TURBO SEMINOLE PA-44-180T

PILOT'S OPERATING HANDBOOK

AND

FAA APPROVED AIRPLANE FLIGHT MANUAL

AIRPLANE SERIAL NO. 44-8107005 AIRPLANE REGIST. NO. D-GOKI

PA-44-180T
REPORT: VB-1100 FAA APPROVED BY: Ward Evans

WARD EVANS
D.O.A. NO. SO-1
PIPER AIRCRAFT CORPORATION
VERO BEACH, FLORIDA

DATE OF APPROVAL:
MARCH 14, 1980

THIS HANDBOOK INCLUDES THE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY THE FEDERAL AVIATION REGULATIONS AND ADDITIONAL INFORMATION PROVIDED BY THE MANUFACTURER AND CONSTITUTES THE FAA APPROVED AIRPLANE FLIGHT MANUAL. THIS HANDBOOK MUST BE CARRIED IN THE AIRPLANE AT ALL TIMES.

WARNING

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

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APPLICABILITY

Application of this handbook is limited to the specific Piper PA-44-180T model airplane designated by serial number and registration number on the face of the title page of this handbook.

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

REVISIONS

The information compiled in the Pilot's Operating Handbook will be kept current by revisions distributed to the airplane owners.

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

I. Revisions

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

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

II. Identification of Revised Material

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

Black lines will indicate only current revisions with changes and additions to or deletions of existing text and illustrations. Changes in capitalization, spelling, punctuation or the physical location of material on a page will not be identified.

ORIGINAL PAGES ISSUED

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

Title, ii through vii, 1-1 through 1-21, 2-1 through 2-10, 3-1 through 3-21, 4-1 through 4-29, 5-1 through 5-32, 6-1 through 6-50, 7-1 through 7-38, 8-1 through 8-19, 9-1 through 9-34, and 10-1 through 10-3.

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Current Revisions to the PA-44-180T Turbo Seminole Pilot's Operating Handbook, REPORT: VB-1100 issued March 14, 1980.

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 1 (PR800709)	2-3 2-4	Revised item 2.7 (f). Revised item 2.9 (e).	Ward Evans Ward Evans July 9, 1980
Rev. 2 (PR800929)	Title Publ. 2-9 2-10 2-11 4-i 4-9 4-11 4-18 4-19 4-20 4-25 6-i 6-6 6-11 6-22 6-26 6-26a 6-26b	Revised title pg. Revised Warning. Revised Takeoff checklist. Revised Landing checklist; relocated placards to pg. 2-11. Added pg. (added placards from pg. 2-10). Revised pg. no. Revised Before Takeoff checklist. Revised Approach and Landing. Added para. 4.25 from pg. 4-19. Relocated para. to pg. 4-18; revised para. 4.27. Revised para. 4.27. Revised para. 4.37. Revised pg. nos. Revised Fig. 6-5. Revised Fig. 6-11. Added items 59 and 61. Added item 104; relocated item 113 to pg. 6-26a. Added pg. (added item 113 from pg. 6-26 and 115 and 117 from pg. 6-27). Added pg.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 2 (cont)	6-27	Relocated items 115 and 117 to pg. 6-26a; added item 127 from pg. 6-28.	
	6-28	Relocated item 127 to pg. 6-27; added items from pg. 6-29; revised item nos.; added new item 142; revised item 137.	
	6-29	Relocated items to pg. 6-28; added items 143 and 144.	
	6-35	Added items 194 and 195.	
	6-35a thru 6-35d	Added items 199 thru 211.	
	6-36, 6-37	Revised item nos.	
	6-39	Revised item 237.	
	6-40	Added new items 246 and 247; revised item no.; relocated item 253 to pg. 6-40a.	
	6-40a	Added pg. (added items from pgs. 6-40 and 6-41).	
	6-40b	Added pg.	
	6-41	Renumbered items; added new items 257 and 259.	
	6-44	Added item 297 from pg. 6-45.	
	6-45	Relocated item 297 to pg. 6-44; added item 302.	
	6-47	Added item 353.	
	6-49	Renumbered items; added items 373, 374 and 375; relocated item to pg. 6-50.	
	6-50	Added item from pg. 6-49; renumbered items.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 2 (cont)	7-18	Revised Fig. 7-17.	
	7-20	Revised Fig. 7-19.	
	7-26	Revised Fig. 7-25.	
	7-31, 7-32	Added info. to para. 7.27.	
	8-4	Revised para. 8.7.	
	8-9	Revised Fig. 8-1.	
	9-i	Added Supplements 8 thru 15.	
	9-35 thru 9-40	Added Supplement 8 (Air Cond. Instl.).	
	9-41 thru 9-44	Added Supplement 9 (Century 21 Autopilot Instl.).	
	9-45 thru 9-56	Added Supplement 10 (Century 41 Autopilot Instl.).	
	9-57, 9-58	Added Supplement 11 (Control Wheel Clock).	
	9-59 thru 9-64	Added Supplement 12 (RCA WeatherScout II Radar).	
	9-65 thru 9-70	Added Supplement 13 (RCA Color WeatherScout II Radar).	
	9-71 thru 9-76	Added Supplement 14 (RDR-160 Radar).	
	9-77 thru 9-82	Added Supplement 15 (RDR-160/IN-2026A Radar).	Ward Evans Ward Evans Sept. 29, 1980

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 3 (PR810105)	3-5	Revised Air Start (Unfeathering Procedures).	
	3-8	Revised Electrical Failures.	
	3-8a, 3-8b, 3-8c, 3-8d	New pages; continue revision Electrical Failures.	
	3-15	Revised para. 3.7 (Air Start - Unfeathering Procedure).	
	3-19	Revised para. 3.25.	
	3-19a, 3-19b	New pages continue para. 3.25 revision.	
	6-34	Added item 182.	
	6-50	Move info. to pg. 6-52.	
	6-51	New page; added items 401, 403 and 405.	
	6-52	New page; relocated info. from pg. 6-50.	
	7-16	Revised para. 7.17.	
	7-17	Revised fig. 7-15.	
	7-19	Cont. para. 7.17 revision.	
	7-21	Cont. para. 7.17 revision.	
	9-i	Added Supplement 16.	
	9-69	Added info.	
	9-83 thru 9-86	Added Supplement 16 (Prop Heat and Ice Light)	Ward Evans Ward Evans Jan. 5, 1981
Rev. 4 (PR810331)	1-6; 1-11	Revised para. 1.9 info.	
	3-ii	Revised Table of Contents.	
	3-3	Added Warning.	
	3-4	Removed Warning.	
	3-13	Relocated revised Warning.	
	3-20	Revised para. 3.27.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 4 (cont) (PR810331)	4-11	Revised procedures.	
	4-14	Revised para. 4.11.	
	4-19	Revised para. 4.27.	
	4-24	Revised para. 4.33.	
	5-4	Corrected syntax.	
	5-14	Revised fig. 5-9.	
	5-18	Revised fig. 5-17.	
	5-23	Revised fig. 5-27.	
	6-9	Revised para. 6.7.	
	6-19	Revised item 11.	
	6-25	Revised items 99 and 101; moved item 101 to pg. 6-26.	
	6-26	Relocated item 101 from pg. 6-25; revised items 103 and 104.	
	6-33a	New page.	
	6-33b	New page; added item 178.	
	6-39	Added item 236; moved item 241 to pg. 6-40.	
	6-40	Relocated item 241 from pg. 6-39; moved item 251 to pg. 6-40a.	
	6-40a	Relocated item 251 from pg. 6-40.	
	6-41	Revised item 257.	
	6-49	Revised items 373, 374 and 375; moved item 375 to pg. 6-50.	
	6-50	Relocated item 375 from pg. 6-49.	
	7-17	Revised fig. 7-15.	
	8-11	Revised para. 8.19.	
	9-29	Revised Sec. 4 (b) (8) a and b.	
	9-32	Revised Sec. 4 Preflight.	Ward Evans
	9-34	Revised Sec. 4 Preflight (b).	
	9-45	Revised Sec. 2 (c).	Ward Evans
	9-47	Revised Note.	March 31, 1981

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 5 (PR810702)	1-5	Revised para. 1.13.	
	5-3	Revised para. 5.5 (a).	
	5-7	Revised para. 5.5 (d), (f) and (g).	
	5-26	Revised Figure 5-33.	
	6-28	Added item 136; moved item 142 to pg. 6-29.	
	6-29	Relocated item 142 from pg. 6-28.	
	6-31	Revised item 163; added item 164; moved item 165 to pg. 6-32.	
	6-32	Relocated item 165 from pg. 6-31; moved item 173 to pg. 6-33.	
	6-33	Relocated item 173 from pg. 6-32; moved item 177 to pg. 6-33b.	
	6-33b	Relocated item 177 from pg. 6-33.	
	6-35	Revised item 195.	
	6-35b	Revised item 207.	
	6-35d	Relocated items 212 thru 215 from pg. 6-36.	
	6-36	Moved items 212 thru 215 to pg. 6-35d; relocated items 216 thru 220 from pg. 6-37.	
	6-37	Moved items 216 thru 220 to pg. 6-36; relocated items 221 and 223 from pg. 6-38; added item 227.	
	6-38	Moved items 221 and 223 to pg. 6-37; added item 229.	
	6-39	Added item 238; moved item 239 to pg. 6-40.	
	6-40	Relocated item 239 from pg. 6-39; moved item 249 to pg. 6-40a.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 5 (cont)	6-40a	Relocated item 249 from pg. 6-40; moved item 256 to pg. 6-40b.	
	6-40b	Relocated item 256 from pg. 6-40a; relocated item 257 from pg. 6-41.	
	6-41	Revised and moved item 257 to pg. 6-40b.	
	6-52	Added item 407; removed info.	
	7-19	Revised para. 7.17; moved info. to pg. 7-21.	
	7-21	Relocated info. from pg. 7-19; added info. from pg. 7-23.	
	7-23	Moved info. to pg. 7-21.	Ward Evans
	7-36	Revised para. 7.41.	Ward Evans
	9-31	Revised Sec. 2 (b) and (c).	July 2, 1981
Rev. 6 (PR820219)	2-i	Revised Table of Contents.	
	2-4	Revised para. 2.9; moved info. to pg. 2-5.	
	2-5	Relocated info. from pg. 2-4; moved para. 2.15 to pg. 2-6.	
	2-6	Relocated para. 2.15 from pg. 2-5.	
	3-i, 3-ii	Revised Table of Contents.	
	3-iii	New page, cont. revised Table of Contents.	
	3-2	Revised procedure.	
	3-5	Added procedure; moved info. to pg. 3-6.	
	3-6	Relocated info. from pg. 3-5; moved info. to pg. 3-7.	
	3-7	Relocated info. from pg. 3-6; moved info. to pg. 3-8.	
	3-8	Relocated info. from pg. 3-7; moved info. to pg. 3-8a.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 6 (cont)	3-8a	Relocated, revised, retitled procedure from pg. 3-8.	
	3-8b, 3-8c, 3-8d	Revised procedure.	
	3-8e, 3-8f, 3-8g	New pages; continued revised procedures.	
	3-8h	New page.	
	3-12	Revised para. 3.7 Engine Securing Procedure.	
	3-15	Added procedure to para. 3.7.	
	3-19, 3-19a, 3-19b	Retitled, revised para. 3.25.	
	3-19c, 3-19d	New pages; cont. revised para. 3.25.	
	3-20	Cont. revised para. 3.25; moved info. to pg. 3-21.	
	3-21	Relocated info. from pg. 3-20; moved para. 3.41 to pg. 3-22.	
	3-22	New page; relocated para. 3.41 from pg. 3-21.	
	4-i	Revised Table of Contents.	
	4-ii	New page; cont. revised Table of Contents.	
	4-3	Relocated info. from pg. 4-4.	
	4-4	Moved info. to pg. 4-3; relocated info. from pg. 4-5.	
	4-5	Moved info. to pg. 4-4; revised procedure; added to note.	
	4-9	Revised procedure.	
	4-11	Revised procedure.	
	4-14	Revised caution.	
	4-15	Added note; moved para. 4.15 to pg. 4-15b.	
	4-15a	New page.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 6 (cont)	4-15b	New page; relocated para. 4.15 from pg. 4-15; relocated info. from pg. 4-16.	
	4-16	Moved info. to pg. 4-15b; relocated para. 4.19 and 4.21 from pg. 4-17.	
	4-17	Moved para. 4.19 and 4.21 to pg. 4-16; relocated info. from pg. 4-18.	
	4-18	Moved info. to pg. 4-17; relocated info. from pg. 4-19.	
	4-19	Moved info. to pg. 4-18; relocated info. from pg. 4-20.	
	4-20	Moved info. to pg. 4-19; added note; moved info. to pg. 4-21.	
	4-21	Relocated info. from pg. 4-20.	
	4-25	Added note; moved info. to pg. 4-26.	
	4-26	Relocated info. from pg. 4-25; moved info. and para. 4.39 to pg. 4-27.	
	4-27	Relocated info. and para. 4.39 from pg. 4-26; moved para. 4.45 and 4.47 to pg. 4-28.	
	4-28	Relocated para. 4.45 and 4.47 from pg. 4-27; moved para. 4.51 to pg. 4-29.	
	4-29	Relocated para. 4.51 from pg. 4-28; moved info. and para. 4.53 to pg. 4-30.	
	4-30	New page; relocated info. and para. 4.53 from pg. 4.29.	
	5-3 thru 5-7	Revised para. 5.5.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 6 (cont)	6-6	Revised fig. 6-5.	
	6-17	Revised para. 6.11.	
	6-24	Revised items 79 and 81.	
	6-27	Revised item 127.	
	6-30	Removed item 147.	
	6-35c	Revised item 209.	
	6-40	Revised item 245; moved item 248 to pg. 6-40a.	
	6-40a	Relocated item 248 from pg. 6-40.	
	6-45	Renumbered items, added new item 302.	
	6-51	Revised item 401; removed item 403.	
	6-52	Removed item 405.	
	7-14	Revised para. 7.15; moved info. to pg. 7-16.	
	7-16	Relocated info. from pg. 7-14.	
	7-17	Revised fig. 7-15.	
	7-17a	New page; added fig. 7-16.	
	7-17b	New page; revised fig. 7-17.	
	7-18	Added fig. 7-18.	
	7-19	Revised para. 7.17; moved info. to pg. 7-20.	
	7-20	Relocated info. from pg. 7-19; relocated info. from pg. 7-21.	
	7-20a	New page; revised fig. 7-19.	
	7-20b	New page; added fig. 7-20.	
	7-21	Moved info. to pg. 7-20.	
	7-31	Revised para. 7.27; relocated info. from pg. 7-32.	
	7-32	Moved info. to pg. 7-31.	
	9-i	Retitled Supplement 16.	
	9-21	Revised section 3(a).	
	9-83 thru 9-90	Revised Supplement 16.	Ward Evans Ward Evans Feb. 19, 1982

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 7 (PR820301)	9-91 thru 9-96	Added Supplement 17 (RDR-160XD/IN-232A Weather Radar System).	Ward Evans Ward Evans March 1, 1982
Rev. 8 (PR820402)	1-12, 1-18	Revised para. 1.21.	
	3-i	Revised Table of Contents.	
	3-4	Relocated info. from pg. 3-5.	
	3-5	Moved info. to pg. 3-4; added to procedure.	
	3-15	Revised para. 3.7.	
	4-4, 4-5, 4-7, 4-8	Revised procedure.	
	4-14	Revised para. 4.11.	
	4-15b	Revised para. 4.15.	
	4-16	Revised para. 4.19.	
	4-19	Revised para. 4.27.	
	5-13	Revised fig. 5-7.	
	5-26	Revised fig. 5-26.	
	6-2	Revised para. 6.3.	
	6-6	Revised fig. 6-5.	
	6-7	Revised fig. 6-7.	
	6-18	Revised item 3.	
	6-26a	Added item 119.	
	6-40b	Revised item 257.	
	7-6	Revised para. 7.7; moved info. to pg. 7-7.	
	7-7	Relocated info. from pg. 7-6; moved info. to pg. 7-8.	
	7-8	Relocated info. from pg. 7-7.	
	7-26	Revised fig. 7-25.	
	8-i	Changed pg. no.	
	8-10	Revised para. 8.17; moved para. 8.19 to pg. 8-11.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 8 (cont)	8-11	Relocated para. 8.19 from pg. 8-10.	
	8-15	Revised paras. 8.23 and 8.25.	
	8-17	Revised para. 8.31.	
	9-13	Revised Sec. 3 (f) (2) and (3).	
	9-23	Revised Sec. 3.	
	9-27	Revised Sec. 3.	
	9-31	Revised Sec. 1.	
	9-46	Revised Sec. 3 (a) (3) b.	
	9-59	Revised Sec. 3.	
	9-65	Revised Sec. 3.	
	9-68	Revised Table 4-3.	
	9-69	Added Sec. 4 (c); moved info. and Sec. 5 to pg. 9-70.	
	9-70	Relocated info. and Sec. 5 from pg. 9-69.	
	9-71	Revised Sec. 3.	
	9-73	Revised Table 4-3.	
	9-77	Revised Sec. 3.	
	9-79, 9-80	Revised Table 4-3.	
	9-81	Revised Table 4-3; continued Table 4-3 to pg. 9-82.	
	9-82	Continued revised Table 4-3 from pg. 9-81.	Ward Evans
	9-86	Revised fig. 9-3.	Ward Evans
	9-87	Revised description.	April 2, 1982
Rev. 9 (PR820812)	Title	Revised title.	
	1-i	Revised Table of Contents.	
	1-5	Revised para. 1.17.	
	1-12 thru 1-21	Deleted pages and para. 1.21.	
	4-15	Revised para. 4.11.	
	6-i	Revised Table of Contents.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 9 (cont)	6-5	Revised para. 6.5.	
	6-10	Revised fig. 6-9.	
	6-14	Revised para. 6.9.	
	7-25	Revised para. 7.23.	
	7-26	Revised fig. 7-25.	
	7-27	Revised para. 7.25; moved info. to pg. 7-30.	
	7-30	Relocated info. from pg. 7-27.	
	7-31	Revised para. 7.27; moved info. to pg. 7-32.	
	7-32	Relocated info. from pg. 7-31; revised para. 7.26.	Ward Evans
	7-33	Revised para. 7.33.	Ward Evans
	8-2	Revised para. 8.3.	Aug. 12, 1982

TABLE OF CONTENTS

TABLE OF CONTENTS

SECTION 1

GENERAL

SECTION 1

GENERAL

1.1 INTRODUCTION

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

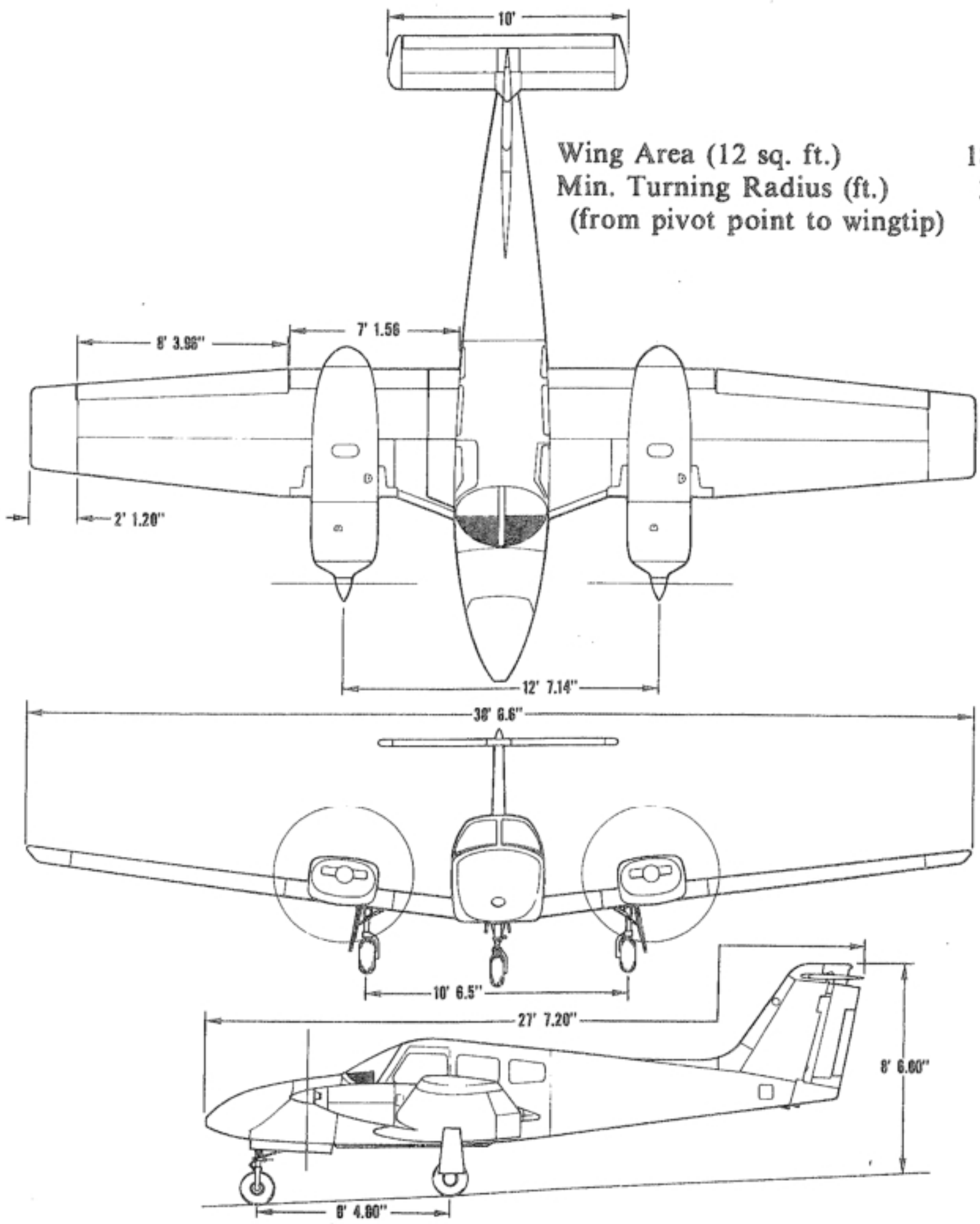
This handbook is not designed as a substitute for adequate and competent flight instruction, knowledge of current airworthiness directives, applicable federal air regulations or advisory circulars. It is not intended to be a guide for basic flight instruction or a training manual and should not be used for operational purposes unless kept in a current status.

Assurance that the airplane is in an airworthy condition is the responsibility of the owner. The pilot in command is responsible for determining that the airplane is safe for flight. The pilot is also responsible for remaining within the operating limitations as outlined by instrument markings, placards, and this handbook.

Although the arrangement of this handbook is intended to increase its in-flight capabilities, it should not be used solely as an occasional operating reference. The pilot should study the entire handbook to become familiar with the limitations, performance, procedures and operational handling characteristics of the airplane before flight.

The handbook has been divided into numbered (arabic) sections, each provided with a "finger-tip" tab divider for quick reference. The limitations and emergency procedures have been placed ahead of the normal procedures, performance and other sections to provide easier access to information that may be required in flight. The "Emergency Procedures" Section has been furnished with a red tab divider to present an instant reference to the section. Provisions for expansion of the handbook have been made by the deliberate omission of certain paragraph numbers, figure numbers, item numbers and pages noted as being intentionally left blank.

Wing Area (12 sq. ft.)	183.8
Min. Turning Radius (ft.) (from pivot point to wingtip)	33.0



THREE VIEW
Figure 1-1

1.3 ENGINE

(a) Number of Engines	2
(b) Engine Manufacturer	Lycoming
(c) Engine Model Number	
Left	TO-360-E1A6D
Right	LTO-360-E1A6D
(d) Rated Horsepower	180
(e) Rated Speed (rpm)	2575
(f) Bore (in.)	5.125
(g) Stroke (in.)	4.375
(h) Displacement (cu. in.)	361
(i) Compression Ratio	8.00:1
(j) Engine Type	Turbosupercharged, Four Cylinder, Direct Drive, Horizontally Opposed, Air Cooled

1.5 PROPELLER

STANDARD

(a) Number of Propellers	2
(b) Propeller Manufacturer	Hartzell
(c) Model	
Left	HC-C2YR-2C( )UF/ FC7666A-2R
Right	HC-C2YR-2CL( )UF/ FJC7666A-2R
(d) Number of Blades	2
(e) Propeller Diameter (in.)	
(1) Maximum	74
(2) Minimum	72
(f) Propeller Type	Constant Speed, Hydraulically Actuated, Full Feathering

OPTIONAL

(a) Number of Propellers	2
(b) Propeller Manufacturer	Hartzell
(c) Model	
Left	HC-C3YR-2( )UF/ FC-7663-5R
Right	HC-C3YR-2L( )UF/ FJC-7663-5R

(d) Number of Blades	3
(e) Propeller Diameter (in.)	
(1) Maximum	73
(2) Minimum	72
(f) Propeller Type	Constant Speed, Hydraulically Actuated, Full Feathering

1.7 FUEL

(a) Fuel Capacity (U.S. gal.) (total)	110
(b) Usable Fuel (U.S. gal.) (total)	108
(c) Fuel	
(1) Minimum Grade	100 Green or 100LL Blue Aviation Grade
(2) Alternate Fuel	Refer to latest revision of Lycoming, Service Instruction 1070.

1.9 OIL

(a) Oil Capacity (U.S. qts.) (per engine)	6
(b) Oil Specifications	Refer to latest issue of Lycoming Service Instructions 1014.
(c) Oil Viscosity	Refer to Section 8 - paragraph 8.19.

1.11 MAXIMUM WEIGHTS

(a) Maximum Ramp Weight (lbs)	3943
(b) Maximum Takeoff Weight (lbs)	3925
(c) Maximum Landing Weight (lbs.)	3800
(d) Maximum Weight Baggage Compartment (lbs.)	200

1.13 STANDARD AIRPLANE WEIGHTS

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

1.15 BAGGAGE SPACE

(a) Compartment Volume (cu. ft.)	24
(b) Entry Width (in.)	22
(c) Entry Height (in.)	20

1.17 SPECIFIC LOADINGS

(a) Wing Loading (lbs. per sq. ft.)	21.4
(b) Power Loading (lbs. per hp)	10.9

1.9 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

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

(a) General Airspeed Terminology and Symbols

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

V_{LE}	Maximum Landing Gear Extended Speed is the maximum speed at which an aircraft can be safely flown with the landing gear extended.
V_{LO}	Maximum Landing Gear Operating Speed is the maximum speed at which the landing gear can be safely extended or retracted.
V_{MCA}	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 C.G.
V_{NE}/M_{NE}	Never Exceed Speed or Mach Number is the speed limit that may not be exceeded at any time.
V_{NO}	Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air and then only with caution.
V_S	Stalling Speed or the minimum steady flight speed at which the airplane is controllable.
V_{SO}	Stalling Speed or the minimum steady flight speed at which the airplane is controllable in the landing configuration.
V_{SSE}	Intentional One Engine Inoperative Speed is a minimum speed selected by the manufacturer for intentionally rendering one engine inoperative in flight for pilot training.

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

(b) Meteorological Terminology

ISA	International Standard Atmosphere in which: The air is a dry perfect gas; The temperature at sea level is 15° Celsius (59° Fahrenheit); The pressure at sea level is 29.92 inches Hg (1013.2 mb); The temperature gradient from seal level to the altitude at which the temperature is -56.6°C (-69.7°F) is -0.00198°C (-0.003564°F) per foot and zero above that altitude.
OAT	Outside Air Temperature is the free air static temperature obtained either from inflight temperature indications or ground meteorological sources, adjusted for instrument error and compressibility effects.
Indicated Pressure Altitude	The number actually read from an altimeter when the barometric subscale has been set to 29.92 inches of mercury (1013.2 millibars).
Pressure Altitude	Altitude measured from standard sea-level pressure (29.92 in. Hg) by a pressure or barometric altimeter. It is the indicated pressure altitude corrected for position and instrument error. In this handbook, altimeter instrument errors are assumed to be zero.
Station Pressure	Actual atmospheric pressure at field elevation.

Wind	The wind velocities recorded as variables on the charts of this handbook are to be understood as the headwind or tailwind components of the reported winds.

(c) Power Terminology

Takeoff Power	Maximum power permissible for takeoff.
Maximum Continuous Power	Maximum power permissible continuously during flight.
Maximum Climb Power	Maximum power permissible during climb.
Maximum Cruise Power	Maximum power permissible during cruise.

(d) Engine Instruments

EGT Gauge	Exhaust Gas Temperature Gauge
CHT Gauge	Cylinder Head Temperature Gauge

(e) Airplane Performance and Flight Planning Terminology

Climb Gradient	The demonstrated ratio of the change in height during a portion of a climb, to the horizontal distance traversed in the same time interval.
Demonstrated Crosswind Velocity	The demonstrated crosswind velocity is the velocity of the crosswind component for which adequate control of the airplane during takeoff and landing was actually demonstrated during certification tests.
Accelerate-Stop Distance	The distance required to accelerate an air plane to a specified speed and, assuming failure of an engine at the instant that speed is attained, to bring the airplane to a stop.

MEA	Minimum en route IFR altitude.
Route Segment	A part of a route. Each end of that part is identified by: (1) a geographical location; or (2) a point at which a definite radio fix can be established.

(f) Weight and Balance Terminology

Reference Datum	An imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Station	A location along the airplane fuselage usually given in terms of distance in inches from the reference datum.
Arm	The horizontal distance from the reference datum to the center of gravity (C.G.) of an item
Moment	The product of the weight of an item multiplied by its arm. (Moment divided by a constant is used to simplify balance calculations by reducing the number of digits.)
Center of Gravity (C.G.)	The point at which an airplane would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the airplane.
C.G. Arm	The arm obtained by adding the airplane's individual moments and dividing the sum by the total weight.
C.G. Limits	The extreme center of gravity locations within which the airplane must be operated at a given weight.

Usable Fuel	Fuel available for flight planning.
Unusable Fuel	Fuel remaining after a runout test has been completed in accordance with governmental regulations.
Standard Empty Weight	Weight of a standard airplane including unusable fuel, full operating fluids and full oil.
Basic Empty Weight	Standard empty weight plus optional equipment.
Payload	Weight of occupants, cargo and baggage.
Useful Load	Difference between takeoff weight, or ramp weight if applicable, and basic empty weight.
Maximum Ramp Weight	Maximum weight approved for ground maneuver, (It includes weight of start, taxi and run up fuel.)
Maximum Takeoff Weight	Maximum weight approved for the start of the takeoff run.
Maximum Landing Weight	Maximum weight approved for the landing touchdown.
Maximum Zero Fuel Weight	Maximum weight exclusive of usable fuel.

1.21 CONVERSION FACTORS

MULTIPLY	BY	TO OBTAIN
acres	0.4047	ha
	43560	sq. ft.
	0.0015625	sq. mi.
atmospheres (atm)	76	cm Hg
	29.92	in. Hg
	1.0133	bar
	1.033	kg/cm^2
	14.70	lb./sq. in.
	2116	lb./sq. ft.
bars (bar)	0.98692	atm.
	14.503768	lb./sq. in.
British Thermal Unit (BTU)	0.2519958	kg-cal
centimeters (cm)	0.3937	in.
	0.032808	ft.
centimeters of mercury at 0°C (cm Hg)	0.01316	atm
	0.3937	in. Hg.
	0.1934	lb./sq. in.
	27.85	lb./sq. ft.
	135.95	kg/m^2
centimeters per second (cm/sec.)	0.032808	ft./sec.
	1.9685	ft./min.
	0.02237	mph
cubic centimeters (cm^3)	0.03381	fl. oz.
	0.06102	cu. in.
	3.531×10^{-5}	cu. ft.
	0.001	l
	2.642×10^{-4}	U.S. gal.

MULTIPLY	BY	TO OBTAIN
cubic feet (cu. ft.)	28317	cm^3
	0.028317	m^3
	1728	cu. in.
	0.037037	cu. yd.
	7.481	U.S. gal.
	28.32	l
cubic feet per minute (cu. ft./min.)	0.472	l/sec.
	0.028317	m^3/min.
cubic inches (cu. in.)	16.39	cm^3
	1.639×10^{-5}	m^3
	5.787×10^{-4}	cu. ft.
	0.5541	fl. oz
	0.01639	l
	4.329×10^{-3}	U.S. gal.
	0.01732	U.S. qt.
cubic meters (m^3)	61024	cu. in.
	1.308	cu. yd.
	35.3147	cu. ft.
	264.2	U.S. gal.
cubic meters per minute (m^3/min.)	35.3147	cu. ft./min.
cubic yards (cu. yd.)	27	cu. ft.
	0.7646	m^3
	202	U.S. gal.
degrees (arc)	0.01745	radians
degrees per second (deg./sec.)	0.01745	radians/sec.
drams, fluid (dr. fl.)	0.125	fl. oz.
drams, avdp. (dr. avdp.)	0.0625	oz. avdp.

MULTIPLY	BY	TO OBTAIN
feet (ft.)	30.48	cm
	0.3048	m
	12	in.
	0.33333	yd.
	0.0606061	rod
	1.894×10^{-4}	mi.
	1.645×10^{-4}	NM
feet per minute (ft./min.)	0.01136	mph
	0.01829	km/hr.
	0.508	cm/sec.
	0.00508	m/sec.
feet per second (ft./sec.)	0.6818	mph
	1.097	km/hr.
	30.48	cm/sec.
	0.5921	kts.
foot-pounds (ft.-lb.)	0.138255	m-kg
	3.24×10^{-4}	kg-cal
foot-pounds per minute (ft.-lb./min.)	3.030×10^{-5}	hp
foot-pounds per second (ft.-lb./sec.)	1.818×10^{-5}	hp
gallons, Imperial (Imperial gal.)	277.4	cu. in.
	1.201	U.S. gal.
	4.546	l
gallons, U.S. dry (U.S. gal. dry)	268.8	cu. in.
	1.556×10^{-1}	cu. ft.
	1.164	U.S. gal.
	4.405	l

MULTIPLY	BY	TO OBTAIN
gallons, U.S. liquid (U.S. gal.)	231	cu. in.
	0.1337	cu. ft.
	4.951×10^{-3}	cu. yd.
	3785.4	cm^3
	3.785×10^{-3}	m^3
	3.785	l
	0.83268	Imperial gal.
	128	fl. oz.
gallons per acre (gal./acre)	9.353	l/ha
grams (g)	0.001	kg
	0.3527	oz. avdp.
	2.205×10^{-3}	lb.
grams per centimeter (g/cm)	0.1	kg/m
	6.721×10^{-2}	lb./ft.
	5.601×10^{-3}	lb./in.
grams per cubic centimeter (g/cm^3)	1000	kg./m^3
	0.03613	lb./cu.in.
	62.43	lb./cu. ft.
hectares (ha)	2.471	acres
	107639	sq. ft.
	10000	m^2
horsepower (hp)	33000	ft.-lb./min.
	550	ft-lb./sec.
	76.04	m-kg/sec.
	1.014	metric hp
horsepower, metric	75	m-kg/sec.
	0.9863	hp
inches (in.)	25.40	mm
	2.540	cm
	0.0254	m
	0.08333	ft.
	0.027777	yd.

MULTIPLY	BY	TO OBTAIN
inches of mercury at 0°C (in. Hg)	0.033421	atm
	0.4912	lb./sq. in.
	70.73	lb./sq/ ft.
	345.3	kg/m^2
	2.540	cm Hg
	25.40	mm Hg
inch-pounds (in.-lb.)	0.011521	m-kg
kilograms (kg)	2.204622	lb.
	35.27	oz. avdp.
	1000	g
kilogram-calories (kg-cal)	3.9683	BTU
	3087	ft.-lb.
	426.9	m-kg
kilograms per cubic meter (kg/m^3)	0.06243	lb./cu. ft.
	0.001	g/cm^3
kilograms per hectare (kg/ha)	0.892	lb./acre
kilograms per square centimeter (kg/cm^2)	0.9678	atm
	28.96	in. Hg
	14.22	lb./sq. in.
	2048	lb./sq. ft.
kilograms per square meter (kg/m^2)	2.896×10^{-3}	in. Hg
	1.422×10^{-3}	lb./sq. in.
	0.2048	lb./sq. ft.
kilometers (km)	1×10^{-5}	cm
	3280.8	ft.
	0.6214	mi.
	0.53996	NM

MULTIPLY	BY	TO OBTAIN
kilometers per hour (km/hr.)	0.9113	ft./sec.
	58.68	ft./min.
	0.53996	kt
	0.6214	mph
	0.27778	m/sec.
	16.67	m/min.
knots (kt)	1	nautical mph
	1.689	ft./sec.
	1.1516	statute mph
	1.852	km/hr.
	51.48	m/sec.
liters (l)	1000	cm^3
	61.02	cu. in.
	0.03531	cu. ft.
	33.814	fl. oz.
	0.264172	U.S. gal.
	0.2200	Imperial gal.
	1.05669	qt.
liters per hectare (l/ha)	13.69	ft. oz/acre
	0.107	gal./acre
liters per second (l/sec.)	2.12	cu. ft./min.
meters (m)	39.37	in.
	3.280840	ft.
	1.0936	yd.
	0.198838	rod
	6.214×10^{-4}	mi.
	5.3996×10^{-4}	NM
meter-kilogram (m-kg)	7.23301	ft.-lb.
	86.798	in.-lb.
meters per minute (m/min.)	0.06	km/hr.

MULTIPLY	BY	TO OBTAIN
meters per second (m/sec.)	3.280840	ft./sec.
	196.8504	ft./min.
	2.237	mph
	3.6	km/hr.
microns	3.937×10^{-5}	in.
miles, statue (mi.)	5280	ft.
	1.6093	km
	1609.3	m
	0.8684	NM
miles per hour (mph)	44.7041	cm/sec.
	4.470×10^{-1}	m/sec.
	1.467	ft./sec.
	88	ft./min.
	1.6093	km/hr.
	0.8684	kt
miles per hour square (m/hr. sq.)	2.151	ft./sec. sq.
millibars	2.953×10^{-2}	in. Hg
millimeters (mm)	0.03937	in.
millimeters of mercury at 0°C (mm Hg)	0.03937	in. Hg
nautical miles (NM)	6080	ft.
	1.1516	statute mi.
	1852	m
	1.852	km
ounces, avdp. (oz. avdp.)	28.35	g
	16	dr. avdp.

MULTIPLY	BY	TO OBTAIN
ounces, fluid (fl. oz.)	8	dr. fl.
	29.57	cm^3
	1.805	cu. in.
	0.0296	l
	0.0078	U.S. gal.
ounces, fluid per acre (fl. oz/acre)	0.073	l/ha
pounds (lb.)	0.453592	kg
	453.6	g
	3.108×10^{-2}	slug
pounds per acre (lb./acre)	1.121	kg/ha
pounds per cubic foot (lb./cu. ft.)	16.02	kg/m^3
pounds per cubic inch (lb./cu. in.)	1728	lb./cu. ft.
	27.68	g/cm^3
pounds per square foot (lb./sq. ft.)	0.1414	in. Hg
	4.88243	kg/m^2
	4.725×10^{-4}	atm
pounds per square inch (psi or lb./sq. in.)	5.1715	cm Hg
	2.036	in. Hg
	0.06804	atm
	0.0689476	bar
	703.1	kg/m^2
quart, U.S. (qt.)	0.94635	l
	57.749	cu. in.
radians	57.30	deg. (arc)
	0.1592	rev.

MULTIPLY	BY	TO OBTAIN
radians per second (radians/sec.)	57.30	deg./sec.
	0.1592	rev./sec.
	9.549	rpm
revolutions (rev.)	6.283	radians
revolutions per minute (rpm or rev./min.)	0.1047	radians/sec.
revolutions per second (rev./sec.)	6.283	radians/sec.
rod	16.5	ft.
	5.5	yd.
	5.029	m
slug	32.174	lb.
square centimeters (cm^2)	0.1550	sq. in.
	0.001076	sq. ft.
square feet (sq. ft.)	929	cm^2
	0.092903	m^2
	144	sq. in.
	0.1111	sq. yd.
	2.296×10^{-5}	acres
square inches (sq. in.)	6.4516	cm^2
	6.944×10^{-3}	sq. ft.
square kilometers (km^2)	0.3861	sq. mi.
square meters (m^2)	10.76391	sq. ft.
	1.196	sq. yd.
	0.0001	ha
square miles (sq. mi.)	2.590	km^2
	640	acres

MULTIPLY	BY	TO OBTAIN
square rods (sq. rods)	30.25	sq. yd.
square yards (sq. yd.)	0.8361	m^2
	9	sq. ft.
	0.0330579	sq. rods
yards (yd.)	0.9144	m
	3	ft.
	36	in.
	0.181818	rod

TABLE OF CONTENTS

SECTION 2

LIMITATIONS

SECTION 2

LIMITATIONS

2.1 GENERAL

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

The airplane must be operated as a normal category airplane in compliance with the operating limitations stated in the form of placards and markings and those given in this section and handbook.

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

2.3 AIRSPEED LIMITATIONS

SPEED	KIAS	KCAS
Design Maneuvering Speed (V_A) - Do not make full or abrupt control movements above this speed.		
3925 lbs.	137	135
2700 lbs.	112	112

CAUTION

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

SPEED	KIAS	KCAS
Never Exceed Speed (V_{NE}) - Do not exceed this speed in any operation.	202	194
Maximum Structural Cruising Speed (V_{NO}) - Do not exceed this speed except in smooth air and then only with caution.	170	165
Maximum Flaps Extended Speed (V_{FE}) - Do not exceed this speed with the flaps extended.	111	109
Maximum Gear Extended Speed (V_{LE}) - Do not exceed this speed with landing gear extended.	140	138
Maximum Landing Gear Extending Speed - Do not extend landing gear above this speed.	140	138
Maximum Landing Gear Retracting Speed - Do not retract landing gear above this speed.	109	109
Air Minimum Control Speed (V_{MCA}) - Lowest airspeed at which airplane is controllable with one engine operating and no flaps. Note: This is a stalled condition.	57	62
One Engine Inoperative Best Rate of Climb Speed.	88	90

2.5 AIRSPEED INDICATOR MARKINGS

MARKING	IAS
Red Radial Line (Never Exceed)	202 KTS
Red Radial Line (One Engine Inoperative Air Minimum Control Speed)	57 KTS

MARKING	IAS
Blue Radial Line (One Engine Inoperative Best Rate of Climb Speed)	88 KTS
Yellow Arc (Caution Range - Smooth Air Only)	170 KTS to 202 KTS
Green Arc (Normal Operating Range)	60 KTS to 170 KTS
White Arc (Flap Down)	56 KTS to 111 KTS

2.7 POWER PLANT LIMITATIONS

(a) Number of Engines	2
(b) Engine Manufacturer	Lycoming
(c) Engine Model No.	
Left	TO-360-E1A6D
Right	LTO-360-E1A6D
(d) Engine Operating Limits	
(1) Maximum Horsepower	180
(2) Maximum Rotation Speed (RPM)	2575
(3) Maximum Manifold Pressure	36.5" Hg
(4) Maximum Cylinder Head Temperature	500°F
(5) Maximum Oil Temperature	245°F
(e) Oil Pressure	
Minimum (red line)	15 PSI
Maximum (red line)	115 PSI
(f) Fuel Pressure	
Minimum (red line)	13 PSI
Maximum (red line)	35 PSI
(g) Fuel (minimum grade)	100 or 100LL Aviation Grade
(h) Number of Propellers	2
(i) Propeller Manufacturer	Hartzell
(j) Propeller Hub and Blade Models	
(1) Standard (Two Blade)	
Left	HC-C2YR-2C ( )UF/ FC7666A-2R
Right	HC-C2YR-2CL( )UF/ FJC7666A-2R

(2) Optional (Three Blade)	
Left	HC-C3YR-2( )UF/ FC-7663-5R
Right	HC-C3YR-2L( )UF/ FJC-7663-5R
(k) Propeller Diameter	
(1) Standard (Two Blade)	
Maximum	74 IN.
Minimum	72 IN.
(2) Optional (Three Blade)	
Maximum	73 IN.
Minimum	72 IN.

2.9 POWER PLANT INSTRUMENT MARKINGS

(a) Tachometer	
Green Arc (Normal Operating Range)	500 to 2575 RPM
Red Line (Maximum)	2575 RPM
(b) Manifold Pressure	
Green Arc (Normal Operating Range)	10 to 36.5 in. Hg.
Red Line (Maximum)	36.5 in. Hg.
(c) Oil Temperature	
Green Arc (Normal Operating Range)	75° to 245°F
Red Line (Maximum)	245°F
(d) Oil Pressure	
Green Arc (Normal Operating Range)	60 PSI to 90 PSI
Yellow Arc (Caution Range) (Idle)	15 PSI to 60 PSI
Yellow Arc (Ground Warm-Up)	90 PSI to 115 PSI
Red Line (Minimum)	15 PSI
Red Line (Maximum)	115 PSI
or	
Green Arc (Normal Operating Range)	55 PSI to 90 PSI
Yellow Arc (Caution Range) (Idle)	15 PSI to 55 PSI
Yellow Arc (Ground Warm-Up)	90 PSI to 115 PSI
Red Line (Minimum)	15 PSI
Red Line (Maximum)	115 PSI
(e) Fuel Pressure	
Green Arc (Normal Operating Range)	13 PSI to 35 PSI
Red Line (Minimum)	13 PSI
Red Line (Maximum)	35 PSI

(f) Cylinder Head Temperature
Green Arc (Normal Range) .... 200° to 435°F
Red Line (Maximum) .... 500°F

(g) Exhaust Gas Temperature (EGT)
Green Arc (Normal Operating Range) .... 1200°F to 1650°F
Red Line (Maximum) .... 1650°F

2.11 WEIGHT LIMITS

(a) Maximum Ramp Weight	3943 lbs.
(b) Maximum Takeoff Weight	3925 lbs.
(c) Maximum Landing Weight	3800 lbs.
(d) Maximum Weight-Baggage Compartment	200 lbs.

2.13 CENTER OF GRAVITY LIMITS

Weight Pounds	Forward Limit Inches Aft of Datum	Rearward Limit Inches Aft of Datum
2700	83.0	93.0
3400	85.0	93.0
3800	87.3	93.0
3925	89.7	93.0

NOTES

Straight line variation between points given.

The datum used is 78.4 inches ahead of the wing leading edge at wing station 106.

It is the responsibility of the airplane owner and the pilot to insure that the airplane is properly loaded. Maximum allowable gross weight is 3925 pounds. See Section 6 (Weight and Balance) for proper loading instructions.

2.15 MANEUVER LIMITS

All intentional acrobatic maneuvers (including spins) are prohibited. Avoid abrupt maneuvers.

2.17 FLIGHT MANEUVERING LOAD FACTORS

FLAPS UP

(a) Positive Load Factor (Maximum)	3.8 G
(b) Negative Load Factor (Maximum)	No inverted maneuvers approved

FLAPS DOWN

(a) Positive Load Factor (Maximum)	2.0 G
(b) Negative Load Factor (Maximum)	No inverted maneuvers approved

2.19 TYPES OF OPERATION

The airplane is approved for the following operations when equipped in accordance with FAR 91 or FAR 135.

(a) Day V.F.R.
(b) Night V.F.R.
(c) Day I.F.R.
(d) Night I.F.R.
(e) Non Icing

2.21 FUEL LIMITATIONS

(a) Total Capacity	110 U.S. GAL.
(b) Unusable Fuel The unusable fuel for this airplane has been determined as 1.0 gallon in each nacelle in critical flight attitudes.	2 U.S. GAL.
(c) Usable Fuel The usable fuel in this airplane has been determined as 54 gallons in each nacelle or a total of 108 gallons.	108 U.S. GAL.

2.23 NOISE LEVEL

The corrected noise level of this aircraft is 71.5d B(A) with the two blade propeller and 72.4d B(A) with the three blade propeller.

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

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

2.25 GYRO SUCTION LIMITS

The operating limits for the suction system are 4.8 to 5.1 inches of mercury for all operations as indicated by the gyro suction gauge.

2.27 OPERATING ALTITUDE LIMITATIONS

Flight above 20,000 feet is not approved. Flight up to and including 20,000 feet is approved if equipped with oxygen in accordance with FAR 23.1441 and avionics in accordance with FAR 91 or FAR 135.

2.29 MAXIMUM SEATING CONFIGURATION

The maximum seating capacity of this aircraft is 4 (four) persons.

2.31 PLACARDS

In full view of the pilot:

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 this category are contained in the airplane flight manual. No acrobatic maneuvers, including spins, approved.

This aircraft approved for V.F.R., I.F.R., day and night non-icing flight when equipped in accordance with FAR 91 or FAR 135.

In full view of the pilot:

ONE ENGINE INOPERATIVE
AIR MINIMUM CONTROL SPEED 57 KIAS

In full view of the pilot:

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

On instrument panel in full view of the pilot:

V_A 137 AT 3925 LBS
(SEE AFM)

V_{LO} 140 DN, 109 UP
V_{LE} 140 MAX.

DEMO X-WIND 17 KTS

Near emergency gear release:

EMERGENCY GEAR EXTENSION
PULL TO RELEASE. SEE AFM
BEFORE RE-ENGAGEMENT

Near gear selector switch:

GEAR UP	109 KIAS MAX.
DOWN	140 KIAS MAX.

Adjacent to upper door latch:

ENGAGE LATCH BEFORE FLIGHT

On inside of baggage compartment door:

BAGGAGE MAXIMUM 200 LBS.

On storm window:

DO NOT OPEN ABOVE 129 KIAS

On pilot's sunvisor:

TAKEOFF CHECK LIST

Fuel Selectors On
Electric Fuel Pumps On
Alternators On
Engine Gauges Checked
Mixtures Set
Propellers Set
Carb Heat Off

Cowl Flaps Set
Seat Backs Erect
Flaps Set
Trim Set (Stab. & Rudder)
Fasten Belts/Harness
Controls Free - Full Travel
Doors Latched
Air Conditioner Off

LANDING CHECK LIST

Seat Backs Erect	Electric Fuel Pumps On
Fasten Belts/Harness	Mixtures Rich
Fuel Selectors On	Propellers Set
Cowl Flaps Set	Gear Down
	Flaps Set - (White Arc)
	Air Conditioner Off

The "AIR CONDITIONER OFF" item in the preceding takeoff and landing check list is mandatory for air conditioned aircraft only.

In full view of the pilot:

ONE ENGINE INOPERATIVE STALLS NOT RECOMMENDED. CAN CAUSE 400 FT. LOSS OF ALTITUDE AND 30° PITCH ANGLE.

In full view of the pilot when the oil cooler winterization kit is installed:

OIL COOLER WINTERIZATION PLATE TO BE REMOVED WHEN AMBIENT TEMPERATURE EXCEEDS 50°F.

On the vertical window post between the first and second left side windows and close to the Emergency Exit release handle:

EMERGENCY EXIT
PULL HANDLE FORWARD
PUSH WINDOW OUT

Adjacent to fuel tank filler caps:

FUEL
100 OR 100LL
AVIATION GRADE

On the manifold pressure gauge face (three blade props only):

CONTINUOUS OPERATION LESS THAN
15" MP ABOVE 12,000 FT PROHIBITED.

TABLE OF CONTENTS

SECTION 3

EMERGENCY PROCEDURES

TABLE OF CONTENTS (cont)

SECTION 3 (cont)

TABLE OF CONTENTS (cont)

SECTION 3 (cont)

SECTION 3

EMERGENCY PROCEDURES

3.1 GENERAL

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

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

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

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

These procedures are suggested as the best course of action for coping with the particular condition described, but are not a substitue for sound judgment and common sense. Since emergencies rarely happen in modern aircraft, their occurrence is usually unexpected and the best corrective action may not always be obvious. Pilots should familiarize themselves with the procedures given in this section and be prepared to take appropriate action should an emergency arise.

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

3.3 EMERGENCY PROCEDURES CHECK LIST

AIRSPEEDS FOR SAFE OPERATIONS

One engine inoperative air minimum control .... 57 KIAS
One engine inoperative best rate of climb .... 88 KIAS
One engine inoperative best angle of climb .... 82 KIAS
Maneuvering .... 137 KIAS
Never exceed .... 202 KIAS

ENGINE INOPERATIVE PROCEDURES

DETECTING DEAD ENGINE

Loss of thrust.
Nose of aircraft will yaw in direction of dead engine (with coordinated controls).

ENGINE SECURING PROCEDURE (FEATHERING PROCEDURE)

Minimum control speed .... 57 KIAS
One engine inoperative best rate of climb .... 88 KIAS
Maintain direction and airspeed above 82 KIAS.
Mixture controls .... forward
Propeller controls .... forward
Throttle controls .... 36.5 in. Hg. Max.
Flaps .... retract
Gear .... retract
Identify inoperative engine.
Throttle of inop. engine .... retard to verify

To attempt to restore power prior to the feathering:
- Mixtures .... as required
- Fuel selector .... ON
- Magnetos .... left or right only
- Electric fuel pump .... check ON
- Carburetor heat .... ON

Prop control of inop. engine .... feather before RPM drops below 950
Mixture of inop. engine .... idle cut-off

Trim .... as required (3° to 5° of bank toward operative engine - ball ½ to ¾ out)
Electric fuel pump of inop. engine .... OFF
Magnetos of inop. engine .... OFF
Cowl flaps .... close on inop. engine, as required on operative engine
Alternator of inop. engine .... OFF
Electrical load .... reduce
Fuel selector .... OFF inop. engine, consider crossfeed
Electric fuel pump operative engine .... OFF

ENGINE FAILURE DURING TAKEOFF (Below 75 KIAS)

If engine failure occurs during takeoff and 75 KIAS has not been attained:
Throttles .... CLOSE both immediately
Stop straight ahead.

If inadequate runway remains to stop:
Throttles .... CLOSED
Brakes .... apply max. braking
Master switch .... OFF
Fuel selectors .... OFF
Continue straight ahead, turning to avoid obstacles.

ENGINE FAILURE DURING TAKEOFF (75 KIAS or above)

If engine failure occurs during takeoff ground roll or after lift-off with gear still down and 75 KIAS has been attained:
If adequate runway remains CLOSE both throttles immediately, land if airborne and stop straight ahead.
If runway remaining is inadequate for stopping, decide whether to abort or continue. if decision is made to continue, maintain heading and when climb is established retract landing gear, accelerate to 88 KIAS, and feather inoperative engine prop (see Engine Securing Procedure).

WARNING

In certain combinations of aircraft weight, configuration, ambient conditions and speed, negative climb performance may result. Refer to One Engine Inoperative Climb Performance chart, Figure 5-27.

ENGINE FAILURE DURING CLIMB

Airspeed .... maintain 88 KIAS
Directional control .... maintain
Inop. engine ....identify and verify
Inop. engine .... complete Engine Securing Procedure
Land as soon as practical at nearest suitable airport.

ENGINE FAILURE DURING FLIGHT

(Maintain Airspeed above 88 KIAS)
Inop. engine .... identify
Operative engine .... adjust as required

Before securing inop. engine:
Fuel pressure .... check (if deficient-Electric fuel pump ON)
Fuel quantity ....check
Fuel selector (inop. eng.) .... ON
Oil pressure and temp ....check
Magneto switches ....check

If engine does not start, complete Engine Securing Procedure.
Land as soon as practical at nearest suitable airport.

ONE ENGINE INOPERATIVE LANDING

Inop. engine prop ....feather
When certain of making field:
Landing gear .... extend
Wing flaps .... lower
Maintain additional altitude and speed during approach.
Final approach speed .... 90 KIAS
Wing flaps ....25°

ONE ENGINE INOPERATIVE GO-AROUND
(SHOULD BE AVOIDED IF AT ALL POSSIBLE)

Mixture ....forward
Propeller ....forward
Throttle .... open slowly (36.5 in Hg. Max.)
Flaps .... retract
Landing gear .... retract

Airspeed .... 88 KIAS
Trim .... set
Cowl flap operating engine .... as required

AIR START (UNFEATHERING PROCEDURE)

Fuel selector inop. engine .... ON
Electric fuel pump inop. engine .... ON
Mixture .... RICH
Throttle .... open 1/4 inch
Magneto switches .... ON
Primer .... ON, 2 seconds maximum
Prop control .... full forward
Starter .... engage until prop windmills freely
Throttle .... reduce power until engine is warm

If engine does not start, prime as required - 2 seconds maximum.
Alternator .... ON

AIR START (UNFEATHERING PROCEDURE)
(Optional propeller unfeathering system installed)

Fuel selector inop. engine .... ON
Electric fuel pump inop. engine .... ON
Mixture .... RICH
Throttle .... open 1/4 inch
Magneto switches .... ON
Prop control and latch .... push full forward
Starter .... engage after 5 - 7 seconds if prop is not windmilling freely
Throttle .... reduce power until engine is warm
Alternator after restart .... ON

STARTER ON LIGHT

If light remains illuminated after the starter switch is released:
BUS ISO (60A) circuit breakers .... PULL
Battery switch .... OFF
Electrical loads .... REDUCE
Land as soon as practical.

FIRE

ENGINE FIRE ON GROUND

If engine has not started:
Mixture .... idle cut-off
Throttle .... open
Starter .... crank engine

If engine has already started and is running, continue operating to try pulling the fire into the engine.
If fire continues, extinguish with best available means.
If external fire extinguishing is to be applied:
Fuel selector valves .... OFF
Mixture .... idle cut-off

ENGINE FIRE IN FLIGHT

Affected engine:
Fuel selector .... OFF
Throttle .... close
Propeller .... feather
Mixture .... idle cut-off
Cowl flap .... OPEN
If terrain permits land immediately.

FUEL MANAGEMENT DURING ONE ENGINE INOPERATIVE OPERATION

CRUISING

When using fuel from tank on the same side as the operating engine:
Fuel selector operating engine .... ON
Fuel selector inop. engine .... OFF
Electric fuel pumps .... OFF
(except in case of engine driven pump failure, electric fuel pump on operating engine side must be used)

When using fuel from tank on the side opposite the operating engine:
Fuel selector operating engine .... CROSSFEED
Fuel selector inop. engine .... OFF
Electric fuel pumps .... OFF
(except in case of engine driven pump failure, electric fuel pump on operating engine side must be used)

If engine failure occurs due to loss of fuel pressure during crossfeed operation, return fuel selector to ON position.

NOTE

Use crossfeed in level cruise flight only.

LANDING

Fuel selector operating engine .... ON
Fuel selector inop. engine .... OFF

CARBURETOR ICE

Carburetor heat .... full ON
Mixture .... adjust as required

ENGINE DRIVEN FUEL PUMP FAILURE

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

LANDING GEAR UNSAFE WARNINGS

Red light indicates gear in transit.
Recycle gear if indication continues.
Light will illuminate and gear horn sounds when the gear is not down and locked if throttles are at low settings or wing flaps are in second or third notch position.

MANUAL EXTENSION OF LANDING GEAR

Check following before extending gear manually:

Circuit breakers .... check
Master switch .... ON
Alternators .... check
Navigation lights .... OFF (daytime)

To extend, proceed as follows:

Airspeed .... reduce (100 KIAS max.)
Gear selector .... GEAR DOWN LOCKED position
Emerg. gear extend knob .... pull
Indicator lights .... 3 green
Leave emergency gear extension knob out.

GEAR UP LANDING

Seat backs .... erect
Seat belts and harness .... fastened
Fuel selectors .... ON
Cowl flaps .... as required
Electric fuel pumps .... ON
Mixture controls .... rich
Prop controls .... full FORWARD
Flaps .... as desired
Approach speed .... 75 KIAS or above
Throttles .... close prior to touchdown
Fuel selector .... OFF prior to touchdown
Master switch .... OFF prior to touchdown
Ignition switches .... OFF prior to touchdown
Touch Down .... minimum possible speed

GYRO SUCTION FAILURES

Suction below 4.5 in. Hg.

RPM .... increase to 2575
Altitude .... descend to maintain 4.5 in. Hg.

Use electric turn indicator to monitor Directional Indicator and Attitude Indicator performance.

ELECTRICAL POWER LOSS - (FOR AIRPLANES WITH INTERLOCKED MASTER AND ALT SWITCH OPERATION)

ALT annunciator light illuminated:
Ammeters .... check to determine inop. alt.

If one ammeter shows zero:
Inop. ALT switch .... OFF

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

If power is not restored:
Inop. ALT switch .... OFF
Electrical loads .... re-establish to 60 amps max.

If both ammeters show zero:
ALT switches .... both OFF

Reduce electrical loads to minimum:
ALT circuit breakers .... check both and reset as required
ALT switches .... ON one at a time

Determine ALT showing LEAST (but not zero) amps:
ALT switches .... least load ON other OFF
Electrical loads .... re-establish to 60 amps max.

If alternator outputs are NOT restored:
ALT switches .... OFF
Electrical loads .... reduce to minimum

Land as soon as practical. The battery is the only remaining source of electrical power. Anticipate complete electrical failure.

WARNING

Compass error may exceed 10 degrees with both alternators inoperative.

NOTE

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

ELECTRICAL POWER LOSS - (FOR AIRPLANES WITH SEPARATE BAT AND ALT SWITCH OPERATION WITH SINGLE ELECTRICAL BUS SYSTEM)

ALT annunciator light illuminated:
Ammeters .... check to determine inop alt.

If one ammeter shows zero:
Inop. ALT switch .... OFF

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

If power is not restored:
Inop. ALT switch .... OFF
Electrical loads .... re-establish to 60 amps max.

If both ammeters show zero:
ALT switches .... both OFF

Reduce electrical loads to minimum:
ALT circuit breakers .... check both and reset as required
ALT switches .... ON one at a time

Determine ALT showing LEAST (but not zero) amps:
ALT switches.. least load ON
other OFF
Electrical loads .... re-establish to
60 amps max.

If alternator outputs are NOT restored:
BAT switch .... OFF
ALT switches.................................. ON one at a time

If one or both alternator outputs are restored:
Electrical loads .... reduce to minimum

Land as soon as practical. The alternator(s) is the only remaining source of electrical power.

NOTE

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

If alternator outputs are NOT restored:
ALT switches.. OFF
Electrical loads .... reduce to minimum

Land as soon as practical. The battery is the only remaining source of electrical power. Anticipate complete electrical system failure.

WARNING

Compass error may exceed 10 degrees with both alternators inoperative.

NOTE

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

ELECTRICAL POWER LOSS - (FOR AIRPLANES WITH SPLIT ELECTRICAL BUS SYSTEM)

ALT annunciator light illuminated:
Ammeters .... check to determine inop. atl.

If one ammeter shows zero:
Inop. ALT switch .... OFF

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

If power is not restored:
Inop. ALT switch .... OFF
Electrical loads .... re-establish to 60 amps. max.

If both ammeters show zero:
ALT switches .... both OFF

Reduce electrical loads to minimum:
ALT circuit breakers .... check both and reset as required
ALT switches .... ON one at at time

Determine ALT showing LEAST (but not zero) amps:
ALT switches .... least load ON other OFF
Electrical loads .... re-establish to 60 amps. max.

If ammeters show zero:
Inop. ALT switches .... OFF

Land as soon as practical. The battery is the only remaining source of electrical power. Anticipate complete electrical failure.

If systems powered from zero reading ammeter bus are inop:
Reduce electrical loads on that bus by pulling circuit breakers of more than 5 amp, and turn avionics Master Switch OFF, then:
Bus ISO circuit breaker .... Pull
Inop. ALT switch .... ON

If power is restored:
Electrical loads may be restored.

If power is not restored:
Inop. ALT switch .... OFF
Land as soon as practical.

WARNING

Compass error may exceed 10 degrees with both alternators inoperative.

NOTE

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

ELECTRICAL OVERLOAD (Alternators over 30 amps above known electrical load) - (FOR AIRPLANES WITH INTERLOCKED MASTER AND ALT SWITCH OPERATION)

Electrical load .... reduce

If alternator loads are NOT reduced:
ALT switches.. OFF

Land as soon as possible. The battery is the only remaining source of electrical power. Anticipate complete electrical failure.

WARNING

Compass error may exceed 10 degrees with both alternators inoperative.

NOTE

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

ELECTRICAL OVERLOAD (Alternators over 30 amps above known electrical load) - (FOR AIRPLANES WITH A SEPARATE BAT AND ALT SWITCH OPERATION)

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

If alternator loads are reduced, this indicates a malfunction of the battery and/or battery wiring.

Electrical loads .... reduce to min.

Land as soon as practical. The alternator(s) is the only remaining source of electrical power.

NOTE

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

If alternator loads are NOT reduced:
ALT switches .... OFF
BAT switch .... as required
Electrical loads .... reduce to minimum

Land as soon as practical. The battery is the only remaining source of electrical power. Anticipate complete electrical failure.

WARNING

Compass error may exceed 10 degrees with both alternators inoperative.

NOTE

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

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SPINS (INTENTIONAL SPINS PROHIBITED)

Throttles .... retard to idle
Rudder .... full opposite to direction of spin
Control wheel .... release back pressure
Control wheel .... full forward if nose does not drop
Ailerons .... neutral
Rudder .... neutralize when rotation stops
Control Wheel..............................smooth back pressure to recover from dive

NOTE

Federal Aviation Administration Regulations do not require spin demonstration of multi-engine airplanes; therefore, spin tests have not been conducted. The recovery technique presented is based on the best available information.

OPEN DOOR (ENTRY DOOR ONLY)

If both upper and side latches are open, the door will trail slightly open and airspeeds will be reduced slightly.

To close the door in flight:
Slow airplane to 82 KIAS.
Cabin vents .... close
Storm window.. open

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

If both latches are open............................ latch side latch then top latch

PROPELLER OVERSPEED

Throttle .... retard
Oil pressure ....check
Prop control ....full DECREASE rpm, then set if any control available
Airspeed .... reduce
Throttle ....as required to remain below 2575 rpm

COMBUSTION HEATER OVERHEAT

Fuel, air and ignition is automatically cut off.
Do not attempt to restart.

OXYGEN SYSTEM MALFUNCTION

Proceed with emergency descent.

EMERGENCY DESCENT

Carburetor heat... ON
Throttles...CLOSED
Prop Control.. FORWARD
Mixture .... as REQD.
Landing gear ....extend 140 KIAS Max
Airspeed ....140 KIAS

EMERGENCY EXIT

Remove thermoplastic cover
Pull handle forward
Push window out.

3.5 AMPLIFIED EMERGENCY PROCEDURES (GENERAL)

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

3.7 ENGINE INOPERATIVE PROCEDURES

DETECTING A DEAD ENGINE

A loss of thrust will be noted with coordinated controls, the nose of the aircraft will yaw in the direction of the dead engine.

ENGINE SECURING PROCEDURE (FEATHERING PROCEDURE)

Keep in mind that the one engine inoperative air minimum control speed is 57 KIAS and the one engine inoperative best rate of climb speed is 88 KIAS when beginning the feathering procedure.

To feather a propeller, maintain direction and an airspeed above 82 KIAS. Move the mixture and propeller controls forward. The throttle controls should be moved forward (36.5 in. Hg. max.) to maintain a safe airspeed. Retract the flaps and landing gear and identify the inoperative engine. The airplane will yaw in the direction of the dead engine. Retard the throttle of the inoperative engine to verify loss of power.

NOTE

If circumstances permit, in the event of an actual engine failure, the pilot may elect to attempt to restore power prior to feathering.

If circumstances permit an attempt to restore power prior to feathering, adjust the mixture control as required, move the fuel selector control to ON and select either L (left) or R (right) magneto. Move the carburetor heat control to ON and the electric fuel pump to the ON position. If power is not immediately restored turn off the electric fuel pump.

The propellers can be feathered only while the engine is rotating above 950 RPM. Loss of centrifugal force due to slowing RPM will actuate a stop pin that keeps the propeller from feathering each time the engine is stopped on the ground. One engine inoperative performance will decrease if the propeller of the inoperative engine is not feathered.

The propeller control of the inoperative engine should be moved to the feather position and the mixture control of the inoperative engine to idle cut-off.

Trim the aircraft as required and maintain a 3° to 5° bank toward the operating engine. The ball will be ½ to ¾ out for minimum drag. The electric fuel pumps should be off except in the case of an engine driven fuel pump failure. Turn OFF the magnetos and close the cowl flaps on the inoperative engine. Cowl flaps should be used as necessary on the operative engine. The alternator of the inoperative engine should be turned OFF and the electrical load reduced to prevent depletion of the battery. Move the fuel selector control for the inoperative engine to the OFF position. If necessary, consider the use of crossfeed (refer to Fuel Management During One Engine Inoperative Operation, paragraph 3.11). Turn OFF the operative engine's electric fuel pump.

NOTE

When an engine is feathered the alternator, gyro air, and oil annunciator warning lights will remain illuminated.

ENGINE FAILURE DURING TAKEOFF (Below 75 KIAS)

The one engine inoperative air minimum control speed for this airplane is 57 KIAS under standard conditions.

NOTE

This is a stalled condition.

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If engine failure occurs during takeoff ground roll and 75 KIAS has not been attained, CLOSE both throttles immediately and stop straight ahead. If inadequate runway remains to stop, close the throttles and apply maximum braking. The master switch and fuel selectors should be turned OFF. Continue path straight ahead turning to avoid obstacles as necessary.

ENGINE FAILURE DURING TAKEOFF (75 KIAS or above)

If engine failure occurs during takeoff ground roll or after lift-off with the gear still down and 75 KIAS has been attained the course of action to be taken will depend on the runway remaining. If adequate runway remains, CLOSE both throttles immediately, land if airborne and stop straight ahead. If the runway remaining is inadequate for stopping, the pilot must decide wheather to abort the takeoff or to continue. The decision must be based on the pilot's judgment considering loading, density altitude, obstructions, the weather, and the pilot's competence. If the decision is made to continue the takeoff, maintain heading and airspeed. When climb is established RETRACT the landing gear, accelerate to 88 KIAS, and FEATHER the inoperative engine (refer to Engine Securing Procedure).

WARNING

In certain combinations of aircraft weight, configuration, ambient conditions and speed, negative climb performance may result. Refer to One Engine Inoperative Climb Performance chart, Figure 5-27.

ENGINE FAILURE DURING CLIMB

If engine failure occurs during climb, a minimum airspeed of 88 KIAS should be maintained. Since one engine will be inoperative and the other will be at maximum power, the airplane will want to turn in the direction of the inoperative engine. Rudder pedal force on the side of the operating engine will be necessary to maintain directional control. After the faulty engine has been identified and power loss verified, complete the "Engine Securing Procedures." Continue a straight ahead climb until sufficient altitude is reached to execute the "One Engine Inoperative Landing" procedure at the nearest suitable airport.

ENGINE FAILURE DURING FLIGHT

Should an engine fail during flight at an airspeed below 88 KIAS, begin corrective response by identifying the inoperative engine. Apply rudder towards the operative engine to maintain directional control. The throttles should be retarded to stop the yaw force produced by the inoperative engine. Lower the nose of the aircraft to accelerate above 88 KIAS and increase the power on the operative engine as the airspeed exceeds 88 KIAS.

Maintain an airspeed above 88 KIAS and, prior to securing the inoperative engine, check to make sure the fuel flow to the engine is sufficient. If the fuel flow is deficient, turn ON the emergency fuel pump. Check the fuel quantity on the inoperative engine side and switch the fuel selector to the other tank if a sufficient supply is indicated. Check the oil pressure and oil temperature and insure that the magneto switches are ON.

If the engine fails to start it should be secured using the "Engine Securing Procedure".

ONE ENGINE INOPERATIVE LANDING

Complete the Engine Securing Procedure. The landing gear should not be extended and the wing flaps should not be lowered until certain of making the field.

Maintain additional altitude and speed during approach, keeping in mind that landing should be made right the first time and that a go-around should be avoided if at all possible.

A final approach speed of 90 KIAS and the use of 25° rather than full wing flaps will place the airplane in the best configuration for a go-around should this be necessary.

WARNING

Under some conditions of loading and density altitude a go-around may be impossible, and in any event the sudden application of power during one engine inoperative operation makes control of the airplane more difficult.

ONE ENGINE INOPERATIVE GO-AROUND

NOTE

A one engine inoperative go-around should be avoided if at all possible.

To execute a one engine inoperative go-around, advance the mixture and propeller levers forward. The throttle should be advanced slowly to 36.5 in. Hg. Retract the flaps and landing gear. Maintain airspeed at the one engine inoperative best rate of climb speed of 88 KIAS. Set the trim and cowl flaps as required.

AIR START (UNFEATHERING PROCEDURE)

Move the fuel selector for the inoperative engine to the ON position and check to make sure the electric fuel pump is ON. The mixture should be set RICH. Open the throttle 1/4 inch and turn ON the magneto switches. Prime the engine for a maximum of 2 seconds. Push the prop control to the full forward position. Engage the starter until the propeller windmills. The throttle should be set at reduced power until the engine is warm. If the engine does not start, prime as necessary (2 seconds maximum). The alternator switch should be turned ON.

AIR START (UNFEATHERING PROCEDURE)

(Optional propeller unfeathering system installed)

Move the fuel selector for the inoperative engine to the ON position and check to make sure the electric fuel pump is ON. The mixture should be set RICH. Open the throttle 1/4 inch and turn ON the magneto switches. Push the prop control and latch to the full forward position. If the propeller does not windmill freely within 5 - 7 seconds after the prop control has been moved full forward, engage the starter for 1 - 2 seconds. The throttle should be set at reduced power until the engine is warm. The alternator switch should be turned ON after restart.

STARTER ON LIGHT

When the STARTER ON light illuminates during flight, pull both isolation (60A) circuit breakers and turn off the battery switch. This will allow self-excited alternator operation to supply electrical power. Reduce electrical loads and land as soon as practical.

3.9 FIRE

ENGINE FIRE ON THE GROUND

The first attempt to extinguish the fire is to try to draw the fire back into the engine. If the engine has not started move the mixture control to idle cut-off and open the throttle. Begin to crank the engine with the starter in an attempt to pull the fire into the engine.

If the engine has already started and is running, continue operating to try to pull the fire into the engine

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

If an external fire extinguisher method is to be applied move the fuel selector valves to OFF and the mixture to idle cut-off.

ENGINE FIRE IN-FLIGHT

The possibility of an engine fire in flight is extremely remote. The procedure given below is general. The pilot judgment should be the deciding factor for action in such an emergency.

If an engine fire occurs in flight, place the fuel selector of the affected engine in the OFF position and close its throttle. Feather the propeller on the faulty engine. Move the mixture control to idle cut-off. The cowl flap should be open. A landing should be made if terrain permits.

3.11 FUEL MANAGEMENT DURING ONE ENGINE INOPERATIVE OPERATION

A crossfeed is provided to increase range during one engine inoperative operation. Use crossfeed in level flight only.

When using fuel from the fuel tank on the same side as the operating engine the fuel selector of the operating engine should be ON and the fuel selector for the inoperative engine should be OFF. The electric fuel pumps should be OFF except in the case of an engine driven fuel pump failure. If an engine driven fuel pump has failed the electric fuel pump on the operating engine side must be ON.

Increased range is available by using fuel from the tank on the opposite side of the operating engine. For this configuration the fuel selector of the operating engine should be on X-FEED (crossfeed) and the fuel selector of the inoperative engine should be OFF. The electric fuel pumps should be OFF. Crossfeed is approved for level cruise flight only.

During the landing sequence the fuel selector of the operating engine must be ON and the fuel selector of the inoperative engine OFF. The electric fuel pump of the operating engine should be ON.

3.13 CARBURETOR ICE

Under certain moist atmospheric conditions at temperatures of -5° to 30° C, it is possible for ice to form in the induction system, even in summer weather. This is due to the high air velocity through the carburetor venturi and the absorption of heat from this air by vaporization of the fuel.

To avoid this, a carburetor preheater is provided to replace the heat lost by vaporization. Carburetor heat should be full on when carburetor ice is encountered. Adjust mixture for maximum smoothness.

3.15 ENGINE DRIVEN FUEL PUMP FAILURE

Loss of fuel pressure and engine power can be an indication of failure of the engine driven fuel pump. Should these occur and engine driven fuel pump failure is suspected, turn ON the electric fuel pump.

CAUTION

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

3.17 LANDING GEAR UNSAFE WARNINGS

The red landing gear light will illuminate when the landing gear is in transition between the full up position and the down and locked position. The pilot should recycle the landing gear if continued illumination of the light occurs. Additionally, the light will illuminate when the gear warning horn sounds. The gear warning horn will sound at low throttle settings if the gear is not down and locked, and when landing flaps are selected and the gear is not down and locked.

3.19 MANUAL EXTENSION OF THE LANDING GEAR

Several items should be checked prior to extending the landing gear manually. Check for popped circuit breakers and ensure the master switch is ON. Now check the alternators. If it is daytime, turn OFF the navigation lights.

To execute a manual extension of the landing gear, power should be reduced to maintain airspeed below 100 KIAS. Place the landing gear selector switch in the GEAR DOWN LOCKED position and pull the emergency gear extension knob. Check for 3 green indicator lights.

WARNING

If the emergency gear extension knob has been pulled out to lower the gear due to a gear system malfunction, leave the control in its extended position until the airplane has been put on jacks to check the proper function of the landing gears hydraulic and electrical systems.

3.21 GEAR-UP EMERGENCY LANDING

An approach should be made with power as required for 75 KIAS with 40° flaps. Close the throttles just before touchdown. Turn OFF the master and ignition switches and move the fuel selector valve controls to OFF. Contact with the surface should be made at a minimum airspeed.

3.23 GYRO SUCTION FAILURES

A malfunction of the instrument suction system will be indicated by a reduction of the suction reading on the gauge. A red button annunciator will show in case of a feathered engine or vacuum pump failure.

In the event of a suction system malfunction, (suction lower than 4.5 inches of mercury) increase engine RPM to 2575. Descend to an altitude at which 4.5 inches of mercury suction can be maintained, if possible. The electric turn indicator should be used to monitor the performance of the directional and attitude indicators.

3.25 ELECTRICAL POWER LOSS

ELECTRICAL POWER LOSS - (FOR AIRPLANES WITH INTERLOCKED MASTER AND ALT SWITCH OPERATION)

If one ammeter shows zero output, turn its switch OFF, reduce electrical loads to a minimum and check its circuit breaker. Reset if required. Turn ALT switch ON. If alternator remains inoperative, repeat the above procedure one more time. If the alternator still remains inoperative, turn ALT switch OFF, maintain an electrical load of 60 amps maximum on the operating alternator and exercise judgment regarding continued flight.

If both ammeters show zero output, turn both ALT switches OFF and reduce electrical loads to a minimum. Check both alternator circuit breakers and reset if required. Turn ALT switches ON one at a time while observing the ammeters. The alternator showing the LEAST (but not zero) output, should be turned ON and the other alternator should be left OFF. Electrical loads may be re-established as required to a maximum of 60 amps.

If neither alternator output can be restored, both alternator switches should be left OFF. Reduce electrical load to essential systems and land as soon as practical. The battery is the only remaining source of electrical power.

WARNING

Compass error may exceed 10 degrees with both alternators inoperative.

NOTE

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

ELECTRICAL POWER LOSS - (FOR AIRPLANES WITH SEPARATE BAT AND ALT SWITCH OPERATION)

If one ammeter shows zero output, turn its switch OFF, reduce electrical loads to a minimum and check its circuit breaker. Reset if required. Turn ALT switch ON. If the alternator remains inoperative, repeat the above procedure one more time. If the alternator still remains inoperative, turn ALT switch OFF, maintain an electrical load of 60 amps maximum on the operating alternator and exercise judgment regarding continued flight.

If both ammeters show zero output, turn both ALT switches OFF and reduce electrical loads to a minimum. Check both alternator circuit breakers and reset if required. Turn ALT switches ON one at a time while observing the ammeters. The alternator showing the LEAST (but not zero) output, should be turned ON and the other alternator should be left OFF. Electrical loads may be re-established as required to a maximum of 60 amps.

If alternator outputs are not restored, turn BAT switch OFF, ALT switches OFF, then ON one at a time, If one or both alternator outputs are restored, leave the BAT switch OFF and land as soon as practical. This condition is an indication of a battery and/or battery wiring malfunction.

NOTE

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

If neither alternator output can be restored, turn both ALT switches OFF and turn the BAT switch ON as required. Maintain a minimum electrical load and land as soon as practical. The battery, is the only remaining source of electrical power.

WARNING

Compass error may exceed 10 degrees with both alternators inoperative.

NOTE

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

ELECTRICAL POWER LOSS - (FOR AIRPLANES WITH SPLIT ELECTRICAL BUS SYSTEM)

If one ammeter shows zero output, turn its switch OFF, reduce electrical loads to a minimum and check its circuit breaker. Reset if required. Turn ALT switch ON. If the alternator remains inoperative, repeat the above procedure one more time. If the alternator still remains inoperative, turn ALT switch OFF, maintain an electrical load of 60 amps maximum on the operating alternator and exercise judgment regarding continued flight.

If both ammeters show zero output, turn both ALT switches OFF and reduce electrical loads to a minimum. Check both alternator circuit breakers and reset if required. Turn ALT switches ON one at a time while observing the ammeters. The alternator showing the LEAST (but not zero) output, should be turned ON and the other alternator should be left OFF. Electrical loads may be re-established as required to a maximum of 60 amps. If the ammeters show zero readings, turn the inoperative ALT switches OFF, and land as soon as practical. The battery is the only remaining source of electrical power. Anticipate complete electrical failure.

If systems powered from a zero reading ammeter bus are inoperative, reduce electrical loads on that bus by pulling circuit breakers of more than 5 amp value and turning the avionics master switch OFF. Pull the BUS ISO circuit breaker and turn the inoperative ALT switch ON. If power is restored, electrical loads may be re-established as required. If power is not restored, turn the inoperative ALT switch OFF, and land as soon as practical.

WARNING

Compass error may exceed 10 degrees with both alternators inoperative.

NOTE

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

3.27 ELECTRICAL OVERLOAD

ELECTRICAL OVERLOAD (Alternators over 30 amps above known electrical load) - (FOR AIRPLANES WITH INTERLOCKED MASTER AND ALT SWITCH OPERATION)

If abnormally high alternator outputs are observed and persist (more than 30 amps above known electrical load for the operating conditions), they may be caused by a low battery, a battery fault or other abnormal electrical load. If the cause is a low battery, the indication should begin to decrease toward normal within 5 minutes. If the overload condition persists proceed as follows:

Reduce electrical loads by turning off non-essential electrical equipment. If the loads cannot be reduced, turn the ALT switches OFF, maintain minimum electrical load and land as soon as practical. The battery is the only remaining source of electrical power. Also anticipate complete electrical failure.

WARNING

Compass error may exceed 10 degrees with both alternators inoperative.

NOTE

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

ELECTRICAL OVERLOAD (Alternators over 30 amps above known electrical load) - (FOR AIRPLANES WITH SEPARATE BAT AND ALT SWITCH OPERATION)

If abnormally high alternator outputs are observed and persist (more than 30 amps above known electrical load for the operating conditions), they may be caused by a low battery, a battery fault or other abnormal electrical load. If the cause is a low battery, the indication should begin to decrease toward normal within 5 minutes. If the overload condition persists proceed as follows:

Turn the BAT switch OFF. If the alternator loads are reduced, this indicates a malfunction of the battery and/or battery wiring. Reduce the electrical load by turning off non-essential electrical equipment. Land as soon as practical. All electrical loads are being supplied by the alternators.

NOTE

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

If the above procedure did not reduce the high alternator outputs, turn the ALT switches OFF and set the BAT switch as required. Reduce the electrical load by turning off non-essential electrical equipment. Land as soon as practical. The battery is the only remaining source of electrical power. Anticipate complete electrical failure.

WARNING

Compass error may exceed 10 degrees with both alternators inoperative.

NOTE

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

3.29 SPINS

Intentional spins are prohibited in this airplane. In the event a spin is encountered unintentionally, immediate recovery actions must be taken.

To recover from an unintentional spin, immediately retard the throttles to the idle position. Apply full rudder opposite the direction of the spin rotation. Let up all back pressure on the control wheel. If the nose does not drop, immediately push the control wheel forward. Keep the ailerons neutral. Maintain the controls in these positions until spin rotation stops, then neutralize the rudder. Recovery from the resultant dive should be with smooth back pressure on the control wheel. No abrupt control movement should be used during recovery from the dive, as the positive limit maneuvering load factor may be exceeded.

NOTE

Federal Aviation Administration Regulations do not require spin demonstration of multi-engine airplanes therefore, spin tests have not been conducted. The recovery technique presented is based on the best available information.

3.31 OPEN DOOR (ENTRY DOOR ONLY)

The cabin door is double latched, so the chances of its springing open in flight at both the top and side are remote. However, should you forget the upper latch, or not fully engage the side latch, the door may spring partially open. This will usually happen at takeoff or soon afterward. A partially open door will not affect normal flight characteristics, and a normal landing can be made with the door open.

If both upper and side latches are open, the door will trail slightly open, and airspeed will be reduced slightly.

To close the door in flight, slow the airplane to 82 KIAS, close the cabin vents and open the storm window. If the top latch is open, latch it. If the side latch is open, pull on the armrest while moving the latch handle to the latched position. If both latches are open, close the side latch then the top latch.

3.33 PROPELLER OVERSPEED

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

If propeller overspeed should occur, retard the throttle. The propeller control should be moved to full "DECREASE rpm" and then set if any control is available. Airspeed should be reduced and throttle used to maintain 2575 RPM.

3.35 COMBUSTION HEATER OVERHEAT

In the event of an overheat condition, the fuel, air and ignition to the heater is automatically cut off. Do not attempt to restart the heater until it has been inspected and the cause of the malfunction has been determined and corrected.

3.37 OXYGEN SYSTEM MALFUNCTION

A malfunction of the oxygen system requires an immediate descent to or below 12,500 ft. Proceed with emergency descent. The time of useful consciousness at 20,000 feet is approximately 10 minutes.

3.39 EMERGENCY DESCENT

In the event an emergency descent becomes necessary, move the carburetor heat control to ON, CLOSE the throttles and move the propeller controls full FORWARD. Adjust the mixture control as necessary to attain smooth operation. Extend the landing gear at 140 KIAS and maintain this airspeed.

3.41 EMERGENCY EXIT

The emergency exit is the pilot's left side window. This is to be used when emergency egress becomes necessary on the ground only. The emergency exit release handle is located beneath the thermoplastic cover on the vertical post between the 1st and 2nd left side windows. To exit the aircraft, remove the thermoplastic cover, push the release handle forward and then push the window out. The window then will fall free from the fuselage.

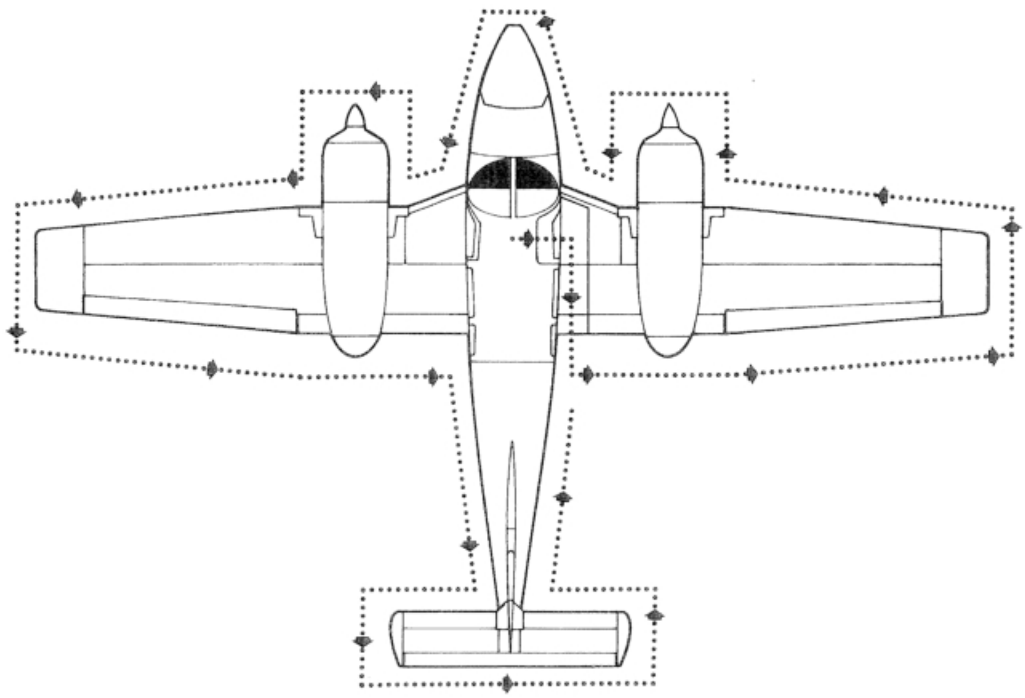
TABLE OF CONTENTS

SECTION 4

NORMAL PROCEDURES

TABLE OF CONTENTS (cont)

SECTION 4 (cont)



WALK-AROUND
Figure 4-1

4.5 NORMAL PROCEDURES CHECK LIST

PREPARATION

Airplane status .... airworthy, papers on board
Weather .... suitable
Baggage .... weighed, stowed, tied
Weight and C.G. .... within limits
Navigation .... planned
Charts and navigation equipment .... on board
Performance and range .... computed and safe

PREFLIGHT CHECK

INSIDE CABIN

Landing gear control .... DOWN position
Avionics .... OFF
Master switch .... ON
Landing gear lights .... 3 GREEN

Fuel quantity .... adequate plus reserve
Cowl flaps .... OPEN
Master switch .... OFF
Magneto switches .... OFF
Mixture controls .... idle cut-off
Trim indicators .... neutral
Flaps .... check operation
Controls .... free
Pitot and static systems .... drain
Empty seats .... fasten belts
Emergency exit .... closed and locked

OUTSIDE CABIN

Fuel sump drains .... drain
Right wing, aileron and flap .... check, no ice
Right main gear .... no leaks
Strut .... proper inflation
Tire .... check
Right wing tip .... check
Right leading edge .... check, no ice
Fuel cap .... open, check quantity and color, secure
Right engine nacelle .... check oil
Right propeller .... check
Cowl flaps .... OPEN and secure
Fuel drains .... drain
Nose section .... check
Nose gear .... no leaks
Strut .... proper inflation
Tire .... check
Tow bar .... removed and stowed
Landing light .... check
Windshield .... clean
Left wing, engine nacelle and landing gear .... check as on right side
Stall warning vanes .... check
Pitot/static mast .... clear, checked
Dorsal fin air scoop .... clear
Empennage .... check, no ice
Stabilator .... free
Antennas .... check
Navigation and landing lights .... check
Baggage door .... secure and locked

STARTING ENGINES WHEN FLOODED

Mixture .... idle cut-off
Throttle .... open full
Propeller.. full forward
Master switch .... ON
Magneto switches .... ON
Electric fuel pump .... OFF
Starter.. engage
Throttle .... retard
Mixture .... advance
Oil pressure .... check

STARTING ENGINES WITH EXTERNAL POWER

Master switch .... OFF
All electric equipment .... OFF
Terminals .... connect
External power plug.. insert in fuselage
Proceed with normal start.
Throttles .... lowest possible RPM

WARNING

Shutdown the right engine when it is warmed prior to disconnecting the external power plug.

External power plug.. disconnect from fuselage
Master switch .... ON - check ammeter
Oil pressure .... check
Right engine .... restart

WARM-UP

Throttles .... 1000 to 1200 RPM

TAXIING

Chocks .... removed
Taxi area .... clear
Throttle .... apply slowly
Brakes .... check
Steering .... check
Instruments .... check
Heater and defroster .... check
Fuel selector .... ON, check crossfeed

BEFORE TAKEOFF - GROUND CHECK

Parking brake .... ON
Mixture controls .... FORWARD
Prop controls .... FORWARD
Throttle controls .... 1500 RPM
Prop controls .... check feathering, 500 RPM max. drop
Throttle controls .... 2000 RPM
Prop controls .... check governor
Prop controls .... full FORWARD
Carburetor heat .... check
Magnetos .... check, max. drop 175 RPM, max. diff. drop 50 RPM
Alternator output .... check
Gyro suction gauge .... 4.8 to 5.2 in. Hg.
Throttles .... 800-1000 RPM
Fuel selectors .... ON
Electric fuel pumps .... ON
Alternators .... ON
Engine gauges .... in the green
Annunciator panel .... press-to-test
Altimeter .... set
Attitude indicator .... set
D.G. .... set
Clock .... wound and set
Mixtures .... set
Primers .... check - OFF
Propellers .... set in forward position

Quadrant friction .... adjusted
Carburetor heat.. OFF
Cowl flaps .... set
Wing flaps .... set
Trim .... set
Seat backs .... erect
Seat belts and harness .... fastened/adjusted
Empty seats .... seat belts fastened
Controls .... free, full travel
Doors .... latched
Air Conditioner.. OFF
Pitot heat .... as required

TAKEOFF

CAUTION

Fast taxi turns immediately prior to takeoff run should be avoided.

Adjust mixture prior to takeoff from high elevations. Do not over heat. Adjust mixture only enough to obtain smooth engine operation.

NORMAL TAKEOFF (Flaps up)

Flaps.. UP
Accelerate to 75 KIAS.
Control wheel .... ease back to rotate to climb attitude
After breaking ground, accelerate to best rate of climb speed of 88 KIAS.
Gear .... UP

SHORT FIELD TAKEOFF (Flaps up)

Flaps.. UP
Stabilator trim.. takeoff range
Brakes.. set
Takeoff power before brake release.
Accelerate to 70 KIAS.
Control wheel .... rotate firmly to attain 75 KIAS through 50 ft.

Accelerate to best angle of climb speed of 82 KIAS for obstacle clearance or best rate of climb speed of 88 KIAS, no obstacle.
Gear .... UP

SHORT FIELD TAKEOFF (25° Flaps)

Flaps .... 25° (second notch)
Stabilator trim .... set
Brakes .... set
Takeoff power before brake release.
Accelerate to 63 KIAS.
Control wheel .... rotate firmly to attain
67 KIAS through 50 ft.
Gear .... UP

TAKEOFF CLIMB

Best rate (flaps up) .... 88 KIAS
Best angle (flaps up) .... 82 KIAS
En route .... 105 KIAS
Cowl flaps .... as required
Electric fuel pumps .... OFF at desired altitude, ON if required above 10,000 ft.

CRUISE CLIMB

Mixture .... full RICH
Power 75%
Climb speed .... 105 KIAS
Cowl flaps .... as required
Electric fuel pumps .... ON if required above 10,000 ft.

CRUISING

Reference performance charts and Avco-Lycoming Operator's Manual.
Power .... set per power table
Mixture controls .... adjust
Cowl flaps .... as required
Electric fuel pumps .... ON if required above 10,000 ft.

DESCENT

Propellers . . . . 2400 RPM
Throttles . . . . as required for 165 KIAS & 500 FPM descent
Airspeed . . . . 165 KIAS
Mixture . . . . as required
Carburetor heat . . . . ON if required
Cowl flaps . . . . closed
Landing gear & wing flaps . . . . UP

DESCENT (Power off)

Prop. controls . . . . FORWARD
Throttles . . . . closed
Airspeed . . . . as required
Mixture . . . . as required
Carburetor heat . . . . ON
Power . . . . Verify - throttle open & closed every 30 seconds
Cowl flaps . . . . CLOSED
Landing gear & wing flaps . . . . UP

APPROACH AND LANDING

Gear warning horn . . . . check
Seat backs . . . . erect
Seat belts and harness . . . . fasten/adjust
Fuel selectors . . . . ON
Cowl flaps . . . . as required
Electric fuel pumps . . . . ON
Mixture controls . . . . rich
Prop controls . . . . full FORWARD
Landing gear . . . . DOWN, 140 KIAS max.
Flaps . . . . set, white arc
Approach speed . . . . 75 KIAS or above
Air Conditioner . . . . OFF

GO-AROUND

Full takeoff power, both engines.
Establish positive climb.
Flaps .... retract
Gear .... UP
Cowl flaps .... adjust

AFTER LANDING

Clear of runway.
Flaps .... retract
Cowl flaps .... fully OPEN
Carburetor heat .... OFF
Electric fuel pumps .... OFF

SHUTDOWN

Electric fuel pumps .... OFF
Radios .... OFF
Throttle .... full aft
Mixture .... idle cut-off
Magnetos .... OFF
Master switch .... OFF

PARKING

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

4.7 AMPLIFIED NORMAL PROCEDURES (GENERAL)

The following paragraphs are provided to supply detailed information and explanations of the normal procedures necessary for the operation of the airplane.

4.9 PREPARATION

The airplane should be given thorough preflight and walk-around check. The preflight should include a determination of the airplane's operational status, a check that necessary papers and charts are on board and in order, and a computation of weight and C.G. limits, takeoff distance and in-flight performance. Baggage should be weighed, stowed and tied down. Passengers should be briefed on the use of seat belts and shoulder harnesses, oxygen, and ventilation controls, advised when smoking is prohibited, and cautioned against handling or interfering with controls, equipment, door handles, etc. A weather briefing for the intended flight path should be obtained, and any other factors relating to the flight should be checked before takeoff.

4.11 PREFLIGHT CHECK

CAUTION

The flap position should be noted before boarding the airplane. The flaps must be placed in the "UP" position before they will lock and support weight on the step.

Upon entering the cockpit, check that the landing gear selector is in the DOWN position, turn OFF all avionics equipment (to save power and prevent wear on the units), and turn the master switch ON. Check the landing gear indicator lights to insure that the three green lights have illuminated and the red light has not illuminated. Check the fuel supply. Adequate fuel should be indicated for the flight plus reserve. The cowl flaps should be OPEN to facilitate inspection and ensure cooling after engine start. Return the master switch to OFF to save the battery.

Check that the magneto switches are OFF and move the mixture controls to idle cut-off to prevent an inadvertent start while checking propellers. Move the trim controls to neutral so that the tabs can be checked for alignment. Extend and retract the flaps to check for proper operation. This check is performed prior to engine start so that you can hear any noise which might indicate binding. The controls should be free and move properly. Drain the pitot and static system lines through the drains located on the side panel next to the pilot's seat. Fasten the seat belts on the empty seats. Before leaving the cockpit, check the emergency exit for security, verify that the emergency exit latch is locked and all components are in place.

CAUTION

If the emergency exit is unlatched in flight it may separate and damage the exterior of the airplane.

The first item to check during the walk-around is the fuel sumps. Drain and check for foreign matter. Check the right wing, aileron and flap hinges and surfaces for damage and ice. Make a close check of the right landing gear for leaks, proper piston exposure under a static load (2.6 inches) and that the tires are properly inflated and not excessively worn. The right wing tip and leading edge should be free from ice and damage.

Open the fuel cap to check the quantity and color of the fuel. Check fuel quantity with the calibrated dipstick provided for the purpose. For an accurate reading, the airplane should be on level ground. The cap vent should be free of obstructions. Secure the fuel cap properly. Check the oil quantity (four to six quarts). Six quarts are required for maximum range. Secure the inspection door. Check the right propeller for nicks or leaks. The spinner should be secure and undamaged (check closely for cracks). The cowl flap should be open and secure.

Check the nose section for damage and the nose landing gear for leaks and proper strut inflation. Under a normal static load, 2.7 inches of strut should be exposed. Check the tire for wear and proper inflation. If the tow bar was used, remove and stow. Check the condition of the landing light.

At the front of the airplane, the windshield should be clean, secure and free from cracks or distortion. Moving around to the left wing, check the wing, engine nacelle and landing gear as described for the right side. Don't forget to check the fuel and oil.

If a pitot cover was installed, it should be removed before flight and the holes checked for obstructions. With the heated pitot switch on, check the heated pitot head for proper heating. Check the stall warning vanes for freedom of movement and for damage. A squat switch in the stall warning system does not allow the units to be activated on the ground.

CAUTION

Care should be taken when an operational check of the heated pitot head is being performed. The unit becomes very hot. Ground operation should be limited to 3 minutes maximum to avoid damaging the heating elements.

Check the dorsal fin air scoop for obstructions. The empennage should be free of ice and damage and all hinges should be secure. Check the stabilator for freedom of movement. Antennas should be secure and undamaged. After turning on the master switch and light switches in the cockpit, check the navigation and landing lights. Check to make sure the baggage door is secured and locked.

4.13 BEFORE STARTING ENGINES

Before starting engines, adjust the seats and fasten the seat belts and shoulder harnesses. Set the parking brake and check to make sure all the circuit breakers are in and the radios are OFF. Cowl flaps should be OPEN and carburetor heat OFF. The alternators should now be switched ON.

NOTES

If the fixed shoulder harness (non-inertia reel type) is installed, it must be connected to the seat belt and adjusted to allow proper accessibility to all controls, including fuel selectors, flaps, trim, etc., while maintaining adequate restraint for the occupant.

If the inertia reel type shoulder harness is installed, a pull test of its locking restraint feature should be performed.

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4.15 STARTING ENGINES

The first step in starting is to move the fuel selector to the ON position. Advance the mixture control to full RICH, open the throttle 1/4 inch and move the propeller control full FORWARD. Turn the master switch, electric fuel pump and magneto switches ON. After ensuring that the propellers are clear, engage the starter and prime for two seconds maximum. The applicable electric fuel pump must be on for engine primer operation. Prime only while engine is cranking with magneto switches ON. Do not prime for more than two seconds continuously. When the engine starts, adjust the throttle and monitor the oil pressure gauge. If no oil pressure is indicated within 30 seconds, shut down the engine and have it checked. In cold weather it may take somewhat longer for an oil pressure indication. Repeat the above procedure for the opposite engine. After the engines have started, check the alternators for sufficient output and the gyro suction for a reading between 4.8 and 5.1 in. Hg.

NOTES

To prevent starter damage, limit starter cranking to 30-second periods. If the engine does not start within that time, allow a cooling period of several minutes before engaging starter again. Do not engage the starter immediately after releasing it. This practice may damage the starter mechanism.

When starting at ambient temperature +20°F and below, operate first engine started with alternator ON (at max charging rate not to exceed 1500 RPM) for 5 minutes minimum before initiating start on second engine.

If the STARTER ON light remains illuminated after the starter switch is released, turn off the battery switch and shut down the engines.

4.16 STARTING ENGINES IN COLD WEATHER (BELOW 10°F)

If available, preheat should be considered. After checking that the master and magneto switches are OFF, rotate each engine through 10 propeller blades manually during the preflight inspection. Read Section 4.21 before starting with external power.

Turn the master switch OFF and connect the external power. Turn the magneto switches OFF, electric fuel pump ON, move the propeller control full forward and open the throttle 1/4 inch. Next turn the magnetos ON and engage the starter and prime for two seconds maximum, reprime at two second intervals until engine fires. It may be necessary to disengage the starter and prime again if the engine does not start. When the engine fires, prime as required until the engine is running smoothly. Follow the instructions in Section 4.21 for removing the external power.

4.17 STARTING ENGINES WHEN HOT

If the engines are hot, open the throttle 1/2 inch. Turn ON the master switch and electric fuel pump. Advance the mixture control to full RICH and engage the starter. When the engine starts, adjust the throttle and monitor the oil pressure gauge.

4.19 STARTING ENGINES WHEN FLOODED

If an engine is flooded, move the mixture control to idle cut-off and advance the throttle and propeller controls full forward. Turn ON the master switch and magneto switches. The electric fuel pump should be OFF. After ensuring that the propeller is clear, engage the starter. When the engine fires, retard the throttle, advance the mixture slowly and check the oil pressure.

4.21 STARTING ENGINES WITH EXTERNAL POWER

An optional feature called the Piper External Power (PEP) allows the operator to use an external battery to crank the engines without having to gain access to the airplane's battery.

Turn the master switch OFF and turn all electrical equipment OFF. Connect the RED lead of the PEP kit jumper cable to the POSITIVE (+) terminal of an external 12-volt battery and the BLACK lead to the NEGATIVE (-) terminal. Insert the plug of the jumper cable into the socket located on the fuselage. Note that when the plug is inserted, the electrical system is ON. Proceed with the normal starting technique.

After the engines have started, reduce power on the left engine to the lowest possible RPM to reduce sparking, and shut down the right engine. Disconnect the jumper cable from the aircraft. Turn the master switch ON and check the alternator ammeter for an indication of output. DO NOT ATTEMPT FLIGHT IF THERE IS NO INDICATION OF ALTERNATOR OUTPUT. Check the oil pressure. Restart the right engine after the external power plug has been removed.

NOTE

For all normal operations using the PEP jumper cables, the master switch should be OFF, but it is possible to use the ship's battery in parallel by turning the master switch ON. This will give longer cranking capabilities, but will not increase the amperage.

CAUTION

Care should be exercised because if the ship's battery has been depleted, the external power supply can be reduced to the level of the ship's battery. This can be tested by turning the master switch ON momentarily while the starter is engaged. If cranking speed increases, the ship's battery is at a higher level than the external power supply. If the battery has been depleted by excessive cranking, it must be recharged before the second engine is started. All the alternator current will go to the low battery until it receives sufficient charge, and it may not start the other engine immediately.

4.23 WARM-UP

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

Takeoff may be made as soon as the ground check is completed, and the engines are warmed up.

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

4.25 TAXIING

Remove chocks from the wheels and check to make sure the taxi area is clear. Always apply the throttles slowly.

Before taxiing, the brakes should be checked by moving forward a few feet, throttling back and applying pressure on the toe pedals. As much as possible, turns during taxiing should be made using rudder pedal motion and differential power (more power on the engine on the outside of the turn, less on the inside engine) rather than brakes.

During the taxi, check the instruments (turn indicator, directional gyro, coordination ball, compass) and the heater and defroster. Check the operation of the fuel management controls by moving each fuel selector to CROSSFEED for a short time, while the other selector is in the ON position. Return the selectors to the ON position.

4.27 BEFORE TAKEOFF - GROUND CHECK

A thorough check should be made before takeoff, using a check list. Before advancing the throttle to check the magnetos and the propeller action, be sure that the engine oil temperature is 75°F or above.

During engine run-up, head the airplane into the wind if possible and set the parking brake. Advance the mixture and propeller controls forward and the throttle controls to 1500 RPM. Check the feather position of the propellers by bringing the controls fully aft and then full forward. Do not allow more than a 500 RPM drop during the feathering check. Move the throttles to 2000 RPM and exercise the propeller controls to check the function of the governor. Retard control until a 200 to 300 drop in RPM is indicated. This should be done three times on the first flight of the day. The governor can be checked by retarding the propeller control until a drop of 100 RPM to 200 RPM appears, then advancing the throttle to get a slight increase in manifold pressure. The propeller speed should stay the same when the throttle is advanced, thus indicating proper function of the governor.

Return the propeller controls to full forward and move the carburetor heat controls to ON then OFF. Check the magnetos at 2000 RPM. The normal drop on each magneto is 100 RPM and the maximum drop should not exceed 175 RPM. The maximum differential drop should not exceed 50 RPM. If the RPM drop or engine roughness is excessive, the engines may be leaned to peak RPM for a short period. After approximately 10 seconds the mixtures should be returned to the full rich position and another mag check performed. The alternator output should be approximately equal for both alternators. A 4.8 to 5.2 in. Hg. indication on the gyro suction gauge signifies proper operation of the gyro suction system.

Set the throttles between 800 and 1000 RPM, check that the fuel selectors and alternator switches are ON and that all the engine gauges are within their normal operating ranges (green arc). Press-to-test the annunciator light to make sure they all illuminate. Set the altimeter, attitude indicator and directional gyro. Wind and set the clock. Set the mixtures, check primers OFF and advance the propeller controls in the forward position. The friction lock should be adjusted. Check to make sure the carburetor heat is OFF. Adjust the cowl flaps and set the wing flaps and trim (stabilator and rudder) tabs as required. The seat backs should be erect and seat belts and harness fastened. Fasten the seat belts on the empty seats.

NOTES

If the fixed shoulder harness (non-inertia reel type) is installed, it must be connected to the seat belt and adjusted to allow proper accessibility to all controls, including fuel selectors, flaps, trim, etc., while maintaining adequate restraint for the occupant.

If the inertia reel type shoulder harness is installed, a pull test of its locking restraint feature should be performed.

All controls should be free with full travel, and all doors should be securely latched. Ensure that the electric fuel pumps are ON. Pitot heat should be used as required. Turn OFF the air conditioner to insure maximum power.

4.29 TAKEOFF

The normally recommended procedure for sea level takeoff is to advance the throttles until a manifold pressure of 36.5 in. Hg. is indicated at 2575 RPM. During pretakeoff check at a high elevation, lean the mixture to obtain smooth operation. Leave the mixture in this position for takeoff. Do not overheat the engine when operating with mixture leaned.

If overheating occurs, enrich the mixture enough that temperature returns to normal.

NOTE

The overboost lights will illuminate at approximately 36.1 in. Hg. manifold pressure. Do not exceed 36.5 in. Hg. manifold pressure.

Takeoff should not be attempted with ice or frost on the wings. Takeoff distances and 50-foot obstacle clearance distances are shown on charts in the Performance Section of this Handbook. The performance shown on charts will be reduced by uphill gradient, tailwind component, or soft, wet, rough or grassy surface, or poor pilot technique.

Avoid fast turns onto the runway, followed by immediate takeoff, especially with a low fuel supply. As power is applied at the start of the takeoff roll, look at the engine instruments to see that the engines are operating properly and putting out normal power, and at the airspeed indicator to see that it is functioning. Apply throttle smoothly.

The flap setting for normal takeoff is 0°. In certain short field takeoff efforts when the shortest possible ground roll and the greatest clearance distance over a 50 ft. obstacle is desired, a flap setting of 25° is recommended.

When obstacle clearance is no problem, a normal flaps up (0°) takeoff may be used. Accelerate to 75 KIAS and ease back on the wheel enough to let the airplane lift off. After lift-off, accelerate to the best rate of climb speed, 88 KIAS, or higher if desired, retracting the landing gear when a gear-down landing is no longer possible on the runway.

When a short field effort is required but the situation presents a wide margin on obstacle clearance, the short field technique to use is with the flaps up (0°). In the event of an engine failure, the airplane is in the best flight configuration to sustain altitude immediately after the gear is raised. Set the stabilator trim indicator in the takeoff range. Set the brakes and bring the engines to full power before release. Accelerate to 70 KIAS and rotate the airplane firmly so that the airspeed is approximately 75 KIAS when passing through the 50-foot height. The airplane should then be allowed to accelerate to the best angle of climb speed (82 KIAS at sea level) if obstacle clearance is necessary, or best rate of climb speed (88 KIAS) if obstacles are not a problem. The landing gear should be retracted when a gear-down landing is no longer possible on the runway.

When the shortest possible ground roll and the greatest clearance distance over a 50-foot obstacle is desired, use a 25-degree flap setting (second notch). Set the stabilator trim indicator slightly nose up from the takeoff range. Set the brakes and bring the engines to takeoff power before release. Accelerate to 63 KIAS and rotate firmly so that when passing through the 50-foot height the airspeed is approximately 67 KIAS. Retract the gear when a gear down landing is no longer possible on the runway. It should also be noted that when a 25-degree flap setting is used on the takeoff roll, an effort to hold the airplane on the runway too long may result in a "wheelbarrowing" tendency. This should be avoided.

The distances required using these takeoff procedures are given on charts in the Performance Section of this Handbook.

4.31 CLIMB

On climb-out after takeoff, it is recommended that the best angle of climb speed (82 KIAS) be maintained only if obstacle clearance is a consideration. The best rate of climb speed (88 KIAS) should be maintained with full power on the engines until adequate terrain clearance is obtained. At this point, engine power should be reduced to approximately 75% power for cruise climb. A cruise climb speed of 105 KIAS or higher is also recommended. This combination of reduced power and increased climb speed provides better engine cooling, less engine wear, reduced fuel consumption, lower cabin noise level, and better forward visibility.

When reducing engine power the throttles should be retarded first, followed by the propeller controls. The mixture controls should remain at full rich during the climb.

CAUTION

When climbing above 12,000 feet, manual mixture leaning is permitted to reduce engine roughness. Cylinder head temperatures must be closely monitored. Do not exceed 1400°F EGT when engine power is above 75 percent.

Cowl flaps should be adjusted to maintain cylinder head and oil temperatures within the normal ranges specified for the engine. Turn the electric fuel pumps off at a safe altitude.

During climbs above 10,000 feet it may be necessary to use the electric fuel pumps for vapor suppression. Presence of fuel vapor may be indicated by a fluctuating fuel pressure indicator.

Consistent operational use of cruise climb power settings is strongly recommended since this practice will make a substantial contribution to fuel economy and increased engine life, and will reduce the incidence of premature engine overhauls.

4.33 CRUISING

When leveling off at cruise altitude, the pilot may reduce to a cruise power setting in accordance with the Power Setting Table in this Handbook.

For maximum service life, cylinder head temperature should be maintained below 435°F during high performance cruise operation and below 400°F during economy cruise operation. If cylinder head temperatures become too high during flight, reduce them by enriching the mixture, by opening cowl flaps, by reducing power, or by use of any combination of these methods.

During cruise above 10,000 feet under hot weather and/or high altitude conditions, it may be necessary to use the electric fuel pumps for vapor suppression. Presence of fuel vapor may be indicated by a fluctuating fuel pressure indicator.

Following level-off for cruise, the cowl flaps should be closed or adjusted as necessary to maintain proper cylinder head temperatures, and the airplane should be trimmed to fly hands off.

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

WARNING

Flight in icing conditions is prohibited. If icing is encountered, immediate action should be taken to fly out of icing conditions. Icing is hazardous due to greatly reduced performance, loss of forward visibility, possible longitudinal control difficulties due to increased control sensitivity, and impaired power plant and fuel system operation.

The ammeters for the electrical system should be monitored during flight, especially during night or instrument flight, so that corrective measures can be taken in case of malfunction. The procedures for dealing with electrical failures are contained in the Emergency Procedure Section of this Handbook. The sooner a problem is recognized and corrective action taken, the greater is the chance of avoiding total electrical failure. Both alternator switches should be ON for normal operation. The two ammeters continuously indicate the alternator outputs. Certain regulator failures can cause the alternator output voltage to increase uncontrollably. To prevent damage, overvoltage relays are installed to automatically shut off the alternator(s). The alternator light on the annunciator panel will illuminate to warn of the tripped condition. Alternator outputs will vary with the electrical equipment in use and the state of charge of the battery. Alternator outputs should not exceed 60 amperes.

It is not recommended to takeoff into IFR operation with a single alternator. During flight, electrical loads should be limited to 50 amperes for each alternator. Although the alternators are capable of 60 amperes output, limiting loads to 50 amperes will assure battery charging current.

Since the fuel system has one tank per engine, it is advisable to feed the engines symmetrically during cruise so that approximately the same amount of fuel will be left in each side for the landing. A crossfeed is provided and can be used to even up the fuel, if necessary.

During flight, keep account of time and fuel used in connection with power settings to determine how the fuel flow and fuel quantity gauging systems are operating.

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

4.35 DESCENT

To achieve the performance indicated in Section 5, the power on descent must be used. Set the propeller controls for 2400 RPM, throttles as required for 165 KIAS and 500 FPM descent and the mixture adjusted as required. The landing gear and wing flaps should be up and cowl flaps closed. In case carburetor ice is encountered apply full carburetor heat.

If a prolonged power off descent is to be made, move propeller controls Full Forward, close throttles, mixture Full Rich and apply full carburetor heat. Verify power by opening and closing the throttle every 30 seconds. When leveling off set power as required and select carb. heat OFF unless carb. ice is encountered.

4.37 APPROACH AND LANDING

Sometime during the approach for a landing, the throttle controls should be retarded to check the gear warning horn. Flying the airplane with the horn inoperative is not advisable. Doing so can lead to a gear up landing as it is easy to forget the landing gear, especially when approaching for a one engine inoperative landing, or when other equipment is inoperative, or when attention is drawn to events outside the cabin. The red landing gear unsafe light will illuminate when the landing gear is in transition between the full up position and the down and locked position. Additionally, the light will illuminate when the gear warning horn sounds. The gear warning horn will sound at low throttle settings if the gear is not down and locked and when landing flaps are selected and the gear is not down and locked.

The light is off when the landing gear is in either the full down and locked or full up positions.

Prior to entering the traffic pattern, the aircraft should be slowed to approximately 100 KIAS and this speed should be maintained on the down wind leg. The landing check should be made on the downwind leg. The seat backs should be erect and the seat belts and shoulder harness fastened. Both fuel selectors should normally be ON and the cowl flaps set as required. The electric fuel pumps must be ON. Set the mixture controls. Select landing gear DOWN and check for three green lights on the panel and look for the nose wheel in the nose wheel mirror. The landing gear should be lowered at speeds below 140 KIAS and the flaps at speeds below 111 KIAS.

NOTES

If the fixed shoulder harness (non-inertia reel type) is installed, it must be connected to the seat belt and adjusted to allow proper accessibility to all controls, including fuel selectors, flaps, trim, etc., while maintaining adequate restraint for the occupant.

If the inertia reel type shoulder harness is installed, a pull test of its locking restraint feature should be performed.

Maintain a traffic pattern speed of 100 KIAS and a final approach speed of 90 KIAS. If the aircraft is lightly loaded, the final approach speed may be reduced to 80 KIAS.

When the power is reduced on close final approach, the propeller controls should be advanced to the full forward position to provide maximum power in the event of a go-around. The air conditioner should also be turned OFF to insure maximum power.

The landing gear position should be checked on the downwind leg and again on final approach by checking the three green indicator lights on the instrument panel and looking at the external mirror to check that the nose gear is extended. Remember that when the navigation lights are on, the gear position lights are dimmed and are difficult to see in the daytime.

Flap position for landing will depend on runway length and surface wind. Full flaps will reduce stall speed during final approach and will permit contact with the runway at a slower speed. Good pattern management includes a smooth, gradual reduction of power on final approach, with the power fully off before the wheels touch the runway. This gives the gear warning horn a chance to blow if the gear is not locked down. If electric trim is available, it can be used to assist a smooth back pressure during flare-out.

Maximum braking after touch-down is achieved by retracting the flaps, applying back pressure to the wheel and applying pressure on the brakes. However, unless extra braking is needed or unless a strong crosswind or gusty air condition exists, it is best to wait until turning off the runway to retract the flaps. This will permit full attention to be given to the landing and landing roll, and will also prevent the pilot's accidentally reaching for the gear handle instead of the flap handle.

For a normal landing, approach with full flaps (40°) and partial power until shortly before touch-down. Hold the nose up as long as possible before and after contacting the ground with the main wheels.

Approach with full flaps at 75 KIAS for a short field landing. Immediately after touch-down, raise the flaps, apply back pressure to the wheel and apply brakes.

If a crosswind or high-wind landing is necessary, approach with higher than normal speed and with zero to 25 degrees of flaps. Immediately after touch-down, raise the flaps. During a crosswind approach hold a crab angle into the wind until ready to flare out for the landing. Then lower the wing that is into the wind, to eliminate the crab angle without drifting, and use the rudder to keep the wheels aligned with the runway. Avoid prolonged side slips with a low fuel indication.

The maximum demonstrated crosswind component for landing is 17 KTS.

4.39 GO-AROUND

If a go-around from a normal approach with the airplane in the landing configuration becomes necessary, apply takeoff power to both engines. Establish a positive climb attitude, retract the flaps and landing gear and adjust the cowl flaps for adequate engine cooling.

4.41 AFTER LANDING

After leaving the runway, retract the flaps and open the cowl flaps. Test the toe brakes, a spongy pedal is often an indication that the brake fluid needs to be replenished. The carburetor heat control and electric fuel pumps should be OFF.

4.43 SHUTDOWN

Turn the electric fuel pumps and all radio and electrical equipment OFF. Move the throttle controls full aft and the mixture controls to idle cut-off. Turn OFF the magneto and master switches.

NOTE

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

4.45 PARKING

The airplane can be moved on the ground with the aid of the optional nose wheel tow bar. Set the parking brake. The ailerons and stabilator should be secured by looping the seat belt through the control wheel and pulling it snug. The rudder need not be secure under normal conditions, as its connection to the nose wheel holds it in position. The flaps are locked when in the fully retracted position. Tie-down ropes may be attached to mooring rings under each wing and to the tail skid.

4.47 TURBULENT AIR OPERATION

In keeping with good operating practice used in all aircraft, it is recommended that when turbulent air is encountered or expected, the airspeed should be reduced to maneuvering speed to reduce the structural loads caused by gusts and to allow for inadvertent speed build-ups which may occur as a result of the turbulence or of distractions caused by the conditions. (See Subsection 2.3).

4.49 V_{SSE} - INTENTIONAL ONE ENGINE INOPERATIVE SPEED

V_{SSE} is a speed selected by the aircraft manufacturer as a training aid for pilots in the handling of multi-engine aircraft. It is the minimum speed for intentionally rendering one engine inoperative in flight. This minimum speed provides the margin the manufacturer recommends for use when intentionally performing engine inoperative maneuvers during training in the particular airplane.

The intentional one engine inoperative speed, V_{SSE} for the PA-44-180T is 82 KIAS.

4.51 VMCA - AIR MINIMUM CONTROL SPEED

VMCA is the minimum flight speed at which a twin-engine 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 toward the operative engine; landing gear up; flaps in takeoff position; and most rearward center of gravity.

VMCA for the PA-44-180T has been determined to be 57 KIAS and is a stalled condition.

The VMCA demonstration which may be required for the FAA flight test for the multi-engine rating approaches an uncontrolled flight condition with power reduced on one engine. The demonstration and all intentional one engine operations should not be performed at an altitude of less than 4000 feet above the ground. The recommended procedure for VMCA demonstration is to reduce the power to idle on the simulated inoperative engine at or above the intentional one engine inoperative speed, VSSE, and slow down approximately one knot per second until the FAA Required Demonstration Speed, VMCA, or stall warning is obtained.

VSSE is a minimum speed selected by the manufacturer for intentionally rendering one engine inoperative in flight for pilot training.

VSSE for the PA-44-180T is 82 KIAS.

VMCA DEMONSTRATION

(a)	Landing Gear	UP
(b)	Flaps	UP
(c)	Airspeed	at or above 82 KIAS (VSSE)
(d)	Propeller Controls	HIGH RPM
(e)	Throttle (Simulated Inoperative Engine)	IDLE
(f)	Throttle (Other Engine)	36.5 In. Hg.
(g)	Airspeed	Reduce approximately 1 knot per second until either VMCA or STALL WARNING is obtained

CAUTIONS

Use rudder to maintain directional control (heading) and ailerons to maintain 5°bank towards the operative engine (lateral attitude). At the first sign of either V_{MCA} or stall warning (which may be evidenced by: Inability to maintain heading or lateral attitude, aerodynamic stall buffet, or stall warning horn) immediately initiate recovery; reduce power to idle on the operative engine, and immediately lower the nose to regain V_{SSE}.

One engine inoperative stalls are not recommended.

Under no circumstances should an attempt be made to fly at a speed below V_{MCA} with only one engine operating.

4.53 STALLS

The loss of altitude during a power off stall with the gear and flaps retracted may be as much as 400 feet.

The stall warning system is inoperative with the master switch OFF.

TABLE OF CONTENTS

SECTION 5

PERFORMANCE

SECTION 5

PERFORMANCE

5.1 GENERAL

All of the required (FAA regulations) and complementary performance information applicable to this aircraft is provided by this section.

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

All data given is for both two and three blade propellers unless otherwise noted.

5.3 INTRODUCTION - PERFORMANCE AND FLIGHT PLANNING

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

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

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

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

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

WARNING

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

5.5 FLIGHT PLANNING EXAMPLE

(a) Aircraft Loading

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

The basic empty weight for the airplane as delivered from the factory has been entered in Figure 6-5. If any alterations to the airplane have been made affecting weight and balance, reference to the aircraft logbook and Weight and Balance Record (Figure 6-7) should be made to determine the current basic empty weight of the airplane.

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

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

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

(1) Basic Empty Weight	2603 lbs.
(2) Occupants (2 x 170 lbs.)	340 lbs.
(3) Baggage and Cargo	27 lbs.
(4) Fuel (6 lb./gal. x 80)	480 lbs.
(5) Takeoff Weight (3925 lb. max. allowable)	3450 lbs.
(6) Landing Weight (a)(5) minus (g)(1), (3450 lbs. minus 277 lbs.)	3173 lbs.

Takeoff and landing weights are below the maximum and the weight and balance calculations have determined the C.G. position within the approved limits.

(b) Takeoff and Landing

Now that aircraft loading has been determined, consider all aspects of the takeoff and landing.

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

Apply the departure airport conditions and takeoff weight to the appropriate Takeoff Performance and Accelerate and Stop Distance graphs (Figures 5-7 thru 5-21) to determine the length of runway necessary for the takeoff and/or the barrier distance.

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

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

	Departure Airport	Destination Airport
(1) Pressure Altitude	5680 ft.	2680 ft.
(2) Temperature	8°C	8°C
(3) Wind Component	5 KTS (Headwind)	6 KTS (Headwind)
(4) Runway Length Available	7400 ft.	9000 ft.
(5) Runway Required (Normal Procedure, Std. Brakes)		
Takeoff	2200 ft. *	
Accelerate and Stop	2800 ft.**	
Landing		1240***

NOTE

The remainder of the performance charts used in this flight plan example assume a no wind condition. The effect of winds aloft must be considered by the pilot when computing climb, cruise and descent performance.

*reference Figure 5-13
**reference Figure 5-7
***reference Figure 5-45

(c) Climb

The next step in the flight plan is to determine the necessary climb segment components.

The desired cruise pressure altitude and corresponding cruise outside air temperature values are the first variables to be considered in determining the climb components from the Time, Distance and Fuel to Climb graph (Figure 5-29). After the time, distance and fuel for the cruise pressure altitude and outside air temperature values have been established, apply the existing conditions at the departure field to graph (Figure 5-29). Now, substract the values obtained from the graph for the field of departure conditions from those for the cruise pressure altitude.

The remaining values are the true time, distance and fuel components for the climb segment of the flight plan corrected for field pressure altitude and temperature.

The following values were determined from the above instructions in the flight planning example.

(1) Airport pressure altitude	5680 ft.
(2) Airport OAT	8°C
(3) Cruise Pressure Altitude	14000 ft.
(4) Cruise OAT	-2°C
(5) Time of Climb (13 min. minus 4 min.)	9.0 min.*
(6) Distance to Climb (22 naut. miles minus 6.5 naut. miles)	15.5 naut. miles
(7) Fuel to Climb (8.5 gal. minus 3 gal.)	5.5 gal.*

(d) Descent

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

Utilizing the cruise pressure altitude and OAT, determine the basic time, distance and fuel for descent (Figure 5-41). These figures must be adjusted for the field pressure altitude and temperature at the destination airport. To find the necessary adjustment values, use the existing pressure altitude and temperature conditions at the destination airport as variables to find the time, distance and fuel

*reference Figure 5-29

values from the graph (Figure 5-41). Now, subtract the values obtained from the field conditions from the values obtained from the cruise conditions to find the true time distance and fuel values needed for the flight plan.

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

(1) Time to Descend
(28 min. minus 5 min.) 23 min.*

(2) Distance to Descend
(84 naut. miles minus 14 naut. miles) 70 naut. miles*

(3) Fuel to Descend
(5 gal. minus 1 gal.) 4 gal.*

(e) Cruise

Using the total distance to be traveled during the flight, subtract the previously calculated distance to climb and distance to descend to establish the total cruise distance. Refer to the appropriate Lycoming Operator's Manual and the Power Setting Tables when selecting the cruise power setting. The established pressure altitude and temperature values and the selected cruise power should now be utilized to determine the true airspeed from the Speed Power graph (Figure 5-33).

Calculate the cruise fuel for the cruise power setting from the information provided on Figure 5-33.

The cruise time is found by dividing the cruise distance by the cruise speed and the cruise fuel is found by multiplying the cruise fuel flow by the cruise time.

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

(1) Total Distance 394 miles

(2) Cruise Distance
(e)(1) minus (c)(6) minus (d)(2).
(394 naut. miles minus 15.5 naut. miles minus 70 naut. miles) 308.5 naut. miles

*reference Figure 5-41

(3) Cruise Power (Best Economy Mixture) — 75% rated power
(4) Cruise Speed — 175 KTS TAS*
(5) Cruise Fuel Consumption — 20.8 GPH*
(6) Cruise Time
(e)(2) divided by (e)(4), (308.5 naut. miles divided by 175 KTS) — 1.76 hrs.
(7) Cruise Fuel
(e)(5)multiplied by (e)(6), (20.8 GPH multiplied by 1.76 hrs.) — 36.7 gal.

(f) Total Flight Time

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

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

(1) Total Flight Time
(c)(5) plus (d)(1) plus (e)(6), (.15 hrs. plus .38 hrs. plus 1.76 hrs.) — 2.29 hrs.

(g) Total Fuel Required

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

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

(1) Total Fuel Required
(c)(7) plus (d)(3) plus (e)(7),
(5.5 gal. plus 4.0 gal. plus 36.7 gal.) — 46.2 gal.
(46.2 gal. multiplied by 6 lb./gal.) — 277 lbs.

*reference Figure 5-33

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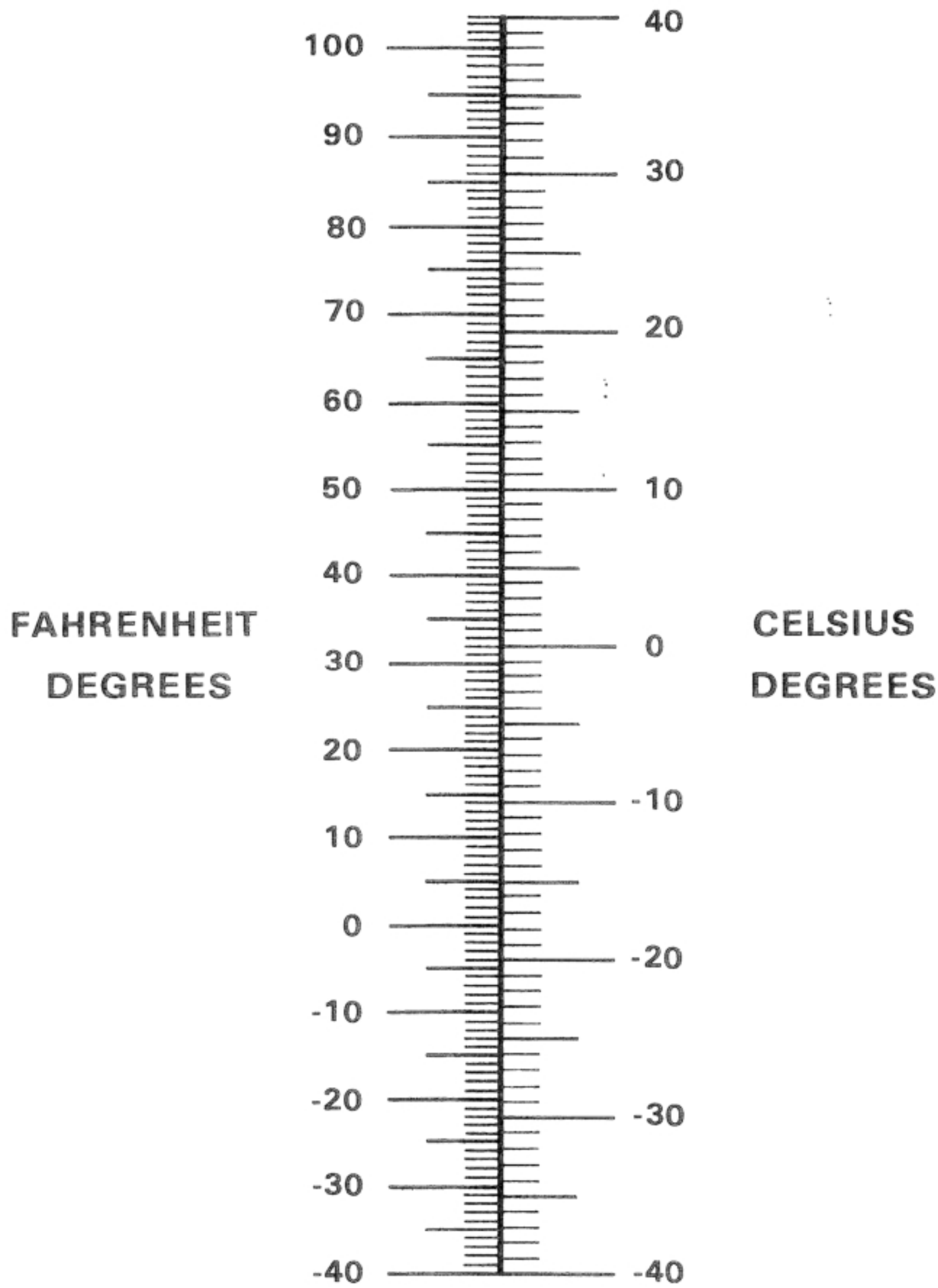
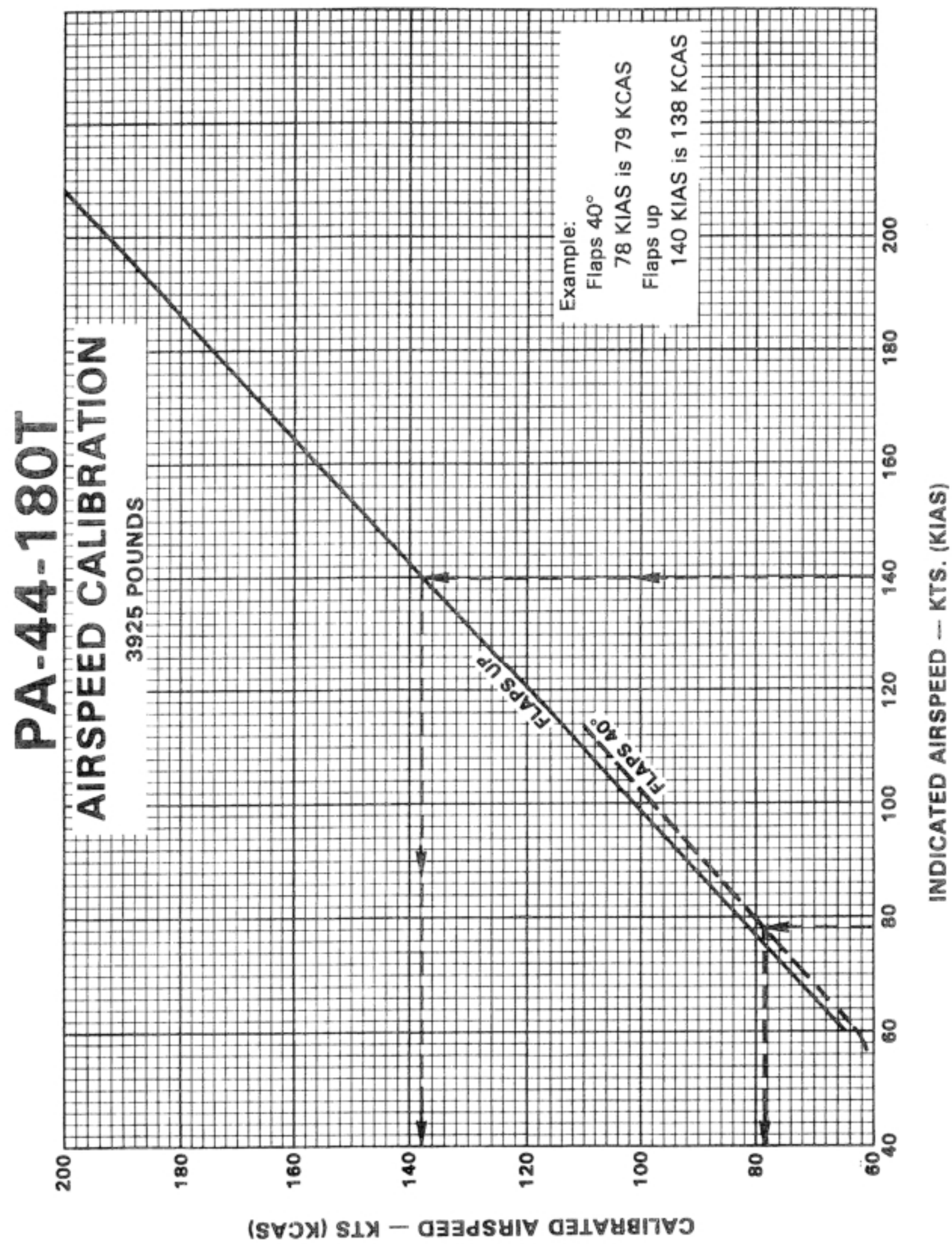
5.7 PERFORMANCE GRAPHS

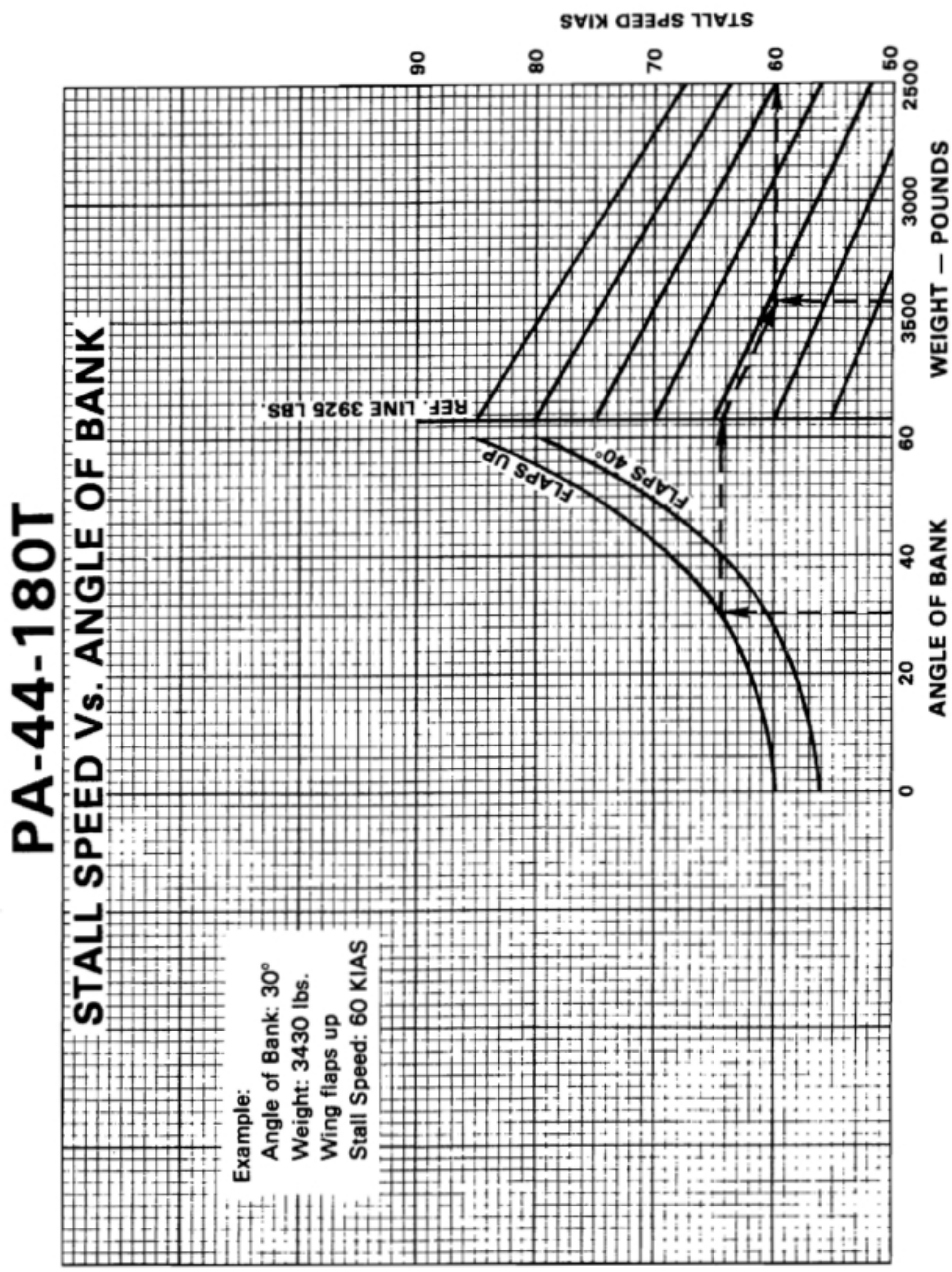
LIST OF FIGURES



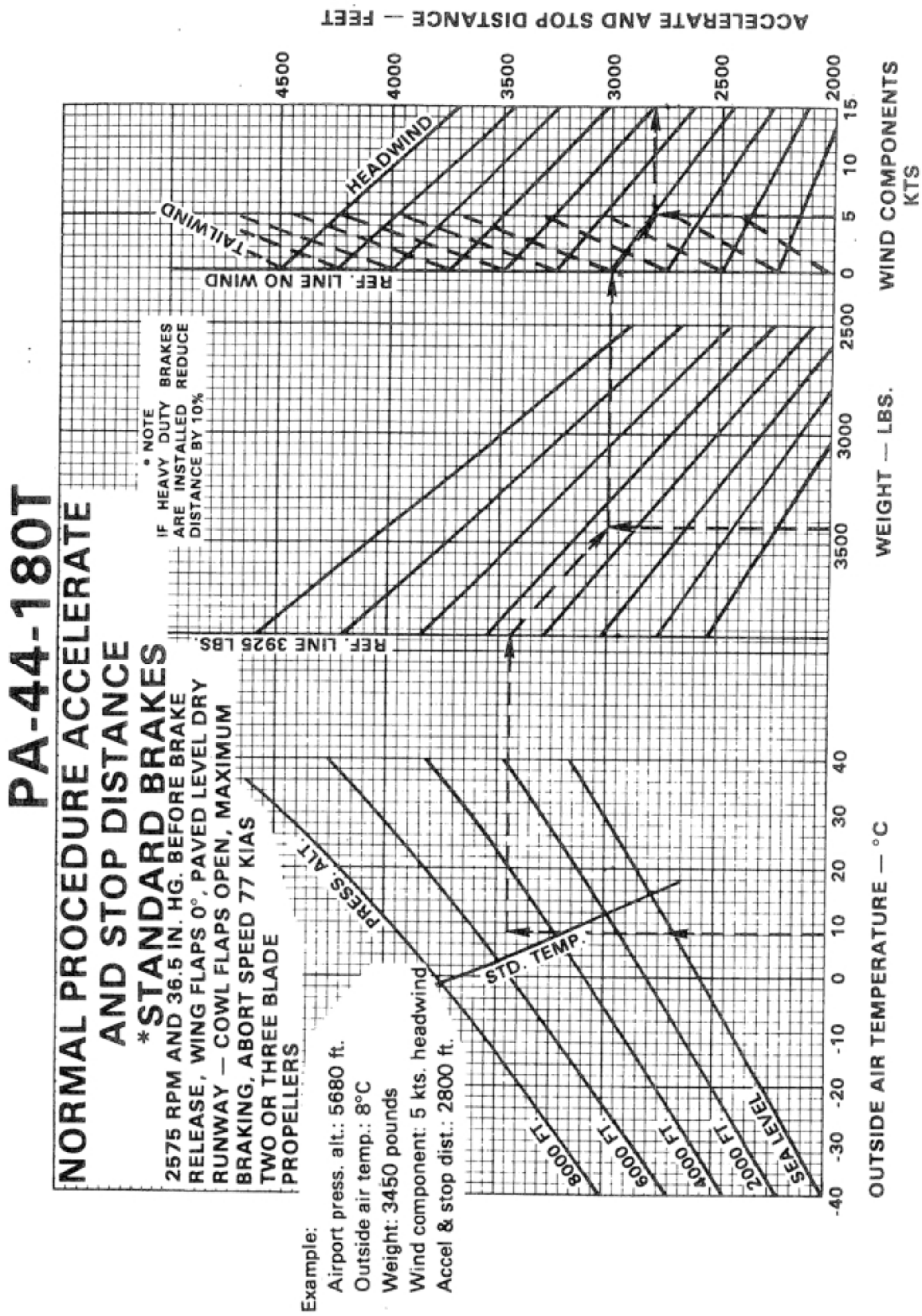
TEMPERATURE CONVERSION CHART
Figure 5-1



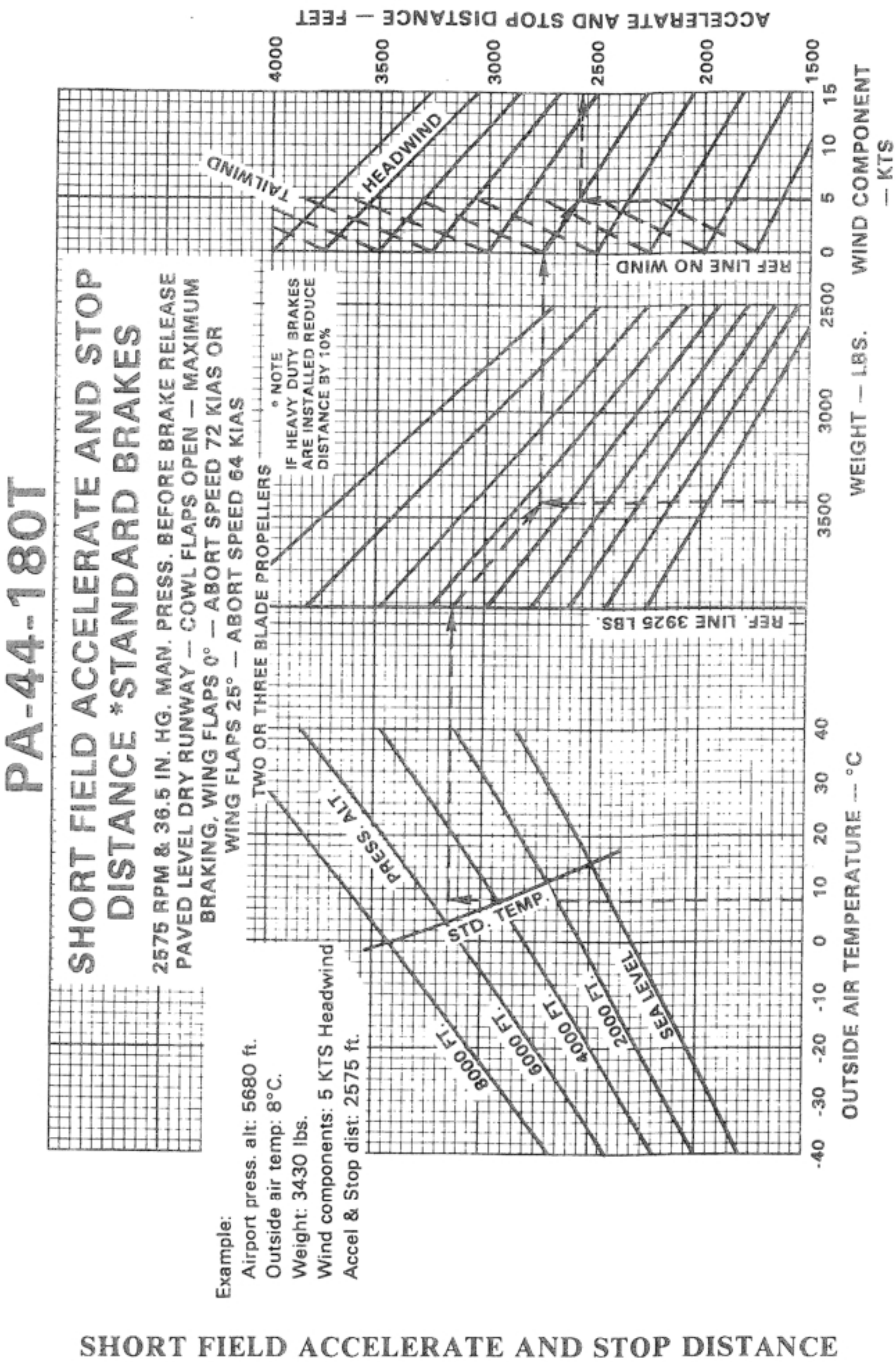
AIRSPEED CALIBRATION
Figure 5-3



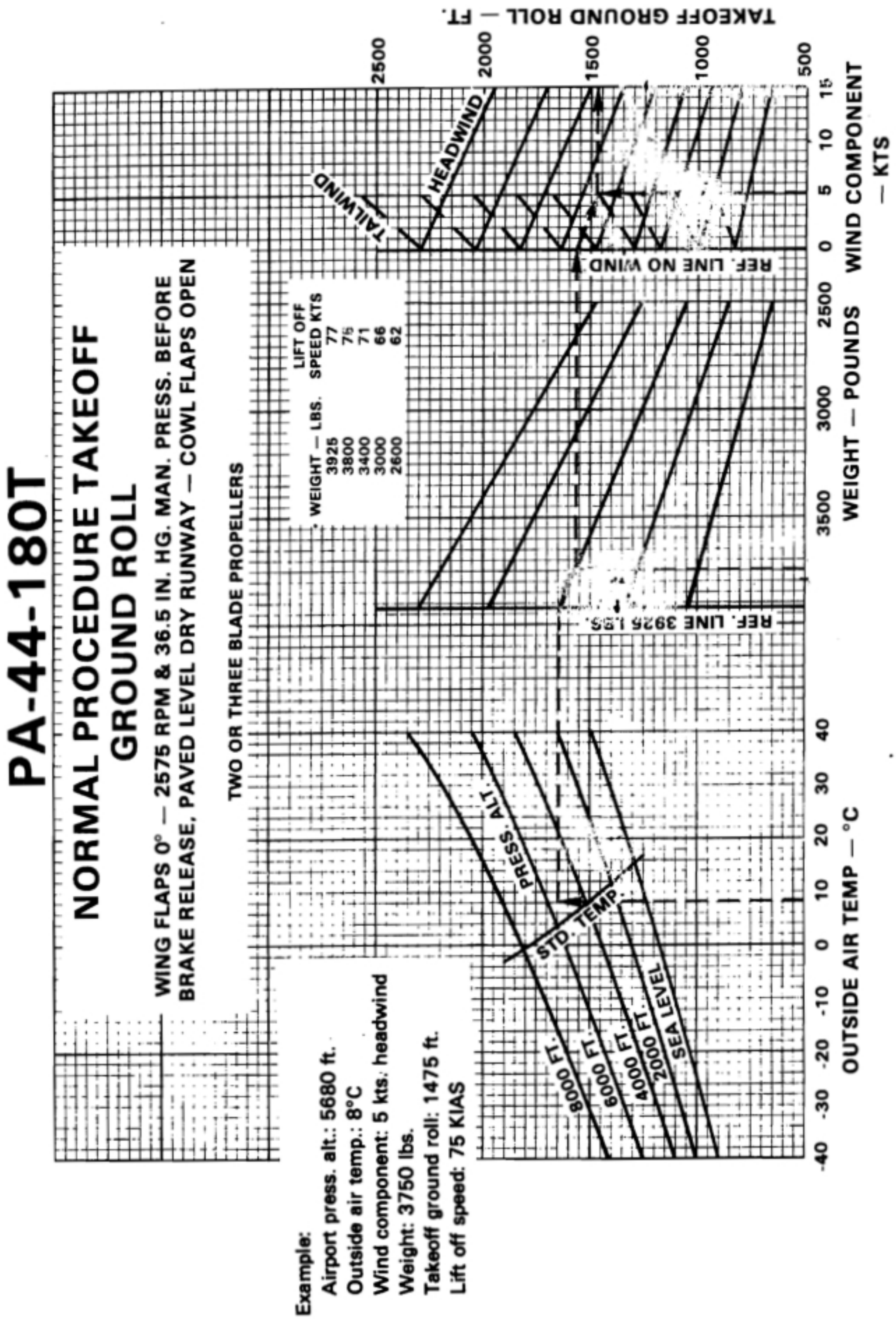
STALL SPEED VS. ANGLE OF BANK
Figure 5-5



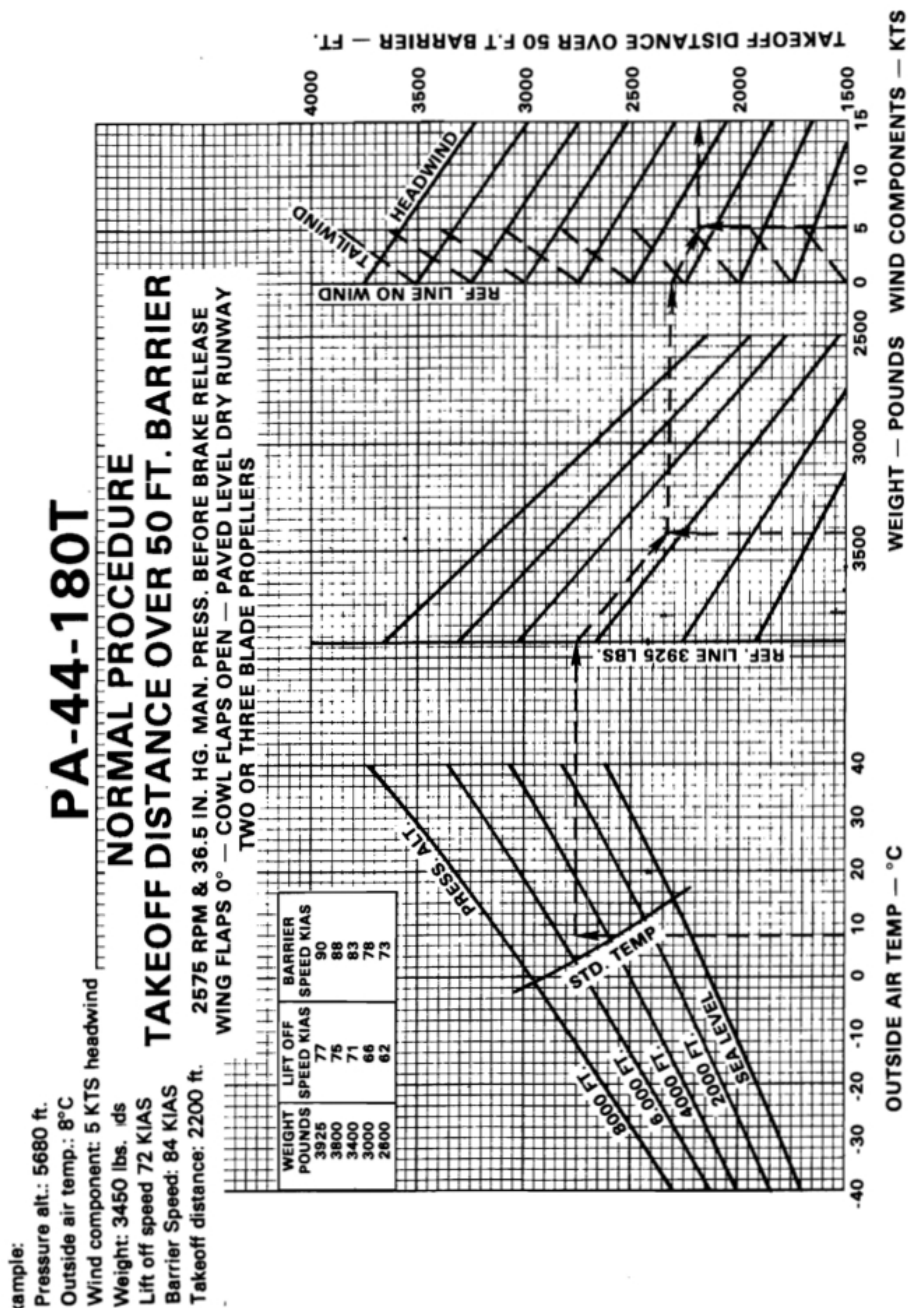
NORMAL PROCEDURE - ACCELERATE AND STOP DISTANCE
Figure 5-7



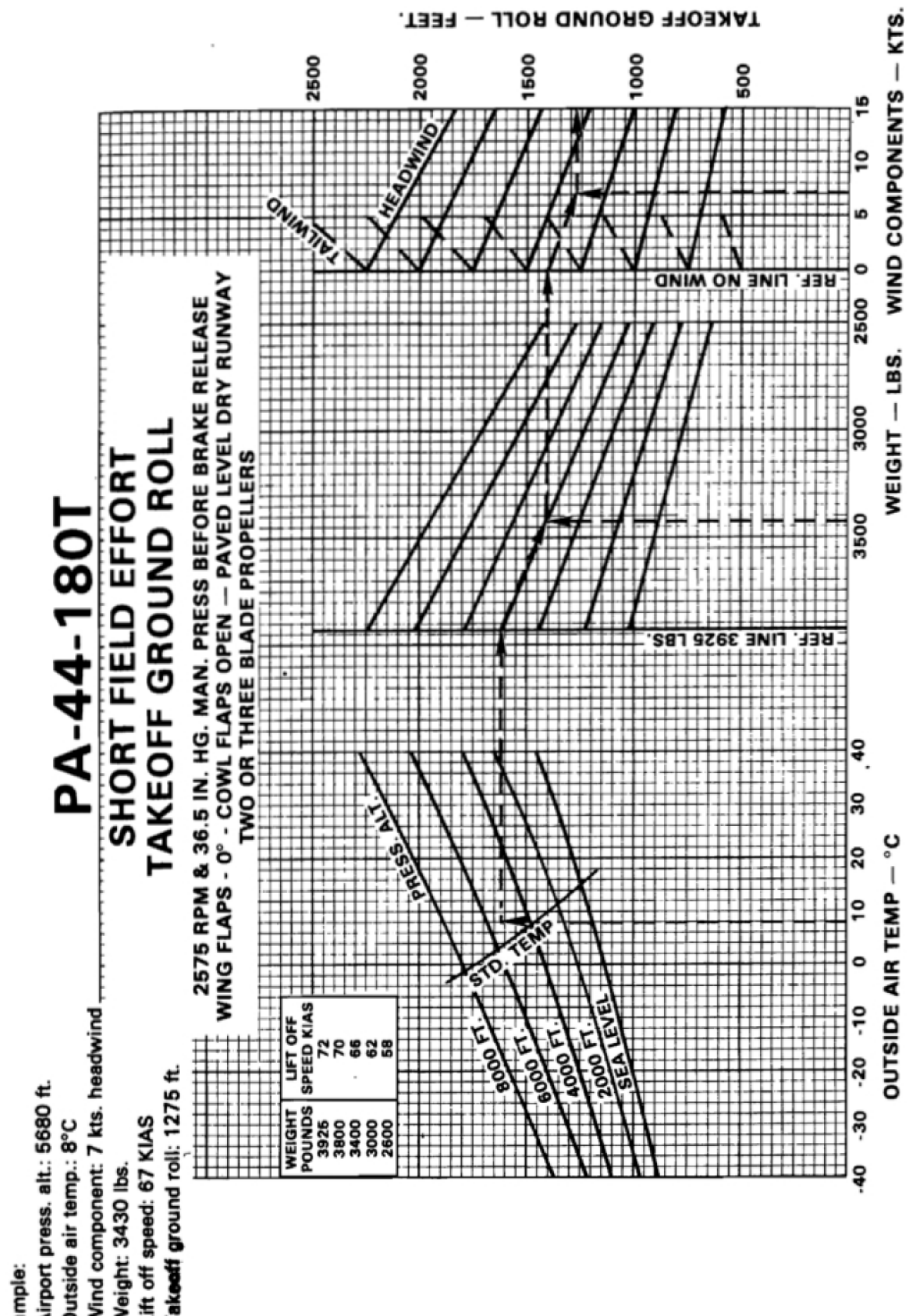
SHORT FIELD ACCELERATE AND STOP DISTANCE
Figure 5-9



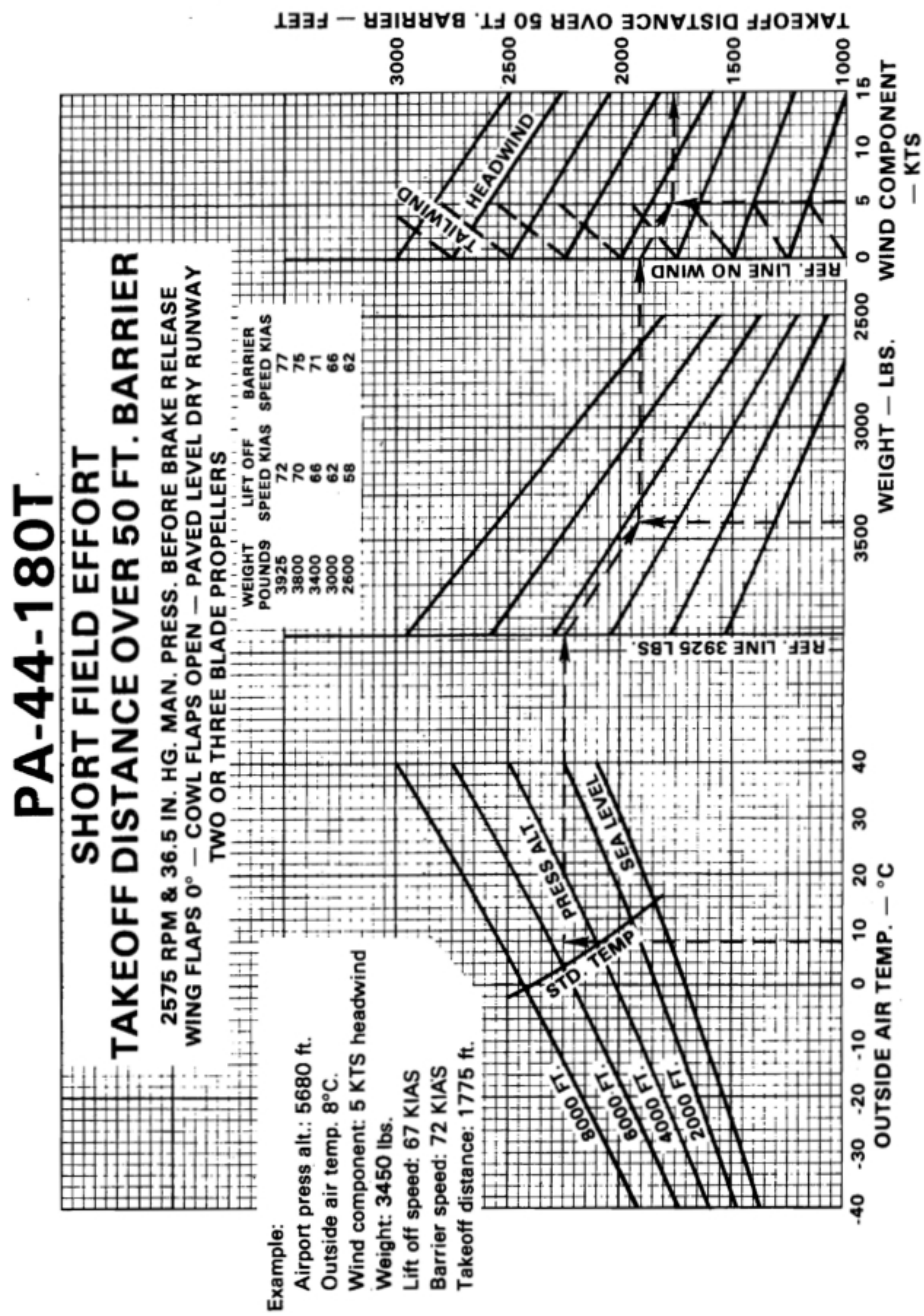
NORMAL PROCEDURE TAKEOFF GROUND ROLL (0° FLAPS)
Figure 5-11



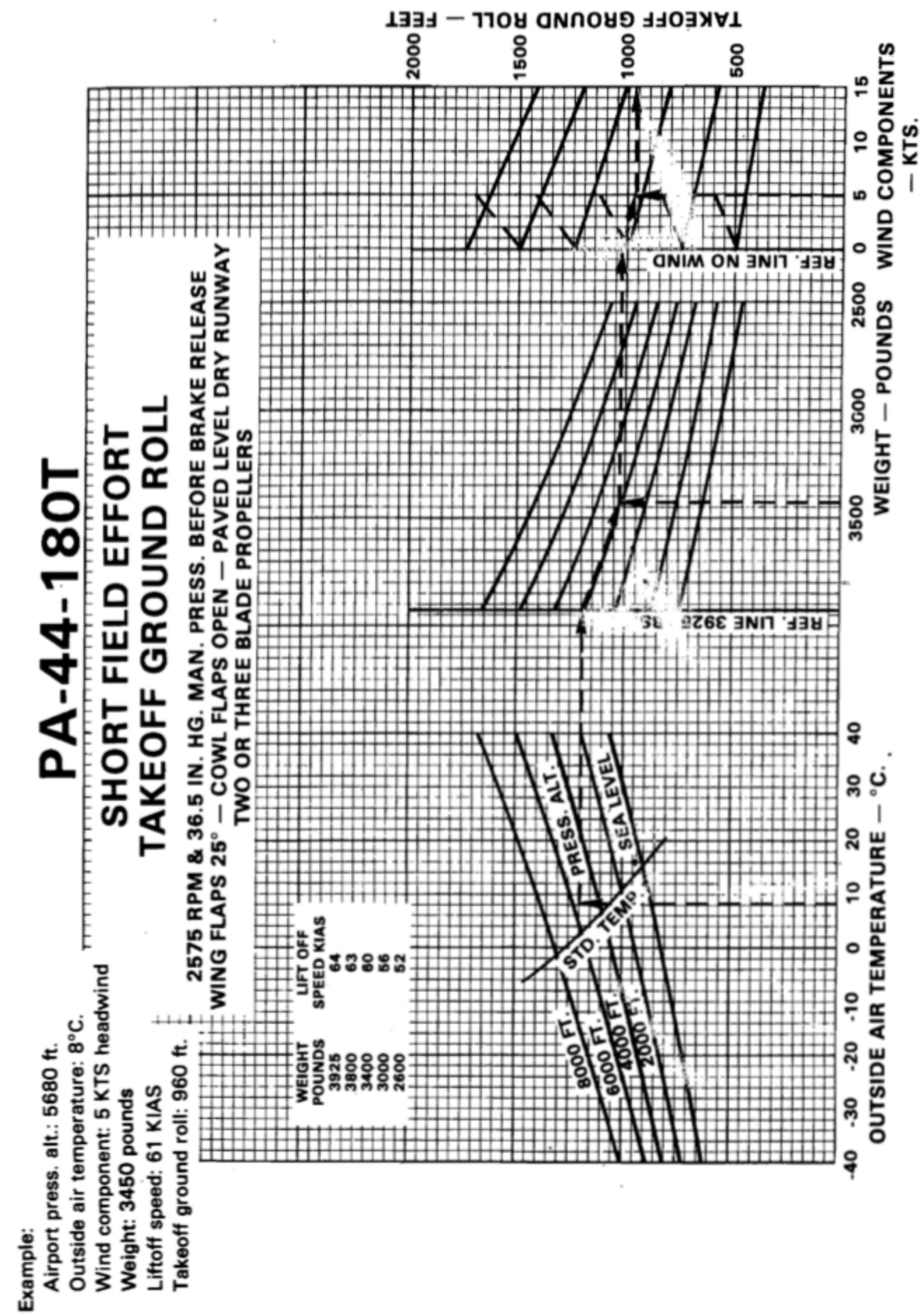
NORMAL PROCEDURE TAKEOFF DISTANCE OVER 50 FT. BARRIER (0° FLAPS)
Figure 5-13



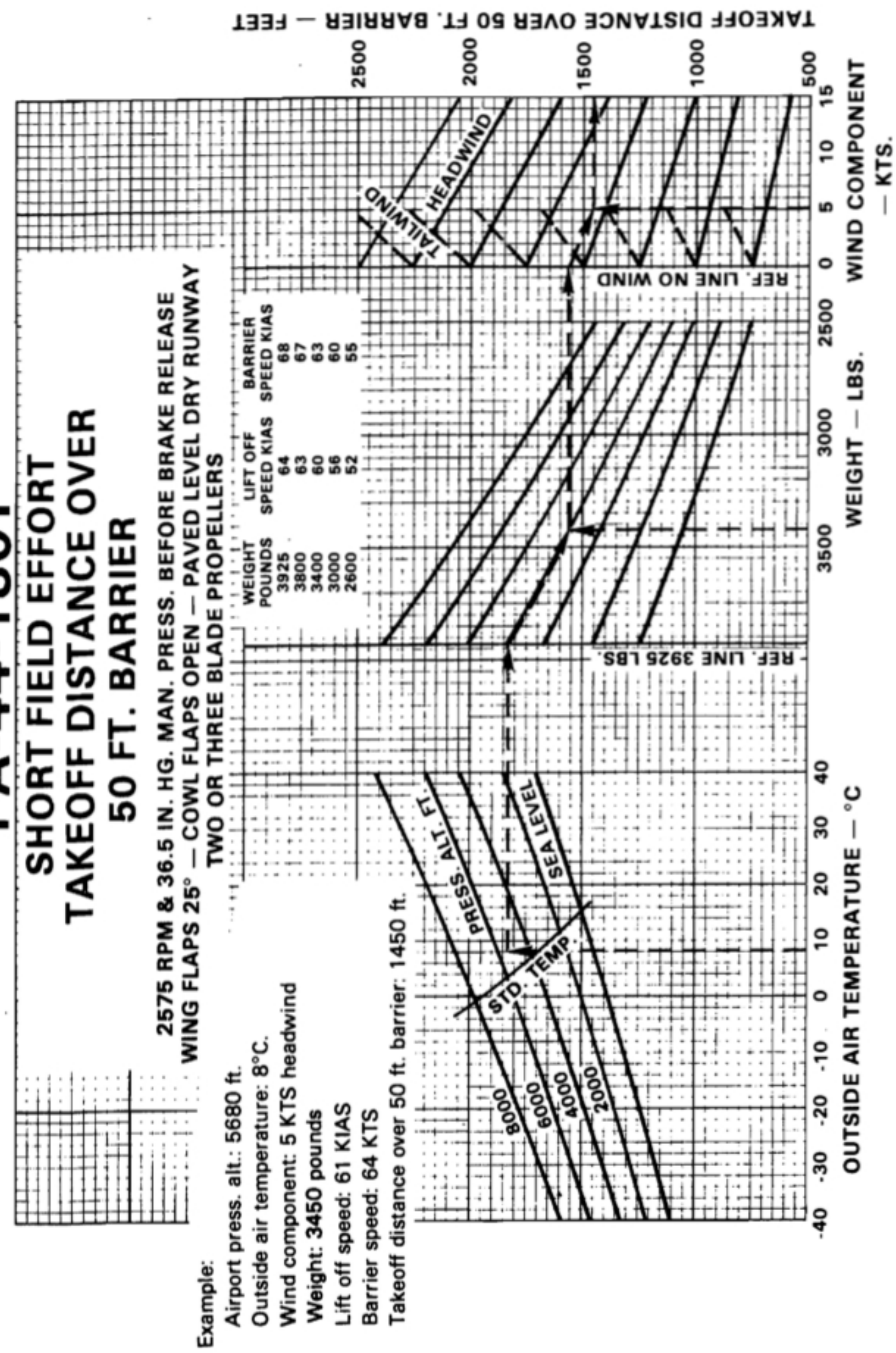
SHORT FIELD EFFORT TAKEOFF GROUND ROLL (0° FLAPS)
Figure 5-15



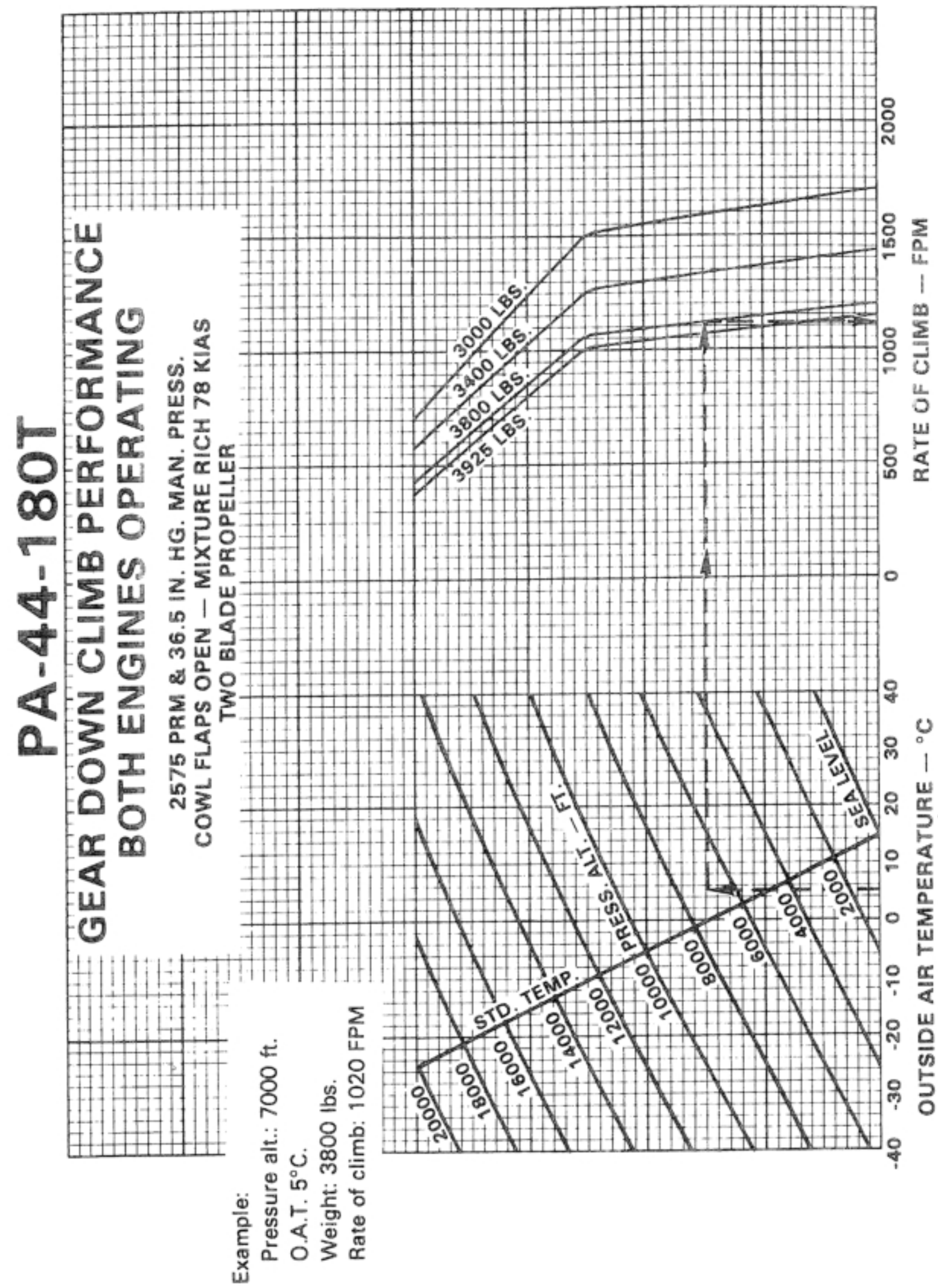
SHORT FIELD EFFORT TAKEOFF DISTANCE OVER 50 FT. BARRIER (0° FLAPS)
Figure 5-17



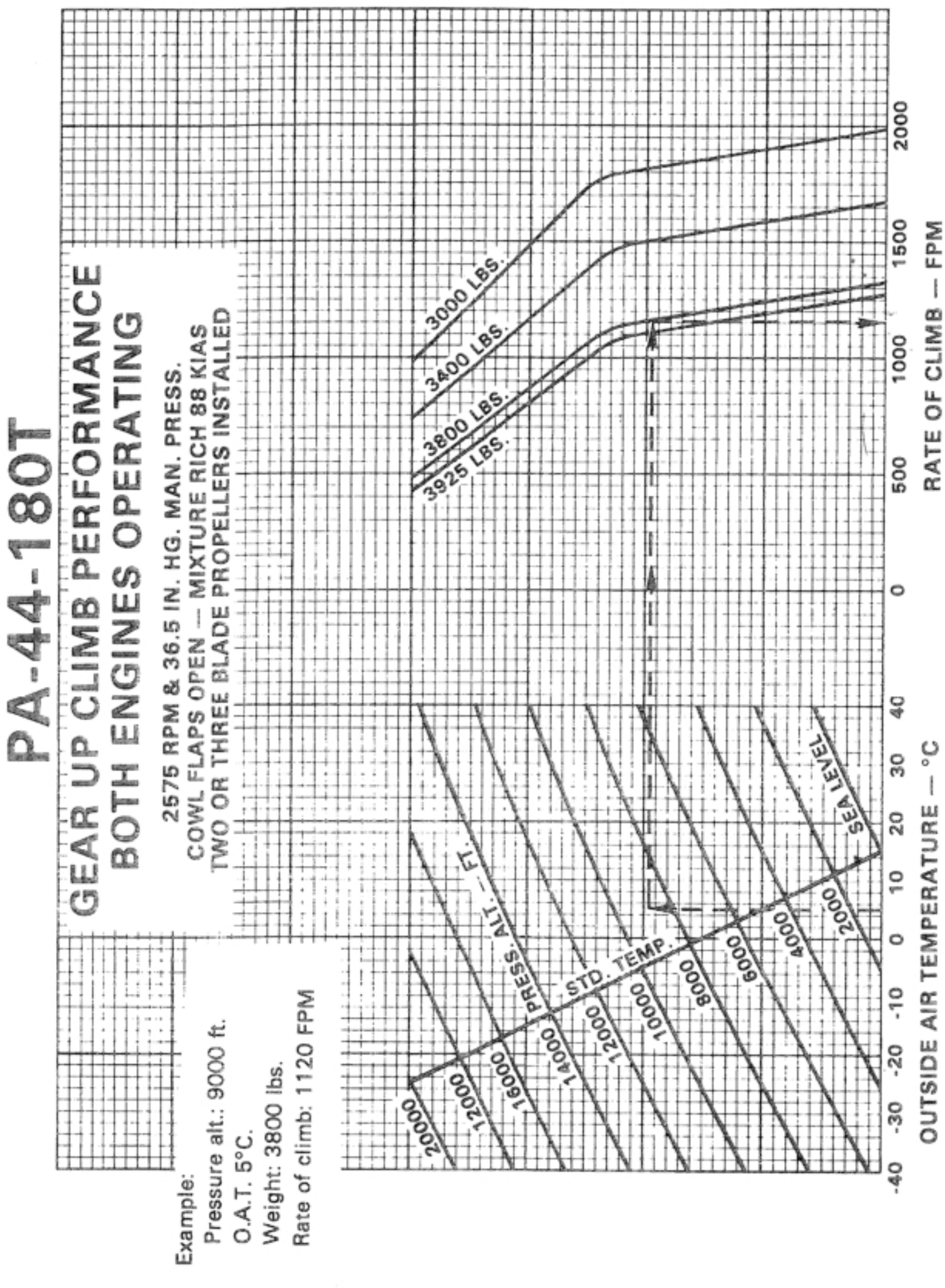
SHORT FIELD EFFORT TAKEOFF GROUND ROLL (25° FLAPS)
Figure 5-19



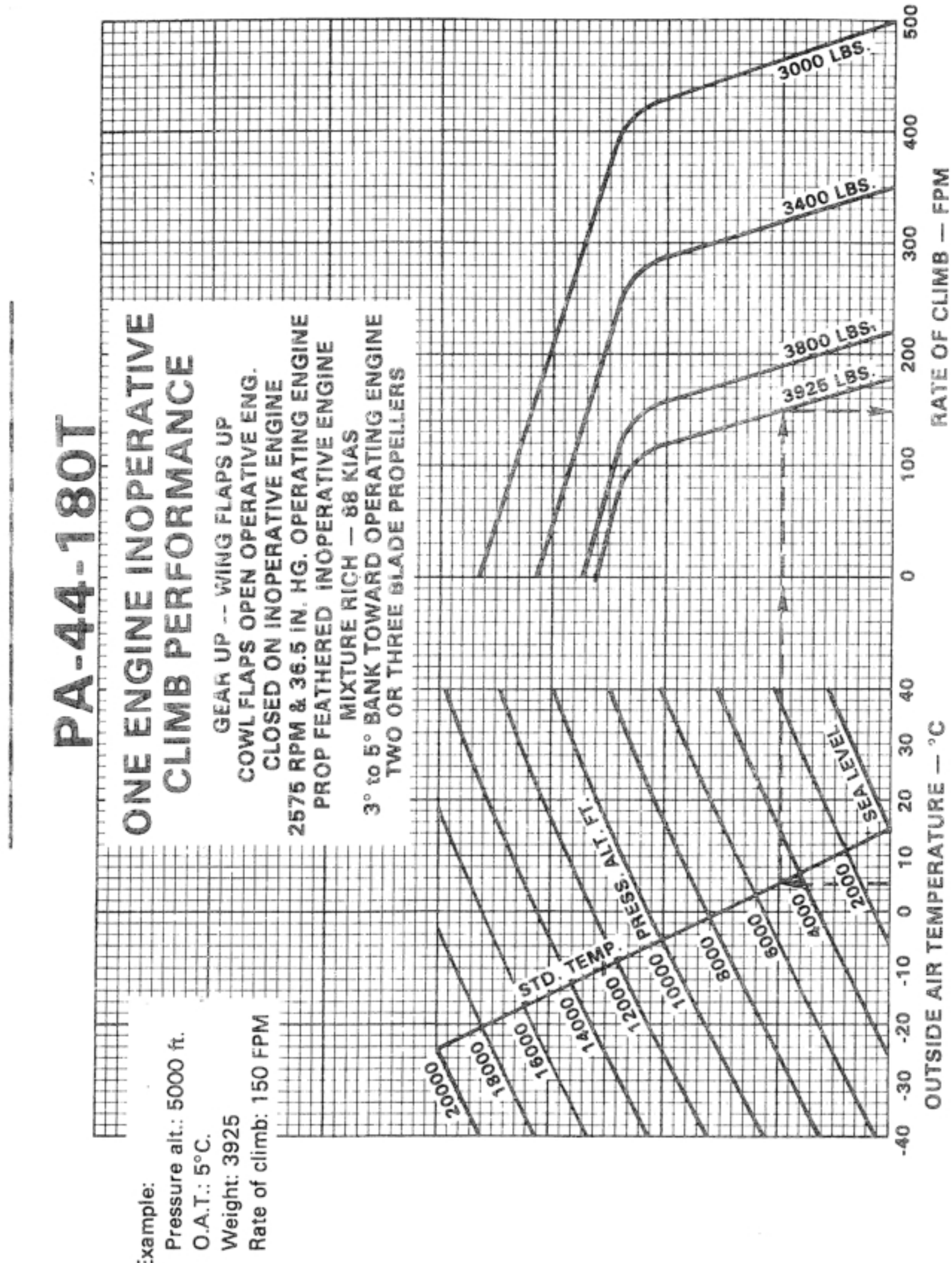
SHORT FIELD EFFORT TAKEOFF DISTANCE OVER 50 FT. BARRIER (25° FLAPS)
Figure 5-21



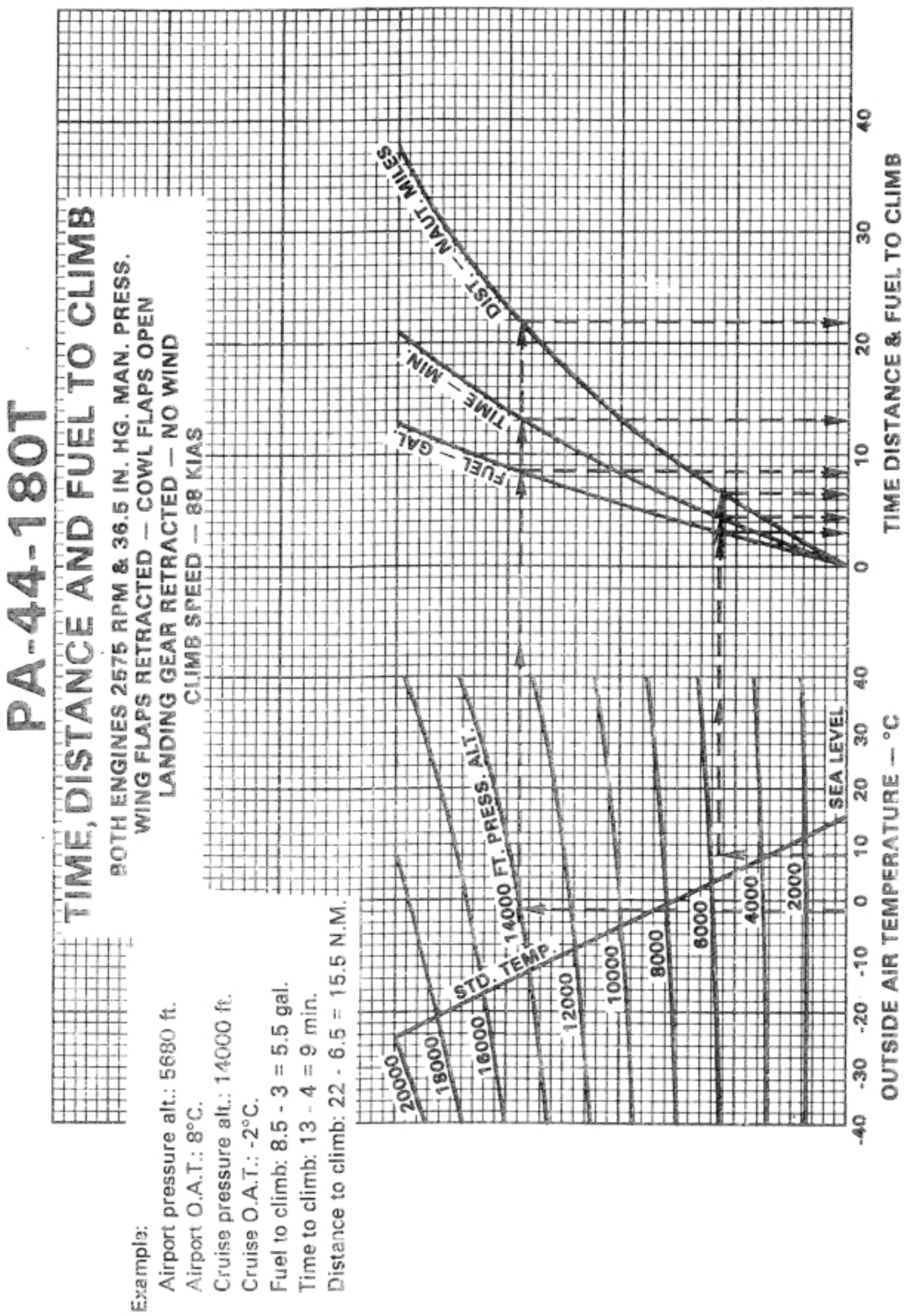
GEAR DOWN - CLIMB PERFORMANCE -
BOTH ENGINES OPERATING
Figure 5-23



GEAR UP - CLIMB PERFORMANCE - BOTH ENGINES OPERATING
Figure 5-25



ONE ENGINE INOPERATIVE - CLIMB PERFORMANCE - GEAR UP
Figure 5-27



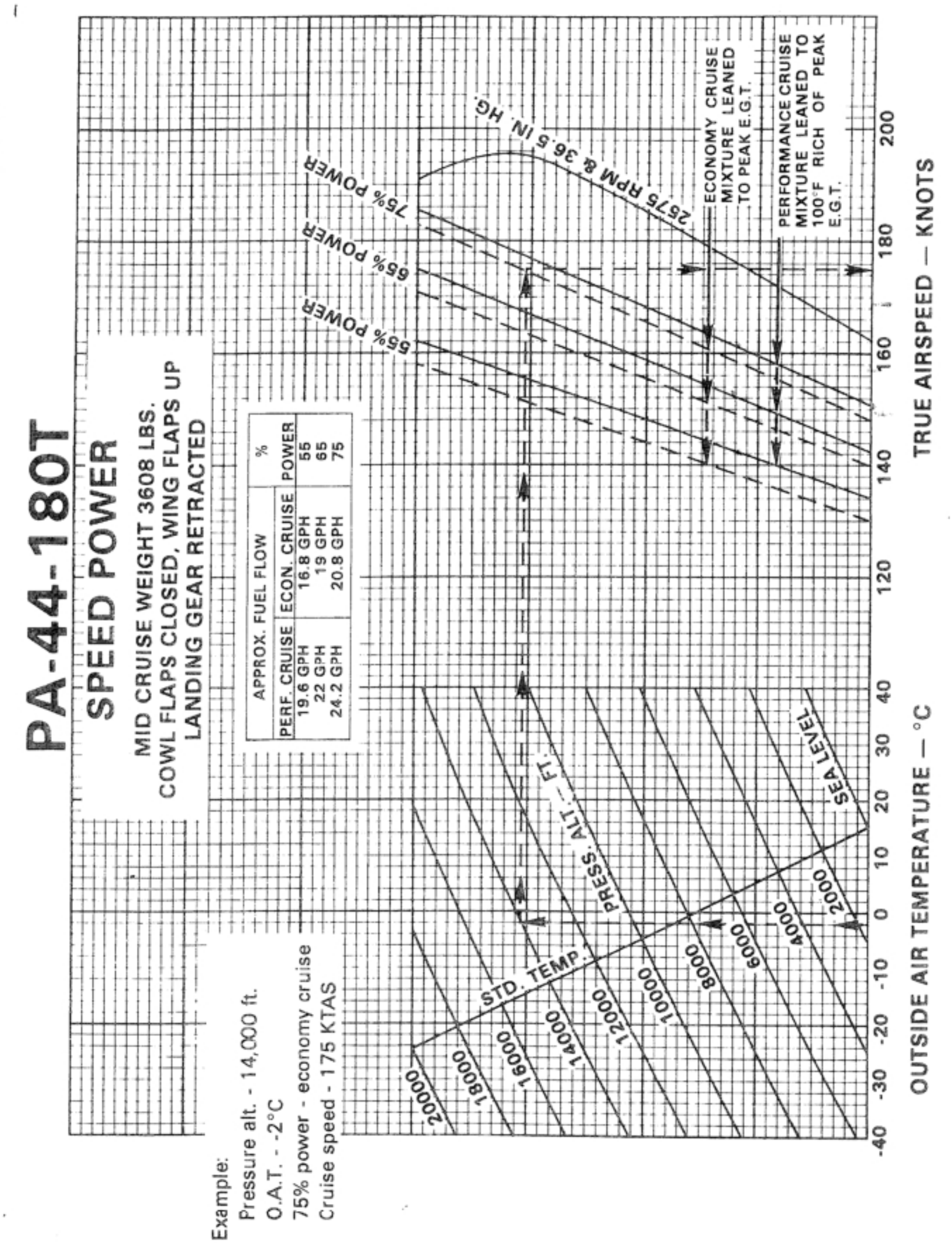
TIME, DISTANCE AND FUEL TO CLIMB
Figure 5-29

POWER SETTING TABLE - LYCOMING (L)TO-360-E1A6D

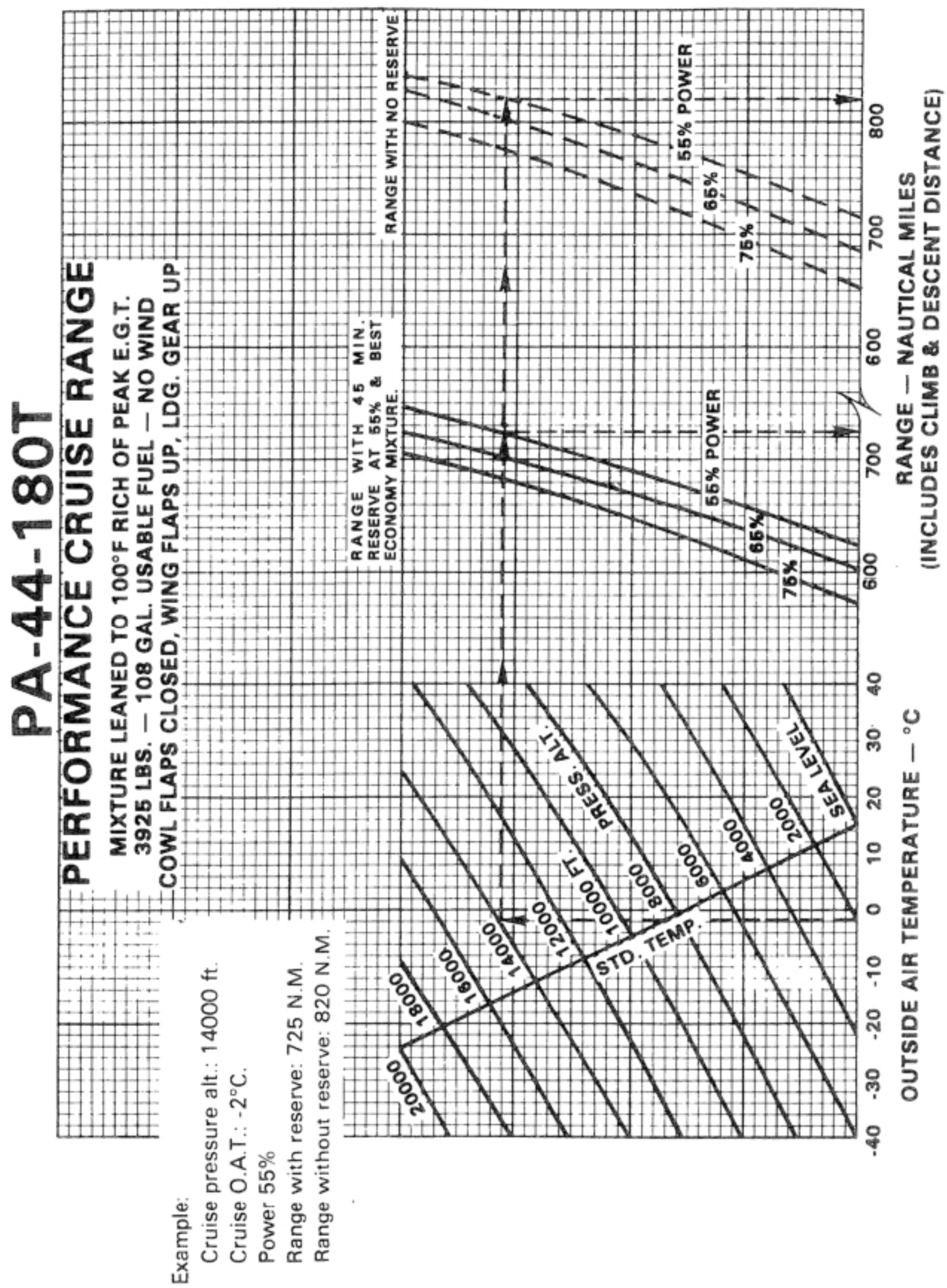
		55% Power				65% Power				75% Power				
Press. Alt. Feet	Std. Temp. °C	*Approx. Fuel Flow G.P.H.				*Approx. Fuel Flow G.P.H.				*Approx. Fuel Flow G.P.H.				Press. Alt. Feet
		9.5	9.7	9.8	10.0	10.6	10.9	11.0	11.1	11.8	12.0	12.1	12.3	
		RPM AND MAN. PRESS.				RPM AND MAN. PRESS.				RPM AND MAN. PRESS.				
		2200	2300	2400	2575	2200	2300	2400	2575	2200	2300	2400	2575	
SL	15	28.2	27.5	26.9	26.3	31.6	30.7	30.0	28.5	34.5	33.5	32.6	31.0	SL
2000	11	27.0	26.2	25.4	24.7	30.3	29.4	28.6	27.1	33.5	32.5	31.6	30.0	2000
4000	7.1	26.0	25.2	24.3	23.5	29.2	28.3	27.5	26.1	32.8	31.7	30.8	29.2	4000
6000	3.1	25.4	24.4	23.4	22.6	28.4	27.5	26.7	25.3	32.2	31.1	30.2	28.7	6000
8000	-0.8	24.8	23.8	22.7	22.0	27.8	27.0	26.0	24.8	31.7	30.5	29.7	28.2	8000
10,000	-4.8	24.4	23.3	22.2	21.5	27.3	26.5	25.5	24.3	—	30.0	29.3	27.8	10,000
12,000	-8.8	24.0	23.0	21.8	21.1	—	26.0	25.1	23.9	—	—	29.0	27.4	12,000
14,000	-12.7	23.7	22.7	21.5	20.8	—	25.7	24.7	23.5	—	—	28.4	27.1	14,000
16,000	-16.7	—	22.4	21.2	20.6	—	—	24.4	23.2	—	—	—	26.8	16,000
18,000	-20.7	—	22.2	21.0	20.4	—	—	24.0	22.9	—	—	—	26.5	18,000
20,000	-24.6	—	—	20.7	20.3	—	—	—	22.6	—	—	—	26.3	20,000

*Mixture leaned to 100°F Rich of Peak E.G.T.

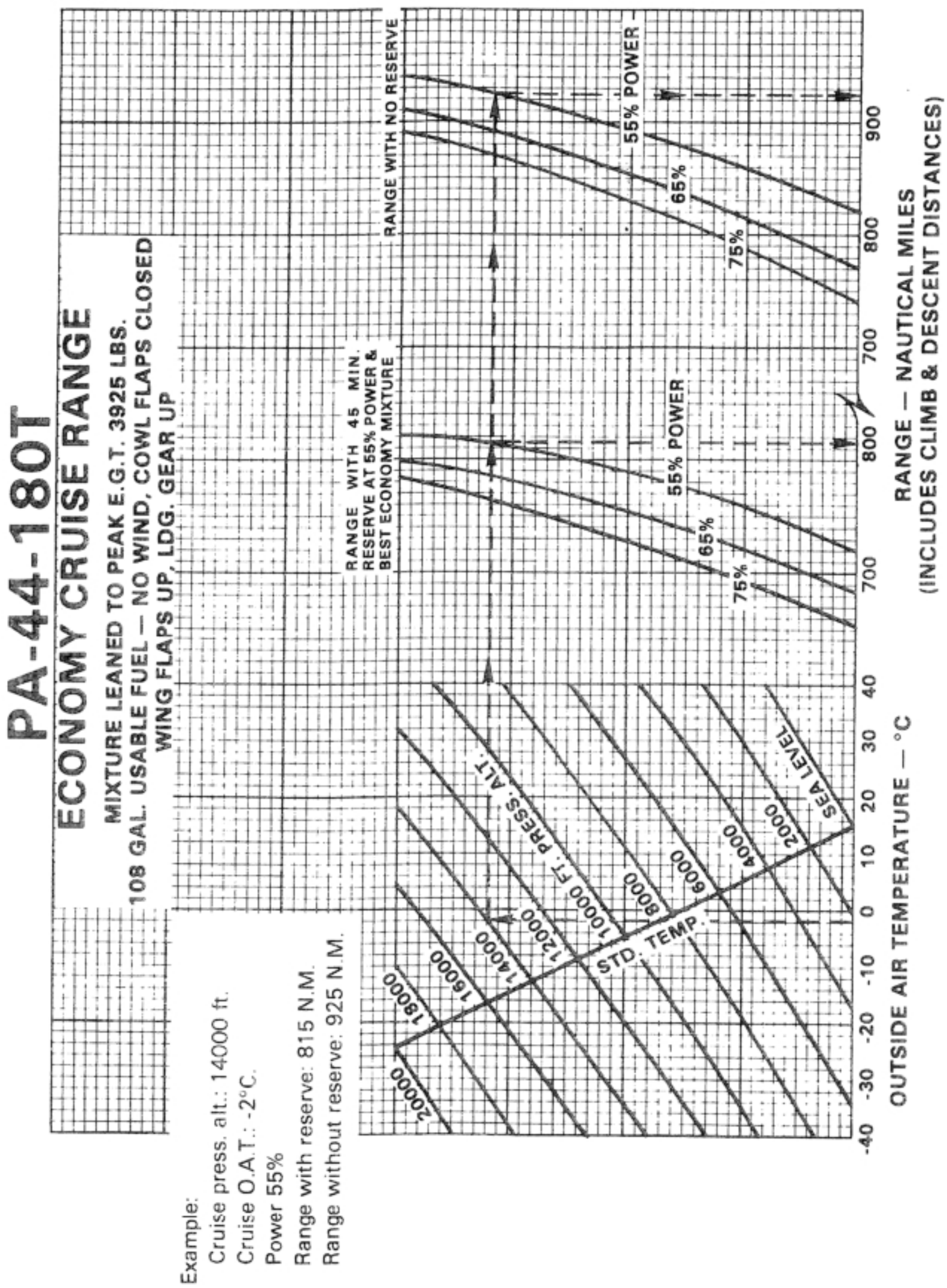
POWER SETTING TABLE
Figure 5-31



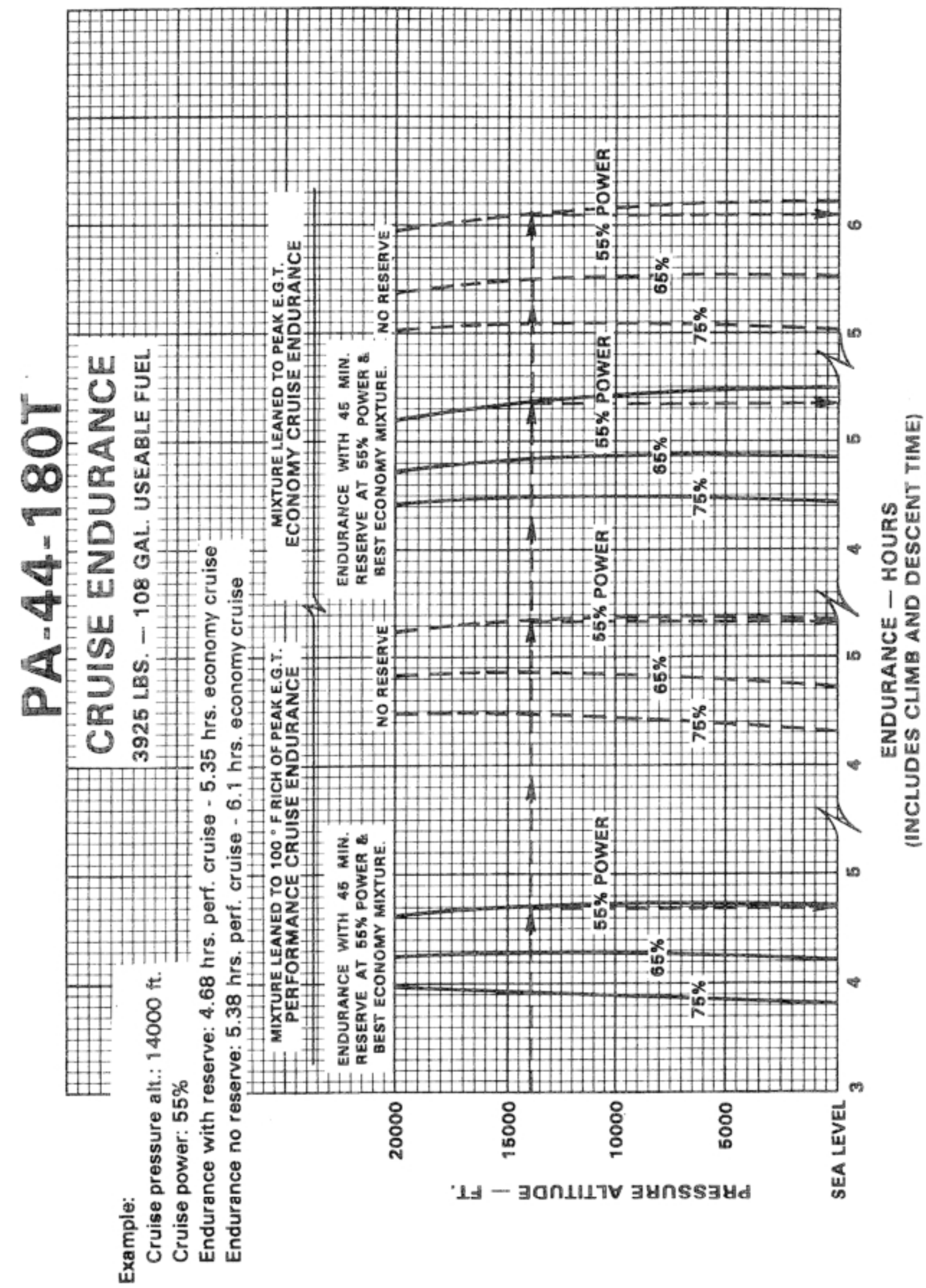
SPEED POWER
Figure 5-33



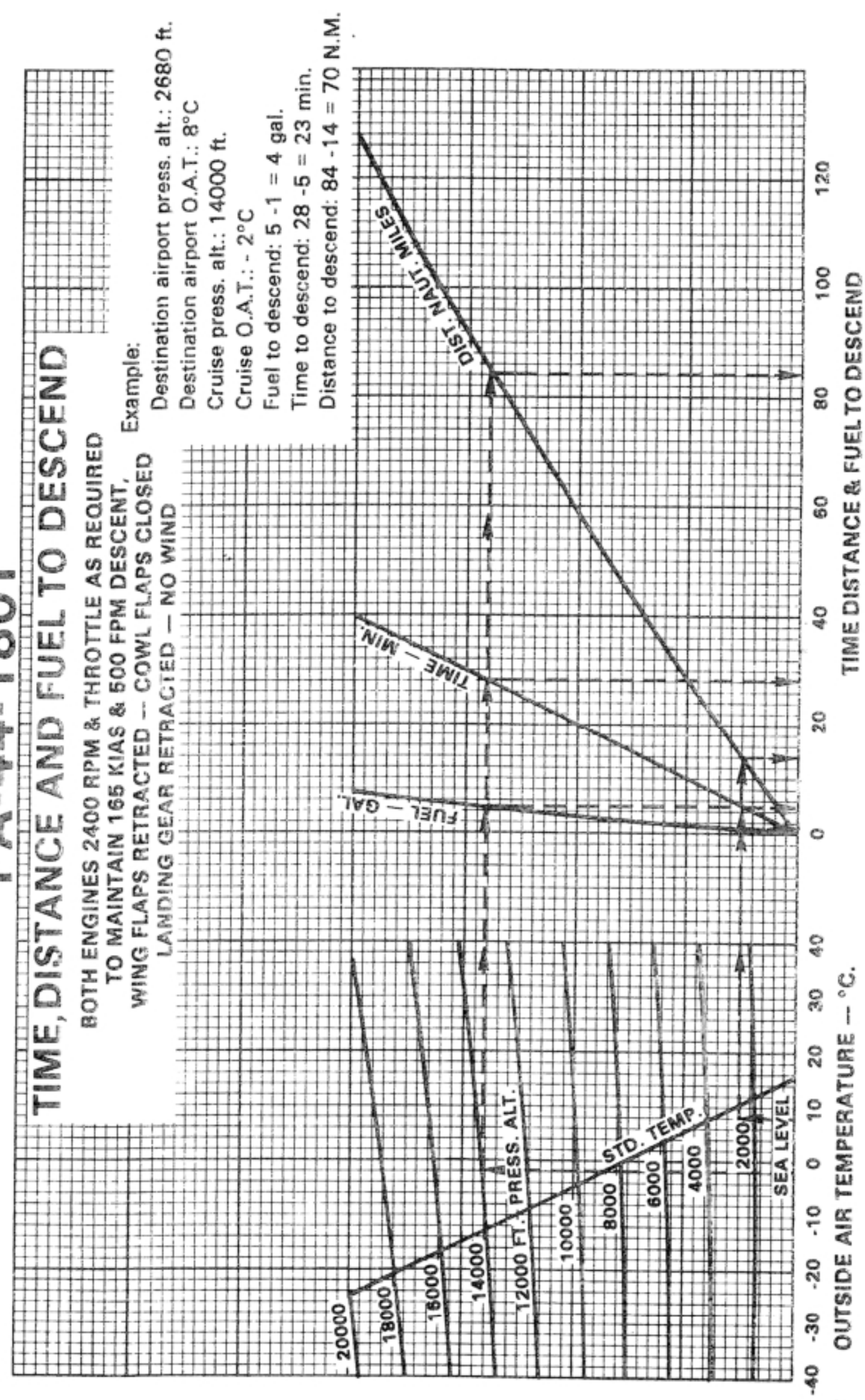
PERFORMANCE CRUISE RANGE
Figure 5-35



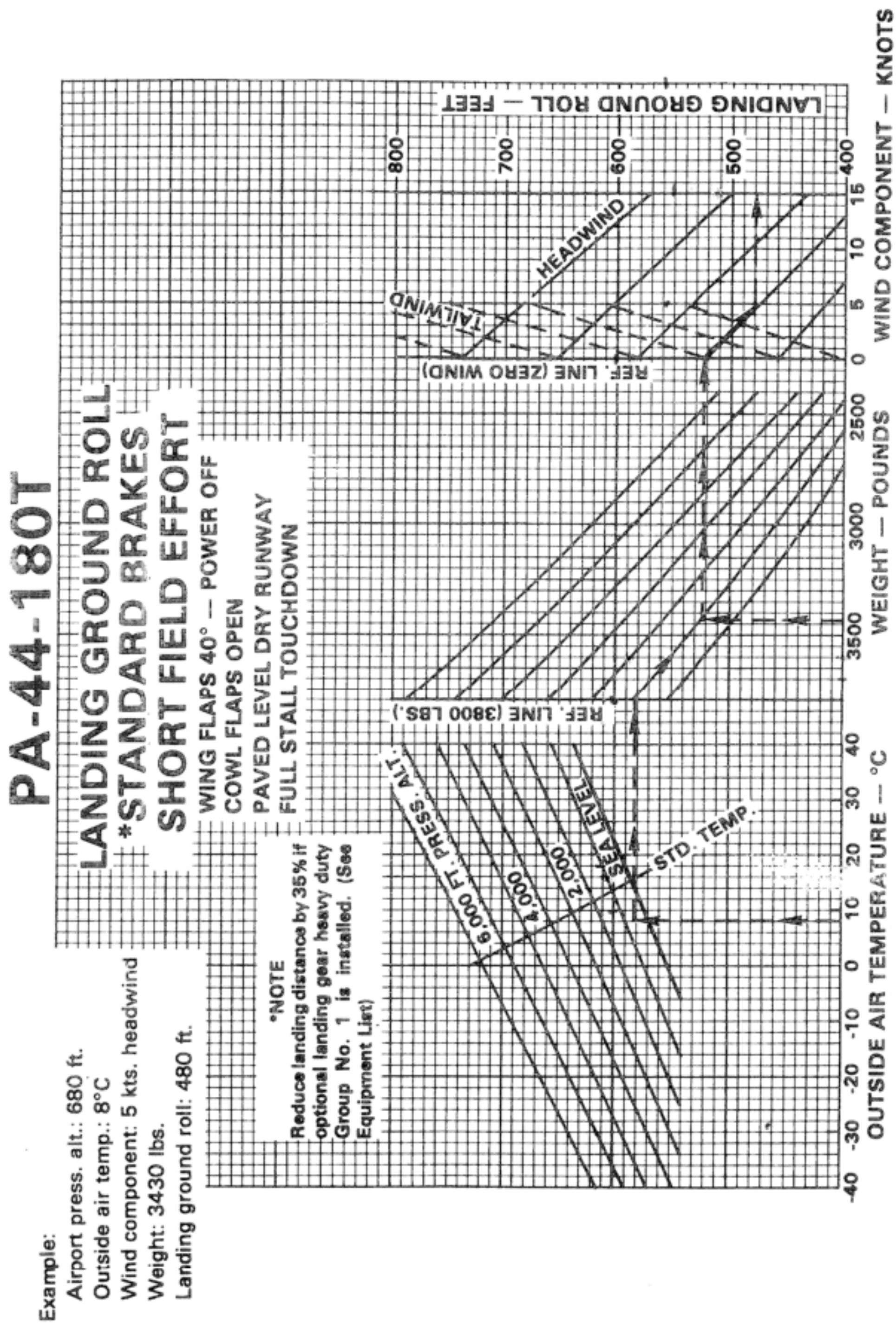
ECONOMY CRUISE RANGE
Figure 5-37



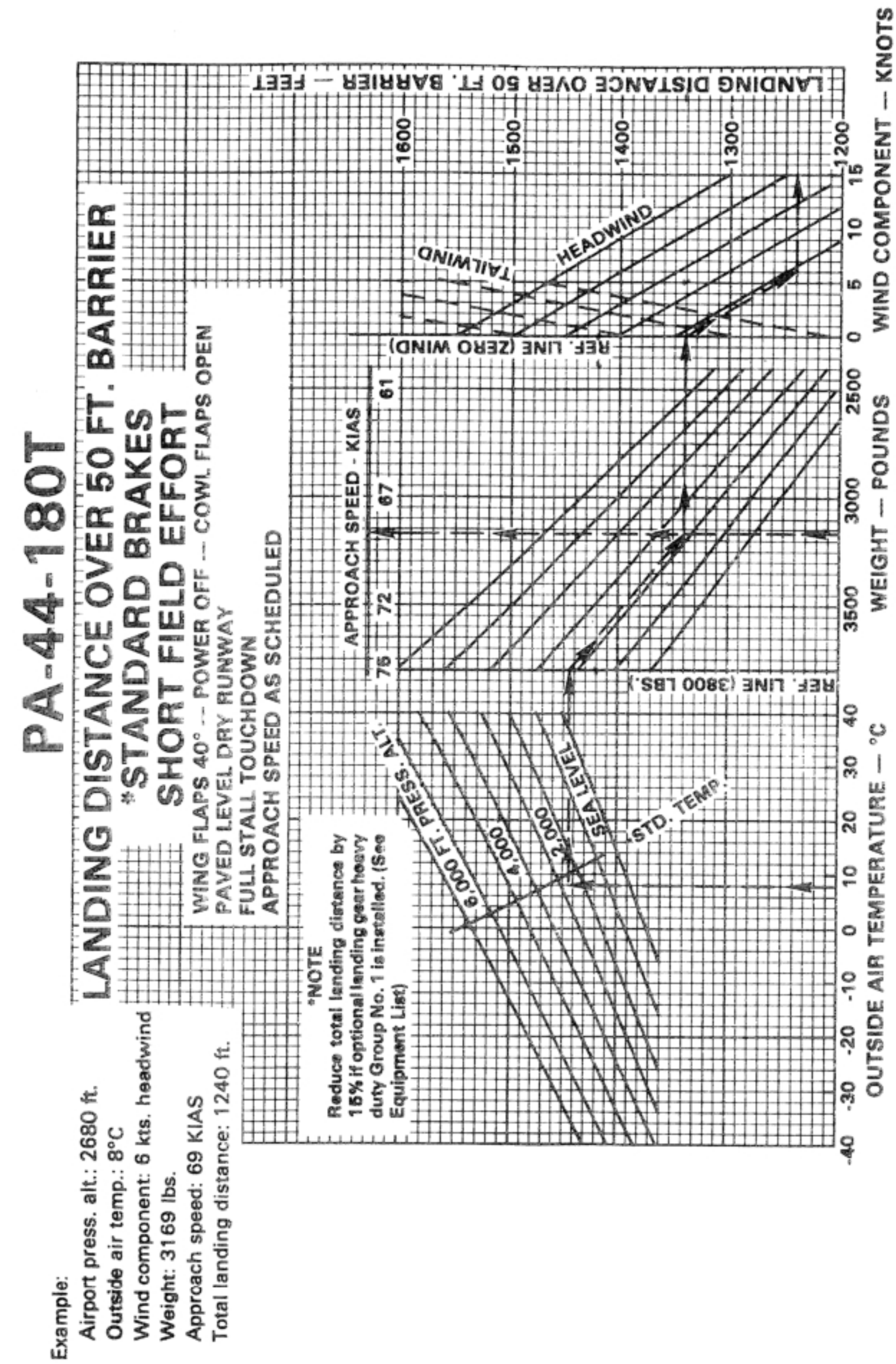
CRUISE ENDURANCE
Figure 5-39



TIME, DISTANCE AND FUEL TO DESCEND
Figure 5-41



LANDING GROUND ROLL
Figure 5-43



LANDING DISTANCE OVER 50 FT. BARRIER
Figure 5-45

TABLE OF CONTENTS

SECTION 6

WEIGHT AND BALANCE

*For 1982 and preceding models only.
**For 1983 and subsequent models only.

SECTION 6

WEIGHT AND BALANCE

6.1 GENERAL

In order to achieve the performance and flying characteristics which are designed into the airplane, it must be flown with the weight and center of gravity (C.G.) position within the approved operating range (envelope). Although the airplane offers flexibility of loading, it cannot be flown with the maximum number of adult passengers, full fuel tanks and maximum baggage. With the flexibility comes responsibility. The pilot must ensure that the airplane is loaded within the loading envelope before he makes a takeoff.

Misloading carries consequences for any aircraft. An overloaded airplane will not take off, climb or cruise as well as a properly loaded one. The heavier the airplane is loaded, the less climb performance it will have.

Center of gravity is a determining factor in the flight characteristics. If the C.G. is too far forward in any airplane, it may be difficult to rotate for takeoff or landing. If the C.G. is too far aft, the airplane may rotate prematurely on takeoff or tend to pitch up during climb. Longitudinal stability will be reduced. This can lead to inadvertent stalls and even spins; and spin recovery becomes more difficult as the center of gravity moves aft of the approved limit.

A properly loaded airplane, however, will perform as intended. This airplane is designed to provide performance within the flight envelope. Before the airplane is licensed, it is weighed, and a basic empty weight and C.G. location is computed (basic empty weight consists of the standard empty weight of the airplane plus the optional equipment). Using the basic empty weight and C.G. location, the pilot can determine the weight and C.G. position for the loaded airplane by computing the total weight and moment and then determining whether they are within the approved envelope.

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

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

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

6.3 AIRPLANE WEIGHING PROCEDURE

At the time of licensing, Piper Aircraft Corporation provides each airplane with the basic empty weight and center of gravity location. This data is supplied by Figure 6-5.

The removal or addition of equipment or airplane modifications can affect the basic empty weight and center of gravity. The following is a weighing procedure to determine this basic empty weight and center of gravity location:

(a) Preparation

(1) Be certain that all items checked in the airplane equipment list are installed in the proper location in the airplane.

(2) Remove excessive dirt, grease, moisture, foreign items such as rags and tools from the airplane before weighing.

(3) Defuel airplane. Then open all fuel drains until all remaining fuel is drained. Operate each engine until all undrainable fuel is used and engine stops. Then add the unusable fuel (2.0 gallons total, 1.0 gallon each wing).

(4) Fill with oil to full capacity.

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

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

(b) Leveling

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

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

(c) Weighing - Airplane Basic Empty Weight

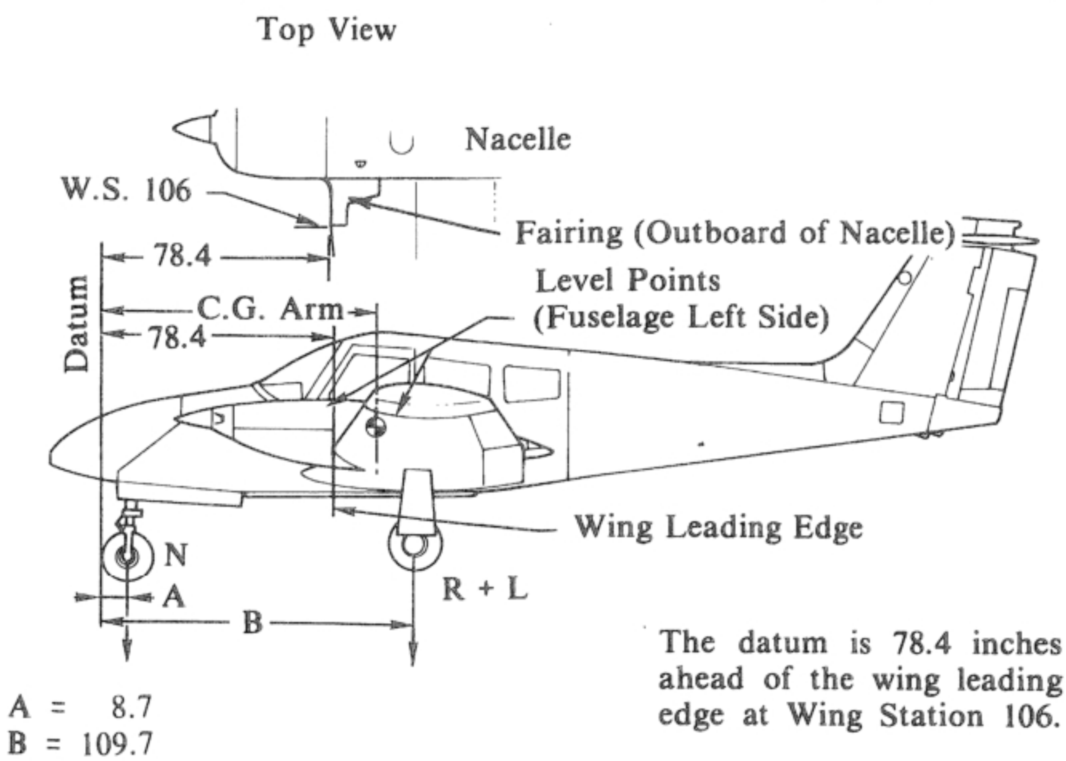
(1) With the airplane level and brakes released, record the weight shown on each scale. Deduct the tare, if any, from each reading.

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

WEIGHING FORM
Figure 6-1

(d) Basic Empty Weight Center of Gravity

(1) The following geometry applies to the PA-44-180T airplane when it is level. Refer to Leveling paragraph 6.3 (b).



LEVELING DIAGRAM
Figure 6-3

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

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

Where: $T = N + R + L$

6.5 WEIGHT AND BALANCE DATA AND RECORD

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

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

MODEL PA-44-180T, TURBO SEMINOLE

Airplane Serial Number ________________

Registration Number ____________________

Date ________________________________

AIRPLANE BASIC EMPTY WEIGHT

Item		Weight (Lbs)	×	C.G. Arm (Inches Aft of Datum)	=	Moment (In-Lbs)
Standard Empty Weight*	Actual Computed					
Optional Equipment						
Basic Empty Weight						

*The standard empty weight includes full oil capacity and 2.0 gallons of unusable fuel.

AIRPLANE USEFUL LOAD - NORMAL CATEGORY OPERATION

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

(3943 lbs.) - (lbs.) =   lbs.

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

**Includes Fuel Allowances for Start-up, Taxi & Run-up (18 lbs.)

WEIGHT AND BALANCE DATA FORM
Figure 6-5

PA-44-180T	Serial Number		Registration Number			Page Number	

Date	Item No.	Description of Article or Modification	Added (+) Removed (-)	Weight Change Wt. (Lb.)	Weight Change Arm (In.)	Weight Change Moment /100	Running Basic Empty Weight Wt. (Lb.)	Running Basic Empty Weight Moment /100
12-9-86		~~As Licensed~~ WEIGHED					2672	2289.14

SUPERSEDED

WEIGHT AND BALANCE RECORD
Figure 6-7

PA-44-180T	Serial Number			Registration Number			Page Number	
Date	Item No.	Description of Article or Modification	Added (+) Removed (-)	Weight Change			Running Basic Empty Weight	
				Wt. (Lb.)	Arm (In.)	Moment /100	Wt. (Lb.)	Moment /100

WEIGHT AND BALANCE RECORD (cont)
Figure 6-7 (cont)

6.7 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT

(a) Add the weight of all items to be loaded to the basic empty weight.
(b) Use the loading graph (Figure 6-13) to determine the moment of all items to be carried in the airplane.
(c) Add the moment of all items to be loaded to the basic empty weight moment.
(d) Divide the total moment by the total weight to determine the C.G. location.
(e) By using the figures in item (a) and item (d) (above), locate a point on the C.G. range and weight graph (Figure 6-15). If the point falls within the C.G. envelope, the loading meets the weight and balance requirements.

NOTES

Actual fuel allowance for start-up, taxi and runup (18 Lbs. Max.) should be determined based on local operating conditions.

Moment due to gear retraction is +819 in. lbs. This does not significantly affect C.G. location.

	Weight (Lbs)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Basic Empty Weight	2730	86.1	235053
Pilot and Front Passenger	340	80.5	27370
Passengers (rear seats)	340	118.1	40154
Fuel (108 Gal. Max.)	533	95.0	50635
Baggage (200 Lbs. Max.)		142.8	
Ramp Weight (3943 Lbs. Max.)	3943	89.6	353212
Fuel Allowance for Start, Taxi, Runup	-18	95.0	-1710
Take-Off Weight (3925 Lbs. Max.)	3925	89.6	351502

The center of gravity (C.G.) for the take-off weight of this sample loading problem is at (89.6) inches aft of the datum line. Locate this point on the C.G. range and weight graph. Since this point falls within the weight - C.G. Envelope, this loading meets the weight and balance requirements.

Takeoff Weight (3925 Lbs. Max.)	3925	89.6	351502
Minus Estimated Fuel Burnoff @ 6.0 Lbs. per Gal.	420	95.0	39900
Landing Weight (3800 Lbs. Max.)	3505	88.9	311602

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

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

SAMPLE LOADING PROBLEM (NORMAL CATEGORY)
Figure 6-9

SPESSART AIR SERVICE

SPAIR GmbH

Service, Zubehör und
Reparatur von
Luftfahrzeugen

Flugplatz
63762 Großostheim
Telefon 06026/6066
Fax 06026/3222
LBA II-A-326

Kennzeichen	D-GOKI
Typ	Piper PA44-180T
Werk Nr.	81070050
Datum	13.12.95
gewogen von	W.Kerkhoff
Unterschrift	

Bezugspunkt	Vorserseite Tragfläche W.S.106
Bezugslinie horiz.	2Schrauben an linker Rumpfseite
Bezugsebene	1991mm vor BP

Auflage	Brutto kg	Tara kg	Netto kg	Hebel cm	Moment kg/cm
Rad LH	483,0	0,0	483,0	278,6	134.563,8
Rad RH	479,0	0,0	479,0	278,6	133.449,4
Rad vorn	288,0	0,0	288,0	22,1	6.364,8
Summe			1.250,0		274.378,0
Korrekturen:		Liter			
ausfliegb. Kraftstoff			0,0		0,0
ausfliegb. Kraftstoff		82,8	59,5	241,3	14.357,4
Summe			1.190,5		260.020,6
Höchstabfluggewicht			1780,0		
Leergewichtsdaten			1.190,5	218,4	260.020,6
Zuladung			589,5		
			lbs	**inch**	**inch-lbs**
Leergewichtsdaten			2.624,6	86,0	225.715,6
Zuladung			1.352,1		

	Weight (Lbs)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Basic Empty Weight			
Pilot and Front Passenger		80.5	
Passenger (rear seats)		118.1	
Fuel (108 Gal. Max.)		95.0	
Baggage (200 Lbs. Max.)		142.8	
Ramp Weight (3943 Lbs. Max.)			
Fuel Allowance for Start, Taxi, Runup	-18	95.0	-1710
Take-Off Weight (3925 Lbs. Max.)			

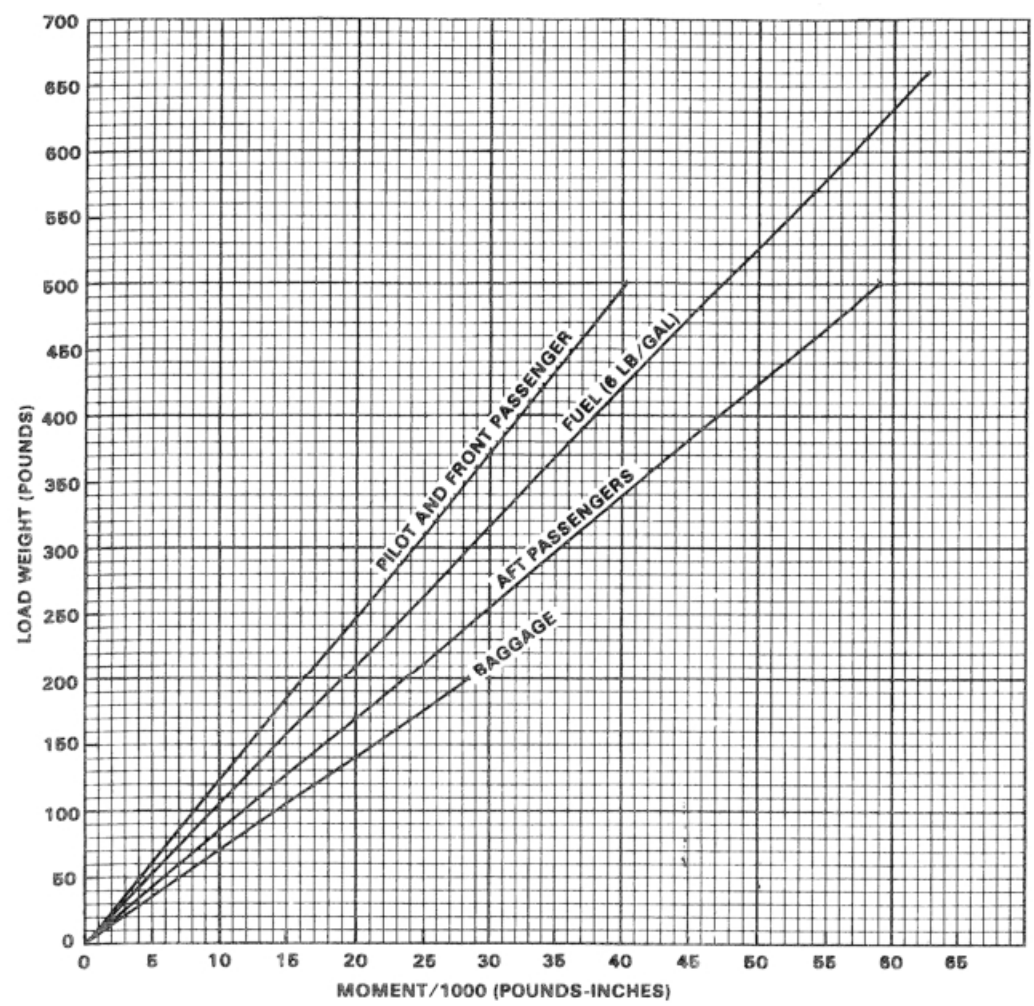
The center of gravity (C.G.) for the take-off weight of the actual loading problem is at (   ) inches aft of the datum line. Locate this point on the C.G. range and weight graph. If this point falls within the weight C.G. envelope, this loading meets the weight and balance requirement.

Take-Off Weight (3925 Lbs. Max.)		
Minus Estimated Fuel Burnoff @ 6.0 Lbs. per Gal.	95.0	
Landing Weight (3800 Lbs. Max.)		

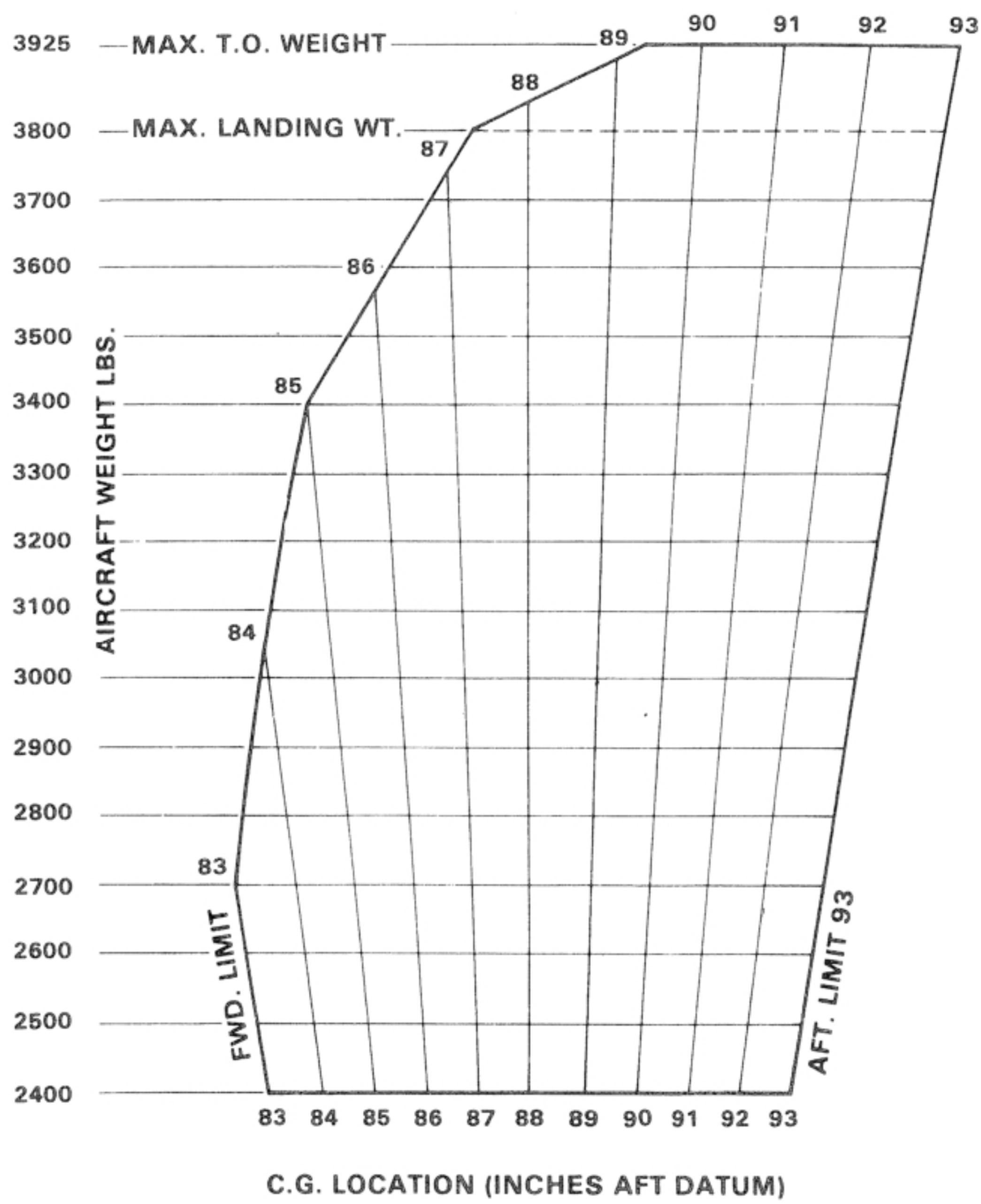
Locate the center of gravity for the landing weight on the C.G. range and weight graph. If this point falls within the weight C.G. envelope, the loading may be assumed acceptable for landing.

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

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



LOADING GRAPH
Figure 6-13



C.G. RANGE AND WEIGHT
Figure 6-15

6.9 INSTRUCTIONS FOR USING THE WEIGHT AND BALANCE PLOTTER

This plotter is provided to enable the pilot quickly and conveniently to:

(a) Determine the total weight and C.G. position.

(b) Decide how to change his load if his first loading is not within the allowable envelope.

Heat can warp or ruin the plotter if it is left in the sunlight. Replacement plotters may be purchased from Piper dealers and distributors.

The Basic Empty Weight Center of Gravity location is taken from the weight and balance form (Figure 6-5); the weight and balance record (Figure 6-7), or the latest FAA major repair or alteration form.

The plotter enables the user to add weights and corresponding moments graphically. The effect of adding or disposing of useful load can easily be seen. The plotter does not cover the situation where cargo is loaded in locations other than on the seats or in the baggage compartments.

Brief instructions are given on the plotter itself. To use it, first plot a point on the grid to locate the basic weight and C.G. location. This can be put on more or less permanently because it will not change until the airplane is modified. Next, position the zero weight end of any one of the loading slots over this point. Using a pencil, draw a line along the slot to the weight which will be carried in that location. Then position the zero weight end of the next slot over the end of this line and draw another line representing the weight which will be located in this second position. When all the loads have been drawn in this manner, the final end of the segmented line locates the total load and the C.G. position of the airplane for takeoff. If this point is not within the allowable envelope it will be necessary to remove fuel, baggage, or passengers and/or to rearrange baggage and passengers to get the final point to fall within the envelope.

Fuel burn-off and gear movement do not significantly affect the center of gravity.

SAMPLE PROBLEM

A sample problem will demonstrate the use of the weight and balance plotter.

Assume a basic weight and C.G. location of 2535 pounds at 86.0 inches respectively. We wish to carry a pilot and 3 passengers. Two men weighing 180 and 200 pounds will occupy the front seats, and two children weighing 80 and 100 pounds will ride in the rear. Two suitcases weighing 25 pounds and 20 pounds respectively, will be carried in the rear compartment. We wish to carry 60 gallons of fuel. Will we be within the safe envelope?

(a) Place a dot on the plotter grid at 2535 pounds and 86.0 inches to represent the basic airplane. (See illustration.)
(b) Slide the slotted plastic into position so that the dot is under the slot for the forward seats, at zero weight.
(c) Draw a line up the slot to the 380 pound position (180 + 200) and put a dot.
(d) Continue moving the plastic and plotting points to account for weight in the rear seats (80 + 100), baggage compartments (45), and fuel tanks (360).
(e) As can be seen from the illustration, the final dot shows the total weight to be 3500 pounds with the C.G. at 88.5. This is well within the envelope.
(f) There will be room for more fuel.

As fuel is burned off, the weight and C.G. will follow down the fuel line and stay within the envelope for landing.

SAMPLE PROBLEM

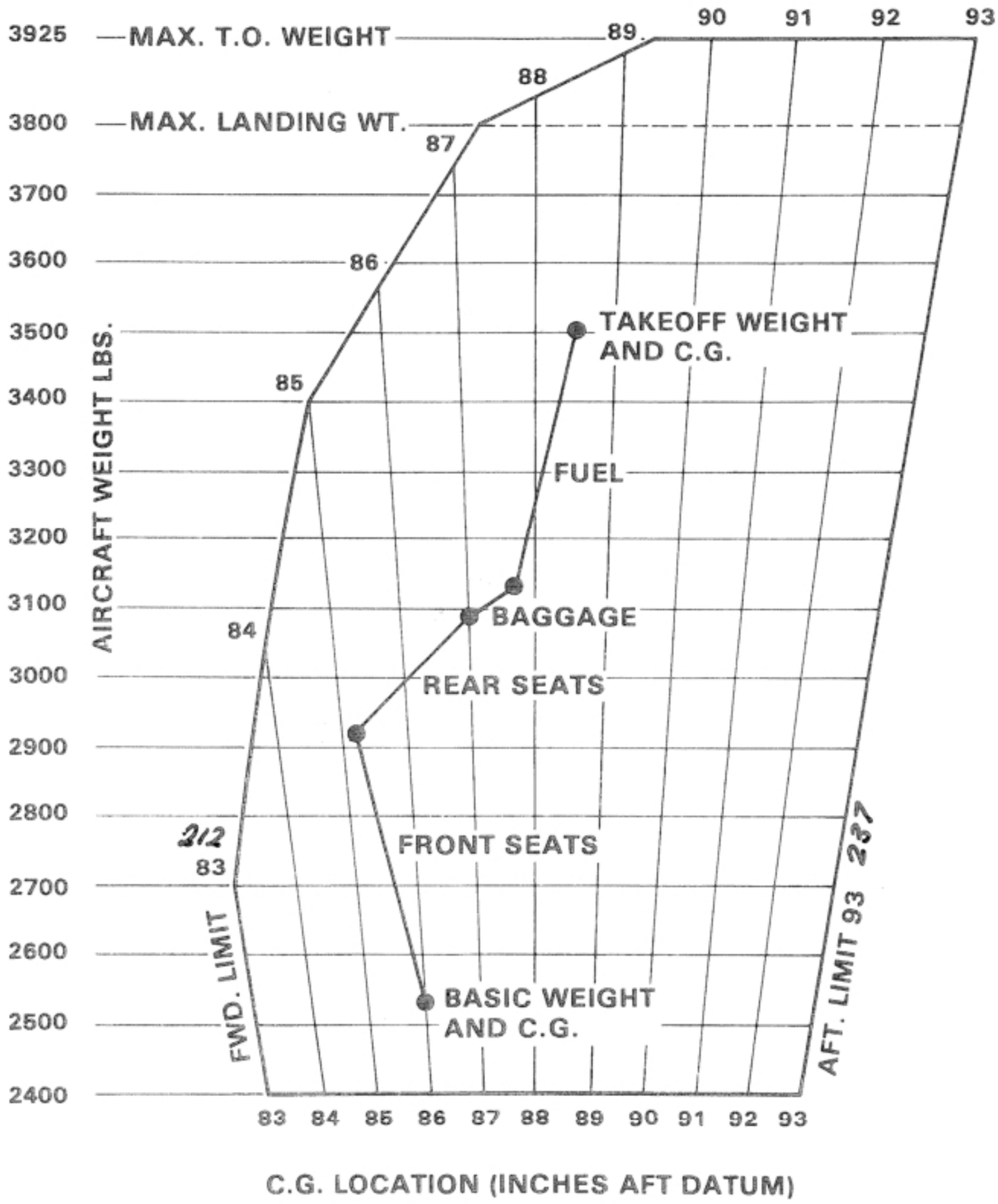


TABLE OF CONTENTS

SECTION 7

DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

SECTION 7

DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

7.1 THE AIRPLANE

The Turbo Seminole is a turbosupercharged twin-engine, all metal, retractable landing gear, airplane. It has seating for up to four occupants and has a two hundred pound luggage compartment.

7.3 AIRFRAME

With the exception of the steel engine mounts and landing gear, the fiberglass nose cone, cowling nose bowls and tips of wings, and the ABS thermoplastic extremities (tail fin, rudder and stabilator), the basic airframe is of aluminum alloy. Aerobatics are prohibited in this airplane since the structure is not designed for aerobatic loads.

The fuselage is a semi-monocoque structure with a passenger door on the forward right side, a cargo door on the aft right side with an emergency egress door on the forward left side.

The wing is of a semi-tapered design and employs a laminar flow NACA 65_2-415 airfoil section. The main spar is located at approximately 40% of the chord. The wings are attached to the fuselage by the insertion of the butt ends of the spar into a spar box carry-through, which is an integral part of the fuselage structure. The bolting of the spar ends into the spar box carry-through structure, which is located under the rear seats, provides in effect a continuous main spar. The wings are also attached fore and aft of the main spar by an auxiliary front spar and a rear spar. The rear spar, in addition to taking torque and drag loads, provides a mount for flaps and ailerons. The four-position wing flaps are mechanically controlled by a handle located between the front seats. When fully retracted, the right flap locks into place to provide a step for cabin entry. Each nacelle contains one fuel tank.

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

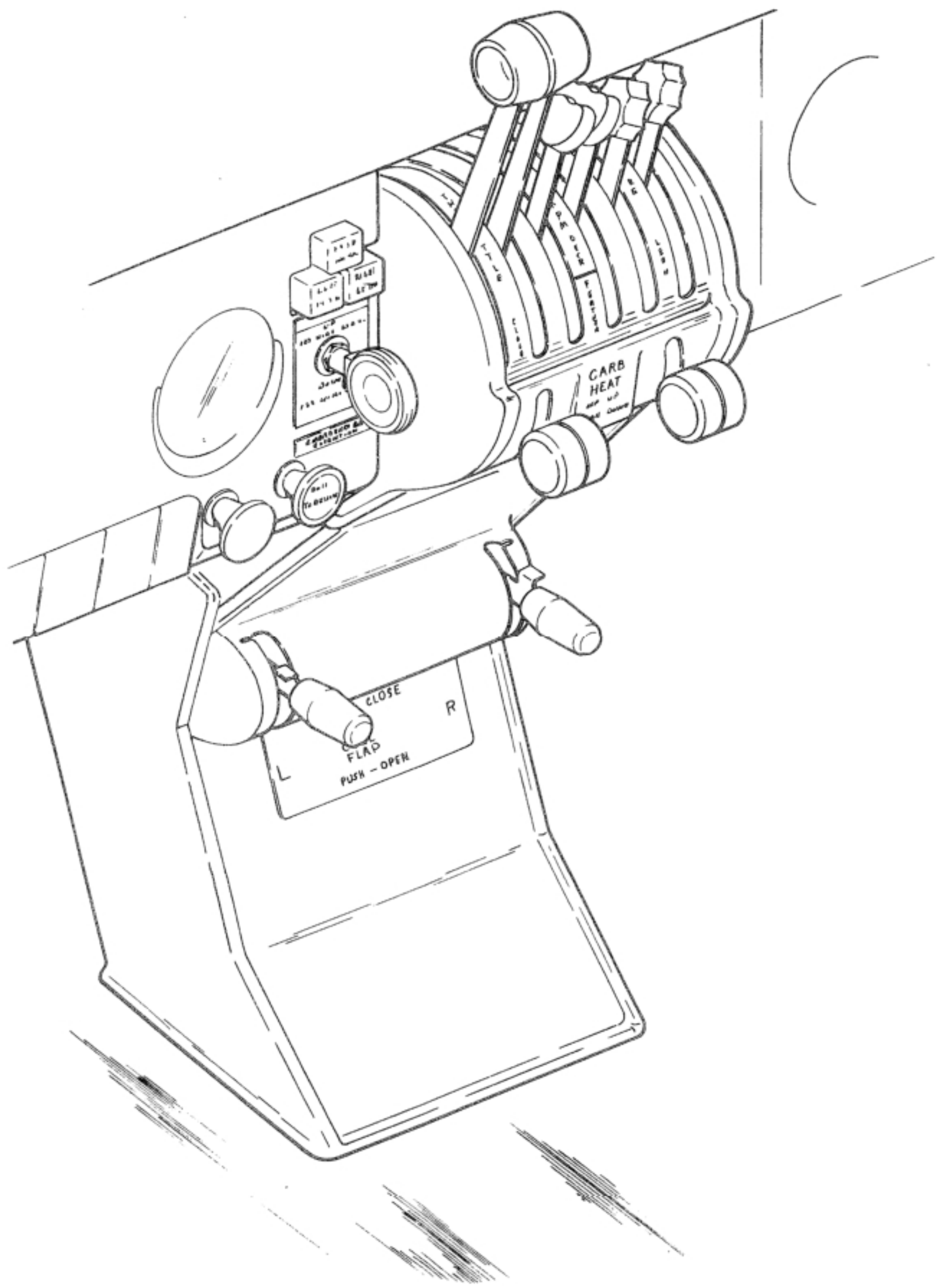
7.5 ENGINES

The aircraft is powered by two turbosupercharged Lycoming four-cylinder engines, each rated at 180 horsepower at 2575 RPM from sea level to 12000 ft. The engines are air cooled and are equipped with oil coolers with low temperature bypass systems and engine-mounted oil filters. A winterization plate is provided to restrict air during winter operation. (See Winterization in Section 8.) Asymmetric thrust during takeoff and climb is eliminated by the counter-rotation of the engines, the left engine rotating in a clockwise direction when viewed from the cockpit, and the right engine rotating counterclockwise.

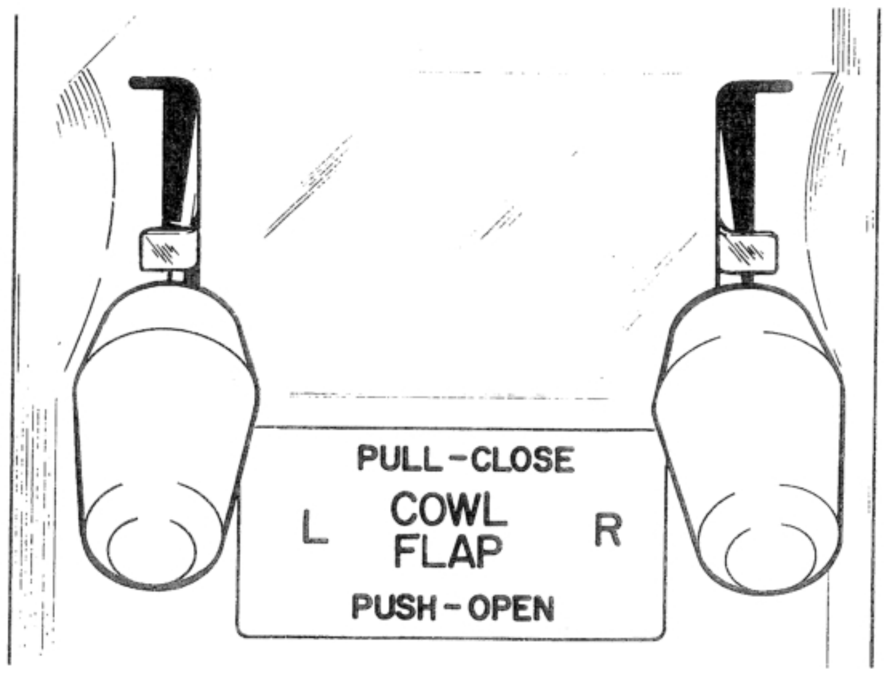
The engines are accessible through removable cowls. The upper cowl half is attached with quarter-turn fasteners and is removable. Engine mounts are constructed of steel tubing, and dynafocal engine mounts are provided to reduce vibration.

The induction air box incorporates a manually operated two-way valve which allows the carburetor to receive either induction air which passes through the air filter or heated air which bypasses the filter. Carburetor heat selection provides heated air to the carburetor in the event of carburetor icing, and also allows selection of an alternate source of air in the event the induction air source or the air filter becomes blocked with ice, snow, freezing rain, etc. Carburetor heat selection provides air which is unfiltered; therefore, it should not be used during ground operation when dust or other contaminants might enter the system. The primary (through the filter) induction source should always be used for takeoffs.

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



CONTROL PEDESTAL
Figure 7-1



COWL FLAP CONTROL
Figure 7-3

The throttle levers are used to adjust the manifold pressure to 36.5 in. HG Max. They incorporate a gear up warning horn switch which is activated during the last portion of travel of the throttle levers to the low power position. If the landing gear is not locked down, the horn will sound until the gear is down and locked or until the power setting is increased. This is a feature to warn the pilot of an inadvertent gear up landing.

The propeller control levers are used to adjust the propeller speed from high RPM to feather.

This aircraft is equipped with a dual electric tachometer which is inoperative with the master switch turned OFF.

The mixture control levers are used to adjust the air to fuel ratio. An engine is shut down by the placing of the mixture control lever in the full lean (idle cut-off) position.

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

The carburetor heat controls are located on the control quadrant just below the engine control levers. When a carburetor heat lever is in the up, or off, position the engine is operating on filtered air. When the lever is in the down, or on, position the engine is operating on unfiltered, heated air.

The cowl flap control levers (Figure 7-3), located below the control quadrant, are used to regulate cooling air for the engines. The levers have three positions; full open, full closed, and intermediate. A lock incorporated in each control lever locks the cowl flap in the selected position. To operate the cowl flaps, depress the lock and move the lever toward the desired setting. Release the lock after initial movement and continue movement of the lever. The control will stop and lock into place at the next setting. The lock must be depressed for each selection of a new cowl flap setting.

All throttle operation should be made with a smooth, not too rapid movement to prevent unnecessary engine wear or damage to the engines.

7.7 PROPELLERS

Counter-rotation of the propellers provides balanced thrust during takeoff and climb and eliminates the "critical engine" factor in single-engine flight.

Constant speed, controllable pitch and feathering Hartzell propellers are installed as standard equipment. The propellers mount directly to the engine crankshafts. Pitch is controlled by oil and nitrogen pressure. Oil pressure sends a propeller toward the high RPM or unfeather position; nitrogen pressure and a large spring send a propeller toward the low RPM or feather position and also prevent propeller overspeeding. Governors, one on each engine, supply engine oil at various pressures through the propeller shafts to maintain constant RPM settings. A governor controls engine speed by varying the pitch of the propeller to match load torque to engine torque in response to changing flight conditions. The recommended nitrogen pressure to be used when charging the unit is listed on placards on the propeller domes and inside the spinners. This pressure varies with ambient temperature at the time of charging. Although dry nitrogen gas is recommended, compressed air may be used provided it contains no moisture. For more detailed instructions, see "Propeller Service" in Section 8 of this Handbook.

Each propeller is controlled by the propeller control levers located in the center of the power control quadrant. Feathering of a propeller is accomplished by moving the control fully aft through the low RPM detent, into the FEATHER position. Feathering takes place in approximately six seconds. Unfeathering is accomplished by moving the propeller control forward and engaging the starter until the propeller is windmilling.

The optional propeller unfeathering system stores air and oil pressure in an accumulator to move the propeller out of the feathered position.

Unfeathering is accomplished by unlatching the mechanical latch on the prop control lever by pressing it forward while pushing the prop control full forward which releases the stored pressure from the accumulator to the propeller dome. Starter assist is required if the propeller is not windmilling freely within 5 - 7 seconds after the prop control has been moved forward.

A feathering lock, operated by centrifugal force, prevents feathering during engine shut down by making it impossible to feather any time the engine speed falls below 950 RPM. For this reason, when airborne, and the pilot wishes to feather a propeller to save an engine, he must be sure to move the propeller control into the FEATHER position before the engine speed drops below 950 RPM.

7.9 LANDING GEAR

The aircraft is equipped with hydraulically operated, fully retractable, tricycle landing gear.

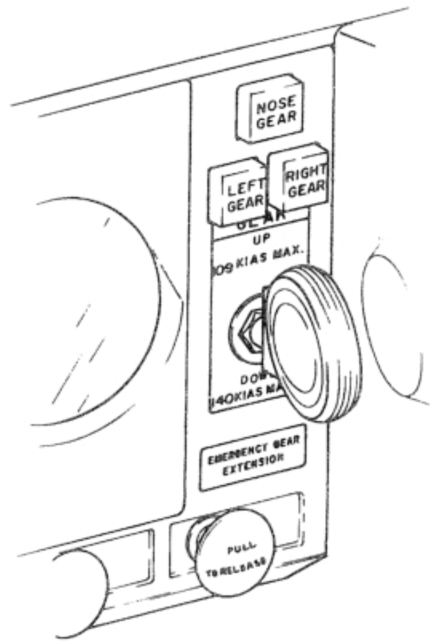
Hydraulic pressure for gear operation is furnished by an electrically powered, reversible hydraulic pump (refer to Figures 7-7 and 7-9). The pump is activated by a two-position gear selector switch located to the left of the control quadrant on the instrument panel (Figure 7-5). The gear selector switch, which has a wheel-shaped knob, must be pulled out before it is moved to the UP or DOWN position. When hydraulic pressure is exerted in one direction, the gear is retracted; when it is exerted in the other direction, the gear is extended. Gear extension or retraction normally takes six to seven seconds.

CAUTION

If the landing gear is in transit, and the hydraulic pump is running, it is NOT advisable to move the gear selector switch to the opposite position before the gear has reached its full travel limit, because a sudden reversal may damage the electric pump.

The landing gear is designed to extend even in the event of hydraulic failure. Since the gear is held in the retracted position by hydraulic pressure, should the hydraulic system fail for any reason, gravity will allow the gear to extend. When the landing gear is retracted, the main wheels retract inboard into the wings and the nose wheel retracts aft into the nose section. Springs assist in gear extension and in locking the gear in the down position. After the gears are down and the downlock hooks engage, springs maintain force on each hook to keep it locked until it is released by hydraulic pressure.

To extend and lock the gears in the event of hydraulic failure, it is necessary only to relieve the hydraulic pressure. An emergency gear extension knob, located directly beneath the gear selector switch is provided for this purpose. Pulling this knob releases the hydraulic pressure holding the gear in the up position and allows the gear to fall free. Before pulling the emergency gear extension knob, place the landing gear selector switch in the DOWN position to prevent the pump from trying to raise the gear. If the emergency gear knob has been pulled out to lower the gear by gravity, due to a gear system malfunction, leave the control in its extended position until the airplane has been put on jacks to check the proper function of the landing gear hydraulic and electrical systems. See the Service Manual for proper landing gear system check out procedures. If the airplane is being used for training purposes or a pilot check out mission, and the emergency gear extension knob has been pulled out, it may be pushed in again when desired if there has not been any apparent malfunction of the landing gear system.



LANDING GEAR SELECTOR
Figure 7-5

When the gear is fully extended or fully retracted and the gear selector is in the corresponding position, electrical limit switches stop the flow of current to the motor of the hydraulic pump. The three green lights directly above the landing gear selector switch illuminate to indicate that each of the three landing gears is down and locked. A convex mirror on the left engine nacelle both serves as a taxiing aid and allows the pilot to visually confirm the condition of the nose gear. If the gear is in neither the full up nor the full down position, a red warning light on the instrument panel illuminates. Should the throttle be placed in a low setting - as for a landing approach- while the gear is retracted, a warning horn sounds to alert the pilot that the gear is retracted. The gear warning horn emits a 90 cycles per minute beeping sound.

The green gear lights are dimmed automatically when the navigation lights are turned on. For this reason, if the navigation lights are turned on in the daytime, it is difficult to see the landing gear lights. If the green lights are not observed after the landing gear selector switch is placed in the DOWN position, the first thing to check is the position of the navigation lights switch.

If one or two of the three green lights do not illuminate when the gear DOWN position has been selected, any of the following conditions could exist for each light that is out:

(a) The gear is not locked down.
(b) A bulb is burned out.
(c) There is a malfunction in the indicating system.

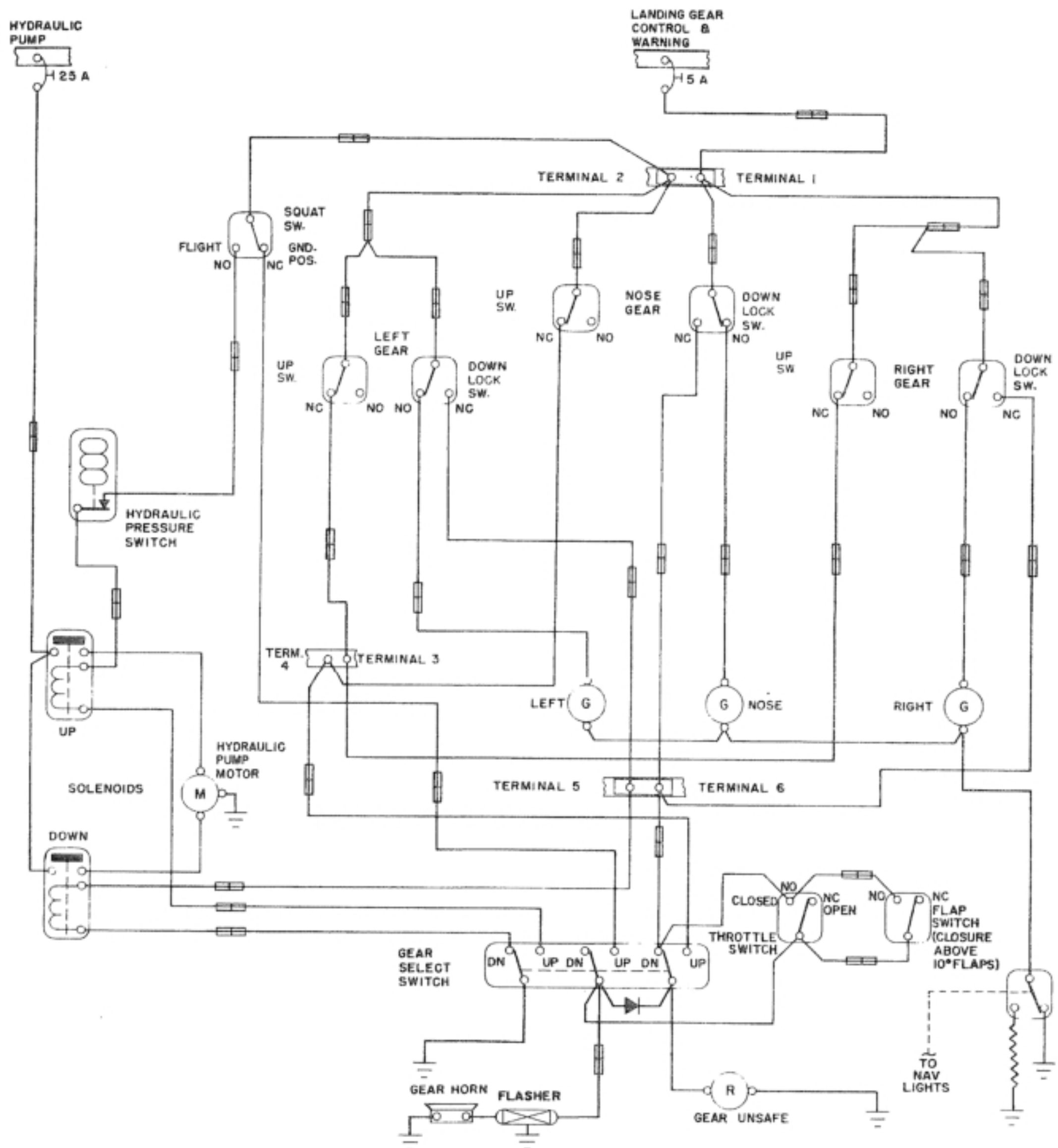
In order to check the bulbs, the square indicator lights can be pulled out and interchanged.

A micro switch incorporated in the throttle quadrant activates the gear warning horn under the following conditions:

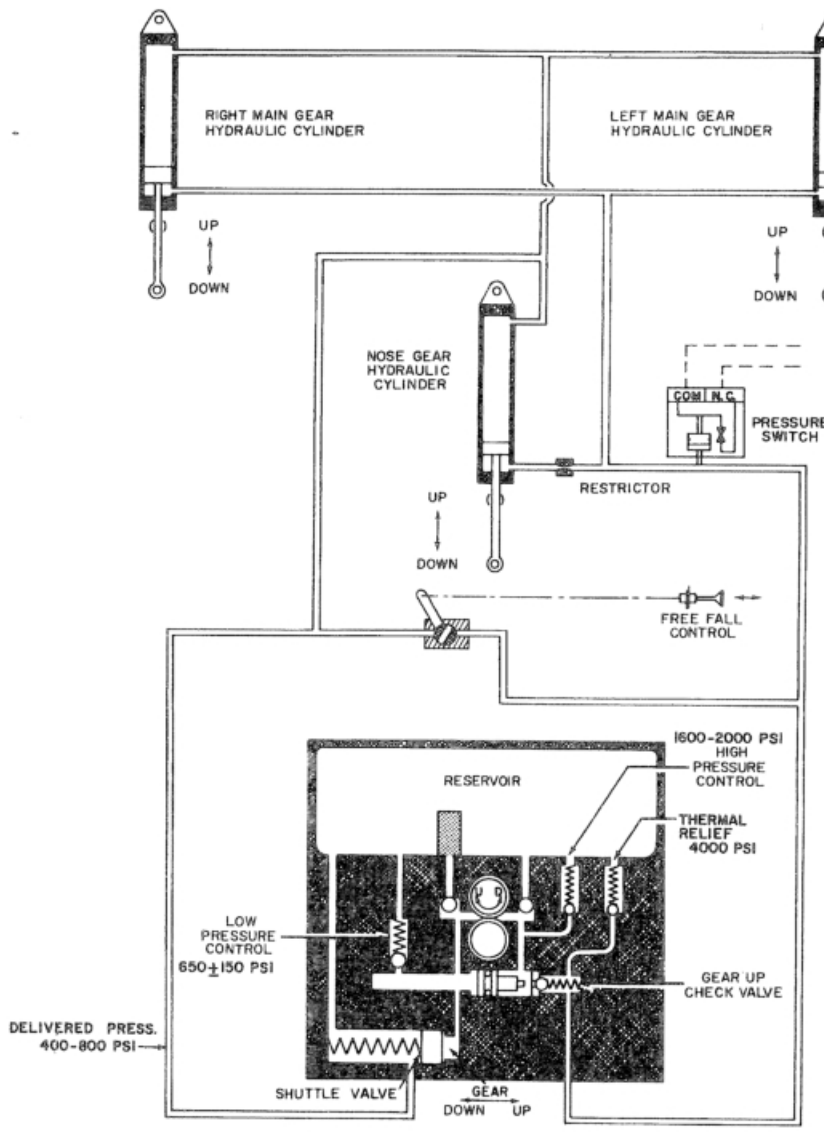
(a) The gear is not locked down and the manifold pressure has fallen below 14 inches on either one or both engines.
(b) The gear selector switch is in the UP position when the airplane is on the ground.
(c) The gear selector switch is in the UP position and landing flaps are extended.

To prevent inadvertent gear retraction should the gear selector be placed in the UP position when the airplane is on the ground, a squat switch located on the left main gear will prevent the hydraulic pump from actuating if the master switch is turned on. On takeoff, when the landing gear oleo strut drops to its full extension, the safety switch closes to complete the circuit which allows the hydraulic pump to be activated to raise the landing gear when the gear selector is moved to the UP position. During the preflight check, be sure the landing gear selector is in the DOWN position and that the three green gear indicator lights are illuminated. On takeoff, the gear should be retracted before an airspeed of 109 KIAS is exceeded. The landing gear may be lowered at any speed up to 140 KIAS.

The hydraulic reservoir for landing gear operation is an integral part of the gear hydraulic pump. Access to the combination pump and reservoir is through a panel in the baggage compartment. For filling instructions, see the Service Manual.



LANDING GEAR ELECTRICAL SYSTEM SCHEMATIC
Figure 7-7



LANDING GEAR HYDRAULIC SYSTEM SCHEMATIC
Figure 7-9

The nose gear is steerable through a 30 degree arc either side of center by use of a combination of full rudder pedal travel and brakes. A gear centering spring, incorporated in the nose gear steering system, prevents shimmy tendencies. A bungee assembly reduces ground steering effort and dampens shocks and bumps during taxiing. When the gear is retracted, the nose wheel centers as it enters the wheel well, and the steering linkage disengages to reduce pedal loads in flight.

The main landing gear carry 6.00 x 6, 8-ply tires. The nose wheel has a 5.00 x 5, 6-ply tire. For information on servicing the tires, see "Tire Inflation" in Section 8 of this Handbook.

Struts for the landing gear are air-oil assemblies. Strut exposure should be checked during each preflight inspection. If a need for service or adjustment is indicated, refer to the instructions printed on the units. Should more detailed landing gear service information be required, refer to the Service Manual.

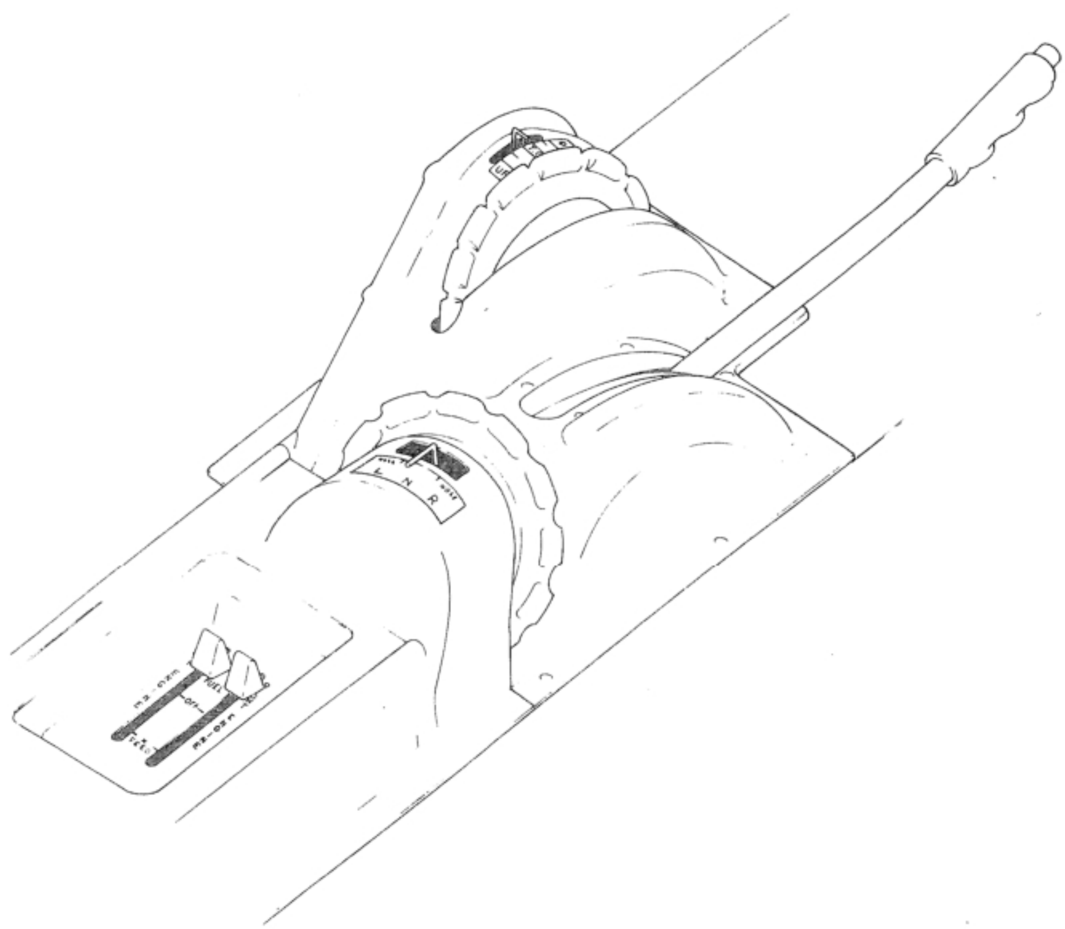
7.11 BRAKE SYSTEM

The brake system is designed to meet all normal braking needs. Two single-disc, double puck brake assemblies, one on each main gear, are actuated by toe brake pedals mounted on both the pilot's and copilot's rudder pedals. A brake system hydraulic reservoir, independent of the landing gear hydraulic reservoir, is located in the rear top of the nose compartment. Brake fluid should be maintained at the level marked on the reservoir. For further information see "Brake Service" in Section 8 of this Handbook.

The parking brake is engaged by depressing the toe brake pedals and pulling out the parking brake knob located on the lower instrument panel adjacent to the throttle quadrant. The parking brake is released by depressing the toe brake pedals and pushing in the parking brake knob.

7.13 FLIGHT CONTROL SYSTEM

Dual flight controls are installed as standard equipment. The controls actuate the control surfaces through a cable system. The horizontal tail surface (stabilator) is of the all movable slab type with an anti-servo tab mounted on the trailing edge. This tab, actuated by a control mounted on the console between the front seats, also acts as a longitudinal trim tab (refer to Figure 7-11).



CONSOLE
Figure 7-11

The vertical tail is fitted with a rudder which incorporates a combination rudder trim and anti-servo tab. The rudder trim control is located on the control console between the front seats.

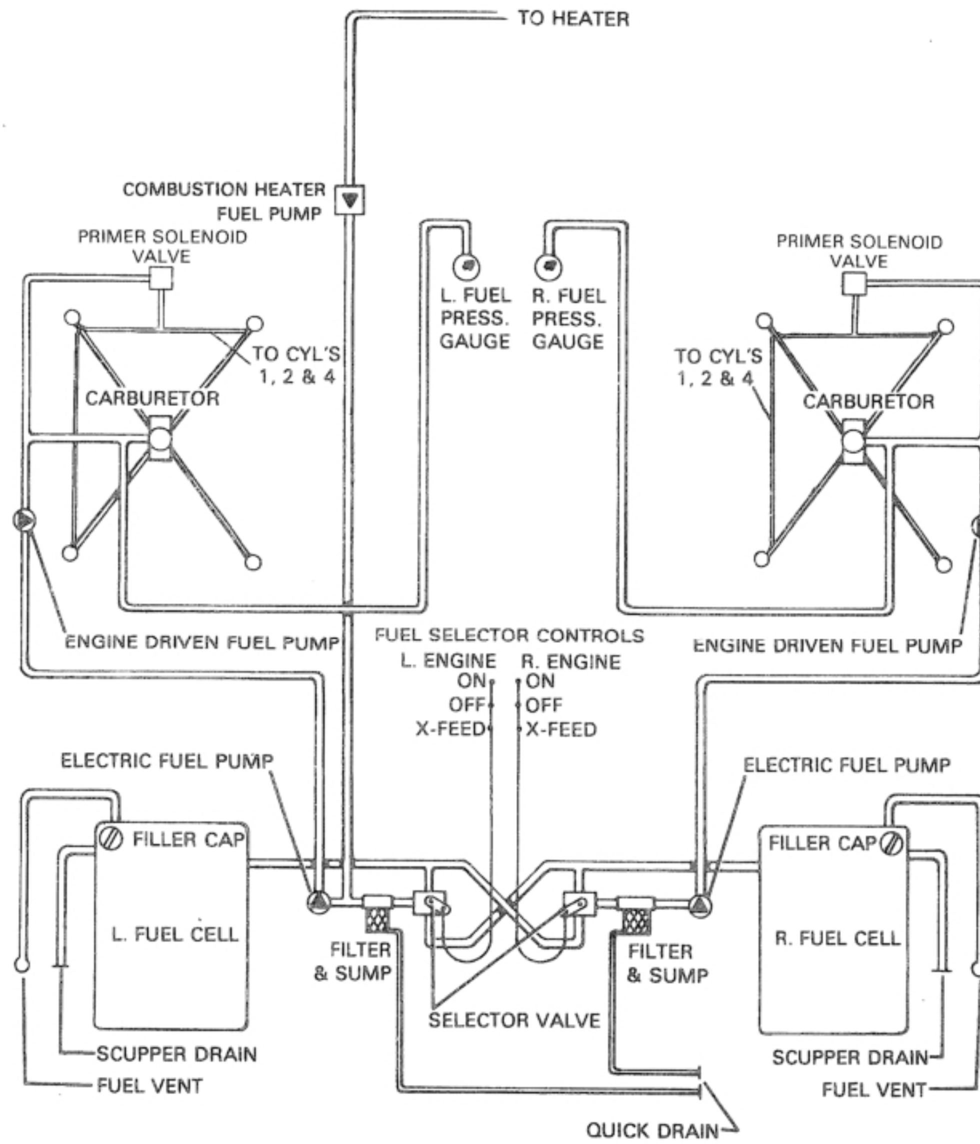
The flaps are manually operated and spring loaded to return to the retracted position. A four-position flap control lever (Figure 7-11) between the front seats adjusts the flaps for reduced landing speeds and glide path control. The flaps have three extended positions - 10, 25 and 40 degrees - as well as the fully retracted position. A button on the end of the lever must be depressed before the control can be moved. A past center lock incorporated in the actuating linkage holds the flap when it is in the retracted position so that it may be used as a step on the right side. Since the flap will not support a step load except in the fully retracted position, the flaps should be retracted when people are entering or leaving the airplane.

7.15 FUEL SYSTEM

Fuel is stored in two 55 gallon fuel tanks, one in each nacelle (Figure 7-13). One gallon of fuel in each nacelle is unusable, giving a total of 108 usable gallons. The minimum fuel grade is 100 or 100LL Aviation Grade. The fuel tank vents, one installed under each wing, feature an anti-icing design to prevent ice formation from blocking the fuel tank vent lines.

Normally, fuel is supplied to the engines through engine-driven fuel pumps. Auxiliary electric fuel pumps serve as a back-up feature. The electric fuel pumps are controlled by rocker switches on the switch panel to the left of the pilot. The electric fuel pumps should be ON during takeoffs and landings. The electric fuel pumps must be on to operate the electric primers. The electric fuel pumps may be used for vapor suppression above 10,000 feet should it be necessary as evidenced by unstable engine operation or fluctuating fuel pressure indications at high altitude.

Fuel quantities and pressures are indicated on gauges on the instrument panel. There is a separate fuel quantity gauge for each tank. A calibrated fuel dipstick is provided with the airplane. To visually check the quantity of fuel in a tank, insert the dipstick to the bottom of the tank, close off the protruding end with a finger, withdraw the dipstick, and read the fuel level. The most accurate reading will be obtained with the airplane on level ground. An optional locking fuel cap is available for each fuel filler. A common key will fit the cabin door and baggage door locks, these fuel caps and the ignition switch.



FUEL SYSTEM SCHEMATIC
Figure 7-13

Fuel management controls are located on the console between the front seats (Figure 7-11). There is a control lever for each of the engines, and each is placarded "ON" - "OFF" "X FEED." During normal operation, the levers are in the ON position, and each engine draws fuel from the tanks on the same side as the engine. When the X FEED position is selected, the engine will draw fuel from the tank on the opposite side in order to extend range and keep fuel weight balanced during single-engine operation. The OFF position shuts off the fuel flow to that engine.

NOTE

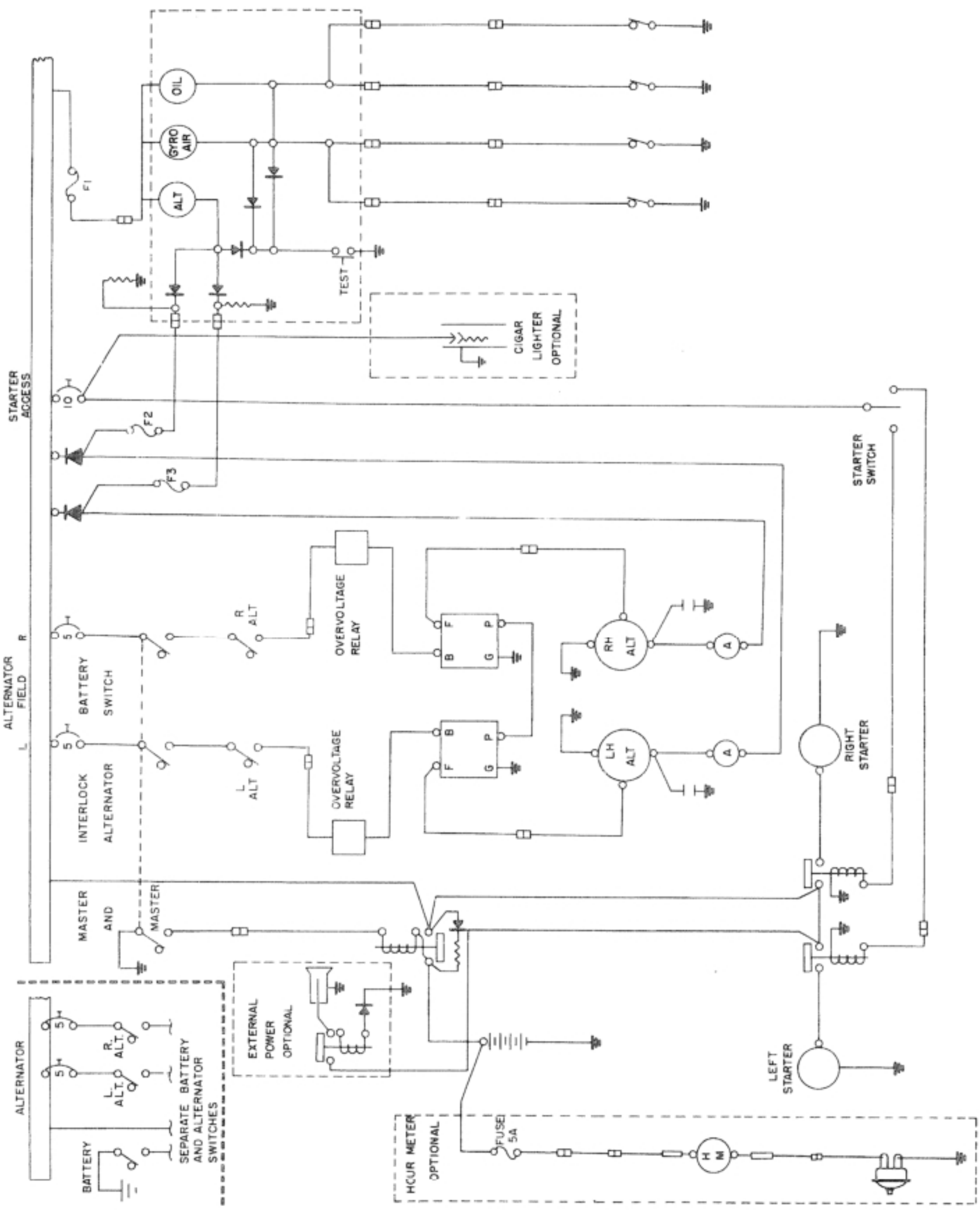
When one engine is inoperative and the fuel selector for the operating engine is on X FEED the selector for the inoperative engine must be in the OFF position. Do not operate with both selectors on X FEED. Do not take off or land with a selector on X FEED.

Before each flight, fuel must be drained from the low points in the fuel system to ensure that any accumulation of moisture or sediment is removed from the system. A fuel drain is provided for each half of the fuel system. The fuel drains are located on the right side of the fuselage just forward of the entrance step. (Refer to fuel draining procedure in paragraph 8.21, Fuel System.)

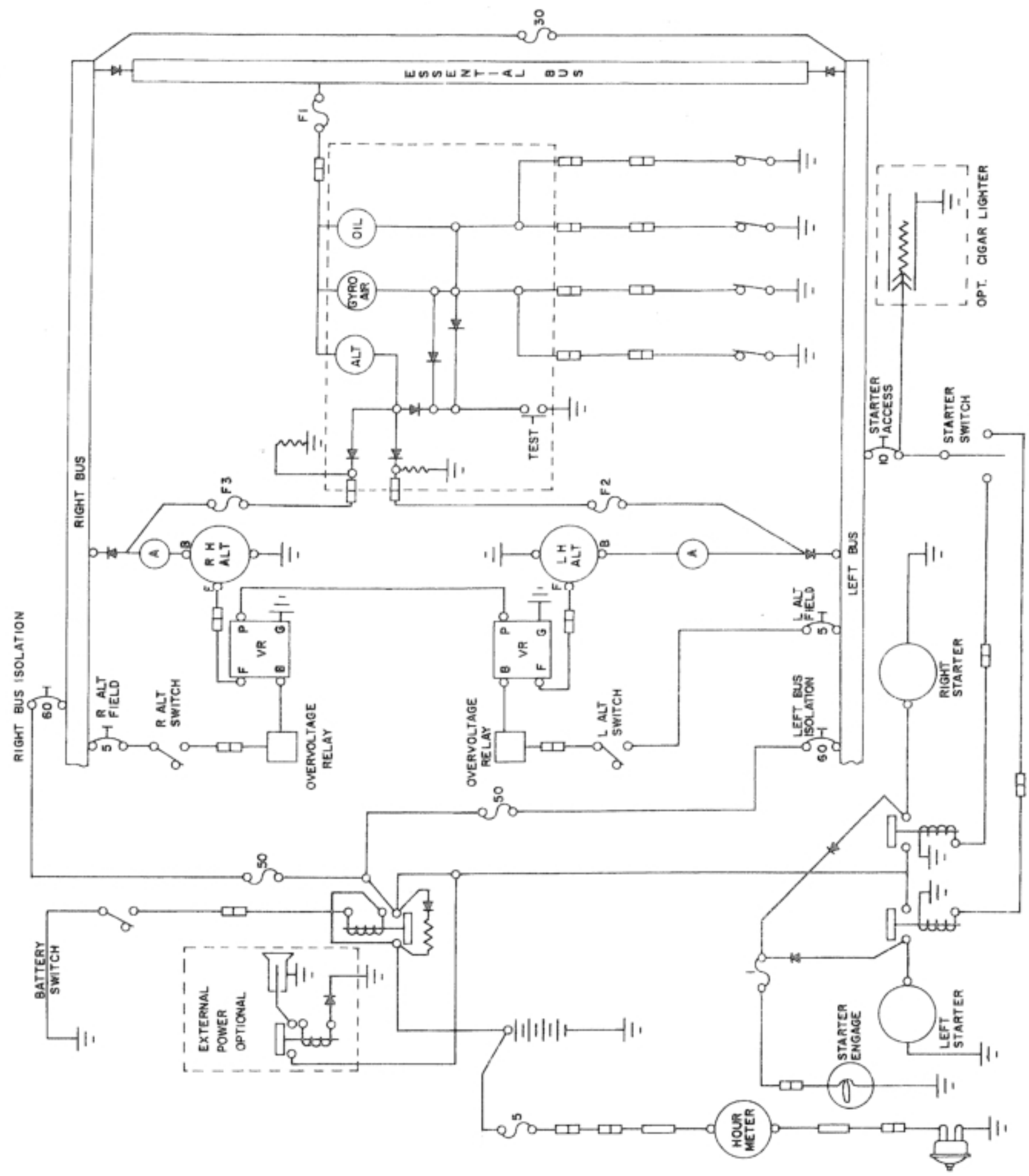
7.17 ELECTRICAL SYSTEM

The electrical system is capable of supplying sufficient current for complete night IFR equipment. Electrical power is supplied by two 60 ampere alternators (Figure 7-15), one mounted on each engine. A 35 ampere-hour, 12 volt battery provides current for starting, for use of electrical equipment when the engines are not running, and for a source of stored electrical power to back up the alternator output. The battery, which is located in the nose section is normally kept charged by the alternators. If it becomes necessary to charge the battery, it should be removed from the airplane.

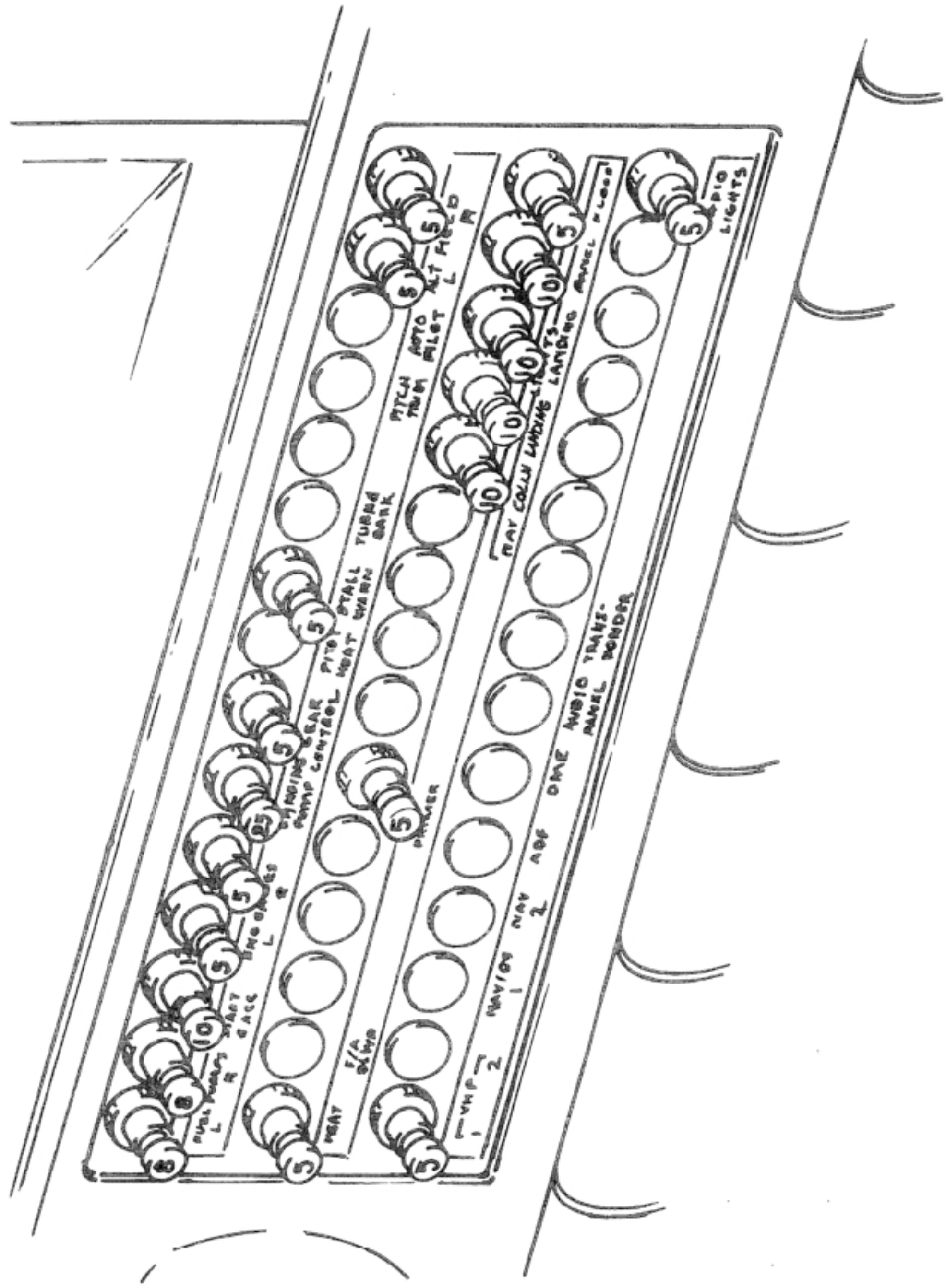
Two solid state voltage regulators maintain effective load sharing while regulating electrical system bus voltage to 14 volts. An overvoltage relay in each alternator circuit prevents damage to electrical and avionics equipment by taking an alternator off the line if its output exceeds 17 volts. If this should occur, the alternator light on the annunciator panel will illuminate. Voltage regulators and overvoltage relays are located in the nose section.



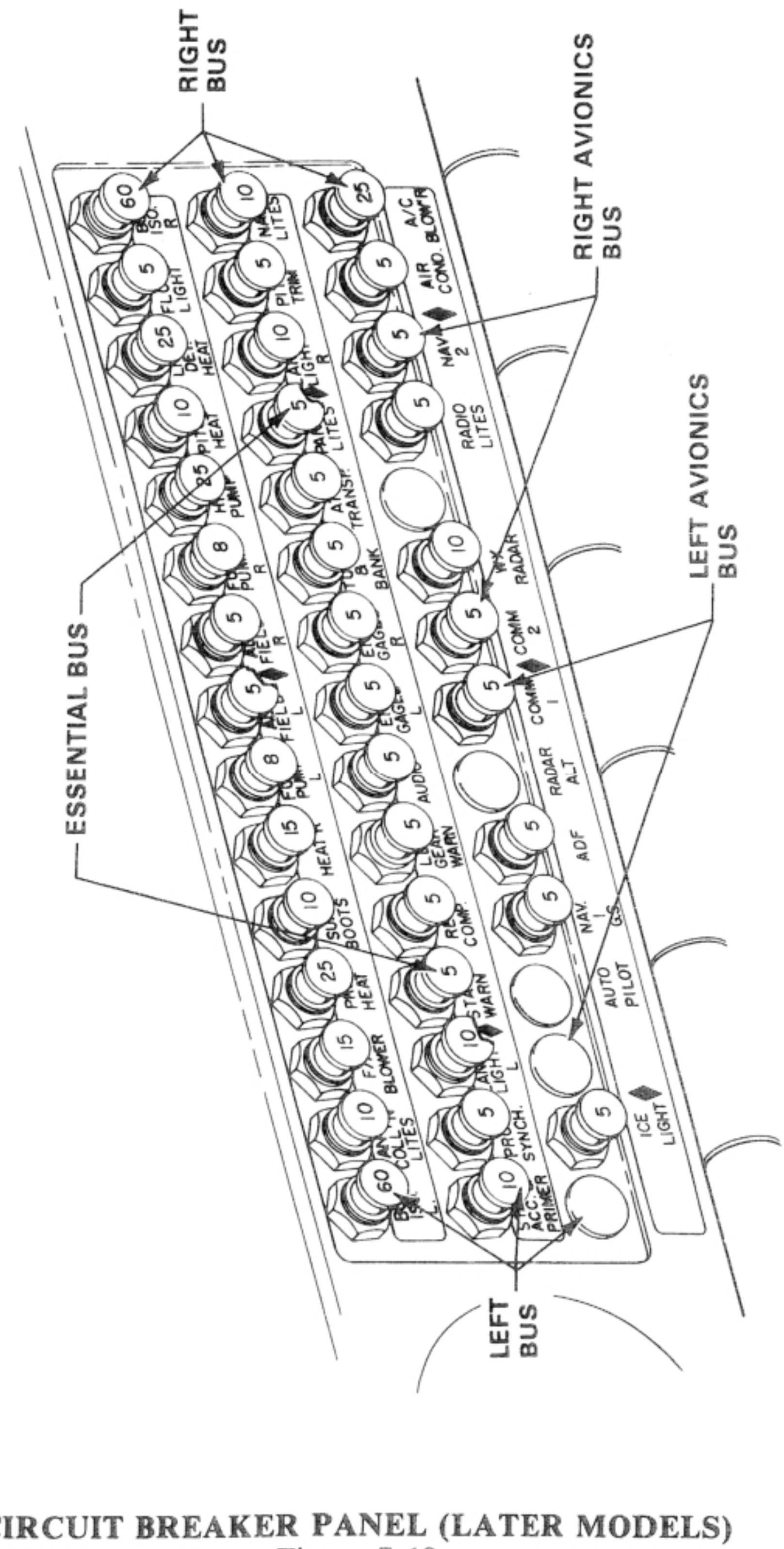
ALTERNATOR AND STARTER SCHEMATIC (EARLY MODELS)
Figure 7-15



ALTERNATOR AND STARTER SCHEMATIC (LATER MODELS)
Figure 7-16



CIRCUIT BREAKER PANEL (EARLY MODELS)
Figure 7-17



CIRCUIT BREAKER PANEL (LATER MODELS)
Figure 7-18

The electrical system and equipment are protected by circuit breakers located on a circuit breaker panel on the lower right side of the instrument panel (Figure 7-17). The circuit breaker panel is provided with enough blank spaces to accommodate additional circuit breakers if extra electrical equipment is installed. In the event of equipment malfunctions or a sudden surge of current, a circuit breaker can trip automatically. The pilot can reset the breaker by pressing it in (preferably after a few minutes cooling period). The circuit breakers can be pulled out manually.

Later airplanes incorporate a split bus electrical system consisting of three electrical buses (left bus, right bus and essential bus), and two avionics buses (left and right avionics). Power to the left and right bus is supplied by a 60 amp alternator, one on each engine. Battery power is provided through two 50 amp current limiters and two 60 amp BUS ISO circuit breakers to each bus. The essential bus is supplied with electrical power from both left and right bus through blocking diodes. A 30 amp fuse connecting the left and right buses provides load equalizing between the two alternators up to 30 amps. The left bus supplies electrical power to the left avionics bus through a relay controlled by the left avionics master switch. The right bus supplies electrical power to the right avionics bus in a similar fashion (Figure 7-16).

In the event a bus has a ground fault, the circuits powered by that bus will be inoperative and the ammeter will indicate zero. For abnormal and or emergency operations and procedures, refer to Section 3, Emergency Procedures.

Circuit breakers located on the left bus are those in the top row of breakers to the left of the diamond (◆), the three breakers to the left of the left diamond in the center row of breakers, and two breakers to the left of the left diamond in the bottom row of breakers. Those on the right bus are located in the same way, to the right of the diamonds (◆). The essential bus circuit breakers are located between the left and right diamonds (◆) in the center row. The left avionics bus breakers are located between the left and center diamond in the bottom row and the right avionics bus breakers are located between the center and right diamonds (◆) Figure 7-18).

Most of the electrical switches, including the master switch and switches for magnetos, fuel pumps, starters, alternators, lights and pitot heat, are conveniently located on the switch panel (Figure 7-19) to the left of the pilot.

Later airplanes incorporate a STARTER ON annunciator light, which illuminates when either starter switch is selected (Figure 7-20). For abnormal and or emergency operation and procedures, refer to Section 3, Emergency Procedures.

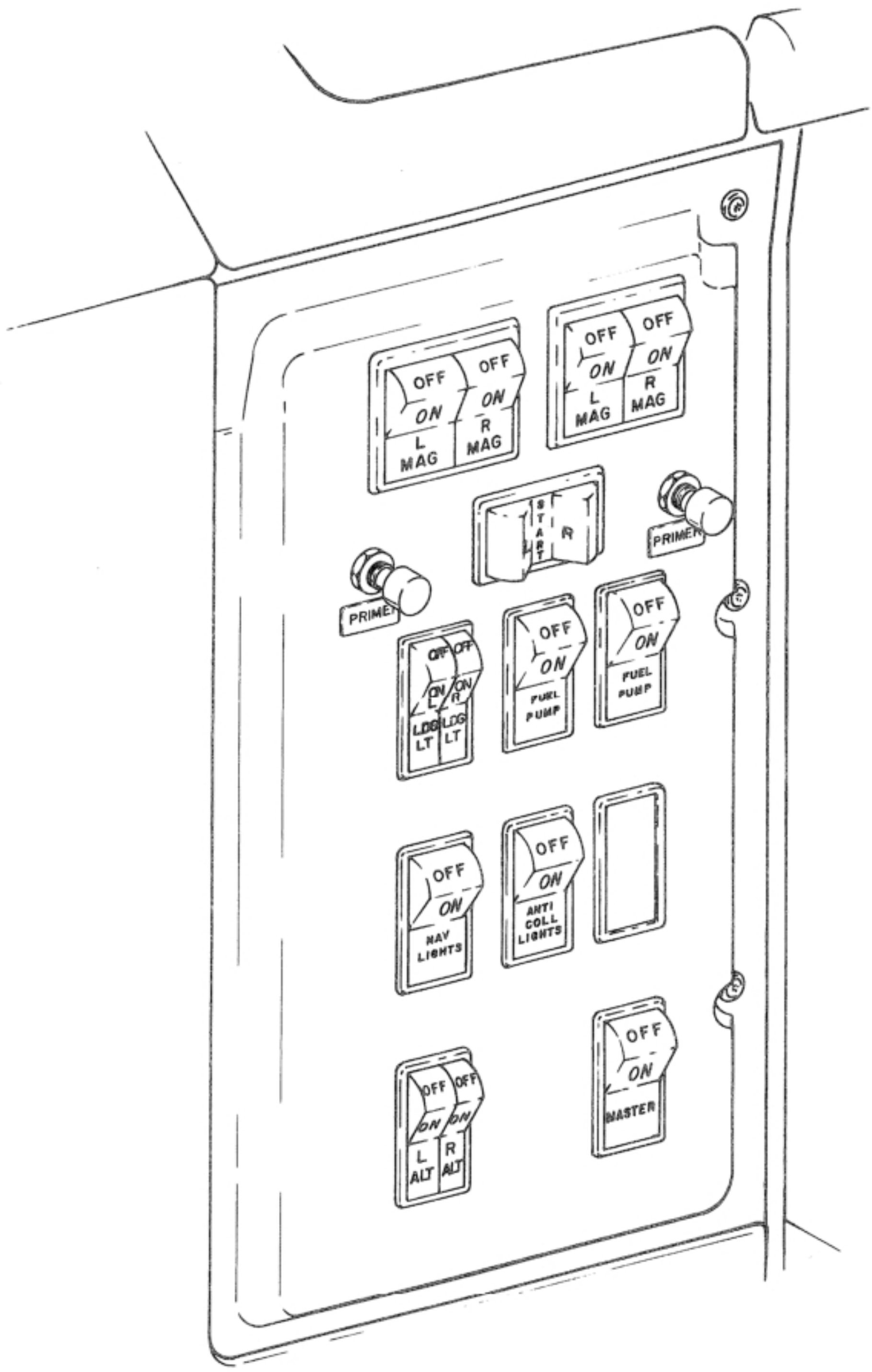
Optional electrical accessories includes navigation, anti-collision, landing, instrument and cabin dome lighting.

An optional light, mounted in the overhead panel, provides instrument and cockpit lighting for night flying. The light is controlled by a rheostat switch located adjacent to the light. A map light window in the lens is actuated by an adjacent switch.

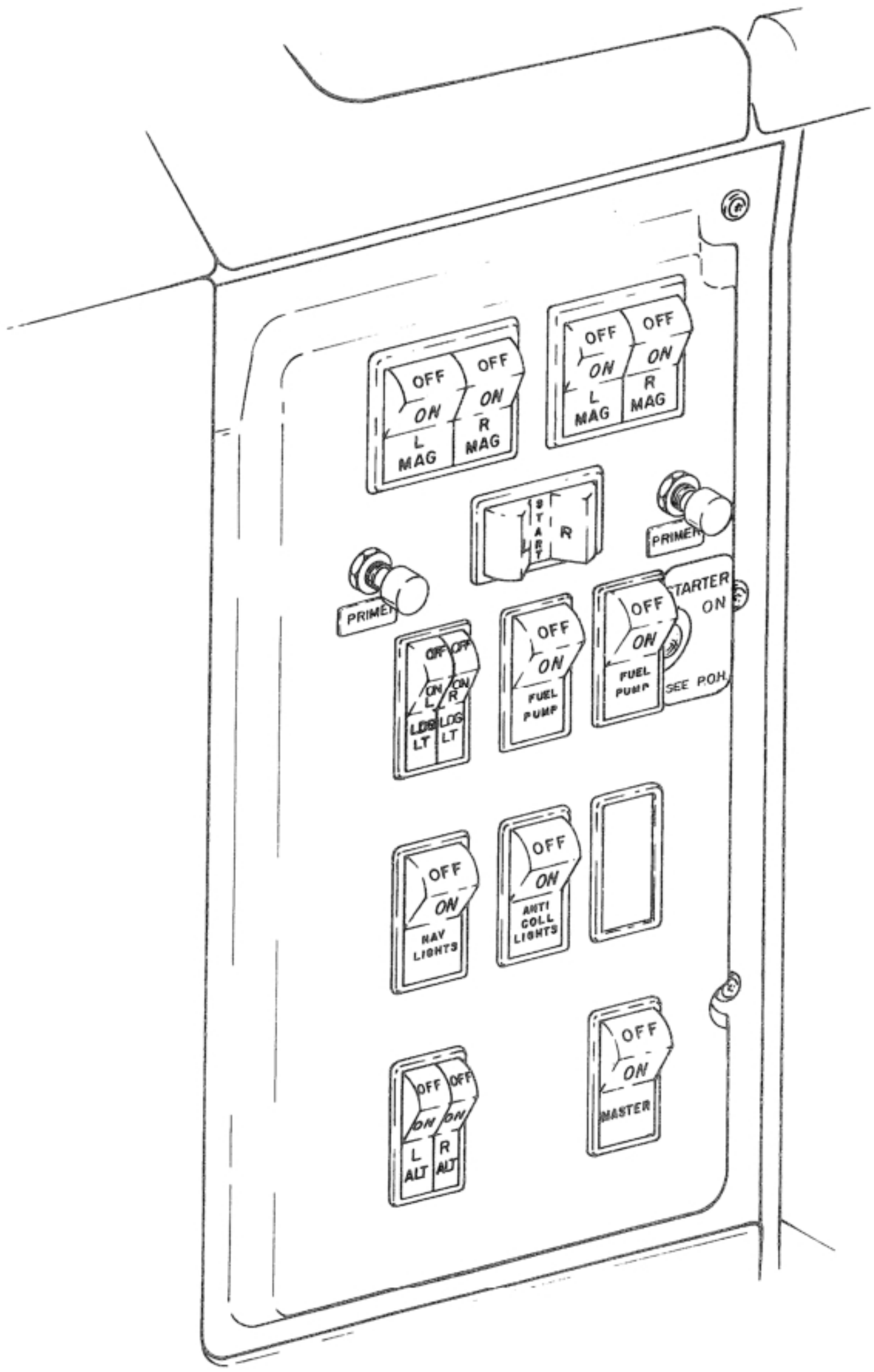
WARNING

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

Approximately 2000 RPM or more is required to obtain full alternator output of 60 amperes. It is normal to have zero output at idle RPM. This is due to the reduced drive ratio from the engine. Dual ammeters and the ALT annunciator light provide a means of monitoring the electrical system operation. The two ammeters (load meters) indicate the output of the alternators. Should an ammeter indicate a load much higher than the known consumption of the electrical equipment in use, it should be suspected of a malfunction and turned off. In this event, the remaining alternator's ammeter should show a normal indication after approximately one minute. If both ammeters indicate a load much higher than the known consumption for more than approximately five minutes, an electrical defect other than the alternator system should be suspected because a discharged battery will reduce the alternator load as it approaches the charged conditions. A zero ammeter reading indicates an alternator is not producing current and should be accompanied by illumination of the ALT annunciator light. A single alternator is capable of supporting a continued flight in case of alternator or engine failure in most conditions; however, with deicing equipment and other high loads, care must be exercised to prevent the loads from exceeding the 60 ampere rating and subsequent depleting of the battery. For abnormal and or emergency operations and procedures, refer to Section 3, Emergency Procedures.



SWITCH PANEL (EARLY MODELS)
Figure 7-19



SWITCH PANEL (LATER MODELS)
Figure 7-20

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

CAUTION

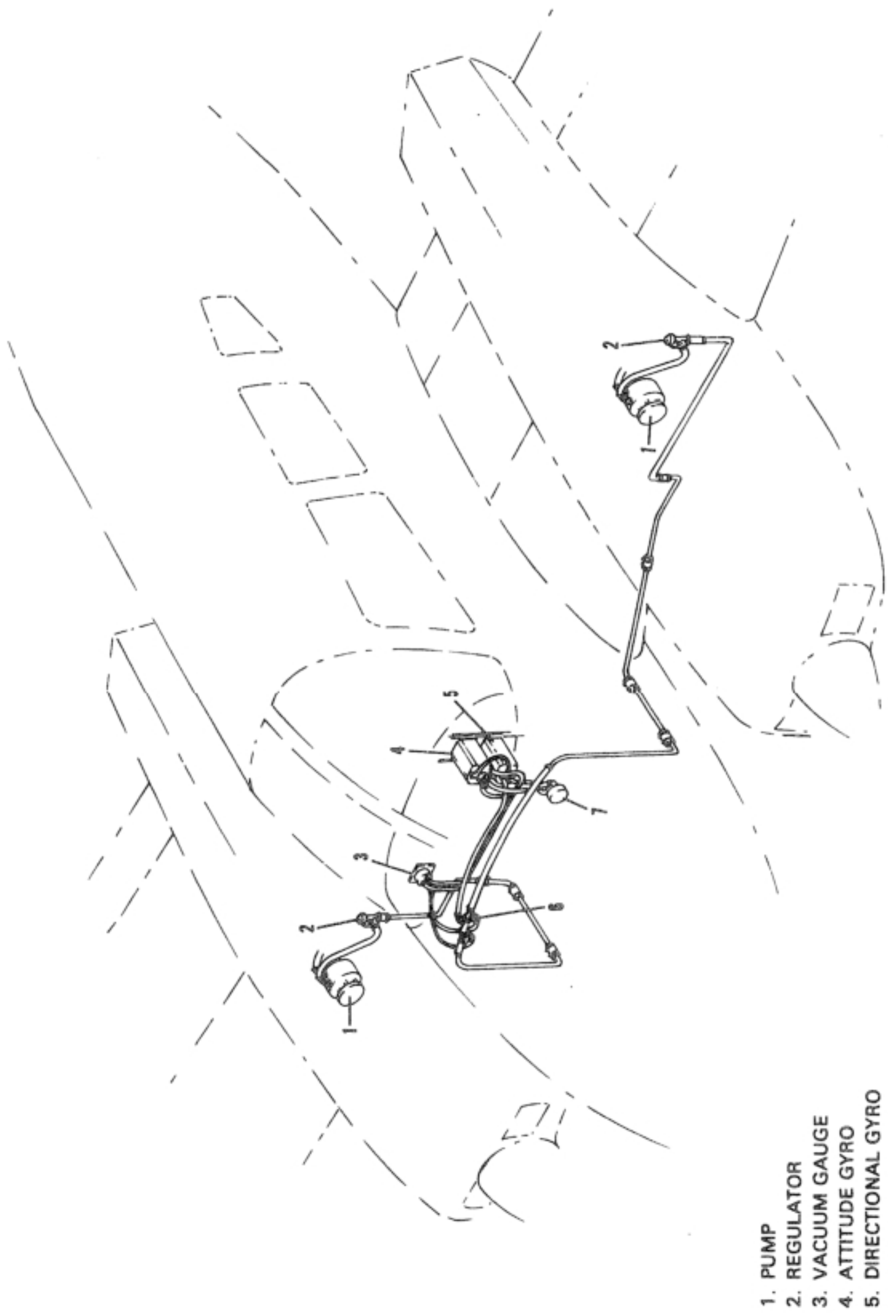
Do not use cigar lighter receptacles as power sources for any devices other than the cigar lighters supplied with the airplane. Any other device plugged into these receptacles may be damaged.

7.19 VACUUM SYSTEM

The vacuum system operates the air-driven gyro instruments. The vacuum system (Figure 7-21) consists of a vacuum pump on each engine, plus plumbing and regulating equipment.

The vacuum pumps are dry-type pumps, which eliminates the need for an air/oil separator and its plumbing. A shear drive protects the engine from damage. If the drive shears, the gyros will become inoperative.

The vacuum gauge, mounted on the right instrument panel to the right of the radios (refer to Figure 7-25), provides valuable information to the pilot about the operation of the vacuum system. A decrease in pressure in a system that has remained constant over an extended period, may indicate a dirty filter, dirty screens, possibly a sticking vacuum regulator or leak in the system (a low vacuum indicator light is provided in the annunciator panel). Zero pressure would indicate a sheared pump drive, defective pump, possibly a defective gauge or collapsed line. In the event of any gauge variation from the norm, the pilot should have a mechanic check the system to prevent possible damage to the system components or eventual failure of the system.



VACUUM SYSTEM
Figure 7-21

A vacuum regulator is provided in the system to protect the gyros. The valve is set so the normal vacuum reads 4.8 to 5.1 inches of mercury, a setting which provides sufficient vacuum to operate all the gyros at their rated RPM. Higher settings will damage the gyros and with a low setting the gyros will be unreliable. The regulator is located behind the instrument panel.

7.21 PITOT STATIC SYSTEM

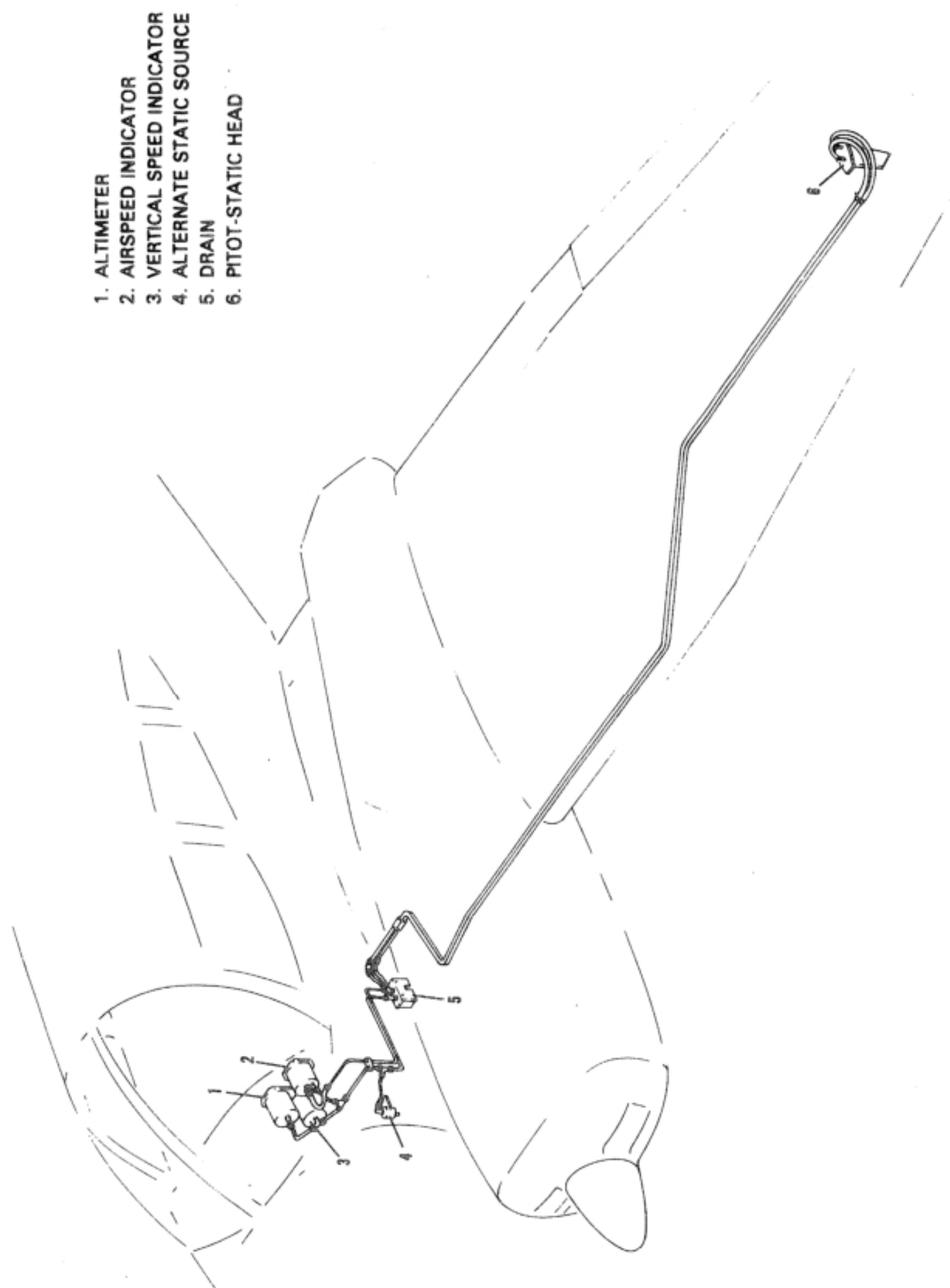
The pitot static system (Figure 7-23) supplies both pitot and static pressure for the airspeed indicator and static pressure for the altimeter and vertical speed indicator (when installed). Pitot and static pressure are picked up by the pitot head on the bottom of the left wing.

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

To prevent bugs and water from entering the pitot and static pressure holes when the airplane is parked, a cover should be placed over the pitot head. A partially or completely blocked pitot head will give erratic or zero readings on the instruments.

NOTE

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



PITOT STATIC SYSTEM
Figure 7-23

An optional heated pitot head installation, which alleviates problems with icing or heavy rains, is available. The switch for pitot heat is located on the switch panel to the pilot's left. The pitot heat system has a separate circuit breaker located in the circuit breaker panel and labeled "Pitot Heat." The operational status of the pitot heat system should be included in the preflight check.

CAUTION

Care should be exercised when checking the operation of the heated pitot head. The unit becomes very hot. Ground operation of pitot heat should be limited to 3 minutes maximum to avoid damaging the heating units.

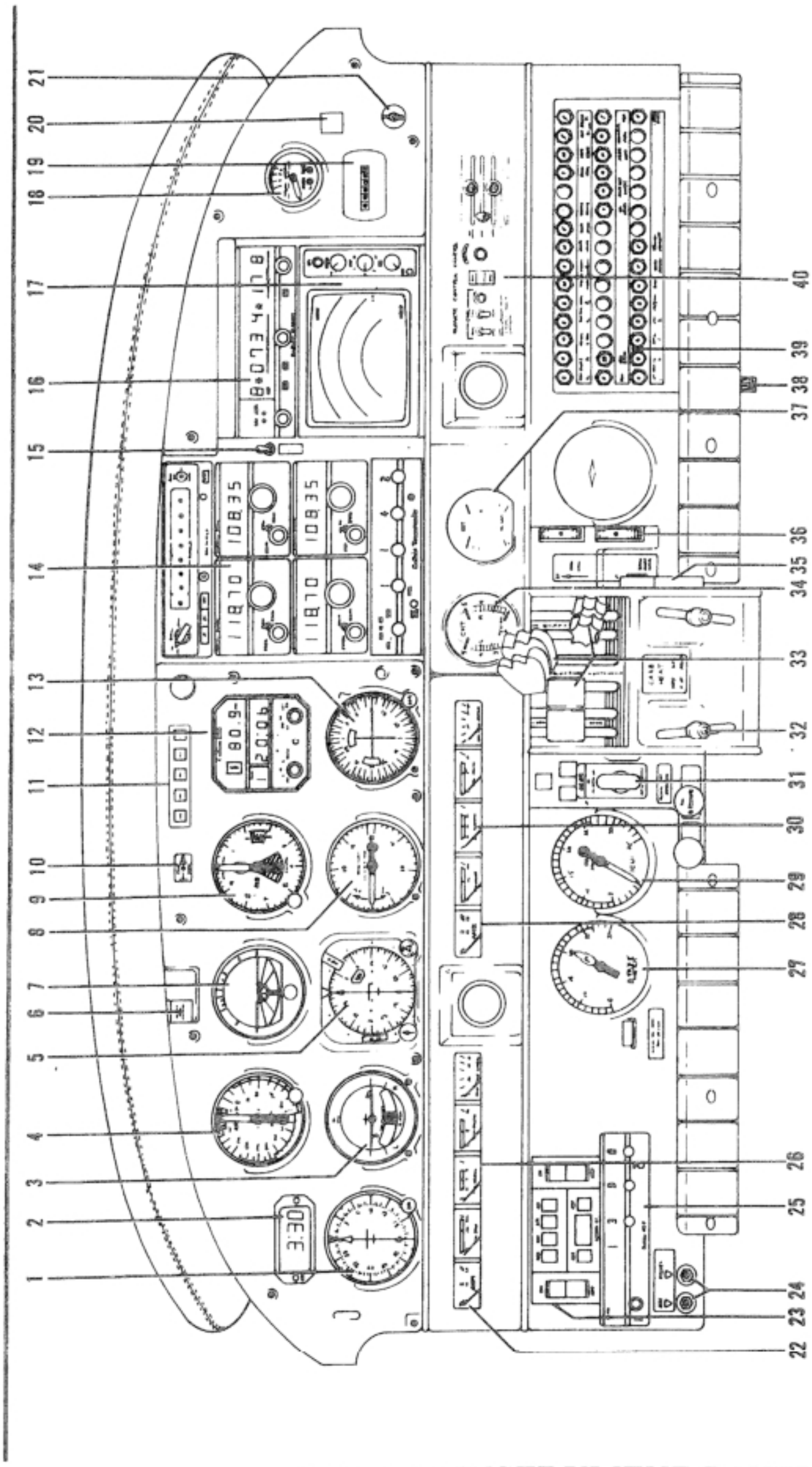
7.23 INSTRUMENT PANEL

Flight instruments are grouped in the upper instrument panel (Figure 7-25); engine and electrical system monitoring instruments, the autopilot, and the circuit breaker panel are in the lower instrument panel. Left and right engine instruments are separated by the left control wheel shaft.

Radios are mounted in the center of the upper instrument panel. An optional radio master switch is located near the top of the instrument panel between the radio stacks. It controls the power to all radios through the aircraft master switch. An emergency bus switch is also provided to provide auxiliary power to the avionics bus in event of a radio master switch circuit failure. The emergency bus switch is located behind the lower right shin guard left of the circuit breaker panel. The control quadrant - throttles and propeller and mixture controls - is in the center of the lower instrument panel. To the left of the control quadrant is the landing gear selector.

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

Various warning lights are located with the pilot's flight instruments on the left upper instrument panel. The gear unsafe warning light is to the left of the annunciator panel.



TYPICAL INSTRUMENT PANEL
Figure 7-25

The annunciator panel, with oil pressure, gyro vacuum alternator, and turbocharger overboost lights, and incorporating a press-to-test feature, is located to the upper left of the radios. The illumination of these lights in flight is an indication of a possible system malfunction. The pilot should closely monitor instrument panel gauges to check the condition of a system whose corresponding light on the annunciator panel illuminates. During preflight, the operational status of the annunciator panel should be tested by use of the press-to-test button. When the button is depressed, all annunciator panel lights should illuminate.

NOTE

When an engine is feathered, the alternator, gyro air and engine oil pressure annunciator lights will remain illuminated.

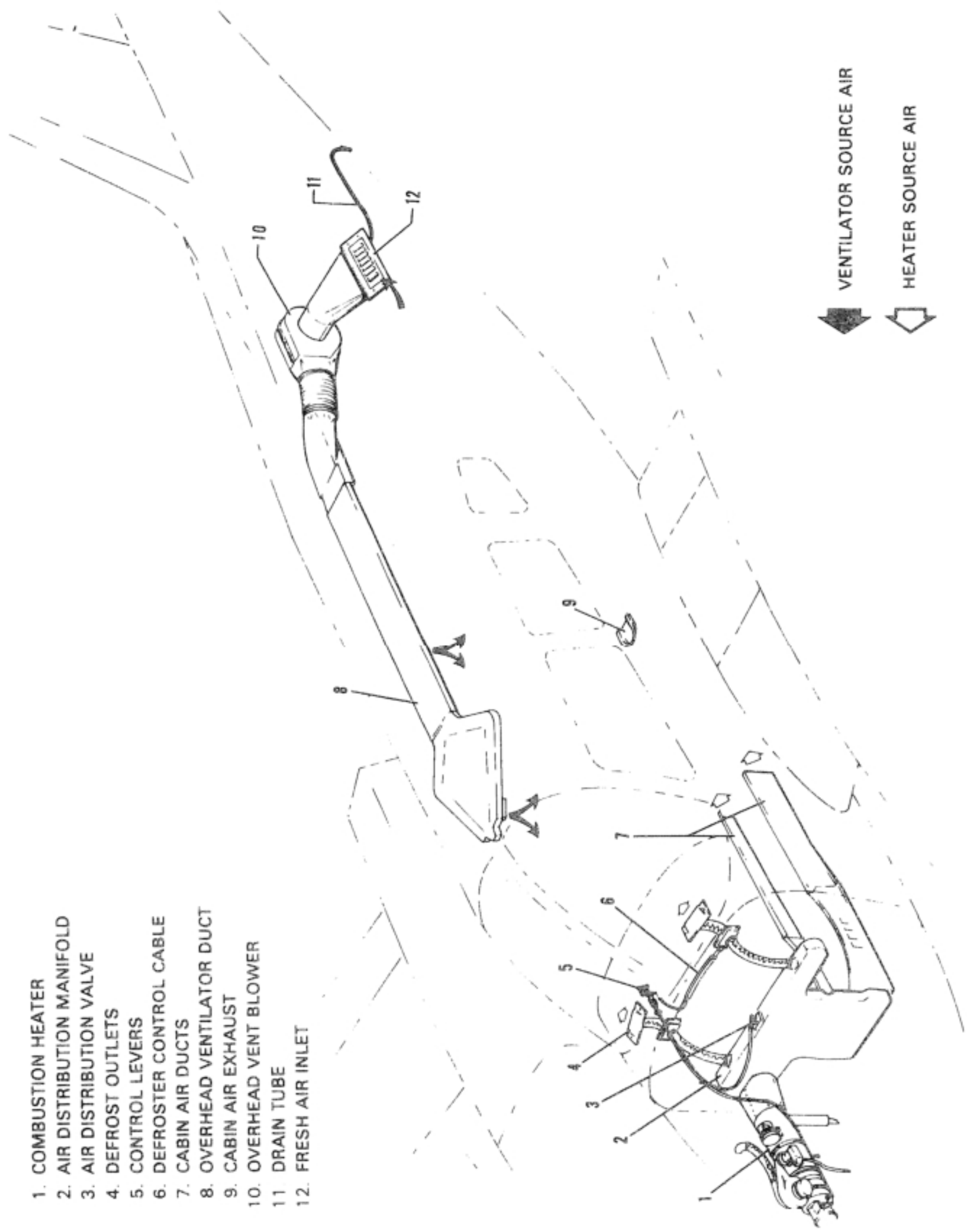
Instrument panel lighting can be dimmed or brightened by rheostat switches to the right of the control quadrant. Back-lights and a red flood light are optional equipment. When instrument panel lights are turned on, annunciator lights are dimmed. However, they will not show dim when the press-to-test switch is depressed.

7.25 HEATING, VENTILATING AND DEFROSTING SYSTEM

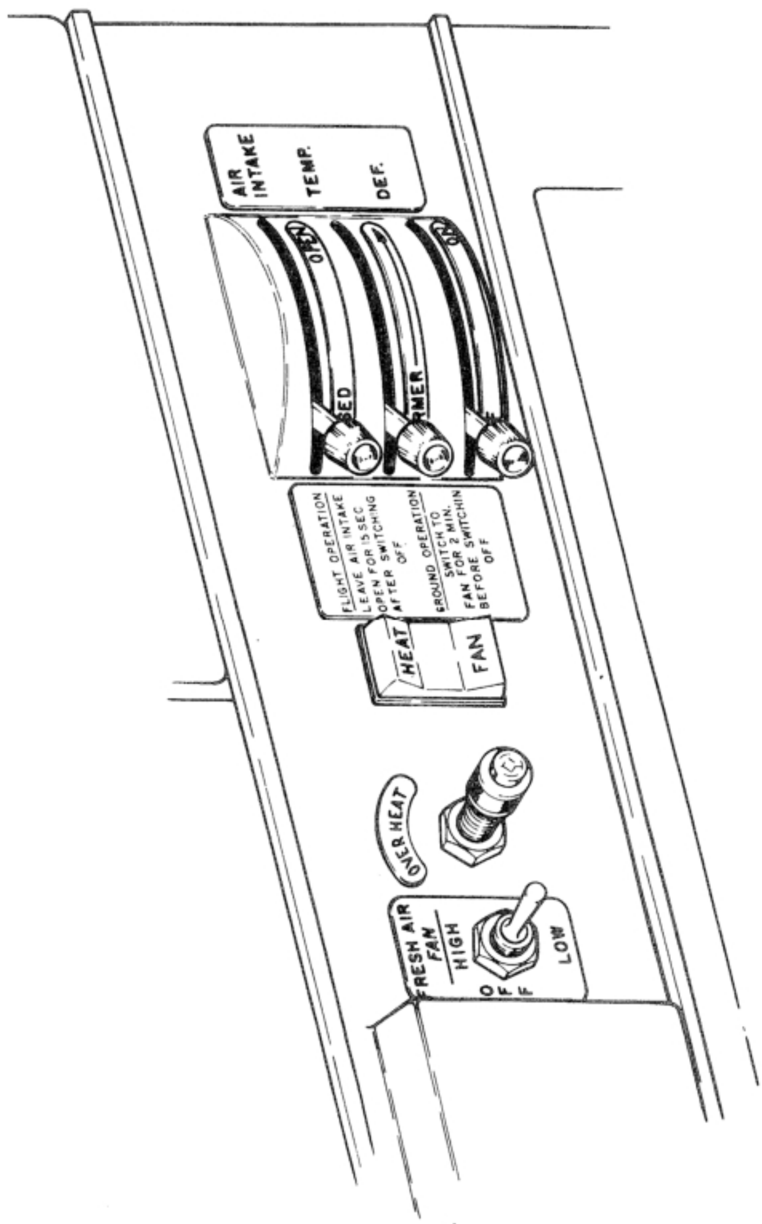
Heated air for cabin heat and windshield defrosting is provided by a Janitrol combustion heater located in the forward fuselage (refer to Figure 7-27). Air from the heater is distributed by a manifold to the ducts along the cabin floor to outlets at each seat and to the defroster outlets.

Operation of the combustion heater is controlled by a three-position switch located on the instrument panel (Figure 7-29) and labeled FAN, OFF and HEATER. Airflow and temperature are regulated by the three levers on the instrument panel. The upper lever regulates air intake and the center lever regulates cabin temperature. Cabin comfort can be maintained as desired through various combinations of lever positions. Passengers have secondary control over heat output by individual adjustable outlets at each seat location. The third lever on the instrument panel controls the windshield defrosters.

For cabin heat, the air intake lever on the instrument panel must be partially or fully open and the three-position switch set to the HEATER position. This simultaneously starts fuel flow and ignites the heater; and, during ground operation, it also activates the ventilation blower which is an



CABIN HEATING, VENTILATING AND DEFROSTING SYSTEM
Figure 7-27



HEATING, VENTILATING & DEFROSTING CONTROL CONSOLE
Figure 7-29

integral part of the combustion heater. With instant starting and no need for priming, heat should be felt within a few seconds. When cabin air reaches the temperature selected on the cabin temperature lever, ignition of the heater cycles automatically to maintain the selected temperature. Two safety switches activated by the intake valve and located aft of the heater unit prevent both fan and heater operation when the air intake lever is in the closed position. A micro switch, which actuates when the landing gear is retracted, turns off the ventilation blower so that in flight the cabin air is circulated by ram air pressure only.

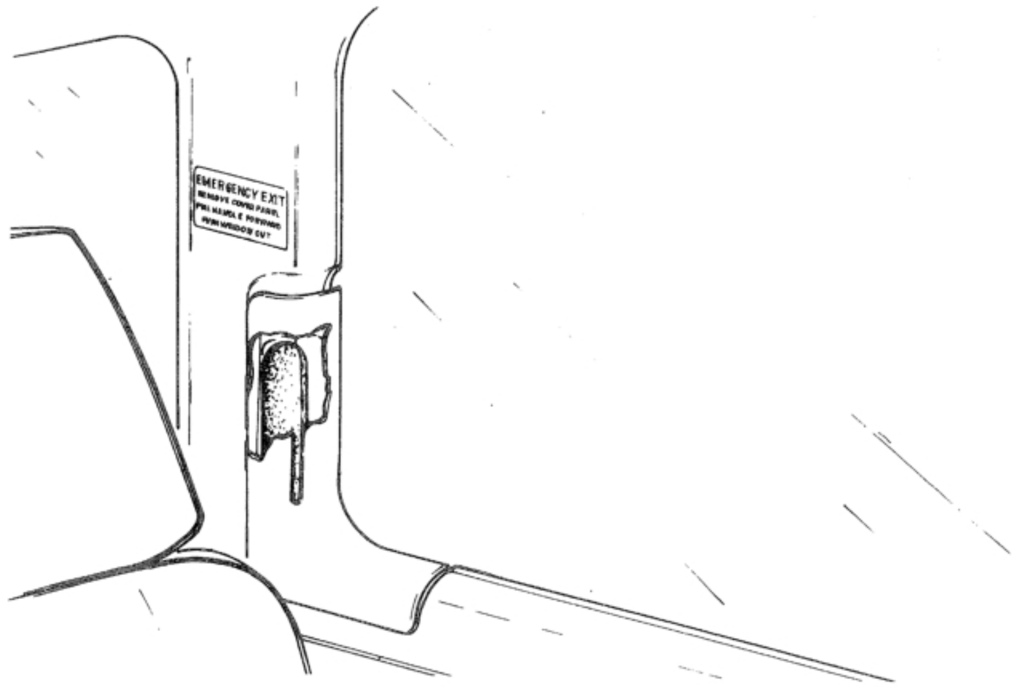
When the three-position switch is in the FAN position during ground operation, the ventilation fan blows fresh air through the heater duct work for cabin ventilation and windshield defogging when heat is not desired.

To introduce fresh, unheated air into the cabin during flight, the air intake should be open and the heater off. Ram air enters the system and can be individually regulated at each floor outlet. Overhead outlets also supply fresh air for cabin ventilation. The occupant of each seat can manually adjust an outlet in the ceiling to regulate the flow of fresh air to that seat area. An optional fresh air blower may be installed in the overhead ventilation system to provide additional fresh air flow during ground operation.

An overheat switch located in the heater unit acts as a safety device to render the heater inoperative if a malfunction should occur. Should the switch deactivate the heater, the OVERHEAT light on the instrument panel will illuminate. The overheat switch is located on the aft inboard end of the heater vent jacket. The red reset button is located on the heater shroud in the nose cone compartment.

To prevent activation of the overheat switch upon normal heater shutdown during ground operation, turn the three-position switch to FAN for two minutes with the air intake lever in the open position before turning the switch to OFF. During flight, leave the air intake lever open for a minimum of fifteen seconds after turning the switch to OFF.

The combustion heater uses fuel from the airplane fuel system. An electric fuel pump draws fuel from the left tank at a rate of approximately one-half gallon per hour. Fuel used for heater operation should be considered when planning for a flight.



EMERGENCY EXIT
Figure 7-31

7.27 CABIN FEATURES

The front seats are adjustable fore and aft. Each seat reclines and is provided with an armrest. The rear seats are easily removed to provide additional cargo space.

NOTE

To remove the rear seats, depress the plunger behind each front leg and slide seat to rear.

Currently, shoulder harnesses with inertia reels are provided for each front seat occupant and are available for all rear seats. A check of the inertia reel mechanism can be made by pulling sharply on the strap and checking that the reel will lock in place under sudden stress. This locking feature prevents the strap from extending and holds the occupant in place. Under normal movement the strap will extend and retract as required. On earlier aircraft provided with a single strap adjustable shoulder harness located above the side window for each front seat the shoulder strap is routed over the shoulder adjacent to the window and attached to the lap belt in the general area of the occupant's hip. Adjust this fixed strap so that all controls are accessible while maintaining adequate restraint for the occupant. Optional shoulder straps are available for the rear occupants. Shoulder harnesses should be routinely worn during takeoff, landing and whenever an inflight emergency situation occurs. Other seat options include headrests and push-button vertically adjustable pilot and copilot seats. The seat belt should be snugly fastened over each unoccupied seat.

Standard cabin features include a pilot's storm window, ashtrays, map pockets, sun visors, and pockets on the front seat backs. Among the options which may be added to suit individual needs are headrests, a fire extinguisher, and a special cabin sound-proofing package.

The pilot's left side window is an emergency exit. The emergency exit release handle is located beneath the thermoplastic cover on the vertical post between the first and second left side windows (Figure 7-31).

CAUTION

The emergency exit is for ground use only. When released, the window will fall free from the fuselage.

7.29 STALL WARNING

An approaching stall is indicated by a stall warning horn which is activated between five and ten knots above stall speed. Mild airframe buffeting and gentle pitching may also precede the stall. Stall speeds are shown on a graph in the Performance Charts Section. The stall warning indication consists of a continuous sounding horn located behind the instrument panel. The stall warning horn has a different sound from that of the gear warning horn which has a 90 cycles per minute beeping sound. The stall warning horn is activated by two lift detectors on the leading edge of the left wing, outboard of the engine nacelle. The inboard detector activates the horn when the flaps are in the 25 and 40 degree positions, the outboard when the flaps are in the other positions.

A squat switch in the stall warning system does not allow the units to be activated on the ground.

7.31 BAGGAGE AREA

The 24 cubic foot baggage compartment, located aft of the seats, has a weight capacity of 200 pounds. This compartment is loaded and unloaded through a separate 22 x 20 inch baggage door, and it is accessible during flight. Tie-down straps are provided and they should be used at all times. The baggage compartment and passenger doors use the same key.

NOTE

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

7.33 FINISH

The standard exterior finish is painted with acrylic lacquer. An optional polyurethane finish is also available. To keep the finish attractive, economy size spray cans of touch-up paint are available from Piper Dealers.

7.35 EMERGENCY LOCATOR TRANSMITTER*

The Emergency Locator Transmitter (ELT), when installed, is located in the aft portion of the fuselage and is accessible through a plate on the right side of the fuselage or through the tail cone by entering through the baggage compartment access panel. The ELT is an emergency locator transmitter which meets the requirements of FAR 91.52. The unit operates on a self-contained battery.

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

On the unit itself is a three-position selector switch placarded "OFF," "ARM" and "ON." The ARM position is provided to set the unit to the automatic position so that it will transmit only after impact and will continue to transmit until the battery is drained to depletion or until the switch is

*Optional equipment

manually moved to the OFF position. The ARM position is selected when the transmitter is installed at the factory and the switch should remain in that position whenever the unit is installed in the airplane. The ON position is provided so the unit can be used as a portable transmitter or in the event the automatic feature was not triggered by impact or to periodically test the function of the transmitter.

Select the OFF position when changing the battery, when rearming the unit if it has been activated for any reason, or to discontinue transmission.

NOTE

If the switch has been placed in the ON position for any reason, the OFF position has to be selected before selecting ARM. If ARM is selected directly from the ON position, the unit will continue to transmit in the ARM position.

A pilot's remote switch, located on the left side panel, is provided to allow the transmitter to be controlled from inside the cabin. The pilot's remote switch is placarded "ON, AUTO/ARM and OFF/RESET." The switch is normally left in the AUTO/ARM position. To turn the transmitter off, move the switch momentarily to the OFF/RESET position. The aircraft master switch must be ON to turn the transmitter OFF. To actuate the transmitter for tests or other reasons, move the switch upward to the ON position and leave it in that position as long as transmission is desired.

The unit is equipped with a portable antenna to allow the locator to be removed from the airplane in case of an emergency and used as a portable signal transmitter.

The locator should be checked during the ground check to make certain the unit has not been accidentally activated. Check by turning a radio receiver to 121.5 MHz. If there is an oscillating sound, the locator may have been activated and should be turned off immediately. Reset to the ARM position and check again to insure against outside interference.

NOTE

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

7.37 PIPER EXTERNAL POWER*

An optional starting installation known as Piper External Power (PEP) allows the airplane engine to be started from an external battery without the necessity of gaining access to the airplane battery. The cable from the external battery can be attached to a receptacle under the right side of the nose section of the fuselage. Instructions on a placard located on the cover of the receptacle should be followed when starting with external power. For instructions on the use of the PEP, refer to Starting Engines - Section 4.

7.39 PROPELLER SYNCHROPHASER*

A propeller synchrophaser installation is available as optional equipment. Its function is to maintain both propellers at the same RPM and at a preselected phase angle. This eliminates the propeller "beat" effect and minimizes vibration. When the synchrophaser is installed, the left engine is established as the master engine, and the right engine is equipped with a slave governor which automatically maintains its RPM with the left engine RPM. When the propeller synchrophaser is installed, a two-position switch is located on the throttle quadrant below the propeller controls. It is labeled "MANUAL" for manual control or standby and "AUTO SYNC" for propeller synchrophaser.

During taxi, takeoff, landing or single engine operations the propeller synchrophaser switch should be in the MANUAL position. During cruise, propellers should be synchronized manually to within approximately 10 RPM and the switch placed in the AUTO SYNC position. Normally, propeller synchrophasing will take place within a few seconds, but occasionally it may take up to a full minute. When the power setting is to be changed, the synchrophaser switch should be set to MANUAL for 30

*Optional equipment

seconds before the power setting is adjusted; then the synchrophaser switch may be returned to the AUTO SYNC position. If the propeller RPM differential exceeds 50 RPM, the switch should be placed on MANUAL for 30 to 40 seconds; then the propellers can be synchronized again and the synchrophaser switch returned to AUTO SYNC. Pulling the circuit breakers completely deactivates the propeller synchrophaser system. If the master switch is turned OFF or if there is an electrical system failure, the slave engine will return to the controlled selected RPM plus approximately 25 RPM "out of synchronization" regardless of the position of the synchrophaser switch.

7.41 OXYGEN*

PORTABLE OXYGEN SYSTEM

A portable oxygen system to provide supplementary oxygen for the crew and passengers during high altitude flights (above 10,000 feet) is available as optional equipment. (Refer to Section 9, Supplement 6, for FAA Approved supplemental information.)

The major components of the system consist of a console cylinder kit and four oxygen masks. The console is equipped with a 22 cubic foot oxygen cylinder, an oxygen supply gauge, an ON-OFF flow control knob and two plug-in receptacles.

The cylinder is enclosed in a console carrying case with a separate supply gauge and ON-OFF flow control knob mounted on the sloped face of the unit. Two plug-in outlets are located below the gauge and control knob on the console. The masks are stowed in the console.

When fully charged, the cylinder contains oxygen at a pressure of 1850 PSI at 70° F. The filler port is enclosed by a cover at the rear of the unit. If high altitude flight is anticipated, it should be determined that the oxygen supply is adequate for the proposed flight and that the passengers are briefed. When oxygen is required, insert the mask plug-in connector into an outlet and lock by rotating the connector approximately 1/4 turn. Don mask(s) and rotate the ON-OFF control knob fully counterclockwise (approximately two full turns).

*Optional equipment

Each mask assembly oxygen line incorporates a flow indicator. When the red pellet in the indicator disappears, oxygen is flowing through the line normally. If the red indicator appears in any of the lines during a period when oxygen is essential, the airplane should be lowered to an altitude below 12,500 feet immediately.

Always remove fittings from the oxygen receptacles and stow the masks when they are not in use. Connect only those mask assemblies being used to prevent oxygen loss through an unused mask assembly. If the control knob is ON and the fitting is in the receptacle, oxygen will flow through the mask continuously. Masks may be damaged if they are not properly stowed.

WARNING

Positively NO SMOKING while oxygen is being used by anyone in the airplane.

To stop the flow of oxygen through the system, the control knob should be turned OFF by rotating fully clockwise, finger tight.

To preclude the possibility of fire by spontaneous combustion, oil, grease, paint, hydraulic fluid and other flammable materials should be kept away from oxygen equipment.

FIXED OXYGEN SYSTEM

A fixed oxygen system to provide supplementary oxygen for the crew and passengers during high altitude flights (above 10,000 feet) is available as optional equipment. (Refer to Section 9, Supplement 7, for FAA Approved supplemental information.)

The major components of the system are a 48.3 cubic foot oxygen cylinder, an oxygen supply gauge, an ON-OFF flow control knob, a pressure regulator, plug in receptacles and oxygen masks.

The oxygen cylinder is mounted aft in the tailcone. When fully charged, the cylinder contains oxygen at a pressure of 1850 psi at 70°F. The oxygen supply gauge is mounted in the aft overhead vent duct. The gauge is complimented with a post light for night viewing. To light, the bottom switch, located near the oxygen control knob must be pushed in. The oxygen flow control knob, labeled "PULL-ON" is mounted in the pilot's overhead panel. The pressure regulator is mounted directly on the oxygen cylinder. Once the oxygen flow control knob is on, each of the oxygen plug-in receptacles operates as an automatic ON-OFF valve. The oxygen cylinder can be recharged through the access door aft of the rear window on the left side of the fuselage.

If high altitude flight is anticipated, it should be determined that the oxygen supply is adequate for the proposed flight and that the passengers are briefed. When oxygen is required, the control knob should be pulled forward to the on position, allowing oxygen to flow from the cylinder through the system. Connecting the constant flow mask fitting to a receptacle and turning it 90 degrees clockwise automatically releases oxygen flow to the mask through the ON-OFF valve feature of the receptacle. The occupant then dons the mask and breathes normally for a sufficient supply of oxygen.

Each mask assembly oxygen line incorporates a flow indicator. When the red pellet in the indicator disappears, oxygen is flowing through the line normally. If the red indicator appears in any of the lines during a period when oxygen use is essential, the airplane should be lowered to an altitude below 12,500 feet immediately.

When not in use, masks may be stowed in the storage pockets behind the front seats. Always remove fittings from the oxygen receptacles and stow the masks when they are not in use. If the control knob is pulled on and the fitting is in the receptacle, oxygen will flow through the mask continuously. Masks may be damaged if they are not properly stowed.

CAUTION

Positively NO SMOKING while oxygen is being used by anyone in the airplane.

To stop the flow of oxygen through the system, the control knob should be pushed aft to the off position. To bleed down low pressure lines, it is recommended that the mask assembly be left connected to the outlet for at least three minutes after the control knob is turned off.

To preclude the possibility of fire by spontaneous combustion, oil, grease, paint, hydraulic fluid, and other flammable material should be kept away from oxygen equipment.

TABLE OF CONTENTS

SECTION 8

AIRPLANE HANDLING, SERVICING AND MAINTENANCE

SECTION 8

AIRPLANE HANDLING, SERVICING AND MAINTENANCE

8.1 GENERAL

This section provides general guidelines relating to the handling, servicing and maintenance.

Every owner should stay in close contact with his Piper dealer or distributor and Authorized Piper Service Center to obtain the latest information pertaining to his aircraft and to avail himself of the Piper Aircraft Service Back-up.

Piper Aircraft Corporation takes a continuing interest in having the owner get the most efficient use from his aircraft and keeping it in the best mechanical condition. Consequently, Piper Aircraft from time to time issues Service Bulletins, Service Letters and Service Spares Letters relating to the aircraft.

Service Bulletins are of special importance and should be complied with promptly. These are sent to the latest registered owners, distributors and dealers. Depending on the nature of the bulletin, material and labor allowances may apply, and will be addressed in the body of the Bulletin.

Service Letters deal with product improvements and service hints pertaining to the aircraft. They are sent to dealers, distributors and occasionally (at the factory's discretion) to latest registered owners, so they can properly service the aircraft and keep it up to date with the latest changes. Owners should give careful attention to the Service Letter information.

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

If an owner is not having his aircraft serviced by an Authorized Piper Service Center, he should periodically check with a Piper dealer or distributor to find out the latest information to keep his aircraft up to date.

Piper Aircraft Corporation has a Subscription Service for the Service Bulletins, Service Letters and Service Spares Letters. This service is offered to interested persons such as owners, pilots and mechanics at a nominal fee, and may be obtained through Piper dealers and distributors.

A service manual, parts catalog, and revisions to both, are available from Piper dealers or distributors. Any correspondence regarding the airplane should include the airplane model and serial number to insure proper response.

8.3 AIRPLANE INSPECTION PERIODS

The Federal Aviation Administration (FAA) occasionally publishes Airworthiness Directives (ADs) that apply to specific groups of aircraft. They are mandatory changes and are to be complied with within a time limit set by the FAA. When an AD is issued, it is sent to the latest registered owner of the affected aircraft and also to subscribers of the service. The owner should periodically check with his Piper dealer or A & P mechanic to see whether he has the latest issued AD against his aircraft.

The Owner Service Agreement which the owner receives upon delivery of the aircraft should be kept in the aircraft at all times. This identifies the owner to authorized Piper dealers and entitles the owner to receive service in accordance with the regular service agreement terms. This agreement also entitles the transient owner full warranty by any Piper dealer in the world.

One hundred hour inspections are required by law if the aircraft is used commercially. Otherwise this inspection is left to the discretion of the owner. This inspection is a complete check of the aircraft and its systems, and should be accomplished by a Piper Authorized Service Center or by a qualified aircraft and power plant mechanic who owns or works for a reputable repair shop. The inspection is listed, in detail, in the inspection report of the appropriate Service Manual.

An annual inspection is required once a year to keep the Airworthiness Certificate in effect. It is the same as a 100-hour inspection except that it must be signed by an Inspection Authorized (IA) mechanic or a General Aviation District Office (GADO) representative. This inspection is required whether the aircraft is operated commercially or for pleasure.

A Programmed Inspection is approved by the FAA and is available to the owner. It involves routine and detailed inspections at 50-hour intervals. The purpose of the program is to allow maximum utilization of the aircraft, to reduce maintenance inspection cost and to maintain a maximum standard of continuous airworthiness. Complete details are available from Piper dealers.

A spectographic analysis of the oil is available from several sources. This system, if used intelligently, provides a good check of the internal condition of the engine. For this system to be accurate, oil samples must be sent in at regular intervals, and induction air filters must be cleaned or changed regularly.

8.5 PREVENTIVE MAINTENANCE

The holder of a Pilot Certificate issued under FAR Part 61 may perform certain preventive maintenance described in FAR Part 43. This maintenance may be performed only on an aircraft which the pilot owns or operates and which is not used to carry persons or property for hire. Although such maintenance is allowed by law, each individual should make a self-analysis as to whether he has the ability to perform the work.

All other maintenance required on the airplane should be accomplished by appropriately licensed personnel.

If maintenance is accomplished, an entry must be made in the appropriate logbook. The entry should contain:

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

8.7 AIRPLANE ALTERATIONS

If the owner desires to have his aircraft modified, he must obtain FAA approval for the alteration. Major alterations accomplished in accordance with Advisory Circular 43.13-2, when performed by an A & P mechanic, may be approved by the local FAA office. Major alterations to the basic airframe or systems not covered by AC 43. 13-2 require a Supplemental Type Certificate.

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

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

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

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

8.9 GROUND HANDLING

(a) Towing

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

CAUTIONS

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

Do not tow the airplane when the controls are secured.

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

(b) Taxiing

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

(1) Taxi a few feet forward and apply the brakes to determine their effectiveness.
(2) Taxi with the propeller set in low pitch, high RPM setting.
(3) While taxiing, make slight turns to ascertain the effectiveness of the steering.
(4) Observe wing clearance when taxiing near buildings or other stationary objects. If possible, station an observer outside the airplane.
(5) When taxiing over uneven ground, avoid holes and ruts.

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

(c) Parking

When parking the airplane, be sure that it is sufficiently protected from adverse weather conditions and that it presents no danger to other aircraft. When parking the airplane for any length of time or overnight, it is suggested that it be moored securely.

(1) To park the airplane, head it into the wind if possible.
(2) Set the parking brake by depressing the toe brakes and pulling out the parking brake control. To release the parking brake, depress the toe brakes and push in the parking brake control, then release the toe brakes.

CAUTION

Care should be taken when setting brakes that are overheated or during cold weather when accumulated moisture may freeze a brake.

(3) Aileron and stabilator controls should be secured with the front seat belt and chocks used to properly block the wheels.

(d) Mooring

The airplane should be moored for immovability, security and and protection. The following procedures should be used for the proper mooring of the airplane:

(1) Head the airplane into the wind if possible.
(2) Retract the flaps.
(3) Immobilize the ailerons and stabilator by looping the seat belt through the control wheel and pulling it snug.
(4) Block the wheels.
(5) Secure tie-down ropes to the wing tie-down rings and to the tail skid at approximately 45 degree angles to the ground. When using rope of non-synthetic material, leave sufficient slack to avoid damage to the airplane should the ropes contract.

CAUTION

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

NOTE

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

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

8.11 ENGINE INDUCTION AIR FILTERS

(a) Removing Induction Air Filter

(1) Remove the upper cowling to gain access to the air filter box.
(2) Unlatch top and bottom filter clamps.
(3) Lift the air filter from the filter box.

(b) Cleaning Induction Air Filters

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

To clean the filter:

(1) Blow out with compressed air from gasket side or wash in warm water and mild detergent, and dry.
(2) Inspect filter. If paper element is torn or ruptured or gasket is damaged, the filter should be replaced. The usable life of the filter should be restricted to one year or 500 hours, whichever comes first.

(c) Installation of Induction Air Filters

After cleaning, place filter in air box and latch bottom and top filter clamps. Replace cowl.

8.13 BRAKE SERVICE

The brake system is filled with MIL-H-5606 (petroleum base) hydraulic brake fluid. This should be checked periodically or at every 50-hour inspection and replenish when necessary. The brake reservoir is located in the forward maintenance area. Remove the four screws and rotate the fiberglass nose cone forward and down. The reservoir is located at the top rear of the compartment. Keep the fluid level at the level marked on the reservoir.

No adjustment of brake clearance is necessary. Refer to the Service Manual for brake lining replacement instructions.

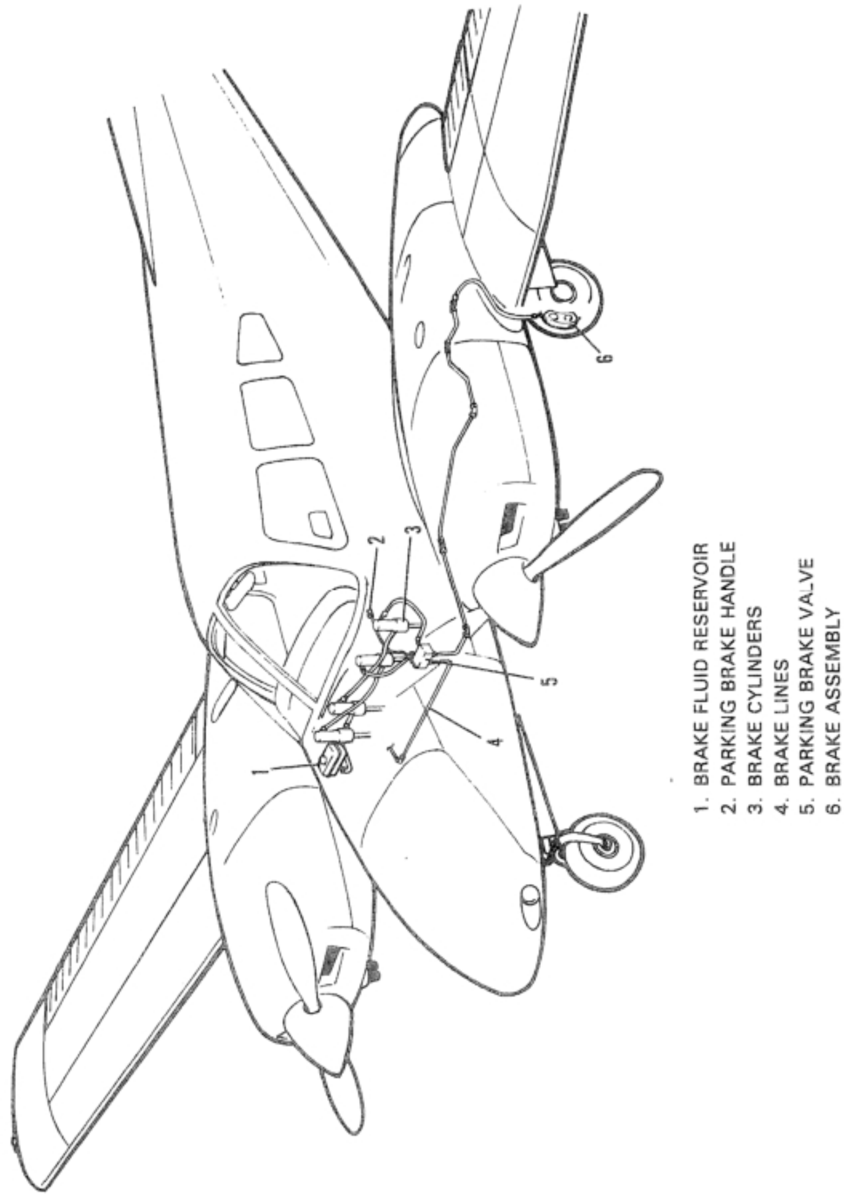
8.15 LANDING GEAR SERVICE

Two jack points are provided for jacking the aircraft for servicing. One is located outboard of each main landing gear. Before jacking, attach a tail support to the tail skid. Approximately 500 pounds of ballast should be placed on the tail support.

CAUTION

Be sure to apply sufficient support ballast; otherwise the airplane may tip forward, and the nose section could be damaged.

Landing gear oleos should be serviced according to instruction on the units. Under normal static load (empty weight or airplane plus full fuel and oil), main oleo struts should be exposed 2.60 inches and the nose oleo strut should be exposed 2.70 inches. Refer to the Service Manual for complete information on servicing oleo struts.



BRAKE SYSTEM
Figure 8-1

8.17 PROPELLER SERVICE

The gas charge in the propeller cylinder should be kept at the pressure specified on the placard located in the spinner cap. The pressure in the cylinder will increase about one-third psi for every degree Fahrenheit increase in temperature. This effect should be considered when checking pressure. The charge maintained must be accurate and free of excessive moisture since moisture may freeze the piston during cold weather. Dry nitrogen gas is recommended.

CHAMBER PRESSURE REQUIREMENTS WITH
TEMPERATURE FOR COUNTERWEIGHT TYPE PROPELLERS

Temp. °F	Pressure (PSI)
	FOR PROPELLER HUBS: HC-C2Y(K,R)-2CEUF, HC-C2Y(K,R)-2CLEUF, HC-C3YK-2EUF AND HC-C3YK-2LEUF
70 to 100	41 ± 1
40 to 70	38 ± 1
0 to 40	36 ± 1
-30 to 0	33 ± 1

NOTE: Do not check pressure or charge with propeller in feather position.

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

The gas charge in the optional unfeathering accumulators should be maintained at 90 - 100 PSI. It is important to use a dry gas for this charge since any moisture in the system may freeze and render it inoperative. Nitrogen is recommended. Do not check this pressure while the engine is running.

8.19 OIL REQUIREMENTS

The oil capacity of the Lycoming engines is 6 quarts per engine with a minimum safe quantity of 2 quarts per engine. It is necessary that oil be maintained at full for maximum endurance flights. It is recommended that engine oil be drained and renewed every 100 hours, or sooner under unfavorable conditions. Full flow cartridge type oil filters should be replaced each 50 hours of operation. The following grades are required for temperatures:

Average Ambient Air Temperature For Starting	MIL-L-6082B Straight Mineral SAE Grades	MIL-L-22851 Ashless Dispersant SAE Grades
Above 60°F	50	SAE 40 or 50
30° to 90°F	40	SAE 40
0° to 70°F	30	SAE 40 or 30
Below 10°F	20	SAE 30

8.21 FUEL SYSTEM

(a) Servicing Fuel System

The fuel screens in the strainers require cleaning at 50 hour or 90 day intervals, whichever occurs first. The fuel gascolator strainers are located in the fuselage under the rear seats. The fuel selector valves and the auxiliary pumps are in the wings adjacent to the nacelles.

(b) Fuel Requirements

The minimum aviation grade fuel for the PA-44-180T is 100. Since the use of lower grades can cause serious engine damage in a short period of time, the engine warranty is invalidated by the use of lower octanes.

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

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

FUEL GRADE COMPARISON CHART

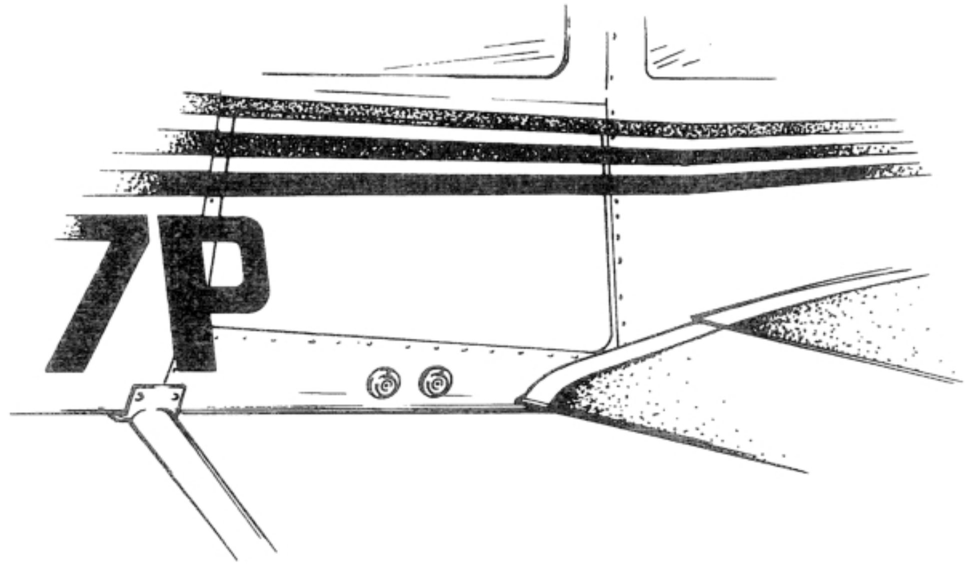
Previous Commercial Fuel Grades (ASTM-D910)			Current Commercial Fuel Grades (ASTM-D910-75)			Current Military Fuel Grades (MIL-G-5572E) Amendment No. 3		
Grade	Color	Max. TEL ml/U.S. gal.	Grade	Color	Max. TEL ml/U.S. gal.	Grade	Color	Max. TEL ml/U.S. gal.
80/87	red	0.5	80	red	0.5	80/87	red	0.5
91/98	blue	2.0	*100LL	blue	2.0	none	none	none
100/130	green	3.0	100	green	**3.0	100/130	green	**3.0
115/145	purple	4.6	none	none	none	115/145	purple	4.6

* - Grade 100LL fuel in some overseas countries is currently colored green and designated as "100L."
**- Commercial fuel grade 100 and grade 100/130 (both of which are colored green) having TEL content of up to 4 ml/U.S. gallon are approved for use in all engines certificated for use with grade 100/130 fuel.

CAUTION

Fuel containing TCP additive is not approved for use in this airplane. Refer to the latest issue of Lycoming Service Letter 190.

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



FUEL DRAINS
Figure 8-2

CAUTIONS

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

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

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

(c) Filling Fuel Tanks

Observe all safety precautions required when handling gasoline. Fill the fuel tanks through the fillers located inside the access cover aft of the engine cowling on the outboard side of the nacelles. Each nacelle tank holds a maximum of 55 U.S. gallons. When using less than the standard 110 gallon capacity, fuel should be distributed equally between each side.

(d) Draining Fuel Strainers, Sumps and Lines

The aircraft is equipped with single point drains which should be drained before the first flight of the day and after refueling, to check for fuel contamination. If contamination is found, fuel should be drained until the contamination stops. If contamination persists after draining fuel for a minute, contact a mechanic to check the fuel system.

Each half of the fuel system can be drained from a single point which is located just forward of the entrance step. Fuel selectors should be in the ON position during draining. The fuel drained should be collected in a transparent container and examined for contamination.

CAUTION

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

(e) Draining Fuel System

The fuel may be drained by opening the valves at the right hand side of the fuselage just forward of the entrance step or by siphoning. The remaining fuel in the lines may be drained through the gascolators.

8.23 TIRE INFLATION

For maximum service from the tires, keep them inflated to the proper pressures. The main gear tires should be inflated to 55 psi and the nose gear tire should be inflated to 50 psi.

Interchange the tires on the main wheels, if necessary, to produce even wear. All wheels and tires are balanced before original installation, and the relationship of the tire, tube, and wheel should be maintained if at all possible. Unbalanced wheels can cause extreme vibration on takeoff. In the installation of new components, it may be necessary to rebalance the wheel with the tire mounted.

When checking the pressure, examine the tires for wear, cuts, bruises and slippage.

8.25 BATTERY SERVICE

Access to the 12-volt 35 ampere hour battery is gained through the fiberglass nose cone. The battery container has a plastic drain tube which is normally closed off. This tube should be opened ocassionally to drain off any accumulation of liquid.

The battery fluid level must not be brought above the baffle plates. It should be checked every 30 days to determine that the fluid level is proper and the connections are tight and free of corrosion. DO NOT fill the battery above the baffle plates. DO NOT fill the battery with acid. Use distilled water only. A hydrometer check will determine the percent of charge in the battery.

If the battery is not properly charged, recharge it starting with a rate of 4 amperes and finishing with a rate of 2 amperes. Quick charges are not recommended.

The external power receptacle, if installed, is located on the right side of the nose section. Be sure that master switch is off and the right engine is shut-down prior to inserting or removing a plug at this receptacle.

Refer to the Service Manual for detailed procedures for cleaning and servicing the battery.

8.27 SERIAL NUMBER PLATES

The serial number plate is located on the bottom of the fuselage near the aft end of the tail cone. The serial number should always be used when referring to the airplane on service or warranty matters.

8.29 LUBRICATION

Lubrication at regular intervals is an essential part of the maintenance of an airplane. For lubrication instructions and a chart showing lubrication points, types of lubricants to be used, lubrication methods and recommended frequencies, refer to the Service Manual.

8.31 CLEANING

(a) Cleaning Engine Compartment

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

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

CAUTION

Do not spray solvent into the alternator, vaccuum pump, starter, air intakes, or alternate air inlets.

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

CAUTION

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

(4) Remove the protective tape from the magnetos.
(5) Lubricate the controls, bearing surfaces, etc., in accordance with the Lubrication Chart in the Service Manual.

(b) Cleaning Landing Gear

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

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

CAUTION

Do not brush the micro switches.

(c) Cleaning Exterior Surfaces

The airplane should be washed with a mild soap and water. Harsh abrasives or alkaline soaps or detergents could make scratches on painted or plastic surfaces or could cause corrosion of metal. Cover areas where cleaning solution could cause damage. To wash the airplane, use the following procedure:

(1) Flush away loose dirt with water.
(2) Apply cleaning solution with a soft cloth, a sponge or a soft bristle brush.
(3) To remove exhaust stains, allow the solution to remain on the surface longer.
(4) To remove stubborn oil and grease, use a cloth dampened with naphtha.
(5) Rinse all surfaces thoroughly.

(6) Any good automotive wax may be used to preserve painted surfaces. Soft cleaning cloths or a chamois should be used to prevent scratches when cleaning or polishing. A heavier coating of wax on the leading surfaces will reduce the abrasion problems in these areas.

(d) Cleaning Windshield and Windows

(1) Remove dirt, mud and other loose particles from exterior surfaces with clean water.
(2) Wash with mild soap and warm water or with aircraft plastic cleaner. Use a soft cloth or sponge in a straight back and forth motion. Do not rub harshly.
(3) Remove oil and grease with a cloth moistened with kerosene.

CAUTION

Do not use gasoline, alcohol, benzene, carbon tetrachoride, thinner, acetone, or window cleaning sprays.

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

(e) Cleaning Headliner, Side Panels and Seats

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

CAUTION

Solvent cleaners require adequate ventilation.

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

(f) Cleaning Carpets

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

8.33 WINTERIZATION

For winter operation a winterization kit is installed on the inlet opening of the oil cooler outboard chamber of the plenum chamber. This kit should be installed whenever the ambient temperature is 50° F or less. When the kit is not being used it can be stowed in the nose cone compartment.

TABLE OF CONTENTS

SECTION 9

SUPPLEMENTS

SECTION 9

SUPPLEMENTS

9.1 GENERAL

This section provides information in the form of supplements which are necessary for efficient operation of the airplane when it is equipped with one or more of the various optional systems and equipment not approved with the standard airplane.

All of the supplements provided in this section are "FAA Approved" and consecutively numbered as a permanent part of this handbook. The information contained in each supplement applies only when the related equipment is installed in the airplane.

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SUPPLEMENT 1

AUTOCONTROL IIIB AUTOPILOT INSTALLATION

SECTION 1 - GENERAL

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

This supplement has been "FAA Approved" as a permanent part of this handbook based on EDO-AIRE Mitchell STC SA3276SW-D and must remain in this handbook at all times when the optional Piper AutoControl IIIB Autopilot is installed.

SECTION 2 - LIMITATIONS

(a) Autopilot operation prohibited above 185 KIAS. (Autopilot Vmo)
(b) Autopilot must be "OFF" for takeoff and landing.

SECTION 3 - EMERGENCY PROCEDURES

(a) In an emergency the AutoControl IIIB can be disconnected by pushing the AP ON-OFF switch "OFF."
(b) The autopilot can be overpowered at either control wheel.
(c) An autopilot runaway, with a 3 second delay in the initiation of recovery while operating in climb, cruise or descending flight, could result in a 58° bank and 400 foot altitude loss. Maximum altitude loss measured at 185 KIAS in descent.
(d) An autopilot runaway, with a 1 second delay in the initiation of recovery during an approach operation, single or multi-engine, coupled or uncoupled, could result in a 12° bank and 20 foot altitude loss.

(e) Emergency operation with optional NSD 360A (HSI) - Slaved and/or Non-Slaved:

NSD 360A

(1) Appearance of HDG Flag:
 a. Check air supply gauge (vac or pressure) for adequate air supply (4 in. Hg. min.).
 b. Check compass circuit breaker.
 c. Observe display for proper operation.

(2) To disable heading card - pull circuit breaker and use magnetic compass for directional data.

NOTE

If heading card is not operational, autopilot should not be used.

(3) With card disabled, VOR/Localizer and Glide Slope displays are still functional; use card set to rotate card to aircraft heading for correct picture.

(4) Slaving Failure - (i.e. failure to self-correct for gyro drift):
 a. Check gyro slaving switch is set to No. 1 position.
 b. Check for HDG Flag.
 c. Check compass circuit breaker.
 d. Reset heading card while observing slaving meter.

NOTE

Dead slaving meter needle or needle displaced fully one direction indicates a slaving system failure.

 e. Select slaving amplifier No. 2 (gyro slaving switch is set to No. 2 position).
 f. Reset heading card while checking slaving meter.
 g. Switch to free gyro mode and periodically set card as unslaved gyro.

NOTE

In the localizer mode the "TO-FROM" arrows may remain out of view, depending upon the design of the NAV converter used in the installation.

SECTION 4 - NORMAL PROCEDURES

PREFLIGHT

(a) AUTOPILOT

(1) Place radio coupler in HDG mode (if installed) and place the AP "ON-OFF" switch to the "ON" position to engage roll section. Rotate roll command knob left and right and observe that control wheel describes a corresponding left and right turn, then center knob.

(2) Set proper D.G. heading on D.G. and turn HDG bug to aircraft heading. Engage HDG mode rocker switch and rotate HDG bug right and left. Aircraft control wheel should turn same direction as bug. Grasp control wheel and manually override servo, both directions.

(b) RADIO COUPLER - (OPTIONAL)

(1) Tune and identify VOR or VOT station. Position radio coupler to OMNI mode. Place autopilot and HDG switches to the ON position. Set HDG bug to aircraft heading and rotate OBS to cause OMNI indicator needle to swing left and right slowly. Observe that control wheel rotates in direction of needle movement.

(2) Disengage AP "ON-OFF" switch. Reset radio coupler control to HDG.

IN-FLIGHT

(a) Trim airplane (ball centered).

(b) Check air pressure or vacuum to ascertain that the directional gyro and attitude gyro are receiving sufficient air.

(c) Roll Section
(1) To engage, center ROLL COMMAND knob, push AP "ON-OFF" switch to "ON" position. To turn, rotate ROLL COMMAND knob in desired direction. (Maximum angle of bank should not exceed 30°.)
(2) For heading mode, set directional gyro with magnetic compass. Push directional gyro HDG knob in, rotate bug to aircraft heading. Push console heading rocker (HDG) switch to "ON" position. To select a new aircraft heading, push D.G. heading knob "IN" and rotate, in desired direction of turn, to the desired heading.

(d) Radio Coupling VOR-ILS with H.S.I. (Horizontal Situation Indicator) Type Instrument Display. (Optional)
(1) VOR Navigation
a. Tune and identify VOR station. Select desired course by rotating CRS knob of H.S.I.
b. Select OMNI mode on radio coupler.
c. Select HDG mode on autopilot console to engage coupler. Aircraft will turn to a 45° intercept angle to intercept the selected VOR course. Intercept angle magnitude depends on radio needle off course magnitude, 100% needle deflection will result in 45° intercept with the intercept angle diminishing as the needle offset diminishes.
d. NAV mode - NAV mode provides reduced VOR sensitivity for tracking weak, or noisy VOR signals. NAV mode should be selected after the aircraft is established on course.

(2) ILS-LOC Front Course
a. Set inbound, front, localizer course with H.S.I. course knob.
b. Select LOC-Normal on radio coupler to intercept and track inbound on the localizer. Select LOC-REV to intercept and track the localizer course outbound to the procedure turn area.
c. Select HDG mode on autopilot console to engage coupler.

(3) ILS - Back Course
   a. Set inbound, front localizer course with H.S.I. course knob.
   b. Select LOC-REV on radio coupler to intercept and track inbound on the back localizer course. Select LOC-NORM to intercept and track outbound on the back course to the procedure turn area.
   c. Select HDG mode on autopilot console to engage coupler.

(e) Radio Coupling - VOR/ILS with standard directional gyro. (Optional)
Radio coupler operation in conjunction with a standard directional gyro and VOR/LOC display differs from operation with an integrated display (H.S.I.) only in one respect. The HDG bug is used as the radio course datum and therefore must be set to match the desired VOR course as selected on the OBS.
(1) For VOR intercepts and tracking:
Select the desired VOR course and set the HDG bug to the same heading. Select OMNI mode on the coupler and HDG mode on the autopilot console.
(2) For ILS Front Course intercepts and tracking:
Tune the localizer frequency and place the HDG bug on the inbound, front course heading. Select LOC-NORM mode on the coupler and HDG mode on the autopilot console.
(3) For LOC Back Course intercepts and tracking:
Tune the localizer frequency and place the HDG bug on the inbound course heading to the airport. Select LOC-REV mode with coupler and HDG mode on the autopilot console.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of the Pilot's Operating Handbook are necessary for this supplement.

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SUPPLEMENT 2

ALTIMATIC IIIC AUTOPILOT INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional AltiMatic IIIC Autopilot is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook based on EDO-AIRE Mitchell STC SA3277SW-D and must remain in this handbook at all times when the optional AltiMatic IIIC Autopilot is installed.

SECTION 2 - LIMITATIONS

(a) Autopilot operation prohibited above 185 KIAS. (Autopilot Vmo)
(b) Autopilot must be "OFF" during takeoff and landing.
(c) Required placard P/N 13A660 "Conduct Trim Check prior to flight (see AFM)" to be installed in clear view of pilot.
(d) During autopilot operation, the pilot must be in his seat with the safety belt fastened.

SECTION 3 - EMERGENCY PROCEDURES

This aircraft is equipped with a Master Disconnect/Interrupt Switch on the pilot's control wheel. When the switch button is depressed it will disconnect the autopilot. When depressed and held it will interrupt all Electric Elevator Trim Operations. Trim operations will be restored when the switch is released. If an autopilot or trim emergency is encountered, do not attempt to determine which system is at fault. Immediately depress and hold the Master Disconnect/Interrupt button. Turn off autopilot and trim master switch and retrim aircraft, then release the interrupt switch.

NOTE

During examination of this supplement, the pilot is advised to locate and identify the autopilot controls, the trim master switch and circuit breaker for both systems.

(a) In the event of an autopilot malfunction the autopilot can be:
   (1) Overpowered at either control wheel.

CAUTION

Do not overpower autopilot pitch axis for periods longer than 3 seconds because the autotrim system will operate in a direction to oppose the pilot and will, thereby, cause an increase in the pitch overpower forces.

   (2) Disconnected by depressing the Master Disconnect/Interrupt Switch.
   (3) Disconnected by depressing the Trim Switch "AP OFF" bar.
   (4) Disconnected by pushing the roll rocker switch "OFF."

(b) In the event of a trim malfunction:
  (1) Depress and hold the Master Trim Interrupt Switch.
  (2) Trim Master Switch - "OFF." Retrim aircraft as necessary using manual trim system.
  (3) Release Master Interrupt Switch - be alert for possible trim action.
  (4) Trim Circuit Breaker - Pull. Do not operate trim until problem is corrected.
  (5) If the trim system operates only in one direction, pull the circuit breaker and do not operate the trim system until corrective action is taken. Monitor autopilot operation closely when operating without trim follow-up.

(c) If a trim runaway occurs with the autopilot operating, the above procedure will disconnect the autopilot which will immediately result in higher control wheel forces. Be prepared to manually retrim, as necessary to eliminate undesirable forces.

(d) Altitude Loss During Malfunction:
  (1) An autopilot malfunction during climb, cruise or descent with a 3 second delay in recovery initiation could result in as much as 60° of bank and 600′ of altitude loss. Maximum altitude loss measured in a descent at Vmo.
  (2) An autopilot malfunction during an approach with a 1 second delay in recovery initiation could result in as much as 12° of bank and 60′ altitude loss. Maximum altitude loss measured in approach configuration gear down and operating either coupled or uncoupled, single or multi-engine.

(e) Emergency Operation With Optional NSD 360A (HSI) - Slaved and/or Non-Slaved:

NSD 360A
  (1) Appearance of HDG Flag:
    a. Check air supply gauge (vac or pressure) for adequate air supply (4 in. Hg. min.).
    b. Check compass circuit breaker.
    c. Observe display for proper operation.

(2) To disable heading card - pull circuit breaker and use magnetic compass for directional data.

NOTE

If heading card is not operational, autopilot should not be used.

(3) With card disabled, VOR/Localizer and Glide Slope displays are still functional; use card set to rotate card to aircraft heading for correct picture.
(4) Slaving Failure - (i.e. failure to self-correct for gyro drift):
   a. Check gyro slaving switch is set to No. 1 position.
   b. Check for HDG Flag.
   c. Check compass circuit breaker.
   d. Reset heading card while observing slaving meter.

NOTE

Dead slaving meter needle or a needle displaced fully one direction indicates a slaving system failure.

   e. Select slaving amplifier No. 2 (gyro slaving switch is set to No. 2 position).
   f. Reset heading card while checking slaving meter.
   g. Switch to free gyro and periodically set card as unslaved gyro.

NOTE

In the localizer mode the "TO-FROM" arrows may remain out of view, depending upon the design of the NAV converter used in the installation.

(f) Single Engine Operations:
   (1) Engine failure during an autopilot approach operation: Disengage autopilot; conduct remainder of approach manually.
   (2) Engine failure during go-around: Disengage autopilot, retrim aircraft, perform basic airplane flight manual engine out procedures; then re-engage autopilot.
   (3) Engine failure during normal climb, cruise, descent: Retrim aircraft, perform basic airplane flight manual engine out procedures.
   (4) Maintain aircraft yaw trim throughout all single engine operations.

SECTION 4 - NORMAL PROCEDURES

PREFLIGHT INSPECTION - AUTOPILOT

(a) Roll Section
   (1) Place Radio Coupler in "Heading" mode and place roll rocker switch "ON" to engage roll section. Rotate roll command knob left and right and observe that control wheel describes a corresponding left and right turn, then center knob.
   (2) Set proper D.G. Heading on D.G. and turn Heading Bug to aircraft heading. Engage "Heading" mode rocker switch and rotate heading bug right and left. Aircraft control wheel should turn same direction as bug. Grasp control wheel and manually override servo, both directions.
   (3) Disengage autopilot by depressing trim switch. Check aileron operation is free and autopilot is disconnected from controls.

(b) Pitch Section
   (1) Engage "Roll" rocker switch.
   (2) Center pitch command disc and engage "Pitch" rocker switch.
   (3) Rotate pitch command disc full UP and full DOWN and check that control wheel moves same direction. Check to see that servo can be overriden by hand at control wheel.

NOTE

Autopilot might not be able to raise elevators, on ground, without assistance from pilot.

(4) Hold control wheel and disengage autopilot by pressing Master Autopilot Disconnect/Trim Interrupt Switch button. Check Roll and Pitch controls to assure autopilot has disconnected.

TRIM SYSTEM

General
This aircraft is equipped with a Command Trim System designed to withstand any type of single malfunction, either mechanical or electrical, without uncontrolled operation resulting. The preflight check procedure is designed to uncover hidden failures that might otherwise go undetected. Proper operation of the electric trim system is predicated on conducting the following preflight check before each flight. If the trim system fails any portion of the procedure, pull the trim circuit breaker out until trim system is repaired. Substitution of any trim system component for another model is not authorized. For emergency interrupt information, refer to Section 3 of this Supplement.

Command Electric Trim Switch
The Command Electric Trim Switch on the left hand portion of the pilot's control wheel has two functions:
(1) When the top bar (AP OFF) is pressed, it disconnects the Autopilot.
(2) When the top bar is pressed AND the rocker is moved forward, nose down trim will occur, when moved aft, nose up trim will occur.

(a) Preflight: Command Trim - Before Each Flight
(1) Check trim circuit breaker - IN.
(2) Trim Master Switch - ON.
(3) AP OFF - Check normal trim operation - UP. Grasp trim wheel and check override capability. Check nose down operation. Recheck override.
(4) With trim operating - depress interrupt switch - trim should stop - release interrupt switch - trim should operate.
(5) Activate center bar only. Push rocker fore and aft only. Trim should not operate with either separate action.

(b) Autotrim - Before Each Flight
   (1) AP ON - (Roll and Pitch Sections) Check automatic operation by activating autopilot pitch command UP then DN. Observe trim operation follows pitch command direction.

NOTE

In autopilot mode, there will be approximately a 3 second delay between operation of pitch command and operation of trim.

   (2) Press center bar (AP OFF) - release - check autopilot disengagement.
   (3) Rotate trim wheel to check manual trim operation. Reset to takeoff position prior to takeoff.

AUTOPILOT IN-FLIGHT PROCEDURE

(a) Trim airplane (ball centered).

(b) Check air pressure or vacuum to ascertain that the directional gyro and attitude gyro are receiving sufficient air.

(c) Roll Section
   (1) To engage - Center ROLL COMMAND knob, push ROLL rocker to "ON" position. To turn, rotate console ROLL knob in desired direction.
   (2) For heading mode, set directional gyro with magnetic compass. Push directional gyro HDG knob in, rotate to select desired heading. Push console heading rocker (HDG) to "ON" position. (Maximum angle to bank will be 20° with heading lock engaged.)

(d) Pitch Section (Roll section must be engaged prior to pitch section engagement).
   (1) Center pitch trim indicator with the pitch command disc.
   (2) Engage pitch rocker switch. To change attitude, rotate pitch command disc in the desired direction.

(e) Altitude Hold
Upon reaching desired or cruising altitude, engage altitude hold mode rocker switch. As long as Altitude Hold mode rocker is engaged, aircraft will maintain selected altitude. For maximum passenger comfort, rate of climb or descent should be reduced to approximately 500 FPM prior to altitude hold engagement. For accurate Altitude Holding below 90 KIAS lower flaps one or two notches.

NOTE

Prior to disengaging Altitude Hold mode, rotate Pitch Command Disc to center.

(f) Radio Coupling VOR-ILS with H.S.I. type instrument display. (Optional)
(1) VOR Navigation
a. Tune and identify VOR Station. Select desired course by rotating CRS knob of H.S.I.
b. Select OMNI mode on Radio Coupler.
c. Select HDG mode on autopilot console to engage coupler. Aircraft will turn to a 45° intercept angle to intercept the selected VOR course. Intercept angle magnitude depends on radio needle off - course magnitude, 100% needle deflection will result in 45° intercept angle, diminishing as the needle off-set diminishes.
d. NAV mode - NAV mode provides reduced VOR sensitivity for tracking weak, or noisy, VOR signals. NAV mode should be selected after the aircraft is established on course.

(2) ILS-LOC Front Course
a. Set inbound, front, localizer course with H.S.I. course knob.
b. Select LOC-Normal on Radio Coupler to intercept and track inbound on the localizer. Select LOC-REV to intercept and track the localizer course outbound to procedure turn area.
c. Select HDG mode on autopilot console to engage coupler.

(3) ILS - Back Course
   a. Set inbound, front, localizer course with H.S.I. course knob.
   b. Select LOC-REV, on radio coupler to intercept and track inbound on the back localizer course. Select LOC-NORM to intercept and track outbound on the back course to the procedure turn area.
   c. Engage HDG mode on autopilot console to engage coupler.

(g) Radio Coupling - VOR/ILS with standard directional gyro. (Optional)
Radio Coupler operation in conjunction with a standard directional gyro and VOR/LOC display differs from operation with an integrated display (H.S.I.) only in one respect. The HDG bug is used as the radio course datum and therefore must be set to match the desired VOR/ILS course as selected on the O.B.S.
   (1) For VOR Intercepts and Tracking:
   Select the desired VOR Course and set the HDG bug to the same heading. Select OMNI mode on the coupler and engage HDG mode on the autopilot console.
   (2) For ILS Front Course Intercepts and Tracking:
   Tune the localizer frequency and place the HDG bug on the inbound, front course heading. Select LOC-NORM mode on the coupler and engage HDG mode on the autopilot console.
   (3) For LOC Back Course Intercepts and Tracking:
   Tune the localizer frequency and place the HDG bug on the inbound course heading to the airport. Select LOC-REV mode on the coupler and engage HDG mode on the autopilot console.

(h) Coupled Approach Operations
   (1) VOR or LOC
      a. After arrival at the VOR Station, track outbound to the procedure turn area as described in Section 4 (f) or (g) as appropriate. Slow to 110 KIAS and lower one notch of flaps.
      b. Use HDG mode and Pitch or Altitude Hold modes as appropriate during procedure turn.

c. At the F.A.F. inbound, return to pitch mode for control of descent and lower landing gear.
d. At the M.D.A. select altitude hold mode and add power for level flight. Monitor altimeter to assure accurate altitude control is being provided by the autopilot.
e. Go Around - For missed approach select desired pitch attitude with pitch command disc and disengage altitude hold mode. This will initiate the pitch up attitude change. Immediately add takeoff power and monitor Altimeter and rate of climb for positive climb indication. After climb is established, retract flaps and gear. Adjust attitude as necessary for desired airspeed and select HDG mode for turn from the VOR final approach course.

(2) ILS - Front Course Approach With Glide Slope Capture. (Optional)
a. Track inbound to LOM as described in Section 4 (f) or (g) above and in Altitude Hold mode.
b. Inbound to LOM slow to 100 to 110 KIAS and lower flaps one notch.
c. Automatic Glide Slope capture will occur at Glide Slope intercept if the following conditions are met:
1. Coupler in LOC-Normal mode.
2. Altitude Hold mode engaged (Altitude Rocker on Console).
3. Under Glide Slope for more than 20 seconds.
4. Localizer radio frequency selected on NAV Receiver.
d. At Glide Slope Intercept immediately lower landing gear and reduce power to maintain approximately 90-100 KIAS on final approach. Glide Slope capture is indicated by lighting of the green Glide Slope engage Annunciator Lamp and by a slight pitch down of the aircraft.
e. Monitor localizer and Glide Slope raw data throughout approach. Adjust power as necessary to maintain correct final approach airspeed. All power changes should be of small magnitude and smoothly applied for best tracking performance. Do not change aircraft configuration during approach while autopilot is engaged.

f. Conduct missed approach maneuver as described in (h) (1) e. above.

NOTE

Glide Slope Coupler will not automatically decouple from Glide Slope. Decoupling may be accomplished by any of the following means:
1. Disengage Altitude Mode.
2. Switch Radio Coupler to HDG Mode.
3. Disengage Autopilot.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of the Pilot's Operating Handbook are necessary for this supplement.

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SUPPLEMENT 3

PIPER ELECTRIC PITCH TRIM

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Piper Electric Pitch Trim is installed. The information contained within this supplement is to be used "as described" in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional Piper Electric Pitch Trim is installed.

SECTION 2 - LIMITATIONS

No changes to the basic limitations provided by Section 2 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 3 - EMERGENCY PROCEDURES

(a) In case of malfunction, ACTIVATE disconnect switch located on the instrument panel below the left control wheel to the OFF position.
(b) In case of malfunction, overpower the electric trim at either control wheel.
(c) Maximum altitude change with a 4 second delay in recovery initiation is 600 feet and occurs in the cruise configuration. Maximum altitude change in the approach configuration with a 2 second recovery delay is 250 feet.

SECTION 4 - NORMAL PROCEDURES

The electric trim system may be turned ON or OFF by a switch located on the instrument panel below the left control wheel. The pitch trim may be changed when the electric trim system is turned on either by moving the manual pitch trim control wheel or by operating the trim control switch on the pilot's control yoke. To prevent excessive speed increase in the event of an electric trim run-away malfunction, the system incorporates an automatic disconnect feature which renders the system inoperative above approximately 169 KIAS. The disconnected condition does not affect the manual trim system.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

SUPPLEMENT 4

ANS 351 AREA NAVIGATION COMPUTER

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional ANS 351 Area Navigation Computer is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional ANS 351 Area Navigation Computer is installed.

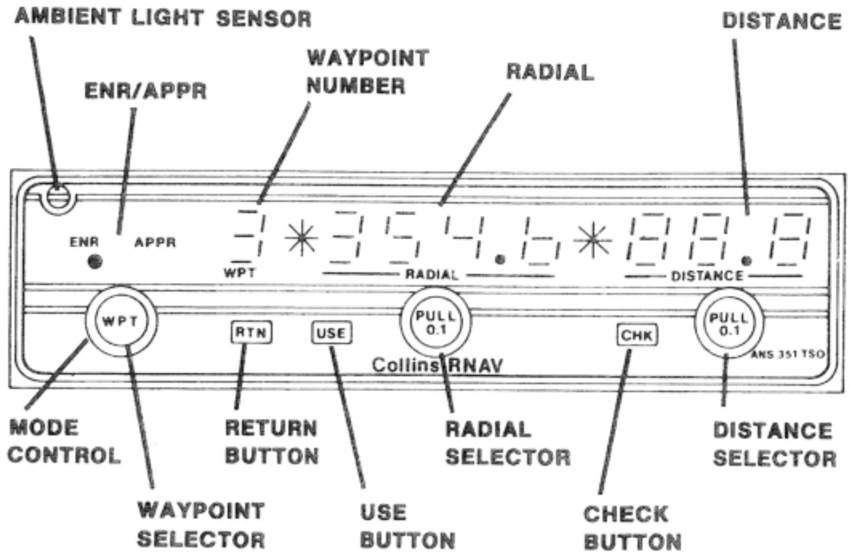
SECTION 2 - LIMITATIONS

No changes to the basic limitations provided by Section 2 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 3 - EMERGENCY PROCEDURES

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

SECTION 4 - NORMAL PROCEDURES



ANS 351 AREA NAVIGATION COMPUTER, CONTROLS AND INDICATORS

(a) CONTROLS

CONTROL OR INDICATOR	FUNCTION
Mode Control	Selects ENR (enroute) or APPR (approach) modes of operation. In the enroute mode, CDI deviation is 1 mile/dot, 5 miles full scale. In approach, CDI deflection is 1/4 mile/dot, 1-1/4 miles full scale.
Waypoint Selector	Sequences display waypoints from 1 through 8. Winking waypoint number indicates inactive waypoints; steadily-on-waypoint number indicates active waypoint.
Return Button	Depressing RTN (return) button returns the display to the active waypoint when an inactive waypoint is currently being displayed.

CONTROL OR INDICATOR	FUNCTION
Use Button	Depressing the USE button converts the way-point being displayed into the active waypoint.
Radial Selector	Two concentric knobs set radial information into the display. Knobs control information as follows: Large knob: Changes display in 10-degree increments. Small knob pushed in: Changes display 1-degree increments. Small knob pulled out: Changes display in 0.1-degree increments.
Distance Selector	Two concentric knobs set distance information in nautical miles into the display. Knobs control information as follows: Large knob: Changes display in 10-mile increments. Small knob pushed in: Changes display 1-mile increments. Small knob pulled out: Changes display in 0.1-mile divisions from 00.0 through 100 miles. Beyond 100 nmi, changes display in 1-mile increments.
Check Button	Depressing CHK (check) button causes DME and bearing indicators to display raw distance and bearing information. RNAV computation, CDI deviation, to/from display, and autopilot tracking of RNAV path remain unaffected. The check button is spring-loaded to prevent permanent actuation.
Ambient Light Sensor	Automatically adjusts display lighting intensity as a function of cockpit ambient light.

(b) AREA NAVIGATION WAYPOINT PROGRAMMING

(1) Presentation Of Waypoint On Ground

Waypoints are entered after engine start, since the waypoint information will probably be lost during the low-voltage condition occurring during engine cranking. Waypoint data should always be written in flight planning form to facilitate checking later in flight. When power is first applied to the ANS 351 and the system is in the RNAV mode, waypoint number 1 will be active, (waypoint number not blinking) and waypoint bearing and distance preset to zero will appear.

a. Waypoint number 1 coordinates are set into the ANS 351 using concentric knobs under bearing and distance display fields.
b. The waypoint selection knob is then rotated to select waypoint number 2. Note that the waypoint number is blinking, indicating that the waypoint is at this point inactive. Waypoint number 2 bearing and distance definitions are then set into the ANS 351.
c. Set up the rest of the desired waypoints as described above.
d. Press the RTN (return) pushbutton to display the active waypoint.

(2) Changing Waypoints In Flight

To change a waypoint in flight, rotate the waypoint selector until the desired waypoint number and coordinates are displayed on the ANS 351.

a. Verify that the waypoint definition is correct by comparing the display with the flight plan.
b. Uncouple the autopilot if tracking RNAV deviation.
c. Select the desired reference facility frequency on the associated NAV receiver.
d. Depress the USE pushbutton and note that the waypoint identification number stops winking.
e. Select the desired course on OBS.
f. Recouple the autopilot after deviation and distance-to-waypoint indications have stabilized.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

SUPPLEMENT 5

KNS 80 NAVIGATION SYSTEM

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional KNS 80 Navigation System is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional KNS 80 Navigation System is installed.

SECTION 2 - LIMITATIONS

No changes to the basic limitations provided by Section 2 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 3 - EMERGENCY PROCEDURES

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

SECTION 4 - NORMAL PROCEDURES

(a) KNS 80 OPERATION

The KNS 80 can be operated in any one of 3 basic modes: (a) VOR, (b) RNAV, or (c) ILS. To change from one mode to another, the appropriate pushbutton switch is pressed, except that the ILS mode is entered automatically whenever an ILS frequency is channeled in the USE waypoint. The display will annunciate the mode by lighting a message above the pushbutton. In addition to the standard VOR and RNAV enroute (RNV ENR) modes, the KNS 80 has a constant course width or parallel VOR mode (VOR PAR) and an RNAV approach mode (RNV APR). To place the unit in either of these secondary modes the VOR pushbutton or the RNAV pushbutton, as the case may be, is pushed a second time. Repetitive pushing of the VOR button will cause the system to alternate between the VOR and VOR PAR modes, while repetitive pushing of the RNAV button causes the system to alternate between RNV ENR and RNV APR modes.

(b) CONTROLS

(1) VOR BUTTON

Momentary pushbutton.

When pushed while system is in either RNV mode causes system to go to VOR mode. Otherwise the button causes system to toggle between VOR and VOR PAR modes.

(2) RNAV BUTTON

Momentary pushbutton.

When pushed while system is in either VOR mode causes system to go to RNV ENR mode. Otherwise the button causes system to toggle between RNV ENR and RNV APR modes.

(3) HOLD BUTTON

Two position pushbutton.

When in depressed position, inhibits DME from channeling to a new station when the VOR frequency is changed. Pushing the button again releases the button and channels the DME to the station paired with the VOR station.

(4) USE BUTTON

Momentary pushbutton.

Causes active waypoint to take on same value as displayed waypoint and data display to go to FRQ mode.

(5) DSP BUTTON
Momentary pushbutton.
Causes displayed waypoint to increment by 1 and data display to go to frequency mode.

(6) DATA BUTTON
Momentary pushbutton.
Causes waypoint data display to change from FRQ to RAD to DST and back to FRQ.

(7) OFF/PULL ID CONTROL
a. Rotate counterclockwise to switch off power to the KNS 80.
b. Rotate clockwise to increase audio level.
c. Pull switch out to hear VOR Ident.

(8) DATA INPUT CONTROL
Dual concentric knobs. Center knob has "in" and "out" positions.
a. Frequency Data
Outer knob varies 1 MHz digit.
A carryover occurs from the units to tens position.
Rollover occurs from 117 to 108, or vice versa.
Center knob varies frequency in .05 MHz steps regardless of whether the switch is in its "in" or "out" position.

b. Radial Data
Outer knob varies 10 degree digit.
A carryover occurs from tens to hundreds position.
A rollover to zero occurs at 360 degrees.
Center knob "in" position varies 1 degree digit.
Center knob "out" position varies 0.1 degree digit.

c. Distance Data
Outer knob varies 10 NM digit.
A carryover occurs from the tens to hundreds place.
A rollover to zero occurs at 200 NM.
Center knob "in" position varies 1 NM digit.
Center knob "out" position varies 0.1 NM digit.

(9) COURSE SELECT KNOB
Located in CDI unit.
Selects desired course through the VOR ground station or way point.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

SUPPLEMENT 6

OXYGEN INSTALLATION - SCOTT AVIATION PRODUCTS EXECUTIVE MARK III PART NUMBER 802180-04

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional portable oxygen system is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional portable oxygen system is installed.

SECTION 2 - LIMITATIONS

(a) No smoking allowed.
(b) Oxygen duration:

DURATION IN HOURS AT ALTITUDE

Persons Using Each Unit	10,000	15,000	20,000
1	6.3	4.7	3.8
2	3.2	2.4	1.9
3	2.1	1.6	1.3
4	1.6	1.2	.95

SECTION 3 - EMERGENCY PROCEDURES

(a) Time of useful consciousness at 20,000 feet is approximately 10 minutes.
(b) If oxygen flow is interrupted as evidenced by the flow indicators or hypoxic indications;
  (1) Install another mask unit.
  (2) Install mask connection in an unused outlet if available.
  (3) If flow is not restored, immediately descend to below 12,500 feet.

SECTION 4 - NORMAL PROCEDURES

PREFLIGHT

(a) Check oxygen quantity.
(b) Installation
  (1) Install mounting base between center seats utilizing slotted receptacles for front and rear attachment points.
  (2) Slide oxygen bottle into position on top of mounting base ensuring that all mounting lugs engage in the slotted receptacle and that the locking pin is in the raised position.
(c) Turn on oxygen system and check flow indicators on all masks. All masks are stowed in the oxygen system containers.

IN-FLIGHT

(a) Adjust oxygen mask.
(b) Turn on system.
(c) Monitor flow indicators and quantity.

CAUTION

Use of oxygen unit is prohibited when gauge approaches red area.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

SUPPLEMENT 7

FIXED OXYGEN SYSTEM INSTALLATION - SCOTT AVIATION PRODUCTS AMBASSADOR MARK III PART NUMBER 802889-04

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional fixed oxygen system is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional fixed oxygen system is installed.

SECTION 2 - LIMITATIONS

(a) No smoking allowed when oxygen system is in use.
(b) Oxygen duration: (bottle pressure 1850 psi)

DURATION IN HOURS AT ALTITUDE
(Based on 90% Consumption)

Persons Using System	10,000	15,000	20,000
1	7.8	8.2	8.5
2	3.9	4.1	4.2
3	2.6	2.7	2.8
4	1.9	2.0	2.1

SECTION 3 - EMERGENCY PROCEDURES

(a) Time of useful consciousness at 20,000 feet is approximately 10 minutes.
(b) If oxygen flow is interrupted as evidenced by the flow indicators or hypoxic indications;
  (1) Install another mask unit.
  (2) Install mask connection in an unused outlet if available.
  (3) If flow is not restored, immediately descend to below 12,500 feet.

SECTION 4 - NORMAL PROCEDURES

PREFLIGHT

(a) Check oxygen quantity.
(b) Turn on oxygen system and check flow indicators on all masks. All masks are stored in the seat pockets of the front seats.

IN-FLIGHT

(a) Adjust oxygen mask
(b) Turn on system
(c) Monitor flow indicators and quantity.

CAUTION

Do not use oxygen system below 200 psi to prevent contamination and/or moisture from entering depleted cylinder-regulator assembly. If cylinder has been depleted it must be removed and refurbished in accordance with the manufacturer's recommended procedures.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

SUPPLEMENT 8

AIR CONDITIONING INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the efficient operation of the airplane when the optional air conditioning system is installed. The information contained within this supplement is to be used "as described" in conjunction with the complete handbook.

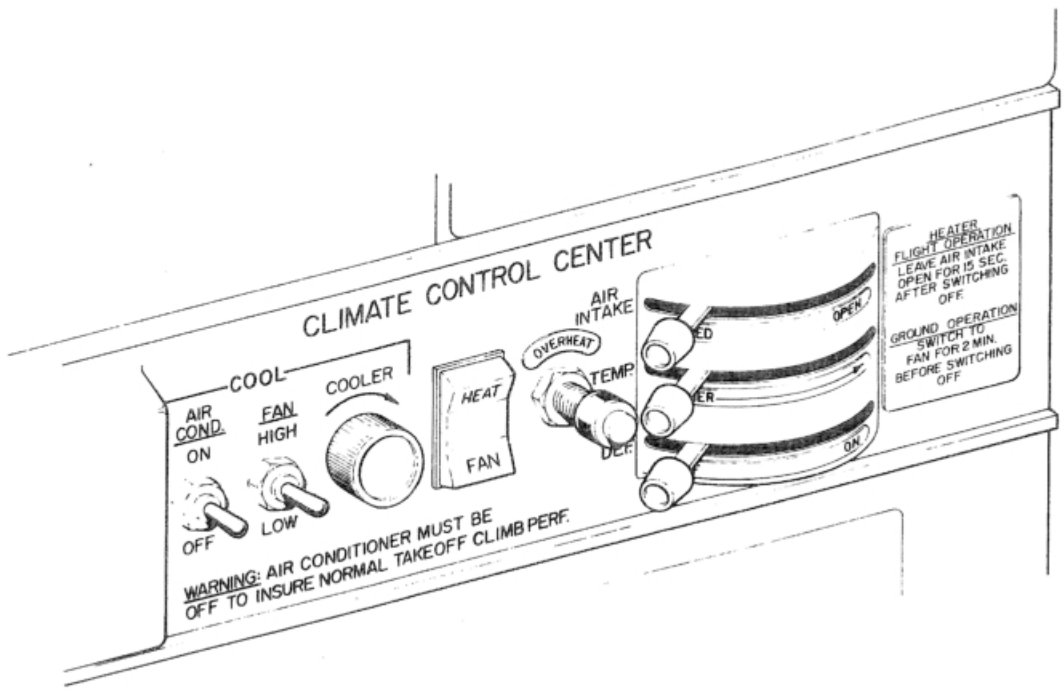
This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional air conditioning system is installed.

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

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

The condenser is mounted aft of the evaporator on the bottom tailcone skin. A continuously operating cooling fan ducts outside air through the condenser and dumps it overboard, on the ground or in flight, when the air conditioning is turned on.

The compressor is mounted on the front side of the left engine. It has an electric clutch which automatically engages or disengages the compressor to its belt drive system.



CLIMATE CONTROL CENTER
Figure 1-1

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

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

NOTE

If the system is not operating within 2 minutes, turn the system OFF until the fault is corrected.

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

Two circuit breakers on the circuit breaker panel protect the air conditioning electrical system.

SECTION 2 - LIMITATIONS

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

(b) Placards

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

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

SECTION 3 - EMERGENCY PROCEDURES

The air conditioner must be off during all one-engine inoperative operations.

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

SECTION 4 - NORMAL PROCEDURES

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

(a) Check aircraft master switch "ON."
(b) Turn the air conditioner control switch to "ON" and the fan switch to one of the operating positions. A slight decrease in left-engine RPM, and an ammeter increase of about 15 amps each, indicates proper equipment operation. Cool air should be felt from the overhead outlets within 2 minutes.
(c) Turn the air conditioner control switch to "OFF." Left-engine RPM should increase and the ammeter indication should drop.
(d) If the system does not respond as specified above, a malfunction is indicated and further investigation should be conducted prior to flight.

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

SECTION 5 - PERFORMANCE

Installation of the air conditioner does not effect the basic cruise performance information presented in Section 5 of this handbook. The climb performance in Section 5 is not effected when the air conditioner is in the off position.

NOTE

To insure maximum climb performance the air conditioner must be turned off manually before takeoff to disengage the compressor. Also the air conditioner must be turned off manually before the landing approach in preparation for a possible go-around. The air conditioner must be off for all one-engine-inoperative operations.

Additionally, the air conditioning system is designed so that the compressor will declutch when the throttle is advanced beyond 36 inches of mercury manifold pressure to provide maximum performance should the air conditioner be in the on position inadvertently.

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SUPPLEMENT 9

CENTURY 21 AUTOPILOT INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Century 21 Autopilot is installed in accordance with STC SA3376SW-D. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional Century 21 Autopilot is installed.

SECTION 2 - LIMITATIONS

(a) Maximum airspeed for autopilot operation is 185 KIAS.
(b) Autopilot OFF during takeoff and landing.

SECTION 3 - EMERGENCY PROCEDURES

(a) AUTOPILOT
In the event of an autopilot malfunction, or anytime the autopilot is not performing as commanded, do not attempt to identify the problem. Regain control of the aircraft by overpowering and immediately disconnecting the autopilot by depressing the AP ON-OFF switch on the programmer OFF.

Do not operate until the system failure has been identified and corrected.

(1) Altitude Loss During Malfunction:

a. An autopilot malfunction during climb, cruise or descent with a 3 second delay in recovery initiation could result in as much as 59° of bank and 350′ altitude loss. Maximum altitude loss was recorded at 185 KIAS during descent.

b. An autopilot malfunction during an approach with a 1 second delay in recovery initiation could result in as much as 18° bank and 40′ altitude loss. Maximum altitude loss measured in approach configuration, and operating either coupled or uncoupled, single or multi-engine.

(b) COMPASS SYSTEM

(1) Emergency Operation With Optional NSD 360A (HSI) Slaved and/or Non-Slaved:

NSD 360A

a. Appearance of HDG Flag:
   1. Check air supply gauge (vac or pressure) for adequate air supply (4 in. Hg. min.).
   2. Check compass circuit breaker.
   3. Observe display for proper operation.

b. To disable heading card - pull circuit breaker and use magnetic compass for directional data.

NOTE

If heading card is not operational, autopilot should not be used.

c. With card disabled VOR/Localizer and Glide Slope displays are still functional; use card set to rotate card to aircraft heading for correct picture.

d. Slaving Failure - (i.e. failure to self correct for gyro drift):
   1. Check gyro slaving switch is set to No. 1 position (if equipped with Slave No. 1 - No. 2 switch) or "Slaved" position when equipped with Slaved and Free Gyro Mode Switch.
   2. Check for HDG Flag.
   3. Check compass circuit breaker.
   4. Reset heading card while observing slaving meter.

NOTE

Dead slaving meter needle or a needle displaced fully one direction indicates a slaving system failure.

5. Select slaving amplifier No. 2, if equipped.
6. Reset heading card while checking slaving meter. If proper slaving indication is not obtained, switch to free gyro mode and periodically set card as an unslaved gyro.

NOTE

In the localizer mode, the "TO-FROM" arrows may remain out of view, depending upon the design of the NAV converter used in the installation.

SECTION 4 - NORMAL PROCEDURES

Refer to Edo-Aire Mitchell Century 21 Autopilot Operator's Manual, P/N 68S805, dated 1-79 for Autopilot Description and Normal Operating Procedures.

(a) PREFLIGHT PROCEDURES

NOTE

During system functional check the system must be provided adequate D.C. voltage (12.0 VDC min.) and instrument air (4.2 in. Hg. min.). It is recommended that one engine (minimum) be operated to provide the necessary power and that the aircraft be positioned in a level attitude, during the functional check.

(b) AUTOPILOT WITH STANDARD D.G.
(1) Engage autopilot.
(2) Control wheel movement should correspond to HDG command input.
(3) Grasp control wheel and override roll servo actuator to assure override capability.
(4) With HDG bug centered select NAV or APPR mode and note control wheel movement toward VOR needle offset.
(5) Select REV mode and note control wheel movement opposite VOR needle offset.
(6) Disengage autopilot.
(7) Check aileron controls through full travel to assure complete autopilot disengagement.

(c) AUTOPILOT WITH COMPASS SYSTEM (NSD 360A)
(For other compass systems, refer to appropriate manufacturer's instructions)
(1) Check slaving switch in slave or slave 1 or 2 position, as appropriate. (Slaving systems with R.M.I. output provide only slave and free gyro positions.)
(2) Rotate card to center slaving meter - check HDG displayed with magnetic compass HDG.
(3) Perform standard VOR receiver check.
(4) Perform Steps (1) - (7) in Section 4 item (b) except in Steps (4) and (5) substitute course arrow for HDG bug when checking control wheel movement in relation to L/R needle. HDG bug is inoperative with NAV, APPR, or REV mode selected.

(d) IN-FLIGHT PROCEDURE
(1) Trim aircraft for existing flight condition (all axes).
(2) Rotate heading bug to desired heading. Engage autopilot.
(3) During maneuvering flight - control aircraft through use of the HDG bug. (HDG mode)
(4) For navigation operations select modes as required by the operation being conducted and in accordance with the mode description provided in the Century 21 Operator's Manual.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

SUPPLEMENT 10

CENTURY 41 AUTOPILOT INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Century 41 Autopilot Model AK873 or Century 41 Flight Director Autopilot Mode AK873FD is installed in accordance with STC SA3375SW-D. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional Century 41 Autopilot or the Century 41 Flight Director Autopilot is installed.

SECTION 2 - LIMITATIONS

(a) Autopilot use prohibited above 185 KIAS.
(b) Autopilot OFF during takeoff and landing.
(c) Required Placard, P/N 13A990 stating "Conduct trim check prior to first flight of day - (See A.F.M.)" to be installed in clear view of pilot.
(d) Autopilot coupled Go-Around maneuvers prohibited [See Section 4 item (i)(3)].
(e) Category I operations only.

SECTION 3 - EMERGENCY PROCEDURES

(a) AUTOPILOT

In the event of an autopilot malfunction, or anytime the autopilot is not performing as commanded, do not attempt to identify the problem system. Regain control by overpowering and immediately disconnecting the autopilot. This will disable both the autotrim system and the autopilot system. If the malfunction was in the autotrim system there may be residual control wheel force after the system is OFF. Be prepared for any residual trim force and retrim, as necessary, using the aircraft's primary trim control system.

NOTE

Do not overpower autopilot in pitch for more than approximately 3 seconds as the autotrim system will cause an increase in pitch overpower forces.

(1) Autopilot may be disconnected by:
   a. Depressing "AP OFF" bar on pilot's trim switch.
   b. Depressing the AP ON-OFF switch on the programmer.
   c. Depressing master disconnect switch on pilot's control wheel.

(2) Autotrim may be disconnected by:
   a. Depressing the autopilot ON-OFF switch - OFF.
   b. Placing the autotrim master switch - OFF.
   c. Depressing master disconnect switch on pilot's control wheel.

   After failed system has been identified, pull system circuit breaker and do not operate until the system has been corrected.

(3) Single Engine Operations:
   a. Engine failure during an autopilot approach operation: Disengage autopilot, conduct remainder of approach manually.
   b. Engine failure during climb, cruise, descent: Retrim aircraft, perform basic airplane flight manual engine out procedures.

c. Maintain aircraft yaw trim throughout all single engine operations.

NOTE

Single engine operations below Single Engine Best Rate of Climb airspeed may require manual rudder application to maintain directional trim depending upon aircraft configuration and power applied.

(4) Altitude Loss During Malfunction:

a. An autopilot malfunction during climb or cruise with a 3 second delay in recovery initiation could result in as much as 59° bank and 700' altitude loss. Maximum altitude loss measured at 185 KIAS during descent.

b. An autopilot malfunction during an approach with a 1 second delay in recovery initiation could result in as much as 20° bank and 80' altitude loss. Maximum altitude loss measured in approach configuration, gear down, and operating either coupled or uncoupled, single or multi-engine.

(b) COMPASS SYSTEM

(1) Emergency Operation With Optional NSD 360A (HSI) Slaved and/or Non-Slaved:

NSD 360A

a. Appearance of HDG Flag:
   1. Check air supply gauge (vac or pressure) for adequate air supply (4 in. Hg. min.).
   2. Check compass circuit breaker.
   3. Observe display for proper operation.

b. To disable heading card - pull circuit breaker and use magnetic compass for directional data.

NOTE

If heading card is not operational, autopilot should not be used.

c. With card disabled VOR/Localizer and Glide Slope displays are still functional; use card set to rotate card to aircraft heading for correct picture.

d. Slaving Failure - (i.e. failure to self correct for gyro drift):
   1. Check gyro slaving switch is set to No. 1 position (if equipped with Slave No. 1 - No. 2 switch) or "Slaved" position when equipped with Slaved and Free Gyro Mode Switch.
   2. Check for HDG Flag.
   3. Check compass circuit breaker.
   4. Reset heading card while observing slaving meter.

NOTE

Dead slaving meter needle or a needle displaced fully one direction indicates a slaving system failure.

   5. Select slaving amplifier No. 2, if equipped. If not equipped, proceed with No. 7.
   6. Reset heading card while checking slaving meter. If proper slaving indication is not obtained,
   7. Switch to free gyro mode and periodically set card as an unslaved gyro.

NOTE

In the localizer mode, the "TO-FROM" arrows may remain out of view, depending upon the design of the NAV converter used in the installation.

SECTION 4 - NORMAL PROCEDURES

(a) NORMAL OPERATING PROCEDURES

NOTE

This autopilot is equipped with an A/P "OFF" warning horn that will sound for approximately 4 seconds anytime the autopilot is disengaged. This will be accompanied by an "A/P" message flash on the autopilot remote annunciator for approximately 5 seconds.

The horn may be silenced before the 4 second time limit is up by:
(1) Pressing "T" bar atop command trim switch.
(2) Or by re-engaging the autopilot.

NOTE

If this autopilot is equipped with a Flight Director steering horizon the F/D must be switched on before the autopilot may be engaged. Any autopilot mode may be preselected and will be retained upon autopilot engagement.

CAUTION

Flight Director Autopilot versions only are equipped with a remote go-around switch. When G/A mode is selected the AUTOPILOT WILL DISCONNECT and warning horn will sound. Pilot may use Flight Director steering for missed approach guidance and after aircraft is stabilized in a proper climb with gear and flaps up autopilot may be re-engaged and will retain G/A mode. Autopilot only versions (no Flight Director) do not have a G/A switch.

CAUTIONS

To avoid inadvertent or false glideslope captures while operating on the localizer use NAV mode instead of APR mode.

Refer to Edo-Aire Mitchell Century 41 Operator's Manual, P/N 68S803, dated 1-79 for additional System Description and Normal Operating Procedures.

(b) PREFLIGHT PROCEDURES

NOTE

During system functional check the system must be provided adequate D.C. voltage (12.0 VDC min.) and instrument air (4.2 in. Hg. min.). It is recommended that one engine be operated (minimum) to provide the necessary power and that the aircraft be positioned in a level attitude, during the functional check.

(1) AUTOPILOT (F/D Switch ON if F/D Equipped)

a. Engage autopilot by pushing programmer OFF - ON switch ON.
b. Rotate D.G. HDG bug left then right and verify that control wheel movement corresponds to HDG command input.
c. Press pitch modifier button first up then down and note that pitch control follows pitch command input. Autotrim should follow pitch command input after approximately three second delay.
d. Grasp control wheel and override roll and pitch servo actuators to assure override capability.
e. Hold control yoke and disengage autopilot by activating the control wheel trim switch.
f. Check controls through full travel in roll and pitch to assure complete autopilot disengagement.
g. Retrim aircraft for takeoff.

(c) TRIM SYSTEM

The autopilot is provided with an electric elevator trim system having two modes of operation. When the autopilot is engaged and the trim master switch is ON, automatic electric trim (autotrim) is provided. When the autopilot is disengaged, command electric elevator trim is available by use of the control wheel switch provided or by use of the primary trim control wheel. The electric elevator trim system has been designed to withstand any type of single failure, either mechanical or electrical, without uncontrolled operation resulting. The automated system self test circuit provided, in conjunction with a functional check, described below, will uncover internal failures that otherwise could remain undetected and thus compromise the fail-safe properties of the system. Proper operation of the system is, therefore, predicated on conducting the following preflight check before first flight of each day. If the trim system fails any portion of this test, turn the autotrim master switch OFF and pull the autotrim circuit breaker, until the system is corrected.

The command electric trim switch on the left portion of the pilot's control wheel has two functions:

(1) When the top bar (AP OFF) is pressed, it disconnects the autopilot.
(2) When the top bar is pressed and the rocker is moved forward, nose down trim will occur; when moved aft, nose up trim will occur.

Command Trim - Before the First Flight of Each Day

(1) Trim master switch - ON.
(2) Verify normal trim UP and DOWN operation with control wheel switch.
(3) Press - center bar only - then release center bar.
(4) Push rocker fore and aft - only. Trim should not operate with either separate action.

Any failure of the preceding operations indicates that a failure exists in the system and the Command Trim shall not be operated until the failure has been identified and corrected.

Autotrim - Before the First Flight of Each Day

(1) Check trim master switch ON, autopilot OFF.

(2) Press and hold TEST pushbutton on Mode Annunciator. Verify the following sequence. (Each sequence will last approximately two seconds.):

a. All annunciations light with FAIL and AP flashing.

b. Autotrim flashes, goes steady, then flashes.

c. All lights go steady.

d. After three to five seconds, AUTOTRIM and FAIL flash continually.

(3) With TEST button on the Mode Annunciator still depressed, verify Trim will not operate in either direction with the Control Wheel Switch.

(4) Release TEST pushbutton. All lights except HDG and ATT shall extinguish.

Any deviation from the above sequence indicates that a failure exists in either the primary system or in the monitor circuits. The autopilot and trim system shall not be operated until the failure has been identified and corrected.

CAUTION

Recheck trim position prior to initiating take-off.

(d) FLIGHT DIRECTOR

(1) Check circuit breaker - IN.

(2) Flight director switch on steering horizon - ON. (Adjacent to instrument on single cue horizon.)

(3) Pitch modifier DN - UP - check pitch steering indicator moves appropriately.

(4) HDG bug RT - LT - check roll steering indicator moves appropriately.

(e) COMPASS SYSTEM (NSD 360A)

For other compass systems, refer to appropriate manufacturer's instructions.

(1) Check slaving switch in slave or slave 1 or 2 position, as appropriate. (Slaving systems with R.M.I. output provide only slave and free gyro positions.)

(2) Rotate card to center slaving meter - check HDG displayed with magnetic compass HDG.

(3) Perform standard VOR receiver check.

(4) NAV - APPR - Engage NAV or APPR mode switch and observe steering bar indicates turn toward the VOR needle.

NOTE

If the Omni Bearing Selector is more than 45° from the aircraft heading, the flight director steering bar will only indicate a turn toward the omni bearing.

(f) IN-FLIGHT PROCEDURE - FLIGHT DIRECTOR

(1) Century 41 circuit breaker - IN. Flight director switch - ON.

(2) Adjust HDG bug to aircraft heading and select desired pitch attitude by activation of the CWS (Pitch Synch) switch or the modifier switch.

(3) Maneuver aircraft manually to satisfy the commands presented. Select other modes as desired; refer to Century 41 Operator's Manual for mode description.

(g) IN-FLIGHT PROCEDURE - AUTOPILOT/FLIGHT DIRECTOR AUTOPILOT

(1) Flight director switch - ON, if F/D equipped. Rotate heading bug to desired heading.

(2) Trim aircraft for existing flight condition (all axes). Engage autopilot.

(3) During maneuvering flight - control aircraft through use of the HDG bug and the pitch modifier. (HDG-ATT modes) (For use of pitch synch switch see Operator's Manual.)

(4) For navigation operations select modes as required by the operation being conducted and in accordance with the mode description provided in Operator's Manual. For specific instructions relating to coupled instrument approach operations, refer to Special Operations and Information Section 4, item (i).

(h) IN-FLIGHT PROCEDURE - COMMAND/AUTOTRIM SYSTEM

(1) Trim master switch - ON.
(2) When the autopilot is engaged, pitch trim is accomplished and maintained automatically.
(3) With the autopilot OFF, command trim is obtained by pressing and rocking the combination TRIM-AP disconnect bar on the pilot's control wheel trim switch.

(i) SPECIAL OPERATIONS AND INFORMATION

(1) Altitude Hold Operation:
For best results, reduce rate of climb or descent to 1000 FPM before engaging altitude hold mode.
(2) Instrument Approach Operations:
Initial and/or intermediate approach segments should be conducted between 95-110 KIAS with the flaps extended as desired. Upon intercepting the glide path or when passing the final approach fix (FAF) immediately lower the landing gear and reduce the power for approximately 80-95 KIAS on the final approach segment. Adjust power as necessary during remainder of approach to maintain correct airspeed. Monitor course guidance information (raw data) throughout the approach. All power changes should be of small magnitude and smoothly applied for best tracking performance. Do not change aircraft configuration during approach while autopilot is engaged. For approaches without glide path coupling, adjust pitch attitude in conjunction with power to maintain desired airspeed and descent rate.

NOTE

Flight director or autopilot will not decouple from the GS or localizer in the event of radio failure, however, warnings will flash in the mode appropriate to the failure. Monitor course guidance raw data during the approach to assure signal quality.

(3) Instrument Approach Go-Around Maneuver (Flight Director Version Only):
   a. Select GA mode at the remote GA switch. Autopilot will disconnect and warning horn will sound.
   b. Add takeoff power, or power as desired.
   c. Check the correct attitude and that a positive rate of climb is indicated, then raise gear and flaps.
   d. Pilot may hand fly aircraft with reference to flight director steering information.
   e. After aircraft is established in climb, gear and flaps up, autopilot may be re-engaged by pushing "ON" button on console if flight director steering is switched on.
   f. Set desired HDG and select HDG mode for lateral maneuvering.

SECTION 5

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

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SUPPLEMENT 11

PIPER CONTROL WHEEL CLOCK INSTALLATION

SECTION 1 - GENERAL

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

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional Piper Control Wheel Clock is installed.

SECTION 2 - LIMITATIONS

No changes to the basic limitations provided by Section 2 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 3 - EMERGENCY PROCEDURES

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

SECTION 4 - NORMAL PROCEDURES

(a) SETTING
While in the CLOCK mode, the time and the date can be set by the operation of the RST button.

(b) DATE SETTING

Pressing the RST button once will cause the date to appear with the month flashing. Pressing the ST-SP button will advance the month at one per second, or at one per push, until the right month appears.

Pressing the RST button once again will cause the date to flash, and it can be set in a similar manner.

(c) TIME SETTING

The RST button must now be pressed two times to cause the hours digits to flash. The correct hour can be set in as described above.

Pressing the RST button once again will now cause the minutes digits to flash. The minutes should be set to the next minute to come up at the zero seconds time mark. The RST button is pressed once more to hold the time displayed. At the time mark, the ST-SP button is pressed momentarily to begin the time counting at the exact second.

If the minutes are not advanced when they are flashing in the set mode, pressing the RST button will return the clock to the normal timekeeping mode without altering the minutes timing. This feature is useful when changing time zones, when only the hours are to be changed.

(d) AUTOMATIC DATE ADVANCE

The calendar function will automatically advance the date correctly according to the four year perpetual calendar. One day must be added manually on Feb. 29 on leap year. The date advances correctly at midnight each day.

(e) DISPLAY TEST

Pressing both the RST and ST-SP buttons at the same time will result in a display test function.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

SUPPLEMENT 12

RCA WEATHERSCOUT II WEATHER RADAR SYSTEM

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional RCA WeatherScout II Weather Radar System is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional RCA WeatherScout II Weather Radar System is installed.

SECTION 2 - LIMITATIONS

No changes to the basic limitations provided by Section 2 of this Pilot's Operating Handbook are necessary for this supplement.

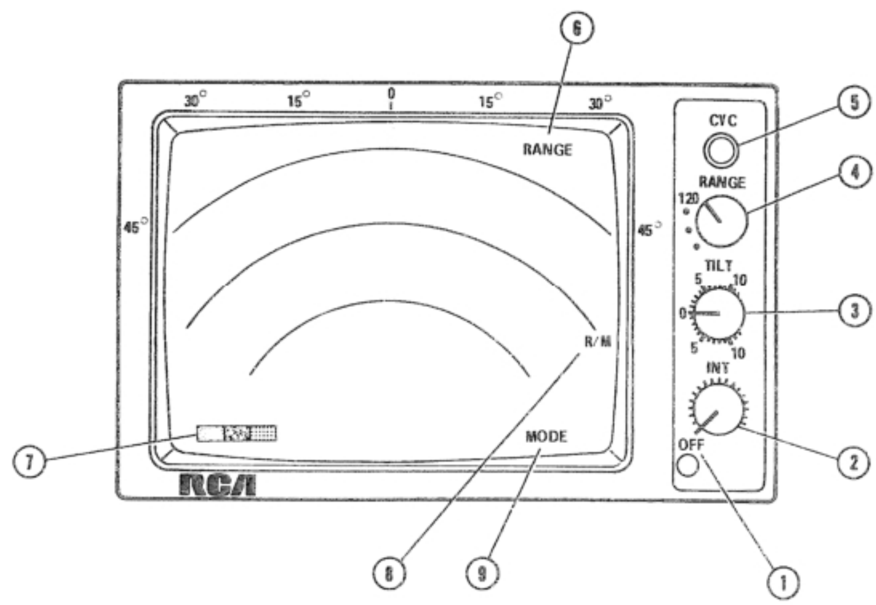
SECTION 3 - EMERGENCY PROCEDURES

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

SECTION 4 - NORMAL PROCEDURES

(a) SYSTEM CONTROLS

All controls used to operate the radar system are located on the front panel. These controls and the display features are indexed and identified in Figure 4-1 and described in Table 4-3.



INDICATOR CONTROLS AND DISPLAY FEATURES
Figure 4-1

(1)	OFF	On/Off function: full CCW rotation of INTensity control places system in OFF condition.
(2)	INT	Rotary control used to regulate brightness (INTensity) of display.
(3)	TILT	Rotary control used to adjust antenna elevation position. Control indexes increments of tilt from 0 to 12 degrees up or down.
(4)	RANGE 12/30/60/90 or 12/30/60/120	Rotary switch used to select one of four ranges.
(5)	CYC	Pushbutton switch used to select cyclical contour mode. Data is presented alternately as normal for 0.5 seconds, then contoured for 0.5 seconds. Pressing switch a second time restores normal or WX mode.
(6)	Range Field	Maximum selected range is displayed. Maximum range is always displayed when indicator is in on-condition.
(7)	Test Field	Test block displays three illumination levels.
(8)	Range Mark Identifier	Individual label displayed for each range mark.
(9)	Mode Field	Operating mode is displayed as WX or CYC. When system is first turned on, WAIT is displayed until system times out (30-40 seconds).

INDICATOR CONTROLS AND DISPLAY FEATURES
Table 4-3

(b) PRELIMINARY CONTROL SETTINGS

Place the Indicator controls in the following positions before applying power from the aircraft electrical system:

INTensity control . . . . Fully counterclockwise, in OFF
TILT control . . . . Fully upward
RANGE switch . . . . 12 nautical miles

(c) OPERATIONAL CONTROL SETTINGS

(1) Rotate INTensity control clockwise to bring system into ON condition.
(2) Note that WAIT is displayed during warm-up period of 30-40 seconds.
(3) When WX is displayed, rotate INTensity control clockwise until display brightness is at desired level.
(4) Set RANGE switch to desired range.
(5) Adjust TILT control for desired forward scan area.

(d) PRECAUTIONS

If the radar is to be operated while the aircraft is on the ground:

(1) Direct nose of aircraft such that antenna scan sector is free of large metallic objects (hangars, other aircraft) for a distance of 100 yards (90 meters), and tilt antenna fully upward.

WARNING

Do not operate the radar during refueling operations or in the vicinity of trucks or containers accommodating flammables or explosives; do not allow personnel within 15 feet of area being scanned by antenna when system is transmitting.

(2) Flash bulbs can be exploded by radar energy.
(3) Since storm patterns are never stationary, the display is constantly changing, and continued observation is always advisable where areas of turbulence prevail.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of the Pilot's Operating Handbook are necessary for this supplement.

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SUPPLEMENT 13

RCA COLOR WEATHERSCOUT II WEATHER RADAR SYSTEM

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional RCA Color WeatherScout II Weather Radar System is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional RCA Color WeatherScout II Weather Radar System is installed.

SECTION 2 - LIMITATIONS

No changes to the basic limitations provided by Section 2 of this Pilot's Operating Handbook are necessary for this supplement.

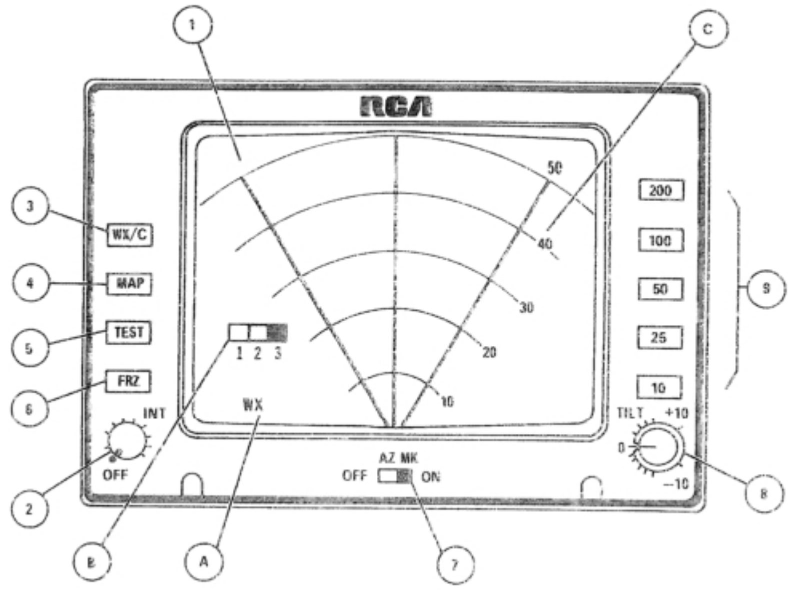
SECTION 3 - EMERGENCY PROCEDURES

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

SECTION 4 - NORMAL PROCEDURES

(a) SYSTEM CONTROLS

All controls used to operate the radar system are located on the indicator front panel. These controls and the display features are indexed and identified in Figure 4-1 and described in Table 4-3.



INDICATOR CONTROLS AND DISPLAY FEATURES
Figure 4-1

(b) OPERATION

Preliminary Control Settings

Place the Indicator controls in the following positions before applying power from the aircraft electrical system:

INTensity control . . . . Fully counterclockwise, in OFF
TILT control . . . . Fully upward
RANGE switch . . . . 10 nautical miles

(1)	Display Area	See item A, B, and C for explanation of alphanumeric display.
	(A) Mode Field	Selected mode is displayed as WX, CYC, MAP, or TEST. STBY is displayed if R-T is warming up and no mode is selected after turn-on. WAIT is displayed if a mode is selected prior to end of warm up or when Indicator and Antenna are synchronizing.
	(B) Auxiliary Field	FRZ is displayed as a blinking word if radar is in freeze mode (to remind pilot that radar display is not being updated for incoming target returns). 1 2 3 and color bar legend is displayed in WX/C, TEST and MAP modes. In weather mode color bar is green, yellow, and red. In map mode, color bar is cyan, yellow, and magenta.
	(C) Range Mark Identifiers	Five labeled range marks are displayed on each range. Label of furthest mark is same as range selected. Range and azimuth marks are displayed in cyan for WX/C and TEST, green for MAP.
(2)	INT/OFF	Rotary control used to regulate brightness (intensity) of display. On/Off function: Full CCW rotation of intensity control places system in OFF condition. CW rotation from OFF setting turns system on. STBY is displayed until WX/C, MAP, or TEST is selected.

INDICATOR CONTROLS AND DISPLAY FEATURES
Table 4-3

	If WX/C or MAP is selected initially or prior to the end of the warm-up period, WAIT will be displayed until RT warms up (approximately 30 seconds).
	If TEST is selected immediately, WAIT will be displayed until Antenna is synchronized (less than 4 seconds) and then test pattern will appear.
(3) WX/C	Alternate-action pushbutton switch used to select weather mode or cyclic contour mode.
	If selected at turn-on, system will come up in weather mode; second depression of switch will select cyclic contour mode.
	If selected when system is already operating in another mode, system will return to weather mode; second switch depression will select cyclic contour mode.
	In cyclic contour mode, 3-level (red) display will flash on and off at 1/2-second intervals.
(4) MAP	Pushbutton switch used to select ground mapping mode.

INDICATOR CONTROLS AND DISPLAY FEATURES (cont)
Table 4-3 (cont)

(5)	TEST	Pushbutton switch used to select test mode. Special test pattern is displayed. In test, transmitter does not transmit and range is automatically 100 nm.
(6)	FRZ	Pushbutton switch used to select freeze mode. Radar display is not updated with incoming target return data. As a warning to the pilot, FRZ level will flash on and off at 1/2-second intervals.
(7)	AZ MK	Slide switch used to display three-azimuth markers at 30-degree intervals.
(8)	TILT	Rotary control that enables pilot to select angles of antenna beam tilt with relation to airframe. Rotating control CW tilts beam upward; CCW rotation tilts beam downward.
(9)	10/25/50/100/ 200 (DI-1005)	Push button switches used to select desired range. Five range marks are displayed for each range.

INDICATOR CONTROLS AND DISPLAY FEATURES (cont)
Table 4-3 (cont)

(c) PRECAUTIONS

If the radar is to be operated while the aircraft is on the ground:

(1) Direct nose of aircraft such that antenna scan sector is free of large metallic objects (hangars, other aircraft) for a distance of 100 yards (90 meters), and tilt antenna fully upward.

WARNING

Do not operate the radar during refueling operations or in the vicinity of trucks or containers accommodating flammables or explosives; do not allow personnel within 15 feet of area being scanned by antenna when system is transmitting.

(2) Flash bulbs can be exploded by radar energy.
(3) Since storm patterns are never stationary, the display is constantly changing, and continued observation is always advisable where areas of turbulence prevail.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of the Pilot's Operating Handbook are necessary for this supplement.

SUPPLEMENT 14

RDR-160 WEATHER RADAR SYSTEM

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional RDR-160 Weather Radar System is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional RDR-160 Weather Radar System is installed.

SECTION 2 - LIMITATIONS

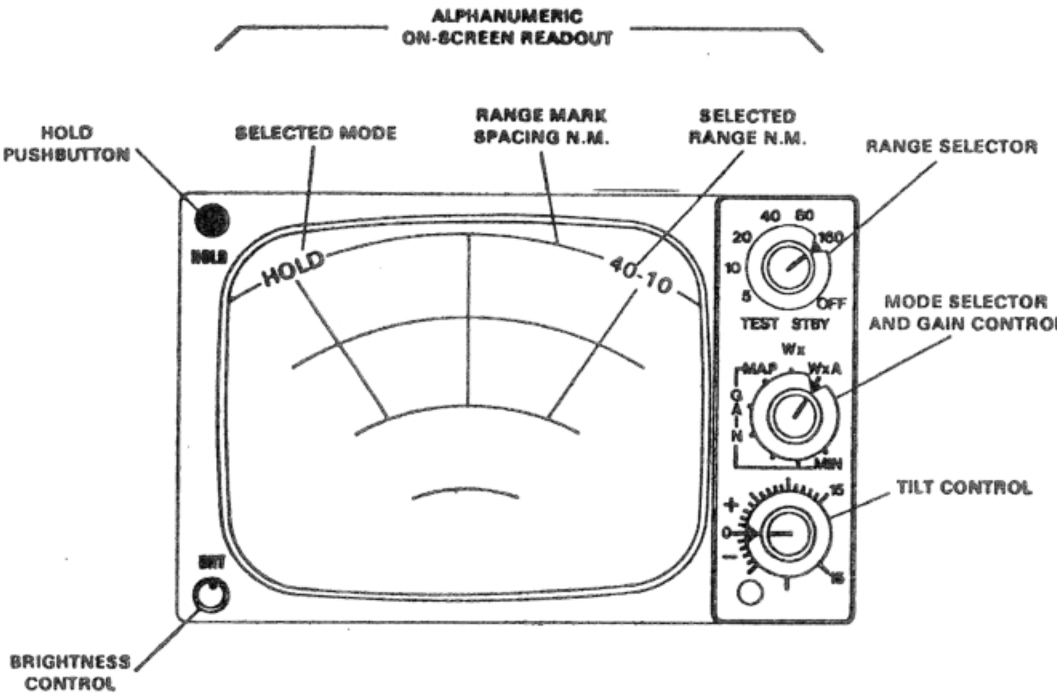
No changes to the basic limitations provided by Section 2 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 3 - EMERGENCY PROCEDURES

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

SECTION 4 - NORMAL PROCEDURES

(a) SYSTEM CONTROLS
Table 4-3 lists and describes the system controls, all of which are mounted on the panel of the radar indicator. Figure 4-1 illustrates the location of these controls. Table 4-5 lists the alphanumeric readouts of range - range marks and mode selection as a function of switch position.



LOCATION OF CONTROLS
Figure 4-1

CONTROL/ FUNCTION	OPERATIONAL USE
OFF/STBY/TEST	1. Controls primary power to radar system.
Range Selector	2. Places system in "standby" condition during warmup period and when system is not in use.
	3. Places system in "test" mode to determine operability of system. No transmission in "test" mode.
	4. Selects operating range. Enables transmitter.

CONTROL FUNCTIONS AND OPERATION
Table 4-3

CONTROL/ FUNCTION	OPERATIONAL USE
Wx/GAIN/Wx A Gain Control and Mode Selector	1. In Wx position, weather image gain is at pre-adjusted level. Contour operation is automatic and constant. 2. In GAIN position, 6 levels from MAP (maximum gain) to MIN may be selected for ground mapping operations. Contour operation is disabled. 3. In Wx A position, the radar indicator display alternately cycles between the Wx position and the GAIN MAP position. This will verify if a contour storm cell area is a storm cell and not a lake or some other terrain feature.
HOLD Pushbutton Video Hold/ Scan	When the HOLD pushbutton is initially depressed, weather or ground mapping image last presented is retained (frozen) on indicator display in order to evaluate the significance of storm cell movement. Depressing for a second time reveals direction and distance of target movement during hold period. During HOLD mode, the antenna continues to scan and a non-updated display will continue to be presented as long as power is supplied to the system. The word HOLD will be flashing.
TILT Antenna Tilt Control	Electrically adjusts the antenna to move the radar beam to 15 degrees up or down from horizontal ("0" position).
BRT Brightness Control	Control CRT picture intensity.

CONTROL FUNCTIONS AND OPERATION (cont)
Table 4-3 (cont)

RADAR-160 WEATHER RADAR SYSTEM

Range Switch Position	Range-Range Mark Readout
**TEST	40-10
5	5-1
10	10-2
20	20-4
40	40-10
80	80-20
160	160-40
Wx-MAP-Wx A Switch Position	**Mode Readout***
Wx	Wx
MAP	MAP
WxA	WxA

*When the HOLD pushbutton is initially depressed, the MODE READOUT displays flashing HOLD.
**The MODE READOUT displays TEST.

ALPHANUMERIC READOUT
Table 4-5

(b) GENERAL OPERATING PRECAUTIONS

WARNING

Do not operate the radar during refueling operations or in the vicinity of trucks or containers accommodating flammables or explosives; do not allow personnel within 15 feet of area being scanned by antenna when system is transmitting.

(1) Flash bulbs can be exploded by radar energy.
(2) Since storm patterns are never stationary, the display is constantly changing, and continued observation is always advisable where areas of turbulence prevail.

NOTE

See RDR-160 pilot manual for detailed operating information and analysis of targets.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of the Pilot's Operating Handbook are necessary for this supplement.

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SUPPLEMENT 15

RDR-160/IN-2026A WEATHER RADAR SYSTEM

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional RDR-160/IN-2026A Weather Radar System is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

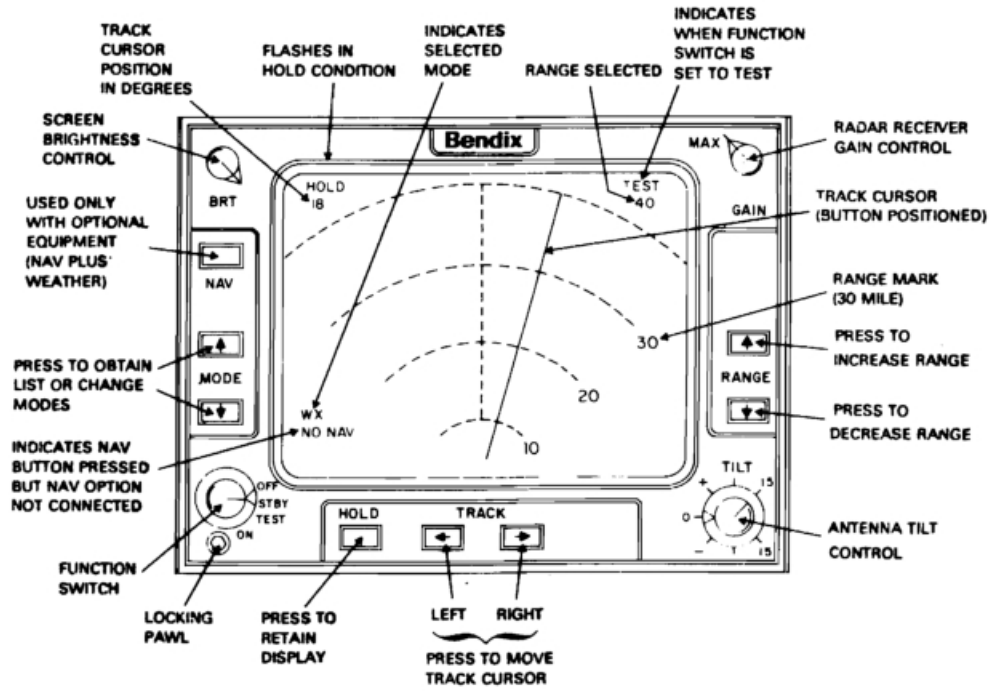
This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional RDR-160/IN-2026A Weather Radar System is installed.

SECTION 2 - LIMITATIONS

No changes to the basic limitations provided by Section 2 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 3 - EMERGENCY PROCEDURES

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



IN-2026A CONTROLS AND DISPLAYS
Figure 4-1

(a) EQUIPMENT OPERATION AND CONTROLS

(1) RDR-160/IN-2026A CONTROLS AND DISPLAYS

Controls and displays for the RDR-160/IN-2026A Weather Radar System are listed in table 4-3, with a functional description. Location of the controls and displays is shown in figure 4-1. All operating controls and displays are located on the indicator.

CONTROL/ DISPLAY	FUNCTION
Function selector	1. OFF position removes primary power from the system. 2. STBY position places system in the standby condition during warm-up period and when the system is not in use. No display. 3. TEST position selects test function to determine operability of the system. A test pattern is displayed. NO transmission exists in the TEST condition. 4. ON position selects the condition for normal operation. Radar transmission exists in the ON position.
[ ] MODE button	Moves the indicator display to the next lower mode each time the button is pressed while the list is present. The sequence is as listed above. NOTE When the bottom mode (WX) is reached, this button will not change the mode.
[ ] MODE button	Pressing momentarily produces an "information list" on the display. Pressing again, while information display is still present, advances the indicator display to the next higher mode shown on the list. The list disappears after a few seconds and the mode does not change if the button is not pressed again. The following standard modes are available in the order shown.

CONTROL/DISPLAY FUNCTIONS
Table 4-3

CONTROL/ DISPLAY	FUNCTION
	NAV FLT LOG - Functions available with optional IU-2023A. MAP - Ground mapping WXA - Weather mapping with alert. The red area flashes. WX - Weather mapping NOTE When the top mode is reached, the button will not change the mode.
NAV button (push-on/push-off)	Operational only when optional IU-2023A Remote Computer Unit is connected. When actuated, provides NAV information superimposed over the MODE selected (WX, WXA, or MAP). If interface is not connected, the words NO NAV will be displayed in the lower left corner.
BRT control	Adjusts brightness of the display for varying cockpit light conditions.
GAIN control	Varies the radar receiver gain when in the MAP mode. Gain and the STC are preset in TEST function and in the WX and WXA modes.
[ ] RANGE button	Clears the display and advances the indicator to the next higher range each time the button is pressed (eg: 20 to 40, 40 to 80, etc.), until 160 mile range is reached. The range selected is displayed in the upper right corner (on the last range mark), and the distance to each of the other range marks circles is displayed along the right edge of the circles (arcs).

CONTROL/DISPLAY FUNCTIONS (cont)
Table 4-3 (cont)

CONTROL/ DISPLAY	FUNCTION
[↓] RANGE button	Clears the display and places the indicator in the next lower range each time the button is pressed (eg: 40 to 20), until minimum range is reached.
TILT control	Electrically adjusts the antenna to move the radar beam up to +15 degrees above the horizontal, or to a maximum of -15 degrees below the horizontal position. The horizontal position is indicated as zero degrees on the control.
TRACK [→] button	When pressed, a yellow track cursor line appears and moves to the right (in one degree steps) while the button is held depressed. The track cursor stops when the button is released, and remains for about 10 to 15 seconds, then disappears unless the button is pressed again. The differential heading will be indicated in yellow numerals in the upper left corner of the display, and disappears simultaneously with the track cursor.
TRACK [←] button	When pressed, the yellow track cursor appears and moves to the left while held depressed. Operation is as explained above.

CONTROL/DISPLAY FUNCTIONS (cont)
Table 4-3 (cont)

CONTROL/ DISPLAY	FUNCTION
HOLD pushbutton (push-on/push-off)	Retains the display (NAV and weather) when button is actuated (push-on). The word HOLD flashes in the upper left corner of the display. The weather or ground mapping image last presented is retained (frozen) on indicator display in order to evaluate the significance of storm cell movement. Switching back to normal operation (pressing HOLD pushbutton a second time) reveals direction and distance of target movement during HOLD period. In HOLD, the antenna continues to scan and a non-updated display will continue to be presented as long as power is supplied to the system. A change in range selection, with indicator in HOLD results in a blank screen.

CONTROL/DISPLAY FUNCTIONS (cont)
Table 4-3 (cont)

(b) OPERATING PRECAUTIONS

WARNING

Do not operate the radar during refueling operations or in the vicinity of trucks or containers accommodating flammables or explosives. Do not allow personnel within 15 feet of area being scanned by antenna when system is transmitting.

(1) Flash bulbs can be exploded by radar energy.
(2) Since storm patterns are never stationary, the display is constantly changing. Continued observation is always advisable in stormy areas.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of the Pilot's Operating Handbook are necessary for this supplement.

PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT 16
SURFACE BOOTS, PROP HEAT AND RELATED EQUIPMENT
PIPER DWGS. 86908-2, 86909-2, -3 & 86911-2

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when optional surface boots, prop heat, windshield heat and related equipment are installed in accordance with "FAA Approved" Piper data.

The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" and must remain in this handbook at all times when the optional systems are installed.

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The installation of the optional equipment in this supplement does not imply the capability to fly into forecast or known icing. The equipment is provided to enlarge the options available to the pilot as he takes appropriate action to exit inadvertent icing encounters. The optional equipment is shown on Figure 1.

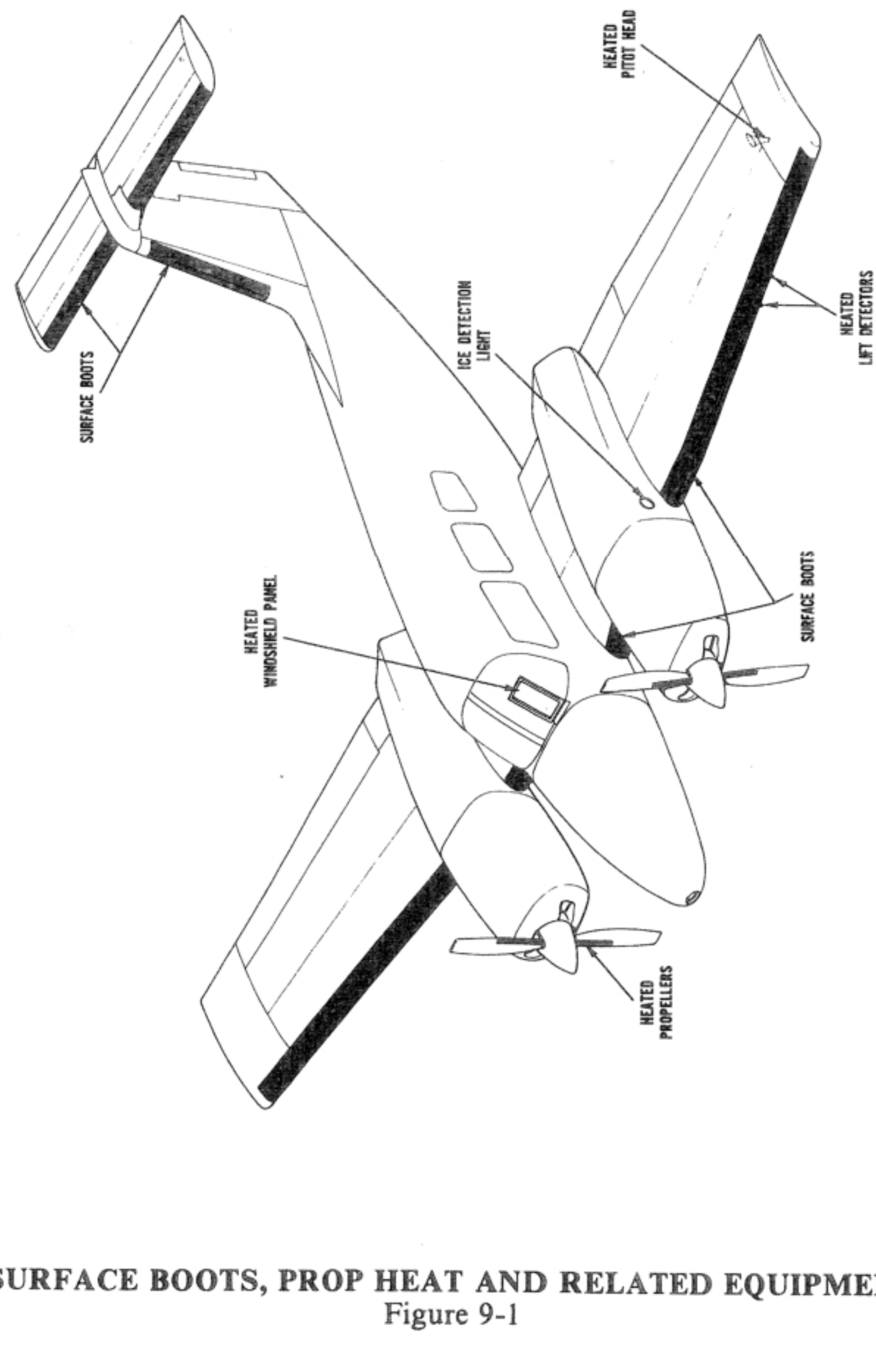
The equipment consists of the following components: surface boots with heated lift detectors, wing ice detection light, heated propellers, heated windshield panel, and heated pitot head. A single system or any combination of systems may be installed. However, the warning placard specified in Section 2 of this supplement is required.

The pneumatic surface boots are installed on the leading edges of the wings, the vertical stabilizer, and the stabilator. During normal operation, when the surface boot system is off, the engine-driven pneumatic pumps apply a constant suction to the surface boots to provide smooth, streamlined leading edges.

Surface boots are inflated by a momentary ON type SURFACE BOOTS switch (Figure 9-3) located on the instrument panel to the right of the control quadrant. Actuation of the surface boots switch activates a system cycle timer that energizes the pneumatic pressure control valves and allows the system pressure to reach 17 psi maximum within 6 seconds. The boot solenoid valves are activated and air pressure is released to the boots, inflating all surface boots on the airplane. A green indicator light illuminates when the boots are inflated above 8 psi. The light also incorporates a press-to-test and turn to dim feature. When the cycle is complete, solenoid valves permit automatic overboard exhaustion of pressurized air. Suction is then reapplied to the surface boots. The surface boots do not inflate during press-to-test light operation.

Circuit protection for the surface boot system is provided by a Surface Boots circuit breaker located on the circuit breaker panel.

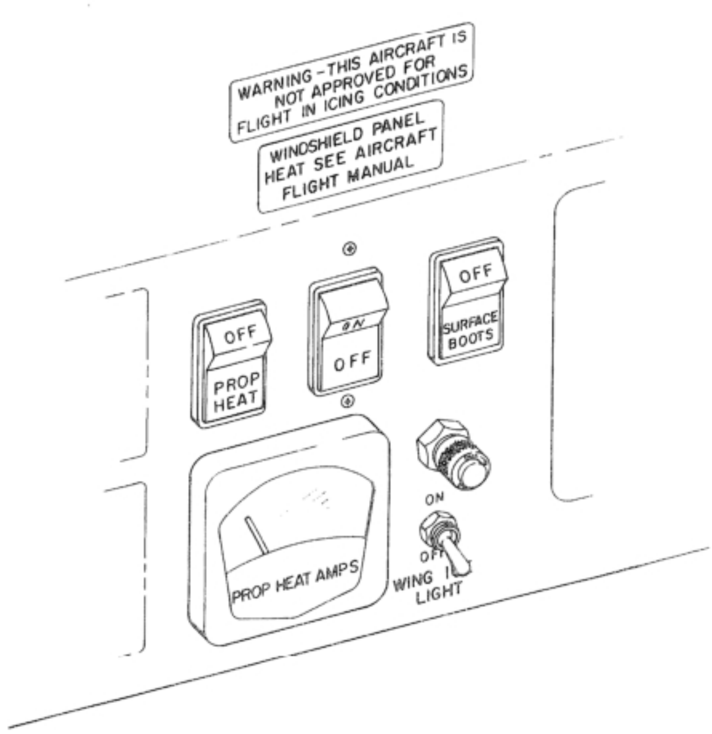
Wing icing conditions may be detected during night flight by use of an ice detection light installed in the outboard side of the left engine nacelle. The light is controlled by a ICE LIGHT switch (Figure 9-3) located on the instrument panel below the surface boot switch. A wing ice light circuit breaker located in the circuit breaker panel provides circuit protection.



SURFACE BOOTS, PROP HEAT AND RELATED EQUIPMENT
Figure 9-1

Two heated lift detectors and a heated pitot head installed on the left wing are controlled by a single ON-OFF type PITOT HEAT switch located on the switch panel to the left of the pilot. The heated pitot head also has a separate circuit breaker located in the circuit breaker panel labeled Pitot Heat. The lift detectors have a pull type 25 amp circuit breaker marked Lift Det Heat. This may be pulled to deactivate the lift detectors in case load shedding is required due to an alternator failure. The lift detectors have an in-line resistor activated by the main gear squat switch which limits the ground electrical load to approximately 25 percent of the inflight load. This allows the pitot heat and lift detectors to be activated prior to takeoff.

A heated glass panel is installed on the exterior of the pilot's windshield to provide visibility in icing conditions. The panel is heated by current from the airplane's electrical power supply and controlled by an ON-OFF control switch/circuit breaker. The control switch/circuit breaker is located in the center of the deice panel and is placarded WINDSHIELD PANEL HEAT - SEE AIRPLANE FLIGHT MANUAL.



ICE DETECTION LIGHT, SURFACE BOOTS, PROPELLER HEAT AND HEATED WINDSHIELD CONTROL SWITCHES
Figure 9-3

CAUTION

If the airplane is to be flown with the heated glass panel removed, rotate the receptacle plate 180° and replace it to cover the holes in the fuselage skin. Also replace the windshield collar screws.

An operational ground check may be performed by turning the heated windshield panel switch on for a period not exceeding 30 seconds. Proper operation is indicated by the glass section being warm to the touch.

Heated propeller pads are bonded to the leading edges of the propeller blades. The system is controlled by an ON-OFF type PROP HEAT switch located on the deice panel to the right of the control quadrant. Power for the propeller pads is supplied by the airplane's electrical system through a PROP HEAT circuit breaker in the circuit breaker panel. When the prop heat switch is actuated, power is applied to a timer through the PROP HEAT ammeter which monitors the current through the heated propeller system. With the heated propeller system on, the prop heat ammeter needle should indicate within the green shaded portion of the ammeter for a normal reading. Power from the timer is cycled to brush assemblies which distribute power to slip rings. The current is then supplied from the slip rings directly to the heated propeller pads. The prop heat system operates by heating the left propeller pads and then the right propeller pads in a time controlled sequence. Once begun, cycling will proceed in the above sequence and will continue until the system is turned off.

WARNING

Flight into known or forecast icing is not approved. If icing is encountered, take avoidance action immediately.

SECTION 2 - LIMITATIONS

(a) Flight into known or forecast icing conditions is not approved regardless of equipment installed.
(b) Under no circumstances should the heated windshield panel, and heated pitot head be turned on for a period exceeding one minute unless the aircraft is in flight.
(c) Maximum speed for surface boot inflation is 180 KIAS.
(d) Placards - in full view of pilot:

WARNING - THIS AIRCRAFT IS NOT APPROVED FOR FLIGHT IN ICING CONDITIONS.

CAUTION - COMPASS MAY BE IN ERROR WITH ELECTRICAL EQUIPMENT OTHER THAN AVIONICS ON.

SECTION 3 - EMERGENCY PROCEDURES

SURFACE BOOTS PANEL LIGHT

If light is illuminated more than 20 seconds pull surface boots circuit breaker.

SECTION 4 - NORMAL PROCEDURES

(a) An operational check of the heated windshield is accomplished by turning the heated panel switch on for a period not exceeding one minute. Proper operation is indicated by the glass section being warm to the touch.
(b) A preflight check of the heated propeller can be performed by turning the prop heat switch on and feeling the propeller pads for proper heating sequence. The pads should become warm to the touch.
(c) With the heated pitot switch on, check the heated pitot head and the heated lift detectors.

CAUTION

Care should be taken when an operational check of the heated pitot head and heated lift detectors is being performed. Ground operations should be limited to one minute maximum to avoid damaging the heating elements.

(d) The surface boots should be checked prior to flight for damage and cleanliness. If necessary, damage should be repaired and boots cleaned prior to flight. An operational check of the boot system should be performed during engine run up at 2000 RPM as follows:
   (1) Actuate the momentary SURFACE BOOTS switch - All boots will inflate simultaneously with a duration of approximately six seconds. The SURFACE BOOTS light will remain on while the pressure is above 8 psi.
   (2) Check visually to insure that the boots have deflated fully to indicate proper operation of the suction system.

WARNING

Do not hold momentary surface boot switch ON.

(e) Flight into known or forecast icing conditions is not approved regardless of equipment installed.

SECTION 5 - PERFORMANCE

Cruise speeds are reduced approximately 9 knots when the optional equipment in this supplement is installed. Range is also reduced accordingly. All other performances are unchanged.

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PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 17 FOR RDR-160XD/IN-232A WEATHER RADAR SYSTEM

SECTION 1 - GENERAL

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the RDR-160XD/IN-232A Weather Radar System is installed.

The information contained herein supplements or supersedes the basic Pilot's Operating Handbook and FAA Approved Airplanc Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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SECTION 2 - LIMITATIONS

No changes to the basic limitations provided by Section 2 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 3 - EMERGENCY PROCEDURES

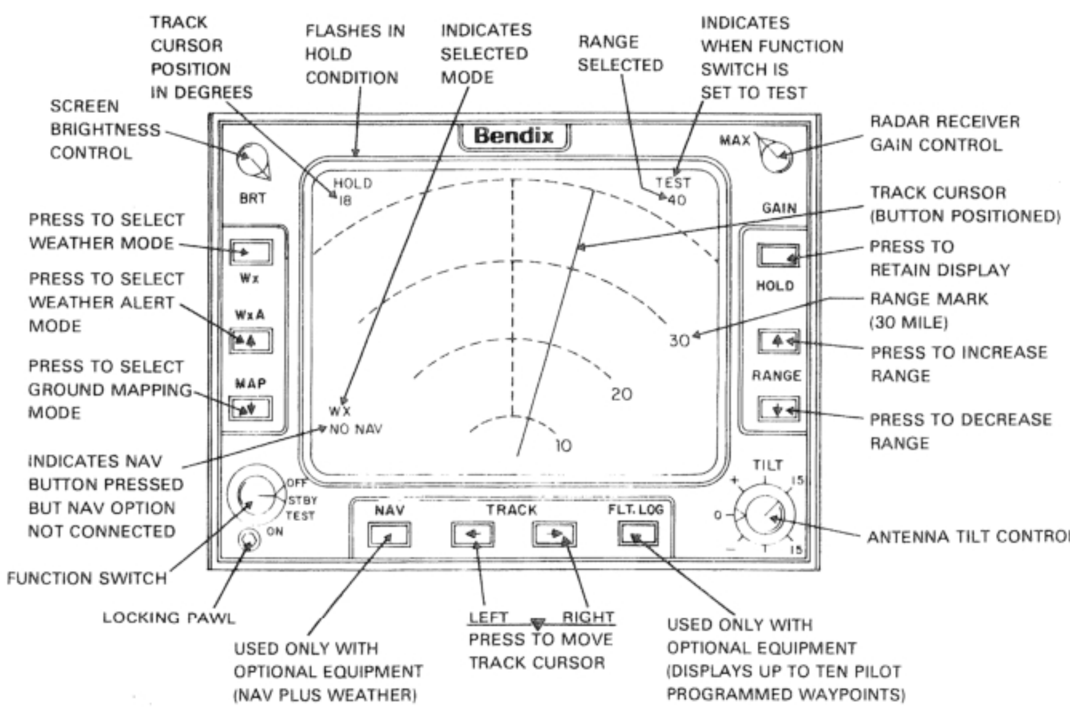
No changes to the basic Emergency Procedures provided by Section 3 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 4 - NORMAL PROCEDURES

(a) EQUIPMENT OPERATION AND CONTROLS

(1) RDR-160XD/IN-232A CONTROLS AND DISPLAYS

Controls and displays for the RDR-160XD/IN-232A Weather Radar System are listed in Table 4-3, with a functional description. Location of the controls and displays is shown in Figure 4-1. All operating controls and displays are located on the indicator.



IN-232A CONTROLS AND DISPLAYS
Figure 4-1

CONTROL/ DISPLAY	FUNCTION
Function selector	1. OFF position removes primary power from the system. 2. STBY position places system in the standby condition during warm-up period and when the system is not in use. No display. 3. TEST position selects test function to determine operability of the system. A test pattern is displayed. NO transmission exists in the TEST condition. 4. ON position selects the condition for normal operation. Radar transmission exists in the ON position.
[↓] RANGE button	Clears the display and places the indicator in the next lower range each time the button is pressed (eg: 40 to 20), until minimum range is reached.
TILT control	Electrically adjusts the antenna to move the radar beam up to +15 degrees above the horizontal, or to a maximum of -15 degrees below the horizontal position. The horizontal position is indicated as zero degrees on the control.
TRACK [→] button	When pressed, a yellow track cursor line appears and moves to the right (in one degree steps) while the button is held depressed. The track cursor stops when the button is released, and remains for about 10 to 15 seconds, then disappears unless the button is pressed again. The differential heading will be indicated in yellow numerals in the upper left corner of the display, and disappears simultaneously with the track cursor.

CONTROL/DISPLAY FUNCTIONS
Table 4-3

CONTROL/ DISPLAY	FUNCTION
TRACK [←] button	When pressed, the yellow track cursor appears and moves to the left while held depressed. Operation is as explained above.
GAIN control	Varies the radar receiver gain when in the MAP mode. Gain and the STC are preset in TEST function and in the WX and WXA modes.
BRT control	Adjusts brightness of the display for varying cockpit light conditions.
NAV button (push-on/push-off)	Operational only when optional IU-2023A Remote Computer Unit is connected. When actuated, provides NAV information superimposed over the MODE selected (WX, WXA, or MAP). If interface is not connected, the words NO NAV will be displayed in the lower left corner.
[↑] RANGE button	Clears the display and advances the indicator to the next higher range each time the button is pressed (eg: 20 to 40, 40 to 80, etc.), until 240 mile range is reached. The range selected is displayed in the upper right corner (on the last range mark), and the distance to each of the other range marks circles is displayed along the right edge of the circles (arcs).

CONTROL/DISPLAY FUNCTIONS (cont)
Table 4-3 (cont)

CONTROL/ DISPLAY	FUNCTION
HOLD pushbutton (push-on/push-off)	Retains the display (NAV and weather) when button is actuated (push-on). The word HOLD flashes in the upper left corner of the display. The weather or ground mapping image last presented is retained (frozen) on indicator display in order to evaluate the significance of storm cell movement. Switching back to normal operation (pressing HOLD pushbutton a second time) reveals direction and distance of target movement during HOLD period. In HOLD, the antenna continues to scan and a non-updated display will continue to be presented as long as power is supplied to the system. A change in range selection, with indicator in HOLD results in a blank screen.
Wx pushbutton	Selects the weather mode (Wx) when pressed. Pushbutton switch returns to normal position when released. "WX" appears in display.
WxA pushbutton (push-on/push-off)	Selects weather alert mode (WxA) when pressed. Red area flashes. Returns to previous mode (Wx or MAP) upon push-off.
MAP pushbutton	Selects ground mapping mode (MAP) when pressed. Mechanical operation same as Wx.
FLT LOG pushbutton	Operational only when optional NAV equipment is connected. When actuated, will display the flight log information stored in the optional NAV programmer. Ten waypoints and course information may be displayed (e.g., from NP-2041A). If a Remote Computer Unit is not connected, the words "NO LOG" appear in the lower left corner.

CONTROL/DISPLAY FUNCTIONS (cont)
Table 4-3 (cont)

(b) OPERATING PRECAUTIONS

WARNING

Do not operate the radar during refueling operations or in the vicinity of trucks or containers accommoding flammables or explosives. Do not allow personnel within 15 feet of area being scanned by antenna when system is transmitting.

(1) Flash bulbs can be exploded by radar energy.
(2) Since storm patterns are never stationary, the display is constantly changing. Continued observation is always advisable in stormy areas.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of the Pilot's Operating Handbook are necessary for this supplement.

PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 18 FOR ELECTRICAL DISTRIBUTION BUS MODIFICATION

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Electrical Distribution Bus Modification is installed in accordance with Piper Kit No. 764 937V.

The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the Electrical Distribution Bus Modification is installed in accordance with "FAA Approved" Piper data.

SECTION 2 - LIMITATIONS

No change.

SECTION 3 - EMERGENCY PROCEDURES

ELECTRICAL POWER LOSS

ALT annunciator light illuminated:
Ammeters .... check to determine inop. ALT

If one ammeter shows zero:
Inop. ALT switch .... OFF

Reduce electrical loads to minimum:
ALT circuit breaker (5A) & (60A) .... check and reset as required

Inop. ALT switch .... ON

If power is not restored:
Inop. ALT switch .... OFF
Electrical loads .... re-establish to 60 amps max.

If both ammeters show zero:
ALT switches .... both OFF

Reduce electrical loads to minimum:
ALT circuit breakers (5A) & (60A) .... check both and reset as required

ALT switches .... ON one at a time
If either or both ALTS are restored leave its associated switch ON.
Turn inop. ALT switch OFF.

TABLE OF CONTENTS

SECTION 10

SAFETY TIPS

SECTION 10

SAFETY TIPS

10.1 GENERAL

This section provides safety tips of particular value in the operation of the Turbo Seminole.

10.3 SAFETY TIPS

(a) Learn to trim for takeoff so that only a very light back pressure on the wheel is required to lift the airplane off the ground.

(b) On takeoff, do not retract the gear prematurely. The airplane may settle and make contact with the ground because of lack of flying speed, atmospheric conditions, or rolling terrain.

(c) Flaps may be lowered at airspeeds up to 111 KIAS. To reduce flap operating loads, it is desirable to have the airplane at a slower speed before extending the flaps. The flap step will not support weight if the flaps are in any extended position. The flaps must be placed in the "UP" position before they will lock and support weight on the step.

(d) Before attempting to reset any circuit breaker, allow a two to five minute cooling off period.

(e) Always determine position of landing gear by checking the gear position lights.

(f) The shape of the nacelle fuel tanks is such that in certain maneuvers and with low fuel levels, the fuel may move away from the tank outlet. If the outlet is uncovered, the fuel flow will be interrupted and a temporary loss of power may result. Pilots can prevent inadvertent uncovering of the outlet by avoiding maneuvers which could result in uncovering the outlet.

Extreme running turning takeoffs should be avoided.

Prolonged slips and skids which result in excess of 2000 feet of altitude loss, or other radical or extreme maneuvers which could cause uncovering of the fuel outlet must be avoided as fuel flow interruption may occur when the tank being used is not full.

(g) The rudder pedals are suspended from a torque tube which extends across the fuselage. The pilot should become familiar with the proper positioning of his feet on the rudder pedals so as to avoid interference with the torque tube when moving the rudder pedals or operating the toe brakes.

(h) Anti-collision lights should not be operating when flying through overcast and clouds, since reflected light can produce spacial disorientation. Strobe lights should not be used in close proximity to the ground such as during taxiing, takeoff or landing.

(i) In an effort to avoid accidents, pilots should obtain and study the safety related information made available in FAA publications such as regulations, advisory circulars, Aviation News, AIM and safety aids.

(j) Pilots who fly above 10,000 feet should be aware of the need for special physiological training. Appropriate training is available at approximately twenty-three Air Force Bases throughout the United States for a small fee. The training is free at the NASA Center in Houston and at the FAA Aeronautical Center in Oklahoma.

Forms to be completed (Physiological Training Application and Agreement) for application for the training course may be obtained by writing to the following address:

Chief of Physiological Training, AAC-143
FAA Aeronautical Center
P. O. Box 25082
Oklahoma City, Oklahoma 73125

It is recommended that all pilots who plan to fly above 10,000 feet take this training before flying this high and then take refresher training every two or three years.

(k) Sluggish RPM control and propeller overspeed with poor RPM recovery after rapid throttle application are indications that nitrogen pressure in the propeller dome is low.

(l) Experience has shown that the training advantage gained by pulling a mixture control or turning off the fuel to simulate engine failure at low altitude is not worth the risk assumed, therefore it is recommended that instead of using either of these procedures to simulate loss of power at low altitude, the throttle be retarded slowly to idle position. Fast reduction of power may be harmful to the engine. A power setting of 2000 RPM and 11.5 in. Hg. MAP is recommended for simulated one engine operation.

(m) Before starting either engine, check that all radio switches, light switches and the pitot heat switch are in the OFF position so as not to create an overloaded condition when the starter is engaged.

(n) The airplane should not be flown in severe turbulence as damage to the airframe structure could result.

(o) The best speed for takeoff is about 75 KIAS under normal conditions. Trying to pull the airplane off the ground at too low an airspeed decreases the controllability of the airplane in the event of an engine failure.