pages Added/Deleted/(Revised)</th>
<th>Revision Number and Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Air Conditioning System</td>
<td>1 of 3 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>6 Deice Boot System</td>
<td>1 of 4 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>6 Deice Boot System</td>
<td>2 of 4 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>6 Deice Boot System</td>
<td>3 of 4 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>6 Deice Boot System</td>
<td>4 of 4 (Added)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>8 Electric Elevator Trim</td>
<td>1 of 1 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>10 Electrical Windshield</td>
<td>2 of 2 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>11 Flight in Icing Conditions</td>
<td>1 of 4 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>11 Flight in Icing Conditions</td>
<td>4 of 4 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>12 Fire Detection and Extinguishing System</td>
<td>2 of 2 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>27 1000 Audio Control Panel</td>
<td>1 of 6 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>27 1000 Audio Control Panel</td>
<td>2 of 6 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>27 1000 Audio Control Panel</td>
<td>2 of 6 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>27 1000 Audio Control Panel</td>
<td>3 of 6 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>27 1000 Audio Control Panel</td>
<td>4 of 6 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>27 1000 Audio Control Panel</td>
<td>5 of 6 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>27 1000 Audio Control Panel</td>
<td>6 of 6 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>31 4008 Navomatic Autopilot System</td>
<td>2 of 12 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>31 4008 Navomatic Autopilot System</td>
<td>3 of 12 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>38 400B Integrated Flight Control System</td>
<td>2 of 17 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>38 400B Integrated Flight Control System</td>
<td>3 of 17 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>39 800B Integrated Flight Control System</td>
<td>2 of 16 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>39 800B Integrated Flight Control System</td>
<td>3 of 16 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>44 400 NAV/COM</td>
<td>4 of 6 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>55 Primus-200 Weather Radar Color Display</td>
<td>1 of 4 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
<tr>
<td>55 Primus-200 Weather Radar Color Display</td>
<td>2 of 4 (Revised)</td>
<td>Revision 1 - 2 Apr 1982</td>
</tr>
</tbody>
</table>

## INTRODUCTION

Section 9 of this handbook provides supplemental information for optional equipment which may be installed on the airplane. Each supplement covers one item of optional equipment. To make it easier to locate a particular supplement within Section 9, supplements are arranged in alphabetical order and assigned reference numbers which are listed in sequence.

3 November 1980
Revision 1 - 2 Apr 1982
AFT CABIN DIVIDER AND SLIDING DOOR

SECTION 1 - GENERAL

This supplement provides information which must be observed when operating the aft cabin divider door.

Description

The aft cabin divider and sliding door provide privacy and separation between the passenger compartment and the lounge area of the passenger compartment.

The divider door is a three-piece assembly with a wood honeycomb core covered with high-pressure plastic laminate. The door slides to left for closing and to the right for opening. A strap is provided to secure the door in the open or STOWED position.

SECTION 2 - LIMITATIONS

A. The aft cabin divider door must always be in the open and SECURED position for takeoff, landing and whenever removal of smoke from the cabin is required.
B. Required Placard:
   1. On the back side of the divider door:
      DOOR MUST BE OPEN AND SECURED FOR TAKEOFF, LANDING AND SMOKE REMOVAL
      NO SMOKING WITH DIVIDER CLOSED

SECTION 3 - EMERGENCY PROCEDURES

A. Emergency Landing, Ditching or Smoke Removal Procedures.
   1. Aft Cabin Divider Door - OPEN and SECURED.

SECTION 4 - NORMAL PROCEDURES

A. Before Takeoff and Landing.
   1. Aft Cabin Divider Door - OPEN and SECURED.

SECTION 5 - PERFORMANCE

Not Applicable.

3 November 1980
SECTION 9
SUPPLMENTS
AIR CONDITIONING SYSTEM

SECTION 1 - GENERAL

This supplement provides information which must be observed when operating the air conditioning system.

Description

The air conditioning system, see Figure 1, consists of a hydraulically driven compressor and condenser in the right nacelle, two evaporators aft of the pilot's and copilot's seats, a control panel located on the lower part of the left instrument panel and a green monitor light on the annunciator panel.

The hydraulic drive for the compressor consists of an engine-driven hydraulic pump, a hydraulic fluid reservoir, an unloading valve and hydraulic motor. During normal engine operation, with the air conditioning system switch to OFF or CIRCULATE, the unloading valve routes hydraulic fluid from the hydraulic pump back to the reservoir so that the hydraulic motor is disengaged; the green monitor light, see Figure 7-3, will be off during this condition. When the air conditioning system switch is turned to COOL, the unloading valve forces hydraulic fluid to flow from the hydraulic pump to the hydraulic motor and opens the condenser air inlet door. During preflight inspections, the spring loaded condenser air inlet door may be actuated by hand without harm to the system. The hydraulic motor drives the compressor to provide conditioned air to the cabin. The green monitor light will come on when the compressor is operating and will cycle off when the cabin temperature corresponds with the temperature controller setting. The monitor light may flicker for two to three minutes prior to turning off due to the required work load on the hydraulic system as the temperature condition becomes satisfied.

The two evaporators and blower motors distribute conditioned air to the cabin area via overhead ducts. Circuit breakers are provided for each blower, right and left.

The system control panel consists of two switches and a rheostat. System switch, placarded COOL-OFF-CIRCULATE, controls the mode of operation. The blower switch, placarded HIGH-LOW, controls the blower speed. The blower will operate whenever the system switch is in either the COOL or CIRCULATE mode. The temperature control rheostat, placarded COOLER, controls the temperature of the conditioned air. Clockwise rotation of the temperature control knob lowers the air temperature.

CAUTION

- To prevent damage to the air conditioning compressor, Do Not operate the air conditioning system in COOL when the outside air temperature is below 20°F (-6.7°C).
- When the outside air temperature is greater than 20°F (-6.7°C), Freon loss and servicing intervals may be reduced by placing the air conditioning selector switch in COOL for 5 minutes each week.

3 November 1980
Revision 1 - 2 Apr 1982
AIR CONDITIONING SCHEMATIC

CODE
- RIGHT EVAPORATOR CONDITIONED AIR
- LEFT EVAPORATOR CONDITIONED AIR

Figure 1
SECTION 2 - LIMITATIONS
A. System must be "OFF" or "CIRCULATE" for takeoff, landing and single-engine operation.
B. Required Placards:
   1. Inside Right Wing Locker Baggage Door.
      a. "MAXIMUM BAGGAGE - 120 LBS."

SECTION 3 - EMERGENCY PROCEDURES
A. Engine Inoperative Procedures
   1. Air Conditioner - OFF or CIRCULATE.

SECTION 4 - NORMAL PROCEDURES
A. Starting Procedures
   1. Air Conditioner - Check OFF.
B. Before Taxi
   1. Air Conditioner - As Desired.
C. Before Takeoff
   1. Air Conditioner - OFF or CIRCULATE.
D. After Takeoff
   1. Air Conditioner - As Desired.
E. Before Landing
   1. Air Conditioner - OFF or CIRCULATE.
F. After Landing
   1. Air Conditioner - As Desired.

SECTION 5 - PERFORMANCE
Not Applicable.

3 November 1980
SECTION 9
SUPPLEMENTS

ALCOHOL WINDSHIELD DEICE SYSTEM

SECTION 1 — GENERAL

This supplement provides information which must be observed when operating the alcohol windshield deice system.

Description

The alcohol windshield deicer system consists of an alcohol tank pump, a dispersal tube for each windshield and a switch breaker.

The alcohol tank, located in the aft end of the right wing locker, has a 3.0-gallon capacity. The tank should be filled with isopropyl alcohol only. Water dilution of the alcohol is not recommended, as any water contained in the alcohol will reduce the efficiency of ice removal and freeze on the windshield at very low temperatures. The pump, located adjacent to the tank, provides positive pressure to each windshield dispersal tube. A dispersal tube, located at the forward base of each windshield, provides flow pattern control throughout the airplane's speed envelope. Each tube contains five holes which should be inspected and cleaned with small diameter wire as necessary.

Abnormal operation of the alcohol windshield deicer system is indicated by the switch breaker tripping to the OFF position or failure of alcohol flow onto the windshield.

SECTION 2 — LIMITATIONS

A. Discontinue alcohol dispersal 20 seconds before reaching minimum scent altitude.
B. Do not operate system longer than 3 minutes without alcohol.

SECTION 3 — EMERGENCY PROCEDURES

Not Applicable.

SECTION 4 — NORMAL PROCEDURES

A. Preflight Inspection
   1. Windshield Dispersal Tubes - CHECK condition and cleanliness.
   2. Alcohol Tank Level - CHECK. Full tank provides approximately 1 hour of continuous operation. If icing is encountered on left or right windshield only, approximately 2 hours of continuous operation is available.

B. Before Takeoff
   1. Alcohol Windshield Switch - ON. Allow 10 seconds for alcohol to begin. Check 5 dispersal holes for flow at the base of each windshield.
   2. Alcohol Windshield Switch - OFF.

3 November 1980
3 ALCOHOL WINDSHIELD DEICE SYSTEM

C. In Flight
   1. During Icing Encounters:
      a. Alcohol Windshield Switch - ON.

   NOTE

   For operation in continuous enroute icing conditions, allow approximately 1/8 to 1/4 inch of ice to accumulate. The windshield deice system can be used as an anti-ice system by continuous use and should be so used during the approach to landing. However, the maximum endurance with a 3.0-gallon tank is approximately 1.0 hour of continuous operation. If alcohol deicing is installed on left or right windshield only, approximately 2 hours of continuous operation is available. Airspeed should be 140 KIAS or below for best results.

   b. Alcohol Windshield Switch - OFF after ice removal.

D. Approach to Landing

   WARNING

   The windshield deice switch breaker must be positioned OFF 20 seconds prior to reaching minimum descent altitude. The alcohol film must be allowed to evaporate before a clear field of vision through the windshield is available.

SECTION 5 – PERFORMANCE

Not Applicable.
SECTION 9
SUPPLEMENTS

ANGLE-OF-ATTACK SYSTEM

SECTION 1 — GENERAL

This supplement provides information which must be observed when operating the angle-of-attack system.

Description

The angle-of-attack system, see Figure 1, is a sensitive lift measurement device which provides a continuous evaluation of lift performance of the airplane, regardless of weight, wing loading, attitude, air density, turbulence, and gear/flap configuration. The system consists of an indicator, stall warning horn test switch, computer and lift sensor. The lift sensor is located in the leading edge of the left wing. The standard airplane stall warning system is removed and its function is assumed by the angle-of-attack system.

The red "SLOW" zone on the left side of the indicator shows the trend toward stall. The stall warning horn will sound at least 5 KCAS above the airplane stall speed.

A PRESS-TO-TEST feature is incorporated to test the general condition of the system. When the test switch is pressed, the pointer should move to the SLOW end of the scale and the stall warning horn should sound.

ANGLE-OF-ATTACK INDICATOR

Figure 1

3 November 1980
SECTION 2 — LIMITATIONS

The angle-of-attack indicating system may be used as a reference system but does not replace the airspeed indicator as a primary instrument. Operations utilizing the angle-of-attack indicating system, except as stated herein, are not approved.

SECTION 3 — EMERGENCY PROCEDURES

Not Applicable.

SECTION 4 — NORMAL PROCEDURES

A. Preflight Inspection
   1. Stall Warning Vane - CHECK freedom of movement and audible warning. Gently push the vane down to the stop; the indicator pointer should move to the full right FAST legend. Gently push the vane up to the stop; the indicator pointer should move to the full left SLOW legend and the prestall warning horn should activate.

   NOTE

   Satisfactory operation of the stall warning transmitter heating element is determined by observing a discharge on the voltmeter when the stall heat switch is turned on. The operation of the heating element may be verified by cautiously feeling the heat of this device while the switch is on.

B. Descent

      For a normal approach to landing, the pointer should be aligned with the center-mark. Alignment of the pointer with the "FAST" diamond provides a more comfortable airspeed margin for an approach in turbulent or gusty conditions.

      To correct for an off-speed condition a small attitude correction should be held while waiting to see the result on the indicator. "Chasing" the pointer may result in a longitudinal, pilot-induced oscillation. The instrument is intended to be used as a reference to assist in determining the proper speed for the landing approach. The airspeed indicator is still the primary instrument for speed control.

SECTION 5 — PERFORMANCE

Not Applicable.
DAVTRON 811B DIGITAL CLOCK

SECTION 1 - GENERAL

This supplement provides information which must be observed when operating the Davtron 811B digital clock.

Description

The Davtron 811B, 24-hour, digital clock, see Figure 1, is a solid-state timing device which presents real time, flight time and elapsed time. The clock's internal memory is maintained, regardless of the airplane battery switch position, by a nonchargeable clock battery. This clock battery should be replaced every three years. The clock's light emitting diode (LED) displays require airplane electrical power.

All operating controls (four switches) are provided on the face of the clock.

The SET switch is used to make minor corrections to the real time memory of the clock. This switch should be used only after checking the clock with an accurate time reference such as the National Bureau of Standards time broadcast. If the clock is found to be inaccurate, position the SET switch to UP for the number of seconds the clock is slow or to DOWN for the number of seconds the clock is fast. The flight time and elapsed time functions will operate normally during the setting of the real time function. Therefore, the elapsed time display can be used to time the hold of the SET switch.

The DIM switch is used to make one-hour changes to the real time and set the light intensity for day and night flight operations. If repeated changes of hours only are required, each momentary actuation of the switch to the 1 hr position will advance the real time one hour. During daylight operations, the switch should be positioned to B. During night operations, the DIM position will decrease illumination intensity to a suitable level.

The ZERO switch is used to zero, stop or run the flight time or elapsed time functions. Actuation of the switch to the ZERO position will zero the elapsed time and stop the flight time if the airplane battery switch is in the OFF position. Actuation of the switch to the STOP position will stop the elapsed time function. Actuation of the switch to the RUN position will start the elapsed time function.

The TIME switch is used to display real time, flight time or elapsed time in hours, minutes and seconds in the two display windows. When the switch is positioned to TIME, the real time will be displayed.

When the switch is positioned to ET, the elapsed time will be displayed. When the switch is positioned to FT, the flight time will be displayed. The flight time function is wired through the landing safety switch; thus, flight time can only be accumulated when the weight of the airplane is off the landing gear.
1. SET SWITCH - Used to correct real time in seconds. UP position advances real time while D position retards real time.
2. DIM SWITCH - Used to set display illumination intensity and to advance real time in one-hour increments.
3. ZERO SWITCH - Used to stop, start and zero the elapsed time function. The flight time function can also be zeroed if the airplane battery switch is OFF.
4. TIME SWITCH - Used to display real time, flight time or elapsed time functions in hours, minutes and seconds.

Figure 1

SECTION 2 – LIMITATIONS
Not Applicable.

SECTION 3 – EMERGENCY PROCEDURES
Not Applicable.

SECTION 4 – NORMAL PROCEDURES
A. Before Starting The Engines
   1. Zero Switch - ZERO momentarily to zero the elapsed flight time functions.
   2. Dim Switch - AS REQUIRED.

SECTION 5 – PERFORMANCE
Not Applicable.
SECTION 1 – GENERAL

This supplement provides information which must be observed when operating the deice boot system.

Description

This system is designed to remove ice after accumulation, rather than prevent ice formation.

The deice boot system consists of pneumatically operated boots, engine-driven pneumatic pumps, an annunciator light to monitor system operation and necessary hardware to complete the system.

The deice boots are attached to the leading edges of the wing and stabilizers. The boots expand and contract, using pressure and vacuum from the engine-driven vacuum pumps. Normally, vacuum is applied to all boots to hold them against the leading edge surfaces. When a deicing cycle is initiated, the vacuum is removed from the boots and a pressure is applied to "blow up" the boots. This change in contour will break the ice accumulation on the leading edges. Ice formations aft of this area will then be removed by normal in-flight air forces.

The deice system will operate satisfactorily on either or both engines during single-engine operation, suction to the gyro will drop momentarily during the boot inflation cycle.

The deicing system is manually controlled by actuating the surface deice switch each time a deice cycle is desired. The switch will instantly spring back to off; however, a 12-second delay action by the sequencer system will complete the deicing inflation cycle.

The sequencing system inflates the tail section boots for approximately 6 seconds, then the wing boots for the next 6 seconds. The annunciator light, see Figure 7-3, should illuminate when the tail section boots reach proper operating pressure. No cyclic illumination after selecting a deice cycle indicates insufficient pressure for proper system operation and icing conditions should be avoided. The system may be recycled 6 seconds after the light goes out or anytime thereafter as required.

SECTION 2 – LIMITATIONS

Not Applicable.

SECTION 3 – EMERGENCY PROCEDURES

Not Applicable.

3 November 1980
Revision 1 - 2 Apr 1982
SECTION 4 – NORMAL PROCEDURES

A. Preflight Inspection
   1. Deice Boots - CHECK for tears, abrasions and cleanliness.

B. Before Takeoff
   1. Surface Deice Switch - ACTUATE. Visually check operation of switch and annunciator light ON.

NOTE
Actuating the surface deice switch will result in one complete inflation and deflation cycle lasting approximately 45 seconds.

C. Inflight
   1. During Icing Encounters.
      a. Surface Deice Switch - ACTUATE when ice accumulates between 1/4 to 1/2 inch. Repeat as necessary, allowing at least 45 seconds between actuations.

NOTE
- Accumulation of a 1/2 inch of ice can cause a cruise speed reduction of up to 30 knots as well as heavy buffet and a significant stall speed increase. Increase power as required to maintain desired airspeed.
- Prestall buffet and stall speeds increase slightly when deice boots are actuated. Maintain extra speed, especially during an approach, before actuating the boots.
- After prolonged icing encounters, increase engine power to maintain desired airspeed as ice accumulates on the unprotected areas.
- Maintain extra airspeed on approach to compensate for the increased prestall buffet associated with ice on the unprotected areas.

2. Leave icing conditions as soon as possible if airplane is not equipped for flight in icing conditions.

NOTE
Since wing, horizontal stabilizer and vertical stabilizer deice boots alone do not provide adequate protection for the entire airplane, icing conditions should be avoided whenever possible unless the airplane is equipped for flight in icing conditions. Refer to Flight In Icing Conditions supplement for details. If icing is encountered, close attention should be given to the pitot-static system, propellers, induction systems and other components subject to icing.

3 November 1980
Revision 1 - 2 Apr 1982
SECTION 5 – PERFORMANCE

A. When climbing through areas of light to moderate icing conditions, use cruise climb airspeeds and maximum climb power (full power) settings to preclude ice buildup on the fuselage undersurface and lower wing surfaces and minimize the exposure time to icing conditions.

B. During prolonged icing encounters in cruise, increase engine power to 75% or greater to maintain cruise speed as ice accumulates on the unprotected areas and preclude ice buildup on the fuselage undersurface and lower wing surfaces.

C. Prestall buffet and stall speeds increase slightly when deice boots are actuated. Maintain extra speed, especially during an approach, before actuating the boots.

D. Maintain extra airspeed on approach to compensate for the increased prestall buffet associated with ice on the unprotected areas and the increased weight.

E. Airplane general performance is decreased with ice on the unprotected areas.
ECONOMY MIXTURE INDICATOR

SECTION 1 — GENERAL

This supplement provides information which must be observed when operating the economy mixture indicator.

Description:

The Cessna Economy Mixture Indicator is an exhaust gas temperature (EGT) sensing device which is used to aid the pilot in selecting the most desirable fuel-air mixture for cruising flight at less than 75% power. The EGT varies with the ratio of fuel-to-air mixture entering the engine cylinders.

SECTION 2 — LIMITATIONS

A. All exhaust gas temperature (EGT) operation must be accomplished in accordance with Figure 1.

MIXTURE DESCRIPTION CHART

<table>
<thead>
<tr>
<th>MIXTURE DESCRIPTION</th>
<th>EXHAUST GAS TEMPERATURE</th>
<th>TAS LOSS FROM BEST POWER</th>
<th>RANGE INCREASE FROM BEST POWER</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEST POWER</td>
<td>PEAK MINUS 100°F (Enrichen)</td>
<td>0 KNOTS</td>
<td>0%</td>
</tr>
<tr>
<td>(Maximum Speed)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RECOMMENDED LEAN</td>
<td>PEAK MINUS 90°F</td>
<td>2 KNOTS</td>
<td>7%</td>
</tr>
<tr>
<td>(Section 5 And Power Computer Performance)</td>
<td>(Enrichen)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BEST ECONOMY *</td>
<td>PEAK EGT</td>
<td>6 KNOTS</td>
<td>15%</td>
</tr>
</tbody>
</table>

*FOR POWER SETTINGS OF 55% OR LESS WITH RPM IN THE GREEN ARC OR FOR POWER SETTINGS OF 55% TO 65% WITH 1800 RPM OR LESS

Figure 1

SECTION 3 — EMERGENCY PROCEDURES

Not Applicable.

SECTION 4 — NORMAL PROCEDURES

1. In takeoff and full power climb, lean the mixtures as indicated by the white or blue arc on the fuel flow indicator.
7 ECONOMY MIXTURE INDICATOR

NOTE

Leaning in accordance with markings on the fuel flow indicator will provide sufficiently rich mixture for engine cooling. Leaner mixtures are not recommended for power settings in excess of 75%.

2. In level flight (at less than 75% power), lean the mixture to peak EGT, then enrich as desired, using Figure 1 as a guide. For Best Economy mixture at power settings of 55 to 65% at 1800 RPM or lower, or power settings up to 55% for any RPM in the green arc, the engines may be operated at peak EGT.

CAUTION

Operation at Best Economy mixture is not recommended until oil consumption stabilizes or during the first 50 hours of operation. The purpose of operating at 65 to 75% power with Best Power or Recommended Lean mixture is to inspect proper seating of the rings and is applicable to new engines, and engines in service following cylinder replacement or top overhaul of one or more cylinders. Operation leaner than peak EGT is not approved.

NOTE

- Changes in altitude, OAT or power settings require the EGT to be rechecked and the mixture reset.
- Operation up to one minute at peak EGT is authorized at power settings of 75% or less to establish peak EGT reference.
- Operation at peak EGT is authorized for normal continuous operation at power settings of 55 to 65% at 1800 RPM or lower, or power settings up to 55% for any RPM in the green arc. See Figure 1 for approved operating limits.

3. Use rich mixture (or mixture appropriate for field elevation) in idle descents or landing approaches. Leaning technique for cruise descents may be with EGT reference method (at least every 5000 feet) or by simply enriching to avoid engine roughness.

SECTION 5 - PERFORMANCE

Not Applicable.
SECTION 9
SUPPLEMENTS

ELECTRIC ELEVATOR TRIM

SECTION 1 — GENERAL

This supplement provides information which must be observed when operating the electric elevator trim.

Description

The electric elevator trim system consists of an electrically operated drive motor and clutch assembly, which receives power through a "momentary on" two-way trim switch and an emergency disengage switch.

SECTION 2 — LIMITATIONS

A. Disengage electric elevator trim if malfunction occurs.
B. Required Placards:
   1. On Pilot's Control Wheel
      a. "AP/TRIM DISC"
      b. "DN" - "UP"

SECTION 3 — EMERGENCY PROCEDURES

A. Electric Elevator Trim Malfunction.
   1. Elevator Control - OVERPOWER as required.
   2. Control Wheel AP/TRIM DISC Switch - DEPRESS.

   **NOTE**
   All control wheel disengage switches should be simultaneously disengaged to prevent having to immediately distinguish between an electric trim or autopilot pitch malfunction.


SECTION 4 — NORMAL PROCEDURES

A. Elevator Trim Disengage Switch - ELEVATOR TRIM.
B. Trim Switch - ACTUATE as desired.

   **NOTE**
   To check the operation of the disengage switch: actuate the elevator trim switch with the disengage switch in the DISENGAGE position. Observe that the manual trim wheel and indicator do not rotate when the elevator trim switch is actuated.

SECTION 5 — PERFORMANCE

Not Applicable.

3 November 1980
Revision 1 - 2 Apr 1982
SECTION 9
SUPPLEMENTS

ELECTRICAL WINDSHIELD ANTI-ICE SYSTEM

SECTION 1 — GENERAL

This supplement provides information which must be observed when operating the DC electrical windshield.

Description

The electrical windshield anti-ice system consists of two electrically heated rectangular areas: one consisting of 294 square inches (Hi Power, large mat) and an additional 141 square inches (Lo Power), a resistance wire sensor imbedded in the windshield, a hi low relay, a remote temperature controller, a fuse, a circuit breaker and a three-position temperature selector switch. With the switch in Hi, only the large mat is heated with the switch in Lo, both mats are heated at a lower power density.

Power for the electrical windshield is supplied by the airplane's D bus bar. The temperature controller, in conjunction with the resistance wire sensor imbedded in the windshield provides ON-OFF control of the D power through the use of the relay. The temperature sensor, an integral part of the windshield, is located in the high power heated area.

SECTION 2 — LIMITATIONS

If the pilot's windshield is covered with ice, do not leave the electrical windshield anti-ice switch on for more than 20 seconds. Operation excess of 20 seconds will cause an overheat condition which can result in failure of the windshield heating element and/or permanent distortion of the windshield.

The electrical windshield must be on HIGH with outside air temperature below -12°C (10°F) when in visible moisture.

Required Placards:
1. MAGNETIC COMPASS DEVIATIONS GREATER THAN 10° CAN BE EXPECTED WHEN DC HEATED WINDSHIELD IS IN OPERATION.

SECTION 3 — EMERGENCY PROCEDURES

Not Applicable.

SECTION 4 — NORMAL PROCEDURES

A. Before Takeoff

1. Electrical Windshield Switch - HIGH momentarily. Check voltmeter for discharge and WINDSHIELD annunciator light for illumination.

   NOTE

   Turn off windshield anti-ice switch as soon as the voltmeter and the annunciator light have been checked.

3 November 1980
B. Inflight

1. Electrical Windshield Switch - Low before entering visible moisture with outside air temperature below 4.4°C (40°F) and above -12°C (10°F). HIGH before entering visible moisture with outside air temperature below -12°C (10°F).

**NOTE**

- When using the electrical windshield on LOW, correct indicated outside air temperature (see Section 5 for ram rise correction) for your particular altitude and airspeed to ensure the outside air temperature is not below -12°C (10°F).
- If ice begins to accumulate on the heated portion of the windshield while operating on LOW, switch to HIGH.
- After icing conditions are encountered with the windshield on HIGH, do not use LOW until the entire heated portion of the windshield is clear of ice.
- The magnetic compass will not be reliable with the electrical heated windshield in operation.

2. Leave icing conditions as soon as possible if airplane is not equipped for flight in icing conditions.

**NOTE**

Since the electrical windshield anti-ice system alone does not provide adequate protection for the entire airplane, icing conditions should be avoided whenever possible unless the airplane is equipped for flight in icing conditions. Refer to Flight In Icing Conditions Supplement for details. If icing is encountered, close attention should be given to the pilot-static system, propellers, induction systems, wing and stabilizer leading edges and other components subject to icing.

C. After Landing

1. Electrical Windshield Anti-Ice Switch - OFF.

SECTION 5 — PERFORMANCE

Not Applicable.
SECTION 1 – GENERAL

This supplement provides information which must be observed when operating the ice protection equipment for flight in icing conditions.

Description

An icing equipment package is available which allows flight in icing conditions as defined by the FAA. The package consists of wing, empennage and propeller deice boots; fuselage ice protection plates; wing deice lights; electrical windshield for the pilot; heated stall warning vane or optional heated angle-of-attack lift sensor vane; heated wing locker fuel tank vents if wing locker tanks are installed; a heated pitot source and 100-ampere alternators.

SECTION 2 – LIMITATIONS

NOTE

This airplane is approved for flight into icing conditions, as defined by the FAA, if the following equipment is installed and operational.

1. Heated stall warning vane or optional angle-of-attack lift sensor vane.
2. Heated pitot head (one minimum required).
   a. Electrical Windshield Anti-Ice System.
   b. Inboard and outboard wing and empennage deice boots (including deice lights).
   c. Propeller deice boots (including fuselage ice protection plates).
4. 100-ampere alternators.
5. Heated wing locker fuel tank vents, if wing locker tanks are installed.

If the pilot's windshield is covered with ice, do not leave the electrical windshield anti-ice switch on for more than 20 seconds. Operation in excess of 20 seconds will cause an overload condition which can result in failure of the windshield heating element and/or permanent distortion of the windshield.

The electrical windshield must be on HIGH with outside air temperature below -12°C (10°F) when in visible moisture.

REQUIRED PLACARDS:

1. MAGNETIC COMPASS DEVIATIONS GREATER THAN 10° CAN BE EXPECTED WHILE D.C. HEATED WINDSHIELD IS IN OPERATION.

3 November 1980
Revision 1 - 2 Apr 1982
SECTION 3 - EMERGENCY PROCEDURES

A. If uneven deicing of propeller blades is indicated by excessive vibration:
   1. Propellers - EXERCISE to MAX RPM. Avoid continuous operation in the yellow arc.
   2. Propeller Ammeter - CHECK for proper operation by periodic fluctuations within the green arc.
   3. If ammeter reading for both propellers is below the green arc, indicating the propeller blades may not be deicing uniformly:
      a. Propeller Deice Switch - OFF.
   4. If ammeter reading for either propeller is below the green arc, indicating the propeller blades may not be deicing uniformly:
      a. PROP DEICE Circuit Breaker - PULL L or R circuit breaker as required.

   **CAUTION**
   Do not operate propeller deice for prolonged periods when propellers are not turning.

SECTION 4 - NORMAL PROCEDURES

A. Preflight Inspection
   1. Pitot Heat Switch(es) - ON 20 seconds - OFF (Ensure Pitot Covers Are Removed).
   2. Stall and Vent Heat Switch - ON 20 seconds - OFF.
   3. Deice Boots - CHECK for tears, abrasions and cleanliness.
   4. Fuel Vents - CLEAR; Optional Wing Locker Vent(s) - WARM.
   5. Pitot Tube(s) - CLEAR and WARM.
   6. Static Ports - CLEAR and WARM if optional heaters are installed.

   **CAUTION**
   Do not operate system heaters for prolonged periods on the ground.

   **NOTE**
   Stall and vent heat switch operates stall vane heater or optional angle-of-attack lift sensor vane, optional wing locker fuel vent heater, and optional static port heaters. Pitot heat switch(es) operates pitot heater(s).

B. Before Takeoff
   1. Surface Deice Switch - ACTUATE. Visually check operation of boots and annunciator light ON.

   **NOTE**
   Positioning the surface deice switch to ACTUATE will result in one complete inflation and deflation cycle lasting approximately 45 seconds.
2. Propeller Deice Switch – ON momentarily. Check propeller ammeter

NOTE

Proper operation of propeller deice system is indicated by periodic fluctuations, within the green arc, on the propeller ammeter.


C. Inflight

1. Before visible moisture is encountered below 4.4°C (40°F):
   a. Pitot Heat Switch(es) – ON.
   b. Stall and Vent Heat Switch – ON.
   c. Propeller Deice Switch – ON.

NOTE

Energizing the propeller deice early in icing conditions will prevent ice build up which will be thrown off and can chip the fuselage paint.

d. Electrical Windshield Anti-Ice Switch – LOW with outside air temperature above -12°C (10°F). HIGH with outside air temperature below -12°C (10°F)

NOTE

• When using the electrical heated windshield on LOW, correct indicated outside air temperature (see Section 5 for ram air temperature rise correction) for your particular altitude and airspeed to ensure the outside air temperature is not below -12°C (10°F).

• If ice begins to accumulate on the heated portion of the windshield while operating on LOW, switch to HIGH.

• After icing conditions are encountered with the windshield on HIGH, do not use LOW until the entire heated portion of the windshield is clear of ice.

• The magnetic compass will not be reliable with the electric heated windshield in operation.
II FLIGHT IN ICING CONDITIONS

2. During Icing Encounters:
   a. Surface Deice Switch - ACTUATE when ice accumulates between 1/4 to 1/2 inch. Repeat as necessary, allowing at least 45 seconds between actuations.

   NOTE
   Accumulation of a 1/2 inch of ice may cause a cruise speed reduction of up to 30 knots as well as a significant buffet and stall speed increase. Increase power as required to maintain desired airspeed.

SECTION 5 – PERFORMANCE

A. When climbing through areas of light to moderate icing conditions, use cruise climb airspeeds and maximum climb power (full power) settings to preclude ice buildup on the fuselage undersurface and lower wing surfaces and minimize the exposure time to icing conditions.

B. During prolonged icing encounters in cruise, increase engine power to 75% or greater to maintain cruise speed as ice accumulates on the unprotected areas and preclude ice buildup on the fuselage undersurface and lower wing surfaces.

C. Prestall buffet and stall speeds increase slightly when deice boots are actuated. Maintain extra speed, especially during an approach, before actuating the boots.

D. Maintain extra airspeed on approach to compensate for the increased prestall buffet associated with ice on the unprotected areas and the increased weight.

E. Airplane general performance is decreased with ice on the unprotected areas.
SECTION 9  SUPPLEMENTS

FIRE DETECTION AND EXTINGUISHING SYSTEM

SECTION 1 – GENERAL

This supplement provides information which must be observed when operating the fire detection and extinguishing system.

Description

The fire detection and extinguishing system consists of three major components: three heat sensitive detectors located in each engine accessory compartment; an annunciator and actuator panel; see Figure 2; and a compressed Freon single-shot gas bottle located in the leading edge of the wing just inboard of the nacelle.

A test function is provided to test the bottle firing cartridge and annunciator lights. When the test switch is pushed, all lights should illuminate; if any light fails to illuminate, replace the bulb. If the green light does not illuminate, check the bottle pressure gage for correct pressure as shown in Figure 1. If the bottle pressure is adequate replace the firing cartridge in the fire extinguisher. Any other light failure, after replacing bulbs and firing cartridge, indicates a malfunction in the unit or associated wiring.

AMBIENT TEMPERATURE VS RECOMMENDED PRESSURE

<table>
<thead>
<tr>
<th>Ambient Temperature-°F</th>
<th>-40</th>
<th>-20</th>
<th>-10</th>
<th>0</th>
<th>+20</th>
<th>+40</th>
<th>+60</th>
<th>+80</th>
<th>+100</th>
<th>+120</th>
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<tbody>
<tr>
<td>Pressure-PSIG</td>
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<td>168</td>
<td>174</td>
<td>207</td>
<td>249</td>
<td>304</td>
<td>367</td>
<td>442</td>
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<td></td>
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<td>417</td>
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</tr>
</tbody>
</table>

Figure 1

FIRE DETECTION AND EXTINGUISHING SYSTEM

ANNUNCIATION

<table>
<thead>
<tr>
<th>LEGEND</th>
<th>COLOR</th>
<th>CAUSE OF ILLUMINATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIRE</td>
<td>RED</td>
<td>FIRE CONDITION EXISTING IN ENGINE COMPARTMENT</td>
</tr>
<tr>
<td>E</td>
<td>AMBER</td>
<td>FIRE EXTINGUISH CONTAINER EMPTY</td>
</tr>
<tr>
<td>OK</td>
<td>GREEN</td>
<td>FIRE CARTRIDGE AND ASSOCIATE WIRING IS IN OPERATIONAL CONDITION</td>
</tr>
</tbody>
</table>

Figure 2

3 November 1980
If an overheat condition is detected, the appropriate FIRE light will
annunciate the engine to be extinguished. To activate the extinguisher,
open the guard for the appropriate engine and press the FIRE light. Freon,
under pressure, will be discharged to the engine and engine accessory com-
partments. The amber light E will illuminate after the extinguisher has
been discharged and will continue to show empty until a new bottle is
installed. The FIRE light will remain illuminated until compartment tem-
peratures cool.

SECTION 2 – LIMITATIONS
Not Applicable.

SECTION 3 – EMERGENCY PROCEDURES

If a fire warning light indicates an engine compartment fire and is
confirmed or if a fire is observed without a fire warning light:

1. Both Auxiliary Fuel Pumps - OFF.
2. Operative Engine Fuel Selector - MAIN TANK (Feet For Detent).
4. Appropriate Engine - SECURE.
   a. Throttle - CLOSE.
   b. Mixture - IDLE CUT-OFF.
   c. Propeller - FEATHER.
   d. Fuel Selector - OFF (Feet For Detent).
   e. Open the appropriate guard and push FIRE light.
   f. Magnetos - OFF.
   g. Propeller Synchronizer - OFF (Optional System).
   h. Alternator - OFF.
5. Cabin Heater - OFF.
6. Land as soon as practical.

NOTE
Best results may be obtained if the airflow through
the nacelle is reduced by slowing the airplane (as
slow as practical) prior to actuating the extin-
guisher.

SECTION 4 – NORMAL PROCEDURES

A. Before Takeoff
   1. Test Switch - PRESS. All lights should illuminate.

SECTION 5 – PERFORMANCE

Not Applicable.
FUEL FLOW INDICATING SYSTEM (WITH TOTALIZER)

SECTION 1 - GENERAL

This supplement provides information which must be observed when operating the electronic fuel flow indicating system with totalizer.

Description

The electronic fuel flow indicating system consists of a dual needle indicator and a fuel flow transducer for each engine. The flow transducer generates electrical pulses, which represents a measure of fuel flow rate, and transmits these pulses to the indicator as input frequency. The indicator then converts the frequency signals into an analog output which is displayed by the indicator as fuel flow rate in pounds per hour. These gage markings are predicated on the use of 100 grade aviation fuel. Increase fuel flow 2% above markings when 100LL grade aviation fuel is used. In addition, these pulses provide information to a totalizer within the indicator. The totalizer indicates the quantity of fuel remaining or consumed, even if power is removed from the normal power input circuit.

The electronic fuel flow indicator has a digital totalizer, a DIM/CLR knob and a counter switch. The totalizer displays either the fuel remaining or the fuel consumed for both the left and right engines or full tanks. The DIM/CLR knob controls the light intensity of the totalizer and resets the totalizer counter to zero. The counter switch is used to set 10-pound and 100-pound increments of fuel for totalizer use.

NOTE

If the "memory" voltage is interrupted, such as when the airplane battery is removed and reinstalled, the totalizer display will not indicate accurately until the counter has been reset.

SECTION 2 - LIMITATIONS

Same as standard fuel flow gage contained in Section 2 of this manual.

SECTION 3 - EMERGENCY PROCEDURES

Not Applicable.

SECTION 4 - NORMAL PROCEDURES

A. Preflight Inspection
   1. Counter Switch - ACTUATE until totalizer reads equal to the amount of fuel in the tanks if a fuel remaining reading is desired.
   2. DIM/CLR Switch - CLR if a fuel consumed reading is desired.

   NOTE

If fuel is added before a flight, insure that the totalizer is adjusted to reflect the additional fuel.

SECTION 5 - PERFORMANCE

Not Applicable.

3 November 1980
MANUALLY ADJUSTABLE SEAT

SECTION 1 — GENERAL

This supplement provides information which must be observed when operating the manually adjustable seats.

Description

The manually adjustable pilot and copilot seats are secured to seat assemblies which are attached to the forward main spar carry-thru structure. The seats may be adjusted fore and aft, vertically and tilted to desired position within the limits of the seat by using the controls located on the front of the seat, see Figure 1.

An optional lumbar support is available for the pilot’s and copilot seat backs. The support is designed to provide increased comfort during long flights. The support is basically an air-tight, foam-filled cushion which can be adjusted in size and shape as governed by external forces the operation of the bleed valve.

MANUALLY ADJUSTABLE SEAT CONTROLS

![Diagram of seat controls]

Figure 1

SECTION 2 — LIMITATIONS

Not Applicable.

SECTION 3 — EMERGENCY PROCEDURES

A. Loss of Cabin Pressure
   1. Lumbar Support Bleed Valve - PRESS as required to decrease inflation.

3 November 1980
SECTION 4 — NORMAL PROCEDURES

Controls for the manually adjustable seats, see Figure 1, are located at the forward side of the seat. Rotating the handcrank, located at the forward right corner of the seat, tilts the back. Rotating the handcrank, located at the forward left corner of the seat, raises and lowers the seat. The fore and aft adjustment lever is located at the forward side of the seat near the center. It is recommended that the seat be moved to the aft position prior to making tilt or vertical adjustments, to provide maximum handcrank clearance.

With the optional lumbar support installed and the seat adjusted as desired, lean back in a comfortable position and press the lumbar support bleed valve as required to achieve the desired level of support. During a climb to high altitude, cabin pressure will slowly decrease relative to the air pressure in the lumbar support, thus the support will expand. This can be corrected by bleeding off the excessive expansion by pressing the lumbar support bleed valve as required. During descents, the cabin pressure will slowly increase relative to the air pressure in the lumbar support, thus the support will contract. This can be corrected by unloading the seat back and pressing the bleed valve as required.

SECTION 5 — PERFORMANCE

Not Applicable.
SECTION 9
SUPPLEMENTS

PROPELLER DEICE SYSTEM

SECTION 1 — GENERAL

This supplement provides information which must be observed when operating the propeller deice system.

Description

The propeller deice system consists of electrically heated boots on propeller blades. Each boot consists of an inboard and outboard heat element, which receive their electrical power through a deice timer. To reduce power drain and maintain propeller balance, the timer directs current to the propeller boots in cycles between elements and between propellers.

The timer directs current to the propeller boots in cycles between elements and between propellers in the following sequence:

- Heating Period No. 1 - Outboard Halves - right engine blades.
- Heating Period No. 2 - Inboard Halves - right engine blades.
- Heating Period No. 3 - Outboard Halves - left engine blades.
- Heating Period No. 4 - Inboard Halves - left engine blades.

Each heating period lasts approximately 20 seconds.

A reading below the green arc on the propeller deice ammeter indicates that the blades of the propeller are not being deiced uniformly.

**WARNING**

When uneven deicing of the propeller blades is indicated, it is imperative that the deice system be turned OFF. Uneven deicing of the blades can result in propeller unbalance and engine failure.

Abnormal operation of the propeller deice system is indicated by deice switch breaker tripping to the OFF position. Failure of the switch breaker to stay reset indicates that deicing is impossible for the propellers.

SECTION 2 — LIMITATIONS

Not Applicable.

3 November 1980
SECTION 3 - EMERGENCY PROCEDURES

A. If uneven deicing of propeller blades is indicated by excessive vibration:
   1. Propellers - EXERCISE to MAX RPM. Avoid continuous operation in the yellow arc.
   2. Propeller Ammeter - CHECK for proper operation by periodic fluctuations within the green arc.
   3. If ammeter reading for both propellers is below the green arc, indicating the propeller blades may not be deicing uniformly:
      - Propeller Deice Switch - OFF
      - Propeller Deice Switch - OFF

4. If ammeter reading for either propeller is below the green arc, indicating the propeller blades may not be deicing uniformly:
   a. PROP DEICE Circuit Breaker - PULL L or R circuit breaker as required.

CAUTION
Do not operate propeller deice for prolonged periods when propellers are not turning.

SECTION 4 - NORMAL PROCEDURES

A. Preflight Inspection
   1. Propeller Heating Elements - CHECK condition and attachment.

B. Before Takeoff
   1. Propeller Deice Switch - ON momentarily. Check propeller ammeter.

C. Inflight
   1. Propeller Deice Switch - ON before entering visible moisture with outside air temperature below 4.4°C (40°F).

NOTE
Energizing the propeller deice system early in icing conditions will prevent ice build up which will be thrown off and can chip the fuselage paint.

2. Leave icing conditions as soon as possible if airplane is not equipped for flight in icing conditions.

NOTE
Since propeller deice boots alone do not provide adequate protection for the entire airplane, icing conditions should be avoided whenever possible unless the airplane is equipped for flight in icing conditions. Refer to Ice Protection Equipment (Flight In Icing Conditions) supplement for details.

a. If icing is encountered, close attention should be given to the pitot-static system, propellers, induction systems, wing and stabilizer leading edges and other components subject to icing.

SECTION 5 - PERFORMANCE

Not Applicable.
SECTION 9
SUPPLEMENTS

YAW DAMPER

SECTION 1—GENERAL

This supplement provides information which must be observed when operating the yaw damper system.

Description

The yaw damper is an independent system that may be engaged at any time regardless of the state of the autopilot or flight director. When engaged, the yaw damper provides yaw axis stabilization. The panel-mounted gyro computer turn-and-slip indicator, see Figure 1, provides yaw rate signals to operate the rudder servo. If an 800B Integrated Flight Control System is installed, the yaw damper is automatically engaged with the basic autopilot engagement and cannot be disengaged with the autopilot ON except by pulling the YAW DAMP circuit breaker.

NOTE

The flags in the turn-and-slip indicator will retract whenever power is applied to this unit.

YAW DAMPER CONTROLS AND INDICATOR

1. YAW DAMPER ON-OFF SWITCH – Turns yaw damper on and holds it on until switch is turned off or control wheel autopilot disengage switch is depressed.

2. CONTROL WHEEL
   AUTOPilot/ELECTRIC ELEVATOR

3. Y/D FLAG – When yellow flag disappears, indicates power is supplied to the yaw damper computer.

4. RATE-OF-TURN POINTER – Indicates rate and direction of airplane movement.

5. GYRO FLAG – When red flag disappears, indicates power is applied to the gyro.

6. SLIP INDICATOR – Indicates slip or skid when ball is displaced from center.

Figure 1

3 November 1980
SECTION 2 - LIMITATIONS
A. Disengage yaw damper if malfunction occurs.
B. Required placards:
   1. On Circuit Breaker Panel:
      a. "YAW DAMP"
   2. Near Yaw Damper Switch:
      a. "YAW DAMP-ON-OFF"
      b. If yaw damper switch is located on the autopilot control head,
         change item "a" to "YAW ON."
   3. On Pilot's Control Wheel:
      a. "AUTOPILOT - DISENGAGE" (also disengages yaw damper).

SECTION 3 - EMERGENCY PROCEDURES
A. Hardover Rudder Deflection
   1. Rudder - OVERPOWER. Requires approximately 70 pounds.
   2. Autopilot Disengage Switch - DISENGAGE.
   3. Yaw Damper Circuit Breaker - PULL.
   4. If optional autopilot installed - REENGAGE if desired.
B. Excessive Rudder Forces (Gear Train Jammed)
   1. Rudder pedal forces in excess of normal control forces required to
      overpower the slip clutch in the event of a jammed servo actuator
      will not exceed 70 pounds.

SECTION 4 - NORMAL PROCEDURES
A. Engagement
   1. Yaw Damper ON-OFF Switch - ON. With 8008 Integrated Flight Control
      System installed, the yaw damper is automatically engaged with the
      autopilot.
   2. Gyro and Y/D Flags - VERIFY that both are out of view.
B. Disengagement
   1. Autopilot Disengage Switch - DISENGAGE (Or)
   2. Yaw Damper ON-OFF Switch - OFF. With 8008 Integrated Flight Control
      System installed, the yaw damper is disabled by pulling the YAW DAMP circuit
      breaker.

SECTION 5 - PERFORMANCE
Not Applicable.
SECTION 1 — GENERAL

This supplement provides information which must be observed when operating the 400 encoding altimeter.

Description

The Cessna 400 encoding altimeter (Type EA-401A) is an electrically driven instrument that provides the pilot with a visual display of the airplane's altitude. The altimeter also includes an optical encoder which automatically produces a logic code that corresponds to the sensed altitude. This code is supplied to the Air Traffic Control Radar Beacon System (ATCRBS) transponder in the airplane to generate replies to Mode C (altitude reporting) interrogations from the ground controller.

The 400 encoding altimeter, see Figure 1, is a panel-mounted barometric altimeter with an altitude range of -1000 to +35,000 feet. Altitude is displayed by a dial and a digital readout. The dial is graduated in numerical divisions which represent increments of 100 feet, with subdivision markings for every 20 feet. The dial pointer completes one revolution for every 1000 feet of altitude change. The digital readout displays airplan altitude in increments of hundreds and thousands of feet only. Friction induced lag and jumping of the display is reduced by the use of a combination of aneroid sensor and motor-driven display. Electronic damping circuits on the unit ensure that the display follows altitude changes rapidly with overshoot. When power is removed from the altimeter, a stripped warm flag appears across the digital altitude display to indicate a "power-off condition.

Except for setting pressure, operation of the altimeter is complete automatic. Ambient atmospheric pressure, set into the altimeter with manually operated baroset knob, is displayed on a four-digit readout either in inches of mercury or in millibars (as ordered). The pressure setting does not affect the output of the optical encoder, since the encoder is always referenced to standard pressure (sea level; 29.92 inches mercury or 1013 millibars).

SECTION 2 — LIMITATIONS

A. A standby barometric altimeter is required when the encoding altimeter is installed.

SECTION 3 — EMERGENCY PROCEDURES

A. Encoding Altimeter Failure (Warning Flag Showing)
   1. ALT Circuit Breaker - CHECK IN.
   2. If warning flag is still showing, use the standby barometric altimeter.
1. **ZERO-TO-THOUSAND FOOT ALTITUDE DISPLAY DIAL** - Calibrated in 10 numerical graduations which represent increments of 100 feet; the subdivisions of each graduation represents increments of 20 feet.

2. **ALTITUDE READOUT** - Displays altitude above 100 feet on three-section counter in increments of 10,000, 1000 and 100 feet. When altitude is below 10,000 feet, a diagonally striped flag appears in the 10,000-foot window.

3. **POWER-OFF WARNING FLAG** - Appears across altitude readout when power is removed from altimeter to indicate that readout is not reliable.

4. **ZERO-TO-THOUSAND FOOT ALTITUDE DISPLAY POINTER** - Directly indicates airplane altitude between 0 and 1000 feet; for altitudes above 1000 feet, indicates the last three digits of altitude (ones, tens and hundreds).

5. **BAROSET KNOB** - Used to set in atmospheric pressure; clockwise rotation increases pressure setting, counterclockwise rotation decreases pressure setting.

6. **ATMOSPHERIC PRESSURE READOUT** - Displays atmospheric pressure set into the altimeter with the baroset knob on the four-digit counter.

Figure 1
SECTION 4 – NORMAL PROCEDURES

A. Altimeter Operation

1. Baro set Knob - TURN as necessary to set readout to requir
   pressure.
2. Power Off Warning Flag - VERIFY that flag is not in view.

WARNING

Do not attempt to use altimeter indication for flight information if warning flag is in view. Flag indicates that power has been removed from the altimeter.

3. Altitude Display - Below 1000 feet, read altitude on display poin
   er and dial. Above 1000 feet, read altitude altitude readout plus pointer and dial indic
   tion for last two digits (for example, for altitude of 12,630 feet, read 12,600 feet readout and read 30 feet on pointer and dial

B. Altitude Encoding Operation.

Operation of the altitude encoding function of the altimeter is co
   pletely automatic as soon as power is applied to the altimeter and t
   warning flag is out of view. However, for transmission of the altitu
   information to the ground controller, the Mode C (ALT) function must
   selected on the transponder.

SECTION 5 – PERFORMANCE

Not Applicable.