

MALIBU MIRAGE

PA-46-350P

SN 4622001 AND UP

PILOT'S OPERATING HANDBOOK

AND

FAA APPROVED
AIRPLANE FLIGHT MANUAL

AIRPLANE
SERIAL NO. 4622012

AIRPLANE
REGIST. NO. N9153W

PA-46-350P

REPORT: VB-1332 FAA APPROVED BY:

D. H. Trompler

D. H. TROMPLER

D.O.A. NO. SO-1

PIPER AIRCRAFT CORPORATION

VERO BEACH, FLORIDA

DATE OF APPROVAL:

AUGUST 26, 1988

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.

Published by
PUBLICATIONS DEPARTMENT

Issued: June 15, 1988

© 1995, 2011 Piper Aircraft Corporation

All Rights Reserved

APPLICABILITY

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

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

REVISIONS

The information compiled in the Pilot's Operating Handbook, with the exception of the equipment list, will be kept current by revisions distributed to the airplane owners. The equipment list was current at the time the airplane was licensed by the manufacturer and thereafter must be maintained by the owner.

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

I. Revisions

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

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

II. Identification of Revised Material

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

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

ORIGINAL PAGES ISSUED

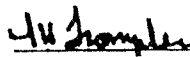
The original pages issued for this handbook prior to revision are given below:

Title, ii through vii, 1-1 through 1-12, 2-1 through 2-16, 3-1 through 3-30, 4-1 through 4-40, 5-1 through 5-32, 6-1 through 6-20, 7-1 through 7-50, 8-1 through 8-22, 9-1 through 9-62, and 10-1 through 10-2.

PIPER AIRCRAFT CORPORATION
PA-46-350P, MALIBU

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Current Revisions to the PA-46-350P Malibu Pilot's Operating Handbook,
 REPORT: VB-1332 issued June 15, 1988

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 1 (PR880915)	Title	Revised name.	 D.H. Trompler <u>Sept. 16, 1988</u> Date
	iv	Para. deleted.	
	4-15	Revised Caution.	
	5-11	Fig. 5-1 redrawn.	
	5-12	Fig. 5-3 redrawn.	
	5-15	Fig. 5-9 added.	
	5-19	Fig. 5-17 redrawn	
	5-21	Fig. 5-21 redrawn	
	5-30	Fig. 5-30 redrawn.	
	5-31	Revised associated conditions format on fig. 5-39.	
Rev. 2 (PR881212)	6-i	Table of Contents revised.	
	2-3	Revised para. 2.7.	
	2-13	Revised para. 2.35.	
	2-14	Revised para. no. Revised para. 2.35.	
	2-15	Revised para. no.	
	2-16	Revised para. no. Added info. to para. 2.35.	
	3-i	Revised T.O.C.	
	thru		
	3-iii		
	3-12	Relocated info. from p. 3-13. Moved info. to p. 3-13. Revised amplified para. no.	
	3-13	Relocated info. from p. 3-12. Revised amplified para. no.	
	3-14a	Added page. Added para. 3.3aa.	
	3-14b	Added page.	
	3-27	Revised para. 3.45.	
	3-30	Added para. 3.59.	
	4-12	Removed blank page note. Revised para. 4.5g.	

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 2 (cont)	4-16	Revised para. 4.5m	
	4-28	Revised para. 4.21	
	4-31	Revised para. 4.27.	
	4-33	Revised para. 4.31.	
	5-9	Revised para. 5.7.	
	5-24a	Added page. Added Fig. 5.26.	
	5-24b	Added page.	
	7-13	Revised Fig. 7-9.	
	7-24	Revised Fig. 7-17.	
	7-25	Revised Fig. 7-19.	
	7-27	Revised Fig. 7-23b.	
	7-30	Revised Fig. 7-25.	
	9-i	Revised T.O.C.	
	9-42	Moved info. to p. 9-43.	
	9-43	Added info. and Note to p. 9-43. Relocated info. from p. 9-42. Moved info. to p. 9-44.	
	9-44	Relocated info. from p. 9-43. Moved info. to p. 9-45.	
	9-45	Relocated info. from p. 9-44. Revised Fig. 7-1.	
	9-60	Revised Fig. 7-1.	
	9-61	Revised Fig. 7-2.	
	9-63	Added Supplement 7.	
	thru 9-92		
	9-93	Added Supplement 8.	
	thru 9-100		
	9-101	Added Supplement 9.	
	thru 9-104		
	9-105	Added Supplement 10.	
	thru 9-110		
	9-111	Added Supplement 11.	
	thru 9-116		

 D.H. Trompler
Dec. 12, 1983
 Date

PIPER AIRCRAFT CORPORATION
PA-46-350P, MALIBU

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 3 (PR890303)	4-i thru 4-iii	Revised T.O.C.	
	4-12	Moved para. 4.5h to p. 4-13.	
	4-13	Relocated para. 4.5h info. from p. 4-12. Repositioned Notes. Revised para. 4.5h. Added info. to para. 4.5h.	
	4-14	Added info. to para 4.5h. Revised and added info. to para. 4.5i.	
	4-16	Revised and added info. to para. 4.5m.	
	4-28	Repositioned Note. Relocated Note from p. 4-29. Added info. to para. 4.23. Revised para 4.23a.	
	4-29	Revised para. 4.23a. Moved Note to p. 4-28. Revised para. 4.23b title. Added para. 4.23b info. Added para. 4.23c.	
	4-30	Revised para. 4.25a title. Added para. 4.25b info.	
	4-33	Revised para. 4.31 title.	
	4-34	Revised para. 4.31a. Added para. 4.31b info.	
	5-3 thru 5-8	Revised para. 5.5.	
	5-9	Revised para. 5.7.	
	5-11	Fig. 5-1 redrawn.	
	5-12	Fig. 5-3 redrawn.	
	5-14	Fig. 5-7 added.	
	5-15	Fig. 5-9 redrawn.	
	5-17	Fig. 5-13 added.	
	5-18	Fig. 5-15 added.	

PIPER AIRCRAFT CORPORATION
PA-46-350P, MALIBU

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 3 (cont)	5-19	Fig. 5-17 redrawn.	
	5-20	Fig. 5-19 added. Fig. 5-19 title added.	
	5-21	Fig. 5-21 redrawn.	
	5-22	Fig. 5-23 added. Revised Fig. 5-23 title.	
	5-23	Added Fig. 5-24. Moved Fig. 5-25 to p. 5-24.	
	5-24	Relocated Fig. 5-25 from p. 5-23. Moved Power Setting Table to p. 5-24b.	
	5-24b	Relocated Power Setting Table from p. 5-24. Added info.	
	5-25	Fig. 5-27 added.	
	5-26	Fig. 5-29 added.	
	5-27	Fig. 5-31 added.	
	5-28	Fig. 5-33 added.	
	5-29	Fig. 5-35 added.	
	5-30	Fig. 5-37 redrawn.	
	5-31	Fig. 5-39 redrawn.	
	5-32	Fig. 5-41 added.	
	6-3	Corrected issue date.	
	6-14	Revised Fig. 6-15.	
	7-23	Revised para. 7.19.	
	7-31	Revised Fig. 7-25 callouts.	
	9-i	Revised T.O.C.	
	9-117 thru 9-120	Added Supplement 12.	
			 D. H. Trompler <u>March 24, 1989</u> Date

PIPER AIRCRAFT CORPORATION
PA-46-350P, MALIBU

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 4 (PR891006)	2-5	Revised para. 2.15.	
	2-7	Revised para. 2.21.	
	3-i,	Revised T.O.C.	
	3-iii		
	3-7	Revised para. 3.3j.	
	3-8,	Revised para. 3.3k.	
	3-9		
	3-11	Added Note. Moved para. 3.3s to p. 3-11b.	
	3-11a	Added page.	
	3-11b	Added page. Relocated para. 3.3s from p. 3-11. Relocated info from p. 3-12.	
	3-12	Moved info. to p. 3-11b. Revised para. 3.3t.	
	3-13	Added change bar to clarify revision to para. 3.3u in Revision 2.	
	3-14	Revised para. 3.3y title. Moved info. to p. 3-14a.	
	3-14a	Relocated info. from p. 3-14. Revised para. 3.3z.	
	3-16	Revised para. 3.9.	
	3-19	Added Note. Moved info. to p. 3-20.	
	3-20	Relocated info. from p. 3-19.	
	3-21	Added info. to para. 3.25. Moved info. to p. 3-22.	
	3-22	Relocated info. from p. 3-21.	
	3-24	Revised paras. 3.27 and 3.33.	
	3-26	Added Notes to paras. 3.39 and 3.41.	
	3-27	Revised para. 3.43.	
	3-29	Revised para. 3.53.	
	4-iv	Revised T.O.C.	
	4-4	Revised para. 4.5a.	

PIPER AIRCRAFT CORPORATION
PA-46-350P, MALIBU

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 4 (cont)	4-6	Revised Caution.	
	4-7	Revised Warning.	
	4-8	Revised Caution.	
	4-12	Revised para. 4.5f.	
	4-17	Revised para. 4.5o checklist heading. Revised para 4.5p title.	
	4-19	Revised para. 4.9a.	
	4-22	Revised Warning.	
	4-25	Revised para. 4.13c.	
	4-26	Revised para. 4.15.	
	4-28	Revised para. 4.21.	
	4-29	Revised paras. 4.23b and 4.23c.	
	4-30	Revised para. 4.25b.	
	4-31,	Revised para. 4.31.	
	4-32		
	4-35	Revised para 4.35 Title.	
	4-39	Revised para. 4.47.	
	5-8	Revised para. 5.5.	
	5-11	Revised Figure 5-1	
	5-22	Revised Figure 5-23	
	5-24	Revised Figure 5-25.	
	5-24b	Revised Power Setting Table info.	
	5-26	Revised Figure 5-29.	
	5-27	Revised Figure 5-31.	
	5-28	Revised Figure 5-33.	
	5-32	Revised Figure 5-41.	
	6-11	Revised Figure 6-9.	
	6-15	Revised para. 6.11.	
	6-16	Added sample problem.	
	6-17	Added Figure 6-17.	
	6-18	Added Figure 6-19.	
	7-16	Revised para. 7.15.	

PIPER AIRCRAFT CORPORATION
PA-46-350P, MALIBU

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 4 (cont)	7-21, 7-23, 7-24 7-25 7-28 7-29 7-31 7-32 7-34, 7-35, 7-36 7-37 7-38 7-41, 7-42 8-1, 8-2 8-3 8-17 9-i 9-27 9-43 9-44 9-50 9-52 9-53 9-57 9-58 9-64	Revised para. 7.19. Revised Figure 7-19 Revised para. 7-21. Added info. to para. 7-21. Revised Figure 7-25 callouts. Revised para. 7.23. Revised para. 7.25. Revised Figure 7-29. Revised para. 7.27. Revised paras. 7.27 and 7.29. Revised para. 8.1. Revised paras. 8.1 and 8.3. Corrected spelling. Revised paras 8.33 and 8.35(a). Revised T.O.C. Revised para. (h)(2). Added para. (h)(3). Revised Sections 6 and 7. Revised Section 7. Removed parenthesis. Revised para. (d). Revised In Flight. Revised In Flight, Wing Deice Light, Electric Propeller Deice, and Electrically Heated Wind-shield. Revised Heated Lift Detector. Added Caution. Revised Heated Pitot Head. Revised Note.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 4 (cont)	9-69	Revised para. B.6.b.(3)(a).	 D. H. Trompler <u>Nov. 2, 1989</u> Date
	9-70	Revised para. B.7.b.(3)(a).	
	9-74	Revised Section 7.	
	9-89	Revised Figure 7-19.	
	9-95	Revised format.	
	9-99	Revised autopilot circuit breaker function.	
	9-115	Revised Section 4, para. (e).	
Rev. 5 (PR891122)	9-121, 9-122	Added Supplement No. 13.	 D. H. Trompler <u>Dec. 12, 1989</u> Date
	vi-f	Added revision 5 to Log of Revisions.	
	8-12	Revised para. 8.23 (a).	
	9-ii	Added page to T.O.C. Added Supplement 14 to T.O.C.	
	9-53	Added Caution. Moved info. to page 9-54.	
	9-54	Relocated info. from page 9-53.	
	9-123 thru 9-128	Pages added. Supplement 14 added.	
Rev. 6 (PR900423)	vi-d, vi-e vi-f	Corrected Log of Revisions title. Corrected Log of Revisions title. Corrected Revision 5 date. Added Revision 6 to Log of Revisions.	
	vi-g, vi-h	Added pages. Added Revision 6 to Log of Revisions.	

PIPER AIRCRAFT CORPORATION
PA-46-350P, MALIBU

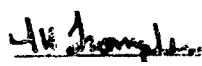
PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 6 (cont)	3-23	Revised para. 3.27.	
	4-17	Revised para. 4.5p checklist.	
	4-35	Revised para. 4.37.	
	5-24a	Revised Figure 5-26.	
	7-27	Corrected Figure 7-23a title.	
	7-48	Revised para. 7.39. Added ELT 910 info. Moved para. 7.41 and para. 7.43 info. to p. 7-49.	
	7-49	Added ELT 910 info. Relocated para. 7.41 and para. 7.43 info. from p. 7-48. Moved info. to p. 7-50.	
	7-50	Relocated info. from p. 7-49.	
	9-i	Corrected header info.	
	9-ii	Corrected header info. Revised T.O.C. info. Added Supplement Nos. 15 and 16 to T.O.C.	
	9-1	Corrected issue date.	
	9-81,	Revised item 7 info.	
	9-82		
	9-123	Revised info.	
	9-125	Revised Section 6 info.	
	9-129	Added Supplement No. 15.	
	thru		
	9-138		
	9-139	Added Supplement No. 16	
	thru		
	9-144		
Rev. 7 (PR910315)	vi-g	Added Revision 7 to Log of Revisions.	 D. H. Trompler <u>May 11, 1990</u> Date
	2-3	Revised para. 2.7 (d) (5).	
	2-4	Added Vac. Press. Limits	

ISSUED: APRIL 23, 1990
REVISED: OCTOBER 14, 1991

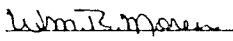
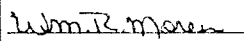
REPORT: VB-1332
vi-g

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 7 (cont)	4-31	Added Note. Revised para. 4.27.	 D. H. Trompler <u>April 22, 1991</u> Date
	7-i	Revised page header	
	7-33	Revised fig. 7-27.	
	8-3	Revised para. 8.5.	
	9-65	Revised Note.	
	9-66	Renumbered para's. 7 thru 9 as 8 thru 10. Added new para. 7	
	9-66a	Note. Moved info. to page 66a. Page added. Info. relocated from page 9-66. Revised para. B, 1.	
	9-66b	Page added.	
	9-124	Added para.to section 4	
	9-130	Added para.to section 4	
Rev. 8 (PR911014)	vi-g	Corrected Revision 7 Log of Revision entry.	
	vi-h	Added Revision 8 to Log of Revisions.	
	vi-i,	Added pages to Log of	
	vi-j	Revisions.	
	2-4	Added para. 2.11, (h).	
	3-12	Deleted info. from and revised para. 3.31.	
	3-27	Deleted info. from and revised para. 3.43.	
	4-11	Revised para. 4.5f.	
	4-12	Added Note and items to Ground Check and Before Takeoff checklists. Moved info. to page 4-13.	
	4-13	Info. relocated from page 4-12. Moved info. to page 4-14.	
	4-14	Info. relocated from page 4-13. Moved info. to page 4-15.	
	4-15	Info. relocated from page 4-14. Moved info. to page 4-16.	

PIPER AIRCRAFT CORPORATION
PA-46-350P, MALIBU

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

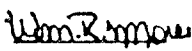
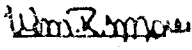
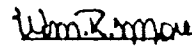
Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 8	4-16	Info. relocated from page 4-15.	 W. R. Moreu FAA/DOA Coordinator <u>29 OCT 91</u> Date
(cont)	4-17	Moved info. to page 4-17. Info. relocated from page 4-16.	
	4-18	Moved info. to page 4-18.	
	4-27	Info. relocated from page 4-17.	
		Revised wording and added Note to para.4.19.	
	4-28	Added Note and wording to para. 4.21.	
	7-41	Deleted info.from and revised para. 7.29.	
	9-64	Revised Section 2, para. E.	
	9-65	Revised Section 4 Note.	
	9-66	Deleted info. from para. 4, a. Revised Note.	
Rev. 9 (PR930122)	vi-i	Added Revision 9 to Log of Revision.	 W. R. Moreu FAA/DOA <u>1-26-93</u> Coordinator Date
	4-32	Revised para. 4.27	
	7-i	Added 7.6 to T.O.C.	
	7-7	Added Para. 7.6	
	7-8	Info. relocated to 7-10	
	9-ii	Revised Table of Contents	
	9-50	Revised Section 3 info.	
	9-63	DELETED Supplement 7	
	thru 9-92		
	9-145	Added Supplement 17	
	thru 9-170		
	9-171	Added Supplement 18	
	thru 9-174		
	9-175	Added Supplement 19	
	thru 9-180		

ISSUED: OCTOBER 14, 1991
REVISID: AUGUST 23, 1994

REPORT: VB-1332
vi-i

PIPER AIRCRAFT CORPORATION
PA-46-350P, MALIBU

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 10 (PR930427)	vi-i	Added Revision 10 to Log of Revision.	 W. R. Moreu FAA/DOA Coordinator <u>4-23-93</u> Date
	4-12	Revised Para. 4.5f Note	
	4-12	Revised Para. 4.5g Note	
	4-27	Revised Para. 4.19 Note.	
	4-28	Revised Para. 4.21 Note	
	9-i	Revised Table of Contents	
	9-93	DELETED Supplement 8	
Rev. 11 (PR940113)	vi-i	Added Revision 11 to Log of Revision.	 W. R. Moreu FAA/DOA Coordinator <u>1-13-94</u> Date
	8-11	Revised Para. 8.21 Table.	
	9-ii	Revised Table of Contents	
	9-42	Revised Section 4 Caution.	
	9-43	Added Caution to Section 4	
	9-181 thru 9-184	Added Supplement 20	
Rev. 12 (PR940113)	vi-i	Added Revision 12 to Log of Revision.	 W. R. MOREU FAA/DOA Coordinator <u>APRIL 1, 1994</u> Date
	7-i	Revised T.O.C.	
	7-49	Relocated para. 7.41 from pg. 7-49 to pg. 7-50 and para. 7.43 from pg. 7-49 to pg. 7-51.	
	7-49	Revised para. 7.39 added ELT info.	
	7-50	Relocated para. 7.43 from pg. 7-50 to page 7-51.	
	7-50	Revised para. 7.39 added ELT info.	
	7-51	Added page.	
	7-52	Added Page.	

PIPER AIRCRAFT CORPORATION
PA-46-350P, MALIBU

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 13 (PR940113)	vi-k	Added Pages vi-k and vi-l to Log of Revision.	 W. R. MOREU FAA/DOA Coordinator <u>August 23, 1994</u> Date
	vi-k	Added Revision 13 to Log of Revision.	
	vi-i	Revised Rev 9 Lof R	
	3-4	Revised para. 3.3d	
	3-12	Revised para. 3.3t	
	3-18	Revised para. 3.13	
	3-20	Revised para. 3.3f, heading	
	3-22	Revised para. 3.27 typo	
	4-7	Revised para. 4.5a	
	4-7	Revised 4.5b (was 4.9b)	
	4-12	Revised 4.5f, Rev. Note	
	4-13	Revised para. 4.5g	
	4-16	Revised para. 4.5m	
	4-22	Revised para. 4.9f	
	4-25	Revised para. 4.13e, typo	
	4-28	Revised para. 4.21	
	4-33	Revised para. 4.31	
	5-8	Revised para. 5.5(g) typo	
	7-35	Revised para. 7.25 typo	
	9-i	T.O.C. item 7, typo	
	9-ii	Revised Table of Contents	
	9-185 thru 9-194	Added Supplement 21	
Rev. 14 (PR950329)	2-16	Revised para. 2.35 (Added Placard)	 Peter E. Peck FAA/DOA Coordinator <u>March 29, 1995</u> Date

ISSUED: OCTOBER 14, 1991
REVISED: MAY 25, 1995

REPORT: VB-1332
vi-k

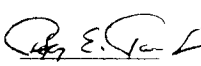
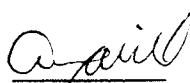
PIPER AIRCRAFT CORPORATION
PA-46-350P, MALIBU

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 15 (PR950525)	vi-k	Correct error to Log of Revision	 Peter E. Peck FAA/DOA Coordinator <u>May 25, 1995</u> Date
	vi-l	Added Revision 15 to Log of Revision.	
	3-7	Revised para. 3.3k	
	3-8	Revised para. 3.3k	
	4-11	Revised para. 4.5e	
	4-29	Revised para. 4.23a	
	7-9	Revised para. Fig. 7-5	
	7-21	Revised para. 7.19	
	7-22	Revised Fig. 7-15	
	7-27	Revised Fig. 7-23a	
	9-ii	Revised TOC	
	9-195 thru	Added Supplement 22 Argus 5000	
	9-202 thru	Added Supplement 23 KLN 90B	
	9-203 thru		
	9-214		
Rev. 16 (971114)	vi-l	Added Rev. 16 to L of R.	
	vi-m	Added page & Rev. 16.	
	vi-n	Added page.	
	3-i	Revised T of C.	
	3-ii	Revised T of C.	
	3-iii	Revised T of C.	
	3-2 thru	Relocated and/or revised information.	
	3-40		
	4-16	Revised para. 4.5m.	
	4-34	Revised para. 4.31.	
	8-i	Revised T of C.	
	8-ii	Added page.	

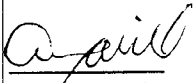
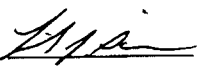
PIPER AIRCRAFT CORPORATION
PA-46-350P, MALIBU

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 16 (continued)	8-17	Revised para. 8.35.	 Peter E. Peck <u>Nov. 14, 1997</u> Date
	8-18	Revised para. 8.35.	
	8-22	Added para. 8.36.	
	8-23	Added page.	
	8-24	Added page.	
	9-48	Revised Section 2.	
	9-51	Revised Section 4.	
	9-54	Revised Section 4.	
	9-56	Revised Section 7.	
	9-186	Revised Section 4.	
	9-187	Revised Section 7.	
	9-194	Revised Section 7.	
Rev. 17 (PR021014)	iii	Added Warning and moved info. to page iv.	 Albert J. Mill <u>Oct. 14, 2002</u> Date
	iv	Moved info. from page iii.	
	vi-m	Added Rev. 17 to L of R.	
	8-1	Moved info. to page 8-1B and revised para. 8.1.	
	8-1A	Added page and revised para. 8.1.	
	8-1B	Added page and moved info. from pages 8-1 and 8-2.	
	8-2	Moved info. to page 8-1B and revised para. 8.3.	
Rev. 18 (PR040707)	vi-m	Added Rev. 18 to L of R.	
	vi-n	Added Rev. 18 to L of R.	
	2-i	Revised T of C.	
	2-12a	Added page; moved para. 2.33 from page 2-13; added Section 2.34, Icing Information.	

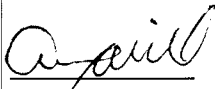
PIPER AIRCRAFT CORPORATION
PA-46-350P, MALIBU

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 18 (PR040707) continued	2-12b	Added page.	 Albert J. Mill July 7, 2004
	2-13	Moved para. 2.33 to page 2-12a.	
	4-iv	Revised T of C.	
	4-41	Added page and para. 4.50, Icing Information.	
	4-42	Added page.	
Rev. 19 (PR060501)	vi-n	Added Rev. 19 to L of R.	 Linda J. Dicken May 1, 2006
	4-i	Revised T of C.	
	4-ii	Revised T of C.	
	4-16	Moved info. to page 4-17.	
	4-17	Moved info. from page 4-16 and to page 4-18, and added Note to para. 4.5m.	
	4-18	Moved info. from page 4-17.	
	4-34	Added Note to para. 4.31.	
	8-9	Revised para. 8.17.	
Rev. 20 (PR110316)	ii	Updated Copyright date.	
	vi-n	Added Rev. 20 to L of R.	
	vi-o	Added page.	
	vi-p	Added page.	
	4-ii	Revised T of C.	
	4-iii	Revised T of C.	
	4-6	Revised Para 4.5a.	
	4-8	Revised Note in Para. 4.5c.	
	4-12	Revised Para. 4.5g.	
		Relocated text to page 4-13.	
	4-13	Added text from page 4-12.	
		Relocated text to page 4-14.	
	4-14	Added text from page 4-13.	
		Relocated text to page 4-15.	
	4-15	Revised Para. 4.5i.	
		Added text from page 4-14.	
		Relocated text to pages 4-15a and 4-15b.	

PIPER AIRCRAFT CORPORATION
PA-46-350P, MALIBU

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 20 (Cont.)	4-15a	Added Page	 Albert J. Mill March 16, 2011
		Revised Para. 4.5j.	
	4-15b	Added Page.	
		Revised Para. 4.5k.	
	4-16	Relocated text to page 4-15b.	
		Revised Para. 4.5k.	
	4-23	Revised Note in Para. 4.13a.	
	4-28	Revised Para. 4.21.	
		Relocated text to page 4-29.	
	4-29	Added text from page 4-28.	
		Relocated text to page 4-30.	
	4-30	Added text from page 4-29.	
		Revised Para.'s 4.25a. and 4.25b. Relocated text to page 4-31.	
	4-31	Added text from page 4-30.	
		Revised Para. 4.25b.	
		Relocated text to page 4-32.	
	4-32	Added text from page 4-31.	
		Revised Para. 4.27.	
		Relocated text to page 4-32a.	
	4-32a	Added Page.	
	4-32b	Added Page.	
	4-33	Relocated text to page 4-32b.	
		Revised Para. 4.29.	
	4-41	Revised Para. 4.50.	
	5-24b	Added Note to Table.	
	7-10	Added Note to Para. 7.9.	
	8-4	Revised Para. 8.9(a).	
	8-5	Revised Para. 8.9(b).	
	9-53	Added Note to Section 4.	
		Re-arranged Notes.	
		Relocated text to page 9-54.	
	9-54	Added text from page 9-53.	
		Relocated text to page 9-55.	
	9-55	Added text from page 9-54.	
	9-58	Revised Caution in Section 7.	

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

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

TABLE OF CONTENTS

SECTION 1

GENERAL

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

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.

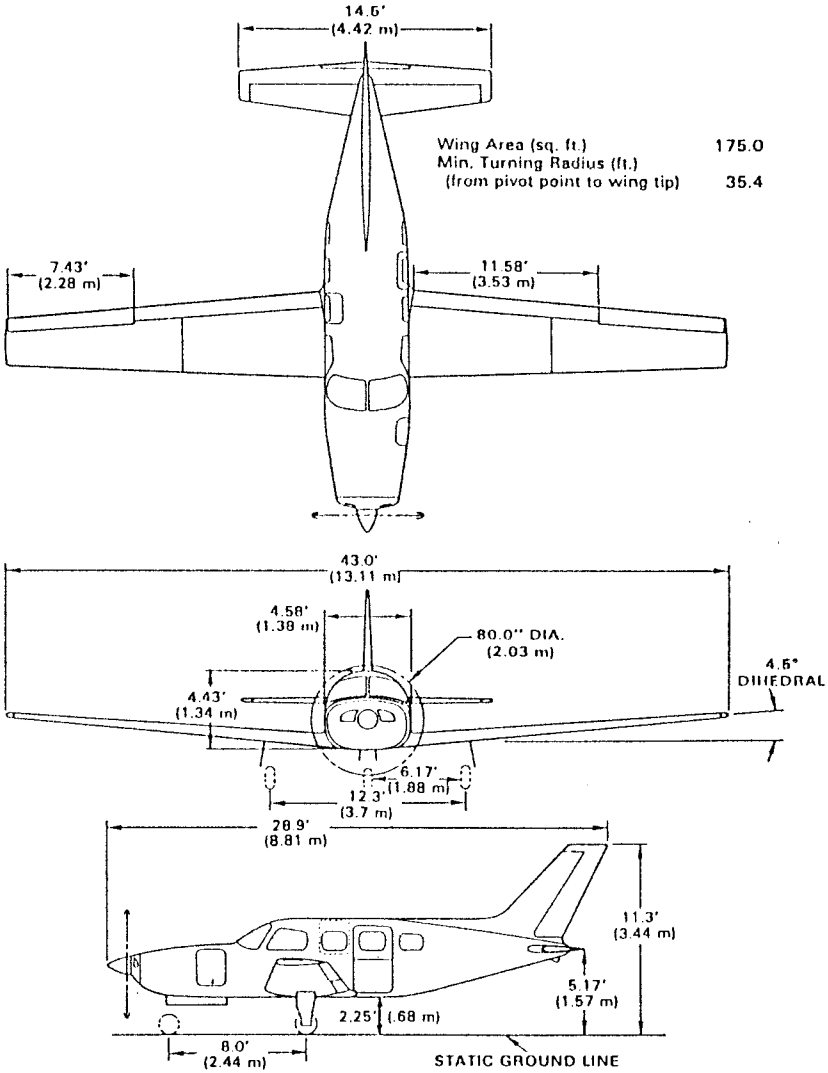
This handbook is not designed as a substitute for adequate and competent flight instruction, knowledge of current airworthiness directives, applicable federal air regulations or advisory circulars. It is not intended to be a guide for basic flight instruction or a training manual and should not be used 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 familiarize himself with the limitations, performance, procedures and operational handling characteristics of the airplane before flight.

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

-46-350P



THREE VIEW
Figure 1-1

1.3 ENGINE

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

1.5 PROPELLER

(a) Number of Propellers	1
(b) Propeller Manufacturer	Hartzell
(c) Blade Model	F8074 Standard F8074K Optional
(d) Number of Blades	2
(e) Hub Model	IIC-I2YR-1BF
(f) Propeller Diameter (inches)	
(1) Minimum	79
(2) Maximum	80
(g) Propeller Type	Constant Speed, Hydraulically Actuated

1.7 FUEL

AVGAS ONLY

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

(2) Alternate Fuels

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

1.9 OIL

- (a) Oil Capacity (U.S. quarts)

12
- (b) Oil Specification

Refer to latest revision of
Lycoming Service Instruction 1014.
- (c) Oil Viscosity per Average Ambient Temperature for Starting

Average Ambient Temperature	MIL-L-6082B SAE Grade	MIL-L-22851 Ashless Dispersant SAE Grades
All Temperatures	—	15W-50 or 20W-50
Above 80F	60	60
Above 60F	50	40 or 50
30F to 90F	40	40
0F to 70F	30	30, 40 or 20W-40
Below 10F	20	30 or 20W-30

When operating temperatures overlap indicated ranges, use the lighter grade oil.

1.11 MAXIMUM WEIGHTS

- (a) Maximum Ramp Weight (lb)

4318
- (b) Maximum Takeoff Weight (lb)

4300
- (c) Maximum Landing Weight (lb)

4100
- (d) Maximum Zero Fuel Weight (lb)

4100
- (e) Maximum Weights in Baggage
Compartments (lb)
- (1) Forward

100
- (2) Aft

100

1.13 STANDARD AIRPLANE WEIGHTS

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

1.15 CABIN AND ENTRY DIMENSIONS (IN.)

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

1.17 BAGGAGE SPACE AND ENTRY DIMENSIONS

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

1.19 SPECIFIC LOADING

(a) Wing Loading (lbs. per sq. ft.)	24.6
(b) Power Loading (lbs. per hp)	12.3

THIS PAGE INTENTIONALLY LEFT BLANK

1.21 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

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

(a) General Airspeed Terminology and Symbols

CAS	Calibrated Airspeed means the indicated speed of an aircraft, corrected for position and instrument error. Calibrated airspeed is equal to true airspeed in standard atmosphere at sea level.
KCAS	Calibrated Airspeed expressed in "Knots."
GS	Ground Speed is the speed of an airplane relative to the ground.
IAS	Indicated Airspeed is the speed of an aircraft as shown on the airspeed indicator when corrected for instrument error. IAS values published in this handbook assume zero instrument error.
KIAS	Indicated Airspeed expressed in "Knots."
M	Mach Number is the ratio of true airspeed to the speed of sound.
TAS	True Airspeed is the airspeed of an airplane relative to undisturbed air which is the CAS corrected for altitude, temperature and compressibility.
V _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.

1.21 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (Continued)

VLE	Maximum Landing Gear Extended Speed is the maximum speed at which an aircraft can be safely flown with the landing gear extended.
VLO	Maximum Landing Gear Operating Speed is the maximum speed at which the landing gear can be safely extended or retracted.
VNE/MNE	Never Exceed Speed or Mach Number is the speed limit that may not be exceeded at any time.
VNOMaximum	Structural Cruising Speed is the speed that should not be exceeded except in smooth air and then only with caution.
Vs	Stalling Speed or the minimum steady flight speed at which the airplane is controllable.
Vso	Stalling Speed or the minimum steady flight speed at which the airplane is controllable in the landing configuration at maximum gross weight.
Vx	Best Angle-of-Climb Speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.
Vy	Best Rate-of-Climb Speed is the airspeed which delivers the greatest gain in altitude in the shortest possible time.

1.21 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (Continued)

(b) Meteorological Terminology

ISA	International Standard Atmosphere in which: (1) The air is a dry perfect gas; (2) The temperature at sea level is 15° Celsius (59° Fahrenheit); (3) The pressure at sea level is 29.92 inches hg. (1013.2 mb); (4) The temperature gradient from sea level to the altitude at which the temperature is -56.5C (-69.7F) is -0.00198C (-0.003564F) per foot and zero above that altitude.
OAT	Outside Air Temperature is the free air static temperature obtained either from inflight temperature indications or ground meteorological sources, adjusted for instrument error and compressibility effects.
Indicated Pressure Altitude	The number actually read from an altimeter when the barometric subscale has been set to 29.92 inches of mercury (1013.2 millibars).
Pressure Altitude	Altitude measured from standard sea-level pressure (29.92 in. Hg) by a pressure or barometric altimeter. It is the indicated pressure altitude corrected for position and instrument error. In this handbook, altimeter instrument errors are assumed to be zero.
Station Pressure	Actual atmospheric pressure at field elevation.
Wind	The wind velocities recorded as variables on the charts of this handbook are to be understood as the headwind or tailwind components of the reported winds.

1.21 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (Continued)

(c) Power Terminology

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

(d) Engine Instruments

T.I.T. Gauge	Turbine Inlet Temperature

(e) Airplane Performance and Flight Planning Terminology

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

1.21 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (Continued)

(f) Weight and Balance Terminology

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

1.21 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (Continued)

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

TABLE OF CONTENTS
SECTION 2
LIMITATIONS

Paragraph No.		Page No.
2.1	General	2-1
2.3	Airspeed Limitations	2-1
2.5	Airspeed Indicator Markings.....	2-2
2.7	Power Plant Limitations	2-3
2.9	Leaning Limitations	2-3
2.11	Power Plant Instrument Markings.....	2-4
2.13	Weight Limits	2-4
2.15	Center of Gravity Limits	2-5
2.17	Maneuver Limits	2-5
2.19	Flight Load Factors	2-5
2.21	Kinds of Operation Equipment List	2-6
2.23	Fuel Limitations	2-12
2.25	Operating Altitude Limitations	2-12
2.27	Cabin Pressurization Limits	2-12
2.29	Air Conditioning System Limitations	2-12
2.31	Electric Auxiliary Cabin Heater Limitations	2-12
2.33	Maximum Seating Configuration.....	2-13
2.35	Placards	2-13

SECTION 2 LIMITATIONS

2.1 GENERAL

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

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

2.3 AIRSPEED LIMITATIONS

SPEED	KIAS	KCAS
Never Exceed Speed (VNE) - Do not exceed this speed in any operation.	198	200
Maximum Structural Cruising Speed (Vno) - Do not exceed this speed except in smooth air and then only with caution.	168	170
Design Maneuvering Speed (VA) - Do not make full or abrupt control movements above this speed.		
At 4300 LBS. Gross Weight	133	135
At 2450 LBS. Gross Weight	100	102

CAUTION

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

2.3 AIRSPEED LIMITATIONS (CONTINUED)

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

2.5 AIRSPEED INDICATOR MARKINGS

MARKING	IAS
Red Radial Line (Never Exceed)	198 KTS
Yellow Arc (Caution Range - Smooth Air Only)	168 KTS to 198 KTS
Green Arc (Normal Operating Range)	69 KTS to 168 KTS
White Arc (Flap Down)	58 KTS to 116 KTS

2.7 POWER PLANT LIMITATIONS

(a) Number of Engines	1
(b) Engine Manufacturer	Textron Lycoming
(c) Engine Model No.	TIO-540-AE2A
(d) Engine Operating Limits	
(1) Maximum Engine Speed	2500 RPM
(2) Maximum Oil Temperature	245°F
(3) Maximum Cylinder Head Temperature	500°F
(4) Maximum Turbine Inlet Temperature	1750°F
(5) Maximum Manifold Pressure	
(inches of mercury)	
To 20,600 feet	42
20,600 to 25,000 feet	42 -1.6 per 1000 foot increase
(e) Oil Pressure	
Minimum (red line)	25 PSI
Maximum (red line)	115 PSI
(f) Fuel (AVGAS ONLY)	
(minimum grade)	100 or 100LL Aviation Grade
(g) Number of Propellers	1
(h) Propeller Manufacturer	Hartzell
(i) Propeller Hub and Blade Model	
Standard	HC-12YR-1BF/F8074
Optional	HC-12YR-1BF/F8074K
(j) Propeller Diameter (inches)	
Minimum	79
Maximum	80
(k) Blade Angle Limits	
Low Pitch Stop	17.6° +/- 0.2°
High Pitch Stop	40.5° +/- 0.5°

2.9 LEANING LIMITATIONS

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

2.11 POWER PLANT INSTRUMENT MARKINGS

(a) Tachometer	
Green Arc (Normal Operating Range)	600 to 2500 RPM
Red Line (Maximum)	2500 RPM
(b) Manifold Pressure	
Green Arc (Normal Operating Range)	10 to 42.0 in. Hg
Red Line (Takeoff Power)	42.0 in. Hg
(c) Oil Temperature	
Green Arc (Normal Cruise Range)	100° to 245°F
Red Line (Maximum)	245°F
(d) Oil Pressure	
Green Arc (Normal Cruise Range)	55 PSI to 95 PSI
Yellow Arc (Caution Range) (Idle)	25 PSI to 55 PSI
Yellow Arc (Caution Range)	
(Start and Warm Up)	95 PSI to 115 PSI
Red Line (Minimum)	25 PSI
Red Line (Maximum)	115 PSI
(e) Turbine Inlet Temperature	
Green Arc (Normal Operating Range)	1200°F to 1750°F
Red Line (Maximum)	1750°F
(f) Cylinder Head Temperature	
Green Arc (Normal Operating Range)	200°F to 500°F
Red Line (Maximum)	500°F
(h) Vacuum Pressure	
Green Arc (Normal Operating Range)	4.8 to 5.2 in. Hg
Red Line (Minimum)	4.8 In. Hg
Red Line (Maximum)	5.2 In. Hg

2.13 WEIGHT LIMITS

(a) Maximum Ramp Weight	4318 LB
(b) Maximum Takeoff Weight	4300 LB
(c) Maximum Landing Weight	4100 LB
(d) Maximum Zero Fuel Weight	4100 LB
(e) Maximum Baggage (100 lb each compartment)	200 LB

NOTE

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

2.15 CENTER OF GRAVITY LIMITS

Weight Pounds	Forward Limit Inches Aft of Datum	Rearward Limit Inches Aft of Datum
4300	143.3	147.1
4100	139.1	147.1
4000	137.0	146.5
2450 (and less)	130.7	137.6
2400		137.3

NOTES

Straight line variation between points given.

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

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

2.17 MANEUVER LIMITS

No acrobatic maneuvers including spins approved.

2.19 FLIGHT LOAD FACTORS

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

2.21 KINDS OF OPERATION EQUIPMENT LIST

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

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

NOTE

The following system and equipment list does not include specific flight instruments and communication/navigation equipment required by the FAR Part 91 and 135 operating requirements.

System	Number Required	Types of Operation and Remarks (DAY, NIGHT, VFR, IFR and ICING Conditions)
1. ELECTRICAL		
Alternators	1	DAY, NIGHT, VFR, IFR
DC Voltmeter	1	DAY, NIGHT, VFR, IFR, ICING
Ammeters	2	DAY, NIGHT, VFR, IFR, ICING
ALT INOP Annunciator	2	DAY, NIGHT, VFR, IFR, ICING
LO BUS VOLT Annunciator	1	DAY, NIGHT, VFR, IFR, ICING
Propeller Heat Ammeter	1	ICING
Stall Warning	1	DAY, NIGHT, VFR, IFR, ICING
2. EQUIPMENT/ FURNISHINGS		
Safety Restraint Each Occupant	AR	DAY, NIGHT, VFR, IFR, ICING

2.21 KINDS OF OPERATION EQUIPMENT LIST (Continued)

System	Number Required	Types of Operation and Remarks (DAY, NIGHT, VFR, IFR and ICING Conditions)
3. FLIGHT CONTROLS		
Flap Position Indicator	1	DAY, NIGHT, VFR, IFR, ICING
Elevator and Rudder Trim Position Indicator	1 ea.	DAY, NIGHT, VFR, IFR, ICING
4. FUEL		
Fuel Quantity Indicating System	2	DAY, NIGHT, VFR, IFR, ICING
BOOST PUMP Annunciator	1	DAY, NIGHT, VFR, IFR, ICING
FUEL PRESS Annunciator	1	DAY, NIGHT, VFR, IFR, ICING
5. ICE PROTECTION		
Pneumatic Deice System (Wing and Empennage Protection)	1	ICING
Wing Ice Detection Light	1	ICING
Electrothermal Pro- peller Deice Pads	1 per Blade	ICING
Heated Windshield	1	ICING

2.21 KINDS OF OPERATION EQUIPMENT LIST (CONTINUED)

System	Number Required	Types of Operation and Remarks (DAY, NIGHT, VFR, IFR and ICING Conditions)
5. ICE PROTECTION (Continued)		
Heated Stall Warning Transducer	1	ICING
Heated Pitot Head	1	ICING
Alternate Static Source	1	ICING
WIND HEAT Annunciator	1	ICING
Vac Pump	2	ICING
SURFACE ICE Annunciator	1	ICING
Alternator	2	ICING
6. INSTRUMENTA- TION - ENGINE		
Tachometer	1	DAY, NIGHT, VFR, IFR, ICING
Oil Pressure Indicator	1	DAY, NIGHT, VFR, IFR, ICING
Oil Temperature Indicator	1	DAY, NIGHT, VFR, IFR, ICING
Manifold Pressure Indicator	1	DAY, NIGHT, VFR, IFR, ICING
Cylinder Head Tem- perature Indicator	1	DAY, NIGHT, VFR, IFR, ICING
Turbine Inlet Tem- perature Indicator	1	DAY, NIGHT, VFR, IFR, ICING

2.21 KINDS OF OPERATION EQUIPMENT LIST (CONTINUED)

System	Number Required	Types of Operation and Remarks (DAY, NIGHT, VFR, IFR and ICING Conditions)
7. INSTRUMENTATION - FLIGHT		
Airspeed Indicator	1	DAY, NIGHT, VFR, IFR, ICING
Altimeter	1	DAY, NIGHT, VFR, IFR, ICING
Free Air Temperature Gauge	1	DAY, NIGHT, VFR, IFR, ICING
Gyroscopic Attitude Indicator	1	IFR, ICING
Gyroscopic Heading Indicator	1	IFR, ICING
Turn Coordinator	1	IFR, ICING
8. LANDING GEAR		
Hydraulic Pump	1	DAY, NIGHT, VFR, IFR, ICING
HYD PUMP Annunciator	1	DAY, NIGHT, VFR, IFR, ICING
Landing Gear Down Position Indicating Lights	3	DAY, NIGHT, VFR, IFR, ICING
Landing Gear Warning Horn	1	DAY, NIGHT, VFR, IFR, ICING
GEAR WARN Annunciator	1	DAY, NIGHT, VFR, IFR, ICING

2.21 KINDS OF OPERATION EQUIPMENT LIST (CONTINUED)

System	Number Required	Types of Operation and Remarks (DAY, NIGHT, VFR, IFR and ICING Conditions)
9. LIGHTS - EXTERNAL		
Position Lights		
a. Left Wing - Red and White	1 ea.	NIGHT
b. Right Wing - Green and White	1 ea.	NIGHT
Anti-Collision (Strobe) Lights	2	NIGHT
10. LIGHTS - COCKPIT		
Instrument Panel Switch Lights	AR	NIGHT
Instrument Lights	AR	NIGHT
Map Lights	2	NIGHT
11. PNEUMATIC/ VACUUM		
Vacuum Pumps	1	IFR
Gyro Suction Indicator	1	IFR, ICING

2.21 KINDS OF OPERATION EQUIPMENT LIST (CONTINUED)

System	Number Required	Types of Operation and Remarks (DAY, NIGHT, VFR, IFR and ICING Conditions)
12. PRESSURIZED FLIGHT		
Cabin Altimeter	1	DAY, NIGHT, VFR, IFR, ICING
Cabin Differential Pressure Indicator	1	DAY, NIGHT, VFR, IFR ICING
Cabin Vertical Speed Indicator	1	DAY, NIGHT, VFR, IFR ICING
Pressure Control Valve	1	DAY, NIGHT, VFR, IFR ICING
Pressure Relief Safety Valve	1	DAY, NIGHT, VFR, IFR ICING
Pressurization Controller	1	DAY, NIGHT, VFR, IFR ICING
CAB ALT Annunciator	1	DAY, NIGHT, VFR, IFR ICING
Vacuum Pump	1	DAY, NIGHT, VFR, IFR ICING
13. MISCELLANEOUS		
Stall Warning System	1	DAY, NIGHT, VFR, IFR, ICING
STALL WARN FAIL Annunciator	1	DAY, NIGHT, VFR, IFR, ICING
Annunciator Test System	1	DAY, NIGHT, VFR, IFR, ICING

2.23 FUEL LIMITATIONS

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

2.25 OPERATING ALTITUDE LIMITATIONS

Flight above 25,000 feet pressure altitude is not approved. Flight up to and including 25,000 feet is approved if equipped with avionics in accordance with FAR 91 or FAR 135.

2.27 CABIN PRESSURIZATION LIMITS

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

2.29 AIR CONDITIONING SYSTEM LIMITATIONS

AIR COND/BLWR switch in OFF or BLWR position for takeoffs and landings.

NOTE

REC BLWR switch may be in HIGH or LOW position.

2.31 ELECTRIC AUXILIARY CABIN HEATER LIMITATIONS

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

2.33 MAXIMUM SEATING CONFIGURATION

The maximum seating capacity is 6 (six) persons.

2.35 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 aerobatic maneuvers, including spins, approved.

This aircraft approved for V.F.R., I.F.R., day and night icing flight when equipped in accordance with the Airplane Flight Manual.

In full view of the pilot, the following takeoff and landing checklists will be installed:

TAKEOFF CHECKLIST

Fuel on Proper Tank	Fasten Belts/Harnesses
Engine Gauges Checked	Flaps Set
Induction Air - Primary	Trim Set
Seat Backs Erect	Controls Free
Armrests Stowed	Door Secured
Mixture Set	Air Conditioner - Off
Propeller Set	Pressurization System - Set
Emergency Fuel Pump - On	

LANDING CHECKLIST

Fuel on Proper Tank	Emergency Fuel Pump - On
Seat Backs Erect	Gear Down
Armrests Stowed	Flaps Set
Fasten Belts/Harnesses	Air Conditioner - Off
Mixture - Rich	Cabin Pressure - Depressurized
Propeller - Set	

2.35 PLACARDS (CONTINUED)

On the instrument panel in full view of the pilot:

VA 133 KIAS at 4300 LBS.
(See A.F.M.)

In full view of the pilot:

V_{LO} 165 DN, 126 UP
V_{LE} 195 MAX

Near emergency gear release:

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

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.

Near the magnetic compass:

CAUTION - COMPASS CAL. MAY BE IN
ERROR WITH ELECT. EQUIPMENT
OTHER THAN AVIONICS ON.

2.35 PLACARDS (CONTINUED)

In full view of the pilot when the air conditioner is installed:

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

On the inside of the forward baggage door:

**MAXIMUM BAGGAGE THIS COMPART-
MENT 100 LBS.**

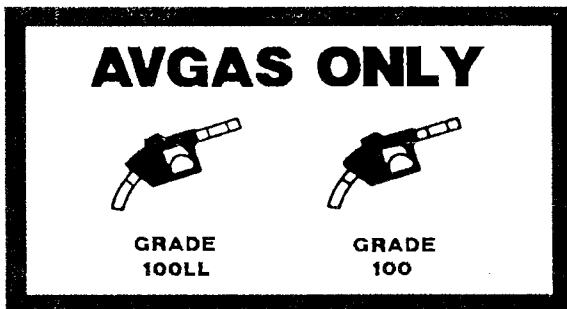
On aft baggage closeout:

**MAXIMUM BAGGAGE THIS COMPART-
MENT 100 LBS.**

In full view of the pilot:

PRESSURIZED LANDING NOT APPROVED

Adjacent to fuel tank filler caps:



2.35 PLACARDS (CONTINUED)

Over emergency exit handle:

EMERGENCY EXIT
REMOVE GLASS
PULL DOOR IN - LIFT UP

On aft baggage closeout:

MAXIMUM LOAD EACH COAT HOOK 8 LBS

In full view of the pilot to the right of the Manifold Pressure Gauge

DO NOT EXCEED

36" MP
BELOW 2400 RPM

32" MP
BELOW 2300 RPM

98-04-26**THE NEW PIPER AIRCRAFT CORPORATION****Amendment: 39-10338****Docket No. No. 97-CE-60-AD****Applicability:**

Models PA-46-310P and PA-46-350P airplanes (all serial numbers), certificated in any category.

NOTE 1

This AD applies to each airplane identified in the preceding applicability provision, regardless of whether it has been modified, altered, or repaired in the area subject to the requirements of this AD. For airplanes that have been modified, altered, or repaired so that the performance of the requirements of this AD is affected, the owner/operator must request approval for an alternative method of compliance in accordance with paragraph (d) of this AD. The request should include an assessment of the effect of the modification, alteration, or repair on the unsafe condition addressed by this AD; and, if the unsafe condition has not been eliminated, the request should include specific proposed actions to address it.

Compliance: Required as indicated, unless already accomplished.

To minimize the potential hazards associated with operating the airplane in severe icing conditions by providing more clearly defined procedures and limitations associated with such conditions, accomplish the following:

- (a) Within 30 days after the effective date of this AD, accomplish the requirements of paragraphs (a)(1) and (a)(2) of this AD.

NOTE 2

Operators should initiate action to notify and ensure that flight crewmembers are apprised of this change.

(1)Revise the FAA-approved Airplane Flight Manual (AFM) by incorporating the following into the Limitations Section of the AFM. this may be accomplished by inserting a copy of this AD in the AFM.

"WARNING

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

- During flight, severe icing conditions that exceed those for which the airplane is certificated shall be determined by the following visual cues. If one or more of these visual cues exists, immediately request priority handling from Air Traffic Control to facilitate a route or an altitude change to exit the icing conditions.

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

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

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

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

(2)Revise the FAA-approved AFM by incorporating the following into the Normal Procedures Section of the AFM. This may be accomplished by inserting a copy of this AD in the AFM.

"THE FOLLOWING WEATHER CONDITIONS MAY BE CONDUCTIVE TO SEVERE IN-FLIGHT ICING:

- Visible rain at temperatures below 0 degrees Celsius ambient air temperature.
- Droplets that splash or splatter on impact at temperatures below 0 degrees Celsius ambient

air temperature.

PROCEDURES FOR EXITING THE SEVERE ICING ENVIRONMENT:

These procedures are applicable to all flight phases from takeoff to landing. Monitor the ambient air temperature. While severe icing may form at temperatures as cold as -18 degrees Celsius, increased vigilance is warranted at temperatures around freezing with visible moisture present. If the visual cues specified in the Limitations Section of the AFM for identifying severe icing conditions are observed, accomplish the following:

- Immediately request priority handling from Air Traffic Control to facilitate a route or an altitude change to exit the severe icing conditions in order to avoid extended exposure to flight conditions more severe than those for which the airplane has been certificated.
- Avoid abrupt and excessive maneuvering that may exacerbate control difficulties.
- Do not engage the autopilot.
- If the autopilot is engaged, hold the control wheel firmly and disengage the autopilot.
- If an unusual roll response or uncommanded roll control movement is observed, reduce the angle-of-attack.
- Do not extend flaps when holding in icing conditions. Operation with flaps extended can result in a reduced wing angle-of-attack, with the possibility of ice forming on the upper surface further aft on the wing than normal, possibly aft of the protected area.
- If the flaps are extended, do not retract them until the airframe is clear of ice.
- Report these weather conditions to Air Traffic Control."

(b)Incorporating the AFM revisions, as required by this AD, may be performed by the owner/operator holding at least a private pilot certificate as authorized by section 43.7 of the Federal Aviation Regulations (14 CFR 43.7), and must be entered into the aircraft records showing compliance with this AD in accordance with section 43.9 of the Federal Aviation Regulations (14 CFR 43.9).

(c)Special flight permits may be issued in accordance with sections 21.197 and 21.199 of the Federal Aviation Regulations (14 CFR 21.197 and 21.199) to operate the airplane to a location where the requirements of this AD can be accomplished.

(d)An alternative method of compliance or adjustment of the compliance time that provides

an equivalent level of safety may be approved by the Manager, Small Airplane Directorate, FAA, 1201 Walnut, suite 900, Kansas City, Missouri 64106. The request shall be forwarded through an appropriate FAA Maintenance Inspector, who may add comments and then send it to the Manager, Small Airplane Directorate.

NOTE 3

Information concerning the existence of approved alternative methods of compliance with this AD, if any, may be obtained from the Small Airplane Directorate.

(e)All persons affected by this directive may examine information related to this AD at the FAA, Central Region, Office of the Regional Counsel, Room 1558, 601 E. 12th Street, Kansas City, Missouri 64106

(f)This amendment (39-10338) becomes effective on March 13, 1998.

FOR FURTHER INFORMATION CONTACT:

Mr. John P. Dow, Sr., Aerospace Engineer, Small Airplane Directorate, Aircraft Certification Service, 1201 Walnut, suite 900, Kansas City, Missouri 64106, telephone (816) 425-6932, facsimile (816) 426-2169.

From Supplement for
replacement propeller

1. GENERAL

Information concerning the Propeller MTV-14-B/195-30a see section 2.

2. LIMITATIONS

Propeller MTV-14-B/195-30a:

Diameter: 76.77 in (195 cm)
cut off to 74.8 in (190 cm) allowed for repair

Blade Angle: at station 28.74 in (73.0 cm)
low pitch 11.5 plus or minus .2
high pitch 35.0 plus or minus 1.0

Propeller-Governor: According to Piper equipment list.

Propeller-Spinner: MT-Propeller No. P-449

Propeller-De-Ice: An electrical de-ice system according to Piper equipment list and VK Installation Instruction No.VK E-467E may be installed.
The propeller de-ice system may be switched on with a non-rotating propeller, for test purposes, no longer than 10 seconds, because overheating or damage of the de-ice boots may occur.

FAA APPROVED

Date 19 19

TABLE OF CONTENTS
SECTION 3
EMERGENCY PROCEDURES

Paragraph No.		Page No.
3.1	General	3-1
3.3	Emergency Procedures Checklist	3-2
3.3a	Engine Fire During Start (3.7)	3-2
3.3b	Turbocharger Failure (3.8)	3-2
3.3c	Engine Power Loss During Takeoff (3.9)	3-4
3.3d	Engine Power Loss In Flight (3.11)	3-5
3.3e	Power Off Landing (3.13)	3-5
3.3f	Fire In Flight (3.15)	3-6
3.3g	Loss of Oil Pressure (3.17)	3-7
3.3h	Loss of Fuel Flow (3.19)	3-7
3.3i	Engine Driven Fuel Pump Failure (3.21)	3-8
3.3j	High Oil Temperature (3.23)	3-8
3.3k	High Cylinder Head Temperature (3.25)	3-9
3.3l	Turbine Inlet Temperature (TIT) Indicator Failure (3.26).....	3-9
3.3m	Electrical Failures (3.27)	3-10
3.3n	Propeller Overspeed (3.29)	3-12
3.3o	Emergency Landing Gear Extension (3.31)	3-12
3.3p	Spin Recovery (3.33)	3-13
3.3q	Engine Roughness (3.35)	3-13
3.3r	Emergency Descent (3.37)	3-13
3.3s	Pressurization System Malfunction (3.39)	3-14
3.3t	Cabin Air Contamination/Smoke Evacuation (Pressurized) (3.41)	3-15
3.3u	Vacuum System Failure (3.43)	3-16
3.3v	Inadvertent Icing Encounter (3.45)	3-16

TABLE OF CONTENTS

SECTION 3 (cont)

EMERGENCY PROCEDURES

Paragraph No.		Page No.
3.3w	Hydraulic System Malfunction (3.49).....	3-17
3.3x	Flap System Malfunction (3.51).....	3-17
3.3y	Fuel Tank Submerged Pump Failure (3.53)	3-18
3.3z	Stall Warning Failure (3.55).....	3-18
3.3aa	Annunciator Light Panel Failure (3.57)	3-18
3.3ab	Emergency Exit (3.59)	3-19
3.5	Amplified Emergency Procedures (General)	3-21
3.7	Engine Fire During Start (3.3a).....	3-21
3.8	Turbocharger Failure (3.3b)	3-21
3.9	Engine Power Loss During Takeoff (3.3c).....	3-23
3.11	Engine Power Loss In Flight (3.3d)	3-24
3.13	Power Off Landing (3.3e)	3-26
3.15	Fire In Flight (3.3f).....	3-27
3.17	Loss of Oil Pressure (3.3g).....	3-28
3.19	Loss of Fuel Flow (3.3h)	3-28
3.21	Engine Driven Fuel Pump Failure (3.3i).....	3-29
3.23	High Oil Temperature (3.3j).....	3-29
3.25	High Cylinder Head Temperature (3.3k).....	3-29
3.26	Turbine Inlet Temperature (TIT) Indicator Failure (3.3l)	3-30
3.27	Electrical Failures (3.3m)	3-32
3.29	Propeller Overspeed (3.3n)	3-34
3.31	Emergency Landing Gear Extension (3.3o).....	3-34
3.33	Spin Recovery (3.3p).....	3-34
3.35	Engine Roughness (3.3q)	3-35
3.37	Emergency Descent (3.3r).....	3-35
3.39	Pressurization System Malfunction (3.3s)	3-36

TABLE OF CONTENTS
SECTION 3 (cont)
EMERGENCY PROCEDURES

Paragraph No.		Page No.
3.41	Cabin Air Contamination/Smoke Evacuation (3.3t)	3-36
3.43	Vacuum Failure (3.3u).....	3-37
3.45	Inadvertent Icing Encounter (3.3v)	3-37
3.49	Hydraulic System Malfunction (3.3w)	3-38
3.51	Flap System Malfunction (3.3x)	3-38
3.53	Fuel Tank Submerged Pump Failure (3.3y)	3-39
3.55	Stall Warning Failure (3.3z)	3-39
3.57	Annunciator Light Panel Failure (3.3aa)	3-39
3.59	Emergency Exit (3.3ab)	3-40

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 3
EMERGENCY PROCEDURES

3.1 GENERAL

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

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

This section is divided into two basic parts. The first part contains the emergency procedures checklists. These checklists supply an immediate action sequence to be followed during critical situations with little emphasis on the operation of the systems. The numbers located in parentheses after each checklist heading indicate where the corresponding paragraph in the amplified procedures can be found.

The second part of the section provides amplified emergency procedures corresponding to the emergency procedures checklist items. These amplified emergency procedures contain additional information to provide the pilot with a more complete description of the procedures so they may be more easily understood. The numbers located in parentheses after each paragraph heading indicates the corresponding checklist paragraph.

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

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

3.3 EMERGENCY PROCEDURES CHECKLIST

3.3a ENGINE FIRE DURING START (3.7)

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

3.3b TURBOCHARGER FAILURE (3.8)

CAUTION:

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

NOTE:

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

COMPLETE LOSS OF ENGINE POWER:

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

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

Reduce power and land as soon as possible.

PARTIAL LOSS OF ENGINE POWER

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

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

ENGINE POWER OVERBOOST

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

Throttle...REDUCE as necessary to keep manifold pressure within limits.

NOTE

Expect manifold pressure response to throttle movements to be sensitive.

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

3.3e POWER OFF LANDING (3.13) (Continued)

When committed to landing:

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

NOTE

If the battery master and alternator switches are OFF, the gear position lights and flaps will be inoperative.

3.3f FIRE IN FLIGHT (3.15)

Source Of Fire	CHECK

NOTE

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

Electrical Fire (smoke in cabin):

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

After 5 second delay:

Battery Master Switch	OFF
ALTR Switches.....	OFF
Cabin Heat	OFF

CAUTION

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

Emergency descent TO A SAFE ALTITUDE
CONSISTENT WITH TERRAIN
Land as soon as possible.

WARNING

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

Engine fire:

Throttle CLOSED
Mixture IDLE CUT-OFF
Fuel Selector OFF
Magnetos Switches.....OFF
Emergency (EMERG) Fuel Pump.....CHECK OFF
Vent Defog Fan OFF
Temperature Control Knob.....PUSH OFF
Auxiliary Heat Switch OFF
Proceed with power off landing procedure (3.3e).

3.3g LOSS OF OIL PRESSURE (3.17)

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

3.3h LOSS OF FUEL FLOW (3.19)

CAUTION

Turn emergency (EMERG) fuel pump OFF if fuel flow and power is not immediately restored. The lack of fuel flow indication could indicate a leak in the fuel system. If fuel system leak is verified, switch fuel selector to OFF.

3.3h LOSS OF FUEL FLOW (3.19) (Continued)

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

If power restored:

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

If power not restored:

Emergency (EMERG) Fuel Pump OFF
Fuel Selector OFF

Proceed with power off landing procedure (3.3e).

3.3i ENGINE DRIVEN FUEL PUMP FAILURE (FUEL PRESS light illuminated - annunciator panel) (3.21)

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

CAUTION

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

If power is not restored, proceed with power off landing procedure (3.3e).

3.3j HIGH OIL TEMPERATURE (3.23)

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

If condition is not corrected:

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

3.3k HIGH CYLINDER HEAD TEMPERATURE (3.25)

If indicated cylinder head temperature reaches 480°F:

CHT Cycle Push Button (if equipped) CYCLE THRU ALL
CYLINDERS
Power REDUCE
Mixture ENRICH, if practical
Airspeed INCREASE, if practical

If condition is not corrected:

Land at nearest airport and investigate problem.

3.3l TURBINE INLET TEMPERATURE (TIT) INDICATOR FAILURE (3.26)

If failure occurs during takeoff, climb, or landing:

Mixture Full Rich

NOTE

During cruise climb operations, a fuel flow of 32
gph may be used.

If failure occurs prior to setting cruise power:

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

CAUTION

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

If failure occurs after setting cruise power and mixture:

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

CAUTION

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

3.3i TURBINE INLET TEMPERATURE (TIT) INDICATOR FAILURE (3.26)
(continued)

If failure occurs prior to or during descent:

Power.....Set for Descent (20" MAP min.)
Mixture.....Full Rich

3.3m ELECTRICAL FAILURES (3.27)

NOTE

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

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

Verify failure CHECK AMMETER
Electrical Load (if LOW BUS VOLTAGE
annunciator illuminated) REDUCE until total load is
less than 70 amps & LOW BUS
VOLTAGE annunciator extinguished
Failed ALTR Switch OFF
Failed ALTR Circuit Breaker CHECK and RESET
as required
Failed ALTR Switch (after OFF at least one second) ON

If power not restored:

Failed ALTR Switch OFF
Ammeter Monitor and maintain
BELOW 70 AMPS

While one alternator will supply sufficient current for minimum required
avionics and cockpit lighting, use of deicing equipment, particularly
windshield or propeller heat, may be limited. Immediate action should be
taken to avoid or exit icing conditions. Under no circumstances may the
total electrical load exceed 70 amps. The supplemental electric cabin heater,
cabin recirculation blowers, and position, strobe, and landing lights should
not be used unless absolutely necessary.

NOTE

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

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

Electrical Load REDUCE TO MINIMUM

required for safe flight

ALTR NO. 1 and NO. 2 Switches OFF

Circuit Breakers CHECK and RESET
as required

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

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

If only one alternator resets:

Operating ALTR Switch ON

Failed ALTR Switch OFF

Electrical Load MAINTAIN LESS
THAN 70 AMPS

Ammeter MONITOR

If neither alternator resets:

Both ALTR Switches OFF

Continue flight with reduced electrical load on battery power only.

NOTE

LOW BUS VOLTAGE annunciator will be
illuminated.

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

NOTE

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

3.3m ELECTRICAL FAILURES (3.27) (Continued)

Supplemental Heater Control Circuit Failure (Heater Continues to Operate With AUX CABIN and VENT/DEFOG BLWR switches OFF):

VENT DEFOG Circuit Breaker PULL

If the heater still operates:

BATT MASTER Switch OFF

ALTR Switches OFF

Land as soon as practical.

3.3n PROPELLER OVERSPEED (3.29)

Throttle RETARD

Oil Pressure CHECK

Propeller Control FULL DECREASE rpm,
then set if any
control available

Airspeed REDUCE

Throttle AS REQUIRED to remain
below 2500 rpm

Land as soon as practical and investigate cause of overspeed.

3.3o EMERGENCY LANDING GEAR EXTENSION (3.31)

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

Prior to emergency extension procedure:

Battery Master Switch CHECK ON

Circuit Breakers CHECK

DAY/NIGHT Dimming Switch (in daytime) DAY

If landing gear does not check down and locked:

Airspeed BELOW 90 KIAS

Hydraulic Pump Power Circuit Breaker (25 amp) PULL

Landing Gear Selector DOWN

Emergency Gear Extend Control PULL
(while fishtailing airplane)

CAUTION

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

3.3p SPIN RECOVERY (3.33)

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

3.3q ENGINE ROUGHNESS (3.35)

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

3.3r EMERGENCY DESCENT (3.37)

NOTE

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

Throttle CLOSED
Propeller Control FULL INCREASE
Mixture AS REQUIRED
Landing Gear DOWN
(165 KIAS maximum)
Flaps UP

SMOOTH AIR

Airspeed After Landing Gear Is Fully Extended 180-195 KIAS

ROUGH AIR

Airspeed After Landing Gear Is Fully Extended 4300 lbs. 133 KIAS
2450 lbs. 100 KIAS

3.3s PRESSURIZATION SYSTEM MALFUNCTION (3.39)

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

NOTE

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

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

NOTE

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

Should the aircraft suddenly lose pressurization, proceed as follows:

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

NOTE

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

3.3t CABIN AIR CONTAMINATION/SMOKE EVACUATION (3.41)
(Pressurized)

NOTE

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

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

Land as soon as practical.

NOTE

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

NOTE

If fumes/smoke dissipate, land as soon as practical to investigate problem. If fumes/smoke persist, refer to Fire in Flight paragraph 3.3f.

3.3u VACUUM SYSTEM FAILURE (3.43)

Single Vacuum System Failure (Reduced suction pressure and left or right vacuum flow button extended.

Gyro Suction Gauge CHECK 4.8 to 5.2 in. Hg
Operating Pump Flow Button RETRACTED

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

Dual Vacuum System Failure (Suction below 4.0 in. Hg, both vacuum flow buttons extended.

If both vacuum systems are inoperable, the turn coordinator and pilot's directional gyro will be the only usable gyroscopic flight instruments, wing and tail deicer boots will be inoperative, and loss of cabin pressure control is possible. Manually dump cabin pressure before landing. A precautionary landing should be considered depending on operating conditions.

3.3v INADVERTENT ICING ENCOUNTER (3.45)

WARNING

Flight into known icing conditions is prohibited unless Ice Protection System is installed and fully operational. Refer to Section 9, Supplement 6.

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

Change heading and/or altitude to exit icing conditions.

3.3w HYDRAULIC SYSTEM MALFUNCTION (3.49)

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

HYDRAULIC PUMP POWER Circuit Breaker PULL
Land as soon as practical and investigate the cause.

Prior to landing, the HYDRAULIC PUMP POWER circuit breaker must be reset in order to extend the landing gear. If pump continues to run after gear is locked down, pull the HYDRAULIC PUMP POWER circuit breaker. If gear fails to extend, refer to Emergency Landing Gear Extension (3.3o).

3.3x FLAP SYSTEM MALFUNCTION (3.51)

FLAPS annunciator light illuminated:

FLAP WARN circuit breaker PULL and RESET
VERIFY Normal Flap Operation.

If FLAPS annunciator light remains illuminated:

FLAP MOTOR Circuit Breaker PULL

CAUTION

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

Land as soon as practical and investigate the cause.

3.3y FUEL TANK SUBMERGED PUMP FAILURE (BOOST PUMP light illuminated - annunciator panel) (3.53)

Fuel Selector CHECK
Boost Pump Circuit Breaker CHECK - RESET
if necessary
BOOST PUMP Annunciator Light EXTINGUISHED

If annunciator remains lit:

Emergency (EMERG) Fuel Pump.....ON
Fuel Flow CHECK for
fluctuation

Continue flight if no fuel flow fluctuations are observed. If fuel flow fluctuations are observed, descend to an altitude where the fluctuations cease and continue flight. After landing, have the inoperative boost pump repaired prior to further flight.

3.3z STALL WARNING FAILURE (STALL WARN FAIL light illuminated - annunciator panel) (3.55)

STALL WARN Circuit Breaker CHECK - RESET
if necessary

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

3.3aa ANNUNCIATOR LIGHT PANEL FAILURE (ANNUNCIATOR INOP light illuminated - annunciator panel) (3.57)

ANNUN Circuit Breaker CHECK - RESET
if necessary
ANNUNCIATOR INOP Light EXTINGUISHED

If ANNUN circuit breaker not open:

Annunciator Test Switch PUSH

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

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

System should be repaired prior to further flight.

3.3ab EMERGENCY EXIT (3.59)

Exit (second window from front
on right side LOCATE

NOTE

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

Plexiglas Cover REMOVE
Handle PULL
Emergency Exit Window PULL IN

THIS PAGE INTENTIONALLY LEFT BLANK

3.5 AMPLIFIED EMERGENCY PROCEDURES (GENERAL)

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

3.7 ENGINE FIRE DURING START (3.3a)

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

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

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

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

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

3.8 TURBOCHARGER FAILURE (3.3b)

CAUTION:

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

NOTE:

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

3.8 TURBOCHARGER FAILURE (CONT'D)(3.3b)

COMPLETE LOSS OF ENGINE POWER:

If a suspected turbocharger or turbocharger control system failure results in a complete loss of engine power, the following procedure is recommended. Retard the mixture control to the IDLE CUTOFF position. If necessary, reset the throttle to cruise power position and the propeller control to the full forward position. Slowly advance the mixture until the engine restarts and adjust for smooth engine operation. Reduce the power to the minimum required and ***land as soon as possible***.

Set the propeller and mixture control as necessary. ***Land as soon as possible***.

PARTIAL LOSS OF ENGINE POWER

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

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

ENGINE POWER OVERBOOST

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

Throttle...REDUCE as necessary to keep manifold pressure within limits

NOTE

Expect manifold pressure response to throttle movements to be sensitive.

Set the propeller and mixture control as necessary. ***Land as soon as possible***.

3.9 ENGINE POWER LOSS DURING TAKEOFF (3.3c)

The proper action to be taken if loss of power occurs during takeoff will depend on the circumstances of the particular situation.

If sufficient runway remains to complete a normal landing, leave the landing gear down and land straight ahead.

If the area ahead is rough, or if it is necessary to clear obstructions, move the landing gear selector switch to the UP position and prepare for a gear up landing. If time permits, move mixture control to idle cut-off, turn OFF the emergency (EMERG) fuel pump, move the fuel selector to OFF and, after the landing gear is retracted, turn battery master switch OFF.

If sufficient altitude has been gained to attempt a restart, maintain a safe airspeed, turn the emergency (EMERG) fuel pump ON, and switch the fuel selector to another tank containing fuel. Ensure the mixture is full RICH and move the induction air lever to the ALTERNATE position.

CAUTION

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

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

If power is not regained, proceed with Power Off Landing procedure (refer to paragraph 3.13).

3.11 ENGINE POWER LOSS IN FLIGHT (3.3d)

Complete engine power loss is usually caused by fuel flow interruption and power will be restored shortly after fuel flow is restored. The first step is to prepare for a power off landing (refer to paragraph 3.13). An airspeed of at least 90 KIAS should be maintained.

If altitude permits, turn the emergency (EMERG) fuel pump ON and switch the fuel selector to another tank containing fuel. Reset the mixture control to RICH and move the induction air lever to ALTERNATE. Check the engine gauges for an indication of the cause of the power loss. If no fuel flow is indicated, check the tank selector position to be sure it is on a tank containing fuel.

If power is restored move the induction air to the PRIMARY position (unless induction ice is suspected). Turn OFF the emergency (EMERG) fuel pump (except in case of engine driven fuel pump failure) and adjust the mixture control as necessary. Land as soon as practical and investigate cause of power loss.

CAUTION

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

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

If previous procedure has not restored power and time permits, secure one magneto at a time, then back to both ON. Move the throttle and mixture control levers to different settings. This may restore power if the problem is too rich or too lean a mixture or if there is a partial fuel system restriction. Water in the fuel could take some time to be used up, and allowing the engine to windmill may restore power. If power loss is due to water, fuel flow indications will be normal.

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

If power is not regained, proceed with the Power Off Landing procedure (refer to paragraph 3.13).

3.13 POWER OFF LANDING (3.3e)

If loss of power occurs at altitude, trim the aircraft for best gliding angle, (90 KIAS) and look for a suitable field. If measures taken to restore power are not effective, and if time permits, check your charts for airports in the immediate vicinity; it may be possible to land at one if you have sufficient altitude. At best gliding angle, with no wind, with the engine windmilling and the propeller control in full DECREASE rpm, the aircraft will travel approximately 2 miles for each thousand feet of altitude. If possible, notify the FAA or any other authority by radio of your difficulty and intentions. If another pilot or passenger is aboard, let them help.

When you have located a suitable field, establish a spiral pattern around this field. Try to be at 1000 feet above the field at the downwind position, to make a normal landing approach. When the field can easily be reached, slow to 77 KIAS with flaps down for the shortest landing. Excess altitude may be lost by widening your pattern, using flaps or slipping, or a combination of these.

Whether to attempt a landing with gear up or down depends on many factors. If the field chosen is obviously smooth and firm, and long enough to bring the plane to a stop, the gear should be down. If there are stumps or rocks or other large obstacles in the field, the gear in the down position will better protect the occupants of the aircraft. If however, the field is suspected to be excessively soft or short, or when landing in water of any depth, a wheels-up landing will normally be safer and do less damage to the airplane.

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

When committed to landing, verify the landing gear selector position as required by field conditions. Close the throttle, move the mixture to idle cut-off, shut OFF the magneto switches, and ensure the emergency (EMERG) fuel pump is OFF. Move the fuel selector valve to OFF. After final flap setting, turn the battery master and alternator switches OFF. The seats should be adjusted and locked in position. The seat belts and shoulder harness should be tightened.

NOTE

If the battery master and alternator switches are OFF, the gear position lights and flaps will be inoperative.

3.15 FIRE IN FLIGHT (3.3f)

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

Check for the source of the fire first.

NOTE

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

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

CAUTION

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

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

WARNING

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

If an engine fire is present, close the throttle, move the mixture control to idle cut-off and place the fuel selector in the OFF position. Turn the magneto switches OFF and check that the emergency (EMERG) fuel pump is OFF. In

3.15 FIRE IN FLIGHT (3.3f) (Continued)

all cases, the heater and defroster should be OFF. If radio communication is not required turn the battery master and alternator switches OFF. If the terrain permits, a landing should be made immediately (refer to Power Off Landing procedure paragraph 3.13). Because the flaps and landing gear position lights will become inoperative, be sure final flap and gear selection is made before turning the battery master and alternator switches OFF.

3.17 LOSS OF OIL PRESSURE (3.3g)

Loss of oil pressure may be either partial or complete. A partial loss of oil pressure usually indicates a malfunction in the oil pressure regulating system, and a landing should be made as soon as possible to investigate the cause and prevent engine damage.

A complete loss of oil pressure indication may signify oil exhaustion or may be the result of a faulty gauge. In either case, proceed toward the nearest airport and be prepared for a forced landing. If the problem is not a pressure gauge malfunction, the engine may stop suddenly. Maintain altitude until such time as a power off landing can be accomplished. Do not change power settings unnecessarily, as this may hasten complete power loss.

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

If engine stoppage occurs, proceed with Power Off Landing procedure (refer to paragraph 3.13).

3.19 LOSS OF FUEL FLOW (3.3h)

CAUTION

Turn emergency (EMERG) fuel pump OFF if fuel flow and power is not immediately restored. The lack of a fuel flow indication could indicate a leak in the fuel system. If fuel system leak is verified, switch fuel selector OFF.

The most probable cause of loss of fuel flow is either fuel depletion in the fuel tank selected or failure of the engine driven fuel pump. If loss of fuel flow occurs, turn the emergency (EMERG) fuel pump ON and check that the fuel selector is on a tank containing usable fuel.

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

If power is not restored, turn the emergency (EMERG) fuel pump and the fuel selector OFF, and proceed with Power Off Landing procedure (refer to paragraph 3.13).

3.21 ENGINE DRIVEN FUEL PUMP FAILURE (FUEL PRESS light illuminated - annunciator panel) (3.3i)

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

CAUTION

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

3.23 HIGH OIL TEMPERATURE (3.3j)

An abnormally high oil temperature indication may be caused by a low oil level, an obstruction in the oil cooler, damaged or improper baffle seals, a defective gauge, or other causes. Reduce power and/or enrich the mixture, and increase airspeed if practical. If condition is not corrected, land as soon as practical at an appropriate airport and have the cause investigated.

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

3.25 HIGH CYLINDER HEAD TEMPERATURE (3.3k)

If the standard cylinder head temperature gauge (aircraft ser. no. 4622076 and up) indication reaches 480°, the CHT CYCLE push button should be periodically used to cycle through all cylinder head temperatures to be sure the hottest cylinder is displayed. A difference of 5°F is needed before the displayed CHT switches to another cylinder.

3.25 HIGH CYLINDER HEAD TEMPERATURE (3.3k) (Continued)

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

3.26 TURBINE INLET TEMPERATURE (TIT) INDICATOR FAILURE (3.3l)

In the event the Turbine Inlet Temperature (TIT) indicator or sensor fails during flight, continued flight is possible using conservative mixture/TIT settings. If TIT failure occurs during takeoff, climb, descent, or landing, maintain a full rich mixture to assure adequate fuel flow for engine cooling. During cruise climb operations, a fuel flow of 32 GPH may be used.

If TIT failure occurs prior to setting cruise power, set power per the POH Section 5 power setting table and then lean to the approximate POH power setting table fuel flow +4 GPH. This fuel flow will maintain adequate engine cooling and a TIT value below TIT limits. Monitor CHT and Oil Temperature for normal indications.

CAUTION

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

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

CAUTION

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

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

THIS PAGE INTENTIONALLY LEFT BLANK

3.27 ELECTRICAL FAILURES (3.3m)

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

NOTE

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

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

If the LOW BUS VOLTAGE annunciator is illuminated, first reduce the electrical load to less than 70 amps, which should extinguish the LOW BUS VOLTAGE annunciator, and prevent overloading the operating alternator.

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

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

If the affected alternator's ammeter continues to read zero, and the annunciator remains lit, turn the failed alternator's switch OFF. Continue flight and monitor the operating alternator's ammeter to ensure the electrical load does not exceed 70 amps. The annunciator of the failed alternator will remain lit.

While one alternator will supply sufficient current for minimum required avionics and cockpit lighting, use of deicing equipment, particularly windshield or propeller heat, may be limited. Immediate action should be taken to avoid or exit icing conditions. Under no circumstances may the total electrical load exceed 70 amps. The electric cabin heater, cabin recirculation blowers, and position, strobe, and landing lights should not be used unless absolutely necessary.

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

NOTE

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

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

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

If only one alternator can be restored, reinstate electrical load as desired to a maximum of 70 amps. Land as soon as practical for proper repairs.

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

NOTE

LOW BUS VOLTAGE annunciator will be illuminated.

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

NOTE

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

3.27 ELECTRICAL FAILURES (3.3m) (Continued)

SUPPLEMENTAL HEATER CONTROL CIRCUIT FAILURE (Heater Continues to Operate With AUX CABIN and VENT/DEFOG BLWR Switches OFF).

Pull the VENT DEFOG circuit breaker. If the heater still operates, turn the BATT MASTER and ALTR switches OFF. Land as soon as practical.

3.29 PROPELLER OVERSPEED (3.3n)

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

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

3.31 EMERGENCY LANDING GEAR EXTENSION (3.3o)

Prior to proceeding with an emergency gear extension, check to ensure that the battery master switch (BATT MSTR) is ON and that the circuit breakers have not popped. If it is daytime, the Day/Night dimmer switch should be in the DAY position.

If the landing gear does not check down and locked, reduce the airspeed to below 90 KIAS, pull out the HYDRAULIC PUMP POWER circuit breaker, place the landing gear selector in the DOWN position, pull the emergency gear extend control OUT and fishtail the airplane. Verify the landing gear position lights indicate down and locked.

CAUTION

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

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

3.33 SPIN RECOVERY (3.3p)

Intentional spins are prohibited in this airplane. If a spin is inadvertently entered, immediately apply full rudder opposite to the direction of rotation. Move the control wheel full forward while neutralizing the ailerons. CLOSE the throttle. When the rotation stops, neutralize the rudder and relax forward pressure on the control wheel as required to smoothly regain a level flight attitude.

3.35 ENGINE ROUGHNESS (3.3q)

Engine roughness may be caused by dirt in the injector nozzles, induction filter icing, ignition problems, or other causes.

First adjust the mixture for maximum smoothness. The engine will run rough if the mixture is too rich or too lean.

Move the induction air to ALTERNATE and turn the emergency (EMERG) fuel pump ON.

Switch the fuel selector to another tank to determine if fuel contamination is the problem.

Check the engine gauges for abnormal readings. If any gauge readings are abnormal proceed accordingly.

The magneto switches should then be turned OFF individually and then both turned back ON. If operation is satisfactory on only one magneto, proceed on the good magneto at reduced power to a landing at the first available airport.

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

3.37 EMERGENCY DESCENT (3.3r)

NOTE

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

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

4300 lb = 133 KIAS

2450 lb = 100 KIAS

Use straight line variation between points.

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

3.39 PRESSURIZATION SYSTEM MALFUNCTION (3.3s)

NOTE

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

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

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

3.41 CABIN AIR CONTAMINATION/SMOKE EVACUATION (3.3t)

NOTE

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

Strong fumes or smoke in the cabin may indicate a malfunction in the pressurization system or a fire. In any event, the primary concern is to establish maximum airflow through the cabin in order to vent the fumes or smoke. To accomplish this, set the cabin pressure dump/normal switch to DUMP and PULL the cabin pressurization (CABIN PRESS) control out. Turn OFF the auxiliary cabin heater. Turn ON the vent/defog blower and turn OFF the cabin air recirculation blower. Do not open the storm window. This procedure will provide the maximum flow of outside ram air through the cabin. If emergency oxygen is not installed, execute an emergency descent to a safe altitude consistent with terrain. If emergency oxygen is installed, don the oxygen masks, activate the oxygen generators and descend to a safe altitude consistent with terrain. Land as soon as practical and investigate the cause. If the fumes or smoke persist the problem may be a fire (see paragraph 3.15, Fire In Flight).

3.43 VACUUM SYSTEM FAILURE (3.3u)

A malfunction of either vacuum pump is indicated by a decreased suction reading combined with the extension of the left or right flow button.

In the event one vacuum pump fails, check that the suction gauge still indicates 4.8 to 5.2 inches of mercury, and that the operating pump's flow button is retracted.

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

Failure of both vacuum pumps is indicated by the suction gauge reading less than 4.0 inches of mercury and extension of both flow buttons.

If both vacuum systems are inoperable, the turn coordinator and pilot's directional gyro will be the only usable gyroscopic flight instruments. The wing and tail deicer boots will be inoperative. Also, loss of cabin pressure control is possible; the cabin pressure will have to be dumped manually before landing. A precautionary landing should be considered depending on operating conditions.

3.45 INADVERTENT ICING ENCOUNTER (3.3v)

WARNING

Flight into known icing conditions is prohibited unless Ice Protection System is installed and fully operational. Refer to Section 9, Supplement 6.

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

3.49 HYDRAULIC SYSTEM MALFUNCTION (3.3w)

A hydraulic system malfunction, which causes the hydraulic pump to either run continuously (more than 15-20 seconds), or cycle on and off rapidly (more than 6-8 times), may be detected by the illumination of the HYDRAULIC PUMP amber annunciator light. Pull the HYDRAULIC PUMP POWER circuit breaker to stop operation. The pump is not designed for continuous duty and will fail if left running. Land as soon as practical and investigate the cause. Prior to landing, the HYDRAULIC PUMP POWER circuit breaker must be reset in order to extend the landing gear. If the pump continues to run after the gear is locked down, again pull the HYDRAULIC PUMP POWER circuit breaker. If the gear fails to extend, refer to Emergency Landing Gear Extension (3.31).

3.51 FLAP SYSTEM MALFUNCTION (3.3x)

Illumination of the FLAPS annunciator would normally be the result of an overcurrent condition in the flap motor/actuator circuit. If an overcurrent fault occurs the flap protection circuit will sense the malfunction and automatically remove power from the flap motor/actuator and flap operation will stop. Pulling and resetting the FLAP WARN circuit breaker will restore flap power to normal operation.

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

CAUTION

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

If normal flap operation is not regained, or the FLAPS annunciator remains illuminated, pull the FLAP MOTOR circuit breaker and land as soon as practical to ascertain the cause of the problem. The flaps will remain in the same position as when the malfunction occurred.

3.53 FUEL TANK SUBMERGED PUMP FAILURE (BOOST PUMP light illuminated - annunciator panel) (3.3y)

Illumination of the BOOST PUMP annunciator light indicates the selected fuel tank's submerged fuel boost pump has failed. Immediately check that the fuel selector is in the proper position and check the appropriate FUEL PUMPS (L BOOST or R BOOST) circuit breaker located on the pilot's forward breaker panel; reset as necessary. Check that the BOOST PUMP annunciator is extinguished.

If the FUEL PUMPS circuit breaker does not remain closed, or the BOOST PUMP annunciator remains lit, turn ON the emergency (EMERG) fuel pump and check for fluctuations in the fuel flow indication. Continue flight if no fuel flow fluctuations are observed. If fuel flow fluctuations are observed, descend to an altitude where the fluctuations cease and continue flight. After landing, have the inoperative boost pump repaired prior to further flight.

3.55 STALL WARNING FAILURE (STALL WARN FAIL light illuminated - annunciator panel) (3.3z)

Illumination of the STALL WARN FAIL annunciator light means the lift computer has failed. Check, and if necessary, reset the STALL WARN circuit breaker located on the pilot's forward circuit breaker panel. If the breaker does not remain closed, or if the STALL WARN FAIL annunciator light does not extinguish, the stall warning system will be inoperative for the remainder of the flight. After landing, have the system repaired before further flight.

3.57 ANNUNCIATOR LIGHT PANEL FAILURE (ANNUNCIATOR INOP light illuminated - annunciator panel) (3.3aa)

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

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

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

3.59 EMERGENCY EXIT (3.3ab)

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

NOTE

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

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

From Supplement for
replaced propeller

3. EMERGENCY PROCEDURES

Malfunction of the propeller pitch control:

If the oil-pressure in the system is decreasing, or the pitch control fails, the propeller will return to low pitch position (take off position).

Hold propeller speed below 2500 RPM by the power lever. Select lower air speed, if applicable. Monitor oil pressure and oil temperature.

Propeller-De-Ice:

The propeller de-ice system may be switched on with a non-rotating propeller, for test purposes, no longer than 10 seconds, because overheating or damage of the de-ice boots may occur.

If the reading of the "PROP DE-ICER" ammeter is not within the green arc, or an unusually high or low reading of the ammeter occurs, turn off the propeller de-ice system with the switch marked "PROP HEAT"!

Uneven deicing may cause propeller imbalance.

Warning:

If there is a malfunction of the de-ice system, flight into known icing conditions is not approved.

4. NORMAL PROCEDURES

Move the propeller lever gently, because the Propeller MTV-14-() is equipped with light weight wood composite blades, reacting quicker to RPM changes than the standard propeller with metal blades.

Propeller-De-Ice System:

An electrical de-ice system may be installed.

The propeller de-ice system may be switched on with a non-rotating propeller, for test purposes, no longer than 10 seconds, because overheating or damage of the de-ice boots may occur.

During flights, switch on "PROP HEAT" at the beginning of icing.

The reading of the "PROP DE-ICER" ammeter must be within the green arc, otherwise switch off the de-icing system! (Uneven de-icing may cause propeller imbalance).

Warning:

If there is a malfunction of the de-ice system, flight into known icing conditions is not approved.

5. PERFORMANCE

No change.

FAA APPROVED

JUN 19 1998
Date _____

TABLE OF CONTENTS

SECTION 4

NORMAL PROCEDURES

Paragraph No.		Page No.
4.1	GENERAL	4-1
4.3	AIRSPEDS FOR SAFE OPERATION.....	4-2
4.5	NORMAL PROCEDURES CHECKLIST.....	4-3
4.5a	Preflight Checklists (4.9).....	4-3
4.5b	Before Starting Engine Checklist (4.11)	4-7
4.5c	Engine Start Checklist (4.13)	4-8
	ENGINE START - GENERAL (4.13a)	4-8
	NORMAL START - COLD ENGINE (4.13b).....	4-8
	NORMAL START - HOT ENGINE (4.13c)	4-9
	ENGINE START WHEN FLOODED (4.13d)	4-9
	ENGINE START WITH EXTERNAL POWER SOURCE (4.13e)	4-10
4.5d	Before Taxiing Checklist (4.15).....	4-11
4.5e	Taxiing Checklist (4.17).....	4-11
4.5f	Ground Check Checklist (4.19).....	4-11
4.5g	Before Takeoff Checklist (4.21).....	4-12
4.5h	Takeoff Checklist (4.23).....	4-13
	NORMAL TECHNIQUE (4.23a).....	4-13
	0° FLAP TAKEOFF PERFORMANCE (4.23b).....	4-14
	SHORT FIELD TAKEOFF PERFORMANCE (4.23c)	4-14

TABLE OF CONTENTS

SECTION 4 (cont)

NORMAL PROCEDURES

Paragraph No.		Page No.
4.5i	Climb Checklist (4.25)	4-14
	MAXIMUM CONTINUOUS POWER CLIMB (4.25a)	4-14
	CRUISE CLIMB (4.25b).....	4-15
4.5j	Cruise Checklist (4.27)	4-15
4.5k	Descent Checklist (4.29)	4-15b
	NORMAL DESCENT (4.29)	4-15b
	REDUCED POWER DESCENT (4.29).....	4-15b
4.5m	Approach And Landing Checklist (4.31)	4-16
	NORMAL TECHNIQUE (4.31a).....	4-17
	SHORT FIELD TECHNIQUE (4.31b)	4-17
4.5n	Go-around Checklist (4.33)	4-17
4.5o	After Landing Checklist (4.35).....	4-18
4.5p	Stopping Engine Checklist (4.37).....	4-18
4.5q	Mooring Checklist (4.39)	4-18
4.7	AMPLIFIED PROCEDURES.....	4-19
4.9	PREFLIGHT CHECK (4.5a).....	4-19
4.9a	Cockpit (4.5a)	4-19
4.9b	Empennage (4.5a).....	4-20
4.9c	Right Wing (4.5a).....	4-20
4.9d	Nose Section (4.5a)	4-21
4.9e	Left Wing (4.5a)	4-21
4.9f	Miscellaneous (4.5a).....	4-22

TABLE OF CONTENTS (CONT)

SECTION 4 (cont)

NORMAL PROCEDURES

Paragraph No.		Page No.
4.11	BEFORE STARTING ENGINE (4.5b)	4-22
4.13	ENGINE START (4.5c)	4-23
4.13a	Engine Start - General (4.5c)	4-23
4.13b	Normal Start - Cold Engine (4.5c)	4-24
4.13c	Normal Start - Hot Engine (4.5c)	4-24
4.13d	Engine Start When Flooded (4.5c)	4-24
4.13e	Engine Start With External Power Source (4.5c)	4-25
4.15	BEFORE TAXIING (4.5d)	4-26
4.17	TAXIING (4.5e)	4-26
4.19	GROUND CHECK (4.5f)	4-27
4.21	BEFORE TAKEOFF (4.5g)	4-28
4.23	TAKEOFF (4.5h)	4-28
4.23a	Normal Technique (4.5h)	4-28
4.23b	0° Flap Takeoff Performance (4.5h)	4-29
4.23c	Short Field Takeoff Performance (4.5h)	4-29
4.25	CLIMB (4.5i)	4-30
4.25a	Maximum Continuous Power Climb (4.5i)	4-30
4.25b	Cruise Climb (4.5i)	4-30
4.27	CRUISE (4.5j)	4-31
4.29	DESCENT (4.5k)	4-32b
4.31	APPROACH AND LANDING (4.5m)	4-33
4.31a	Normal Technique (4.5m)	4-34
4.31b	Short Field Technique (4.5m)	4-34

TABLE OF CONTENTS (cont)

SECTION 4 (cont)

NORMAL PROCEDURES

Paragraph No.		Page No.
4.33	GO-AROUND (4.5n)	4-35
4.35	AFTER LANDING (4.5o)	4-35
4.37	STOPPING ENGINE (4.5p)	4-35
4.39	MOORING (4.5q)	4-36
4.41	STALLS	4-36
4.43	TURBULENT AIR OPERATION	4-36
4.45	CABIN PRESSURIZATION SYSTEM	4-37
4.47	SUPPLEMENTAL ELECTRIC HEATER	4-39
4.49	NOISE LEVEL	4-40
4.50	ICING INFORMATION	4-41

SECTION 4
NORMAL PROCEDURES

4.1 GENERAL

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

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

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

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

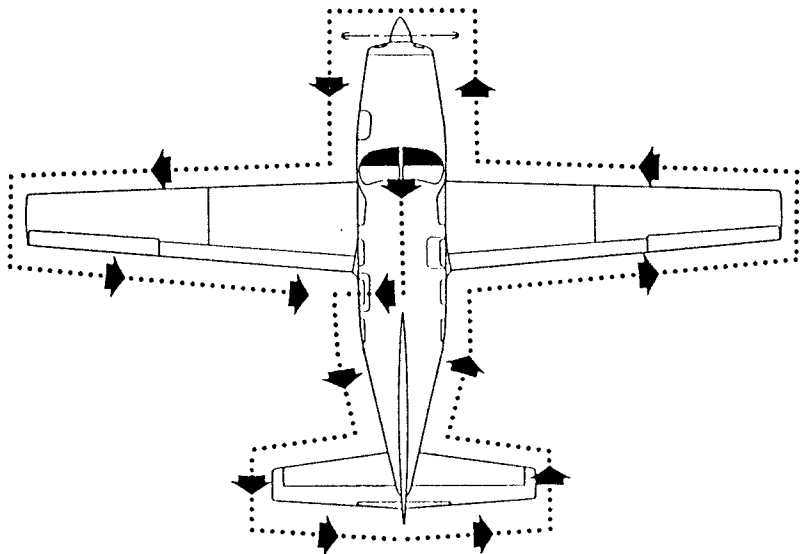
The second part of this section contains the amplified normal procedures which provide detailed information and explanations of the procedures and how to perform them. This portion of the section is not intended for use as an inflight reference due to the lengthy explanation. The short form checklists should be used on the ground and in flight. Numbers in parentheses after each paragraph title indicate where the corresponding checklist can be found.

4.3 AIRSPEEDS FOR SAFE OPERATIONS

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

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

(a)Best Rate of Climb Speed	110 KIAS
(b)Best Angle of Climb Speed.....	81 KIAS
(c)Turbulent Air Operating Speed (See Subsection 2.3)	133 KIAS
(d)Landing Final Approach Speed (Full Flaps).....	77 KIAS
(e)Maximum Demonstrated Crosswind Velocity	17 KTS
(f)Maximum Flaps Extended Speed	
10°	165 KIAS
20°	130 KIAS
Full Flaps (36°).....	116 KIAS



WALK-AROUND
 Figure 4-1

4.5 NORMAL PROCEDURES CHECKLIST

4.5a Preflight Checklists (4.9)

COCKPIT (4.9a)

Control wheel	release restraints
Parking Brake	SET
Gear Handle	DOWN
All Switches	OFF
Magneto Switches	OFF
Radio Master Switch	OFF
Mixture	IDLE CUT-OFF
Battery Master Switch	ON

CAUTION

See fuel imbalance limitations, 2.23.

- Fuel Gauges..... check QUANTITY & IMBALANCE

4.5a Preflight Checklist (Continued)

COCKPIT (4.9a) (Continued)

- Annunciator Panel CHECK
- FUEL PRESS Annunciator ON
- Oxygen Light (if installed) CHECK
- Stall Warning System TEST
- Flaps EXTEND
- Battery Master Switch OFF
- Primary Flight Controls PROPER OPERATION
- Trim NEUTRAL
- Static System DRAIN
- Alternate Static System CHECK PLACARD
- Emergency Exit CHECK
- Windows check CLEAN
- Required Papers check ON BOARD
- Baggage STOW PROPERLY - SECURE

EMPENNAGE (4.9b)

- Antennas CHECK
- Surface Condition CLEAR OF ICE, FROST, SNOW
- Left Static Port CLEAR
- Alternate and Pressurization Static Ports CLEAR
- Elevator CHECK
- Elevator Trim Tab CHECK
- Rudder CHECK
- Static Wicks CHECK
- Tie Down REMOVE
- Right Static Port CLEAR

RIGHT WING (4.9c)

- Surface Condition CLEAR OF ICE, FROST, SNOW
- Flap and Hinges CHECK
- Aileron and Hinges CHECK
- Static Wicks CHECK
- Wing Tip and Lights CHECK
- Fuel Tank CHECK supply
visually - SECURE CAP
- Fuel Tank Vent CLEAR
- Tie Down and Chock REMOVE
- Main Gear Strut PROPER
INFLATION (3.44 +/- 0.25 in.)
- Tire CHECK
- Brake Block and Disc CHECK

4.5a Preflight Checklist (4.9) (Continued)

RIGHT WING (4.9c) (Continued)

CAUTION

When draining any amount of fuel, care should be taken to ensure that no fire hazard exists before starting engine.

Fuel Tank Sump.....DRAIN and CHECK
for water, sediment
and proper fuel

NOSE SECTION (4.9d)

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

Cowling..... SECURE
Windshield..... CLEAN
Propeller and Spinner CHECK
Air Inlets CLEAR
landing Light.....CHECK
Chock REMOVE
Nose Gear Strut.....PROPER
INFLATION (1.65 ± 0.25 in.)

Nose Wheel Tire CHECK
Engine Baffle Seal CHECK
Oil...CHECK QUANTITY
Oil Filler/Dipstick Cap PROPERLY SEATED
and SECURE
Cowl Oil Door CLOSED
Tow Bar STOW properly- SECURE
Baggage Door CLOSE and SECURE

LEFT WING (4.9)

Surface Condition CLEAR of ICE, FROST, SNOW

4.5a Preflight Checklist (4.9) (Continued)

LEFT WING (4.9e) (Continued)

CAUTION

When draining any amount of fuel, care should be taken to ensure that no fire hazard exists before starting engine.

- Fuel Tank Sump.....DRAIN and CHECK
for water, sediment
- Tie Down and Chock REMOVE
- Main Gear Strut PROPER INFLATION
- Tire..... CHECK
- Brake Block and Disc CHECK
- Pitot Head HOLES CLEAR
- Fuel Tank CHECK supply
visually - SECURE CAP
- Fuel Tank Vent CLEAR
- Wing Tip and Light CHECK
- Aileron and Hinges CHECK
- Flap and Hinges CHECK
- Static Wicks CHECK

MISCELLANEOUS (4.9f)

- Oxygen System (if installed) CHECK MASKS and HOSES
- Battery Master Switch ON
- Flaps.....RETRACT
- Interior Lighting.....ON and CHECK
- Pitot Heat Switch ON
- Stall Warning Heat Switch ON

CAUTION

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

4.5a Preflight Checklist (4.9) (Continued)

MISCELLANEOUS (4.9f) (Continued)

- Exterior Lighting Switches ON and CHECK
- Pitot CHECK - WARM
- Stall Warning Heat CHECK WARM
- All Lighting Switches OFF
- Pitot Heat Switch OFF
- Stall Warning Heat Switch OFF
- Battery Master Switch OFF
- Passengers BOARD
- Door CLOSE and LATCH

WARNING

Do not initiate any flight if all four door pin indicators are not green and/or the DOOR AJAR annunciator is lit.

- Door Pins all INDICATORS GREEN
- Seats.....adjusted andlocked in position
- Seat Belts and Harness FASTEN/ADJUST
CHECK inertia reel

4.5b Before Starting Engine Checklist (4.11)

BEFORE STARTING ENGINE (4.11)

- Parking Brake SET
- Propeller Control FULL INCREASE
- Fuel Selector DESIRED TANK
- Circuit Breakers check IN
- Radios OFF
- Alternators ON
- Cabin Altitude Selector SET
- Altitude Rate Control SET
- Cabin Pressurization Control SET
- Cabin Pressure Dump/Normal Switch NORM
- Induction Air Control CHECK
then PRIMARY

4.5c Engine Start Checklist (4.13)

ENGINE START - GENERAL (4.13a)

CAUTION

Do not attempt flight if there is no indication of alternator output.

CAUTION

The STARTER ENGAGE annunciator will illuminate during engine cranking. If the annunciator remains lit after the engine is running, stop the engine and determine the cause.

CAUTION

If a positive oil pressure is not indicated within 30 seconds following an engine start, stop the engine and determine the trouble. In cold weather it will take a few seconds longer to get a positive oil pressure indication.

NOTE

Starter manufacturer recommends starter cranking periods be limited to 10 seconds with a 20 second rest period between cranking periods. Maximum of 6 start periods allowed. If start is not achieved on sixth attempt allow starter to cool for 30 minutes before attempting additional starts.

NORMAL START - COLD ENGINE (4.13b)

Throttle 1/2 INCH OPEN
Battery Master Switch ON
Emergency (EMERG) Fuel Pump OFF
Mixture RICH - then IDLE CUT-OFF

4.5a Preflight Checklist (4.9) (Continued)

MISCELLANEOUS (4.9f) (Continued)

Exterior Lighting Switches ON and CHECK
Pitot CHECK - WARM
Stall Warning Heat CHECK WARM
All Lighting Switches OFF
Pitot Heat Switch OFF
Stall Warning Heat Switch OFF
Battery Master Switch OFF
Passengers BOARD
Door CLOSE and LATCH

WARNING

Do not initiate any flight if all four door pin
indicators are not green and/or the DOOR
AJAR annunciator is lit.

Door Pins all INDICATORS GREEN
Seats adjusted andlocked in position |
Seat Belts and Harness FASTEN/ADJUST
CHECK inertia reel

4.5b Before Starting Engine Checklist (4.11)

BEFORE STARTING ENGINE (4.11)

Parking Brake SET
Propeller Control FULL INCREASE
Fuel Selector DESIRED TANK
Circuit Breakers check IN
Radios OFF
Alternators ON
Cabin Altitude Selector SET
Altitude Rate Control SET
Cabin Pressurization Control SET
Cabin Pressure Dump/Normal Switch NORM
Induction Air Control CHECK
then PRIMARY

4.5c Engine Start Checklist (4.13)

ENGINE START - GENERAL (4.13a)

CAUTION

Do not attempt flight if there is no indication of alternator output.

CAUTION

The STARTER ENGAGE annunciator will illuminate during engine cranking. If the annunciator remains lit after the engine is running, stop the engine and determine the cause.

CAUTION

If a positive oil pressure is not indicated within 30 seconds following an engine start, stop the engine and determine the trouble. In cold weather it will take a few seconds longer to get a positive oil pressure indication.

NOTE

Starter manufacturers recommend that starter cranking periods be limited to 30 seconds with a two minute rest period between cranking periods. Longer cranking periods will shorten the life of the starter.

NORMAL START - COLD ENGINE (4.13b)

- Throttle 1/2 INCH OPEN
- Battery Master Switch ON
- Emergency (EMERG) Fuel Pump OFF
- Mixture RICH - then IDLE CUT-OFF

4.5c Engine Start Checklist (4.13) (Continued)

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

NOTE

The amount of prime depends on engine temperature. Familiarity and practice will enable the operator to estimate the amount of prime required.

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

NORMAL START - HOT ENGINE (4.13c)

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

ENGINE START WHEN FLOODED (4.13d)

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

4.5c Engine Start Checklist (4.13) (Continued)

ENGINE START WITH EXTERNAL POWER SOURCE (4.13e)

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

NOTE

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

CAUTION

Care should be exercised because if the ship's battery has been depleted, the external power supply can be reduced to the level of the ship's battery. This can be tested by turning the battery master switch ON momentarily while the starter is engaged. If cranking speed increases, the ship's battery is at a higher level than the external power supply.

- Throttle.....LOWEST POSSIBLE RPM
- External Power Plug DISCONNECT from receptacle
- Baggage Door.....CLOSED and SECURE
- Battery Master Switch.....ON
- Voltmeter CHECK
- Alternators.....ON
- Ammeters CHECK
- Throttle ADVANCE to 1000 RPM
- Oil Pressure CHECK
- Gyro Suction.....CHECK

BEFORE TAXING (4.15)

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

4.5e Taxiing Checklist (4.17)

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

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

GROUND CHECK (4.19)

Alternate air is unfiltered. Use of alternate air during ground or flight operations, when dust or other contaminants are present, may result in engine damage from particle ingestion.

Parking Brake	SET
Propeller Control	FULL INCREASE
Throttle	2000 RPM
Magnetos.....	max. drop 175 RPM
	- max. diff. 50 RPM
Gyro Suction	4.8 to 5.2 in. Hg.

4.5f Ground Check Checklist (4.19) (Continued)

GROUND CHECK (4.19) (Continued)

NOTE

If flight into icing conditions (in visible moisture below +5°C) is anticipated, conduct a preflight check of the ice protection systems per Supplement No. 6 - Ice Protection System.

Ice protection equipment	CHECK AS REQUIRED
Voltmeter	CHECK
Ammeters	CHECK
Oil Temperature	CHECK
Oil Pressure	CHECK
Propeller Control	EXERCISE - then FULL INCREASE
Fuel Flow	CHECK
Throttle	RETARD
Annunciator Panel	PRESS-TO-TEST
Manifold Pressure Line	DRAIN

4.5g Before Takeoff Checklist (4.21)

BEFORE TAKEOFF (4.21)

Battery Master Switch	ON
Alternators	ON - CHECK AMMETERS
Pressurization Controls	SET
Flight Instruments	CHECK
Fuel Selector	PROPER TANK
Emergency (EMERG) Fuel Pump	ON
Engine Gauges	CHECK
Induction Air	PRIMARY

WARNING

If flight into icing conditions (in visible moisture below +5°C) is anticipated or encountered during climb, cruise or descent, activate the aircraft ice protection system,including the pitot heat, as described in supplement no. 6 - Ice Protection System.

NOTE

Prolonged operation of the stall warning vane heater in temperatures greater than 5°C will reduce the operational life of the stall warning vane.

4.5g Before Takeoff Checklist (4.21) (Continued)

BEFORE TAKEOFF (4.21) (Continued)

Pitot heat	AS REQUIRED
Stall warning heat	AS REQUIRED
Wshld heat	AS REQUIRED
Prop heat	AS REQUIRED
Seat Backs	ERECT
Seats	ADJUSTED& LOCKED IN POSITION
Armrests	STOWED
Mixture	FULL RICH
Propeller Control	FULL INCREASE
Belts/Harness	FASTENED/ADJUSTED
Empty Seats	SEAT BELTS SNUGLY FASTENED
Flaps	SET
Trim	SET
Controls	FREE
Door	LATCHED
Air Conditioner	OFF
Parking Brake	RELEASED

4.5h Takeoff Checklist (4.23)

NORMAL TECHNIQUE (4.23a)

Flaps RETRACTED

NOTE

Takeoffs are normally made with full throttle. However, under some off standard conditions, the manifold pressure indication can exceed its indicated limit at full throttle. Limit manifold pressure to 42 in. Hg maximum. (See Section 7.)

NOTE

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

NORMAL TECHNIQUE (4.23a)

Flaps	0° to 10°
Trim	SET
Power	SET TO MAXIMUM

4.5i Climb Checklist (Continued)

MAXIMUM CONTINUOUS POWER CLIMB (4.25a) (Continued)

Cylinder Head Temperature (CHT).....	500°F MAX
Turbine Inlet Temperature (TIT)	1750°F MAX
Oil Temperature.....	245°F MAX
Best Angle of Climb (short duration only)	81 KIAS
Best Rate of Climb.....	110 KIAS
Pressurization Controls	SET
Emergency (EMERG) Fuel Pump	OFF at safe altitude

NOTE

For maximum engine life it is recommended to transition to Cruise Climb once a safe altitude is attained.

CRUISE CLIMB (4.25b)

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

4.5j Cruise Checklist (4.27)

CRUISE (4.27)

WARNING

Operation above 25,000 ft is not approved.

4.5j Cruise Checklist (4.27 (Continued))

CRUISE (4.27) (Continued)

CAUTION

To maintain lateral balance, alternate between right and left fuel tanks. See paragraphs 2.23 and 7.17.

Reference Section 5 power setting table and performance charts.

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

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

Pressurization Controls.....CHECK

NOTE

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

NOTE

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

4.5j Cruise Checklist (4.27) (Continued)

CRUISE (4.27) (Continued)

NOTE

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

4.5k Descent Checklist (4.29)

NORMAL DESCENT (4.29)

Power	CRUISE
Mixture	CRUISE SETTING
Airspeed	AS REQUIRED
Pressurization Controls	SET
Altimeter	SET
Windshield Defrost	AS REQUIRED
Pitot Heat	AS REQUIRED
Stall Warning Heat	AS REQUIRED

NOTE

Prolonged operation of the stall warning vane heater in temperatures greater than 5°C will reduce the operational life of the stall warning vane.

REDUCED POWER DESCENT (4.29)

Throttle	AT or ABOVE 20 in. Hg.
Mixture	MAINTAIN 1350 TIT
Propeller Speed	CRUISE SETTING
Pressurization Controls	SET
Altimeter	SET
Windshield Defrost	AS REQUIRED

4.5k Descent Checklist (4.29) (Continued)

REDUCED POWER DESCENT (4.29)

Throttle AT or ABOVE 20 in. Hg.
Mixture MAINTAIN 1350 TIT
Propeller Speed..... CRUISE SETTING
Pressurization Controls.....SET
Altimeter.....SET
Windshield Defrost AS REQUIRED
Pitot Heat AS REQUIRED
Stall Warning Heat AS REQUIRED

4.5m Approach And Landing Checklist (4.31)

APPROACH AND LANDING (4.31)

Fuel Selector.....PROPER TANK
Seat Backs..... ERECT
Seats.....ADJUSTED & LOCKED IN POSITION
Armrests.....STOWED
Belts/Harness FASTEN/ADJUST
Emergency (EMERG) Fuel Pump..... ON
Cabin Pressure DEPRESSURIZED
Mixture RICH
Propeller Control SET
Gear.....DOWN - 165 KIAS max.

NOTE

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

Flaps.....SET
Trim (Rudder).....SET TO NEUTRAL
Air Conditioner..... OFF
Toe Brakes DEPRESS to check

WARNING

After pumping several times, if one or both toe brakes are inoperative, DO NOT attempt landing on a short field.

4.5m Approach And Landing Checklist (4.31) (Continued)

SHORT FIELD TECHNIQUE (4.31b)

Flaps FULL DOWN
Airspeed 78 KIAS
Throttle AS REQUIRED
Over obstacle:
Throttle REDUCE TO IDLE
After touchdown:
Brakes MAXIMUM

4.5n Go-around Checklist (4.33)

GO-AROUND (4.33)

Mixture FULL RICH
Propeller Control FULL INCREASE
Throttle FULL POWER
Control Wheel back pressure to
ROTATE to CLIMB ATTITUDE
Airspeed 80 KIAS
Gear UP
Flaps RETRACT SLOWLY
Trim AS REQUIRED

4.5o After Landing Checklist (4.35)

AFTER LANDING (4.35)

Induction Air Control PRIMARY
Flaps RETRACT
Air Conditioner AS DESIRED
Radar OFF
Emergency (EMERG) Fuel Pump OFF
Strobe Lights OFF
Landing Taxi Lights AS REQUIRED

4.5p Stopping Engine Checklist (4.37)

STOPPING ENGINE (4.37)

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

4.5q Mooring Checklist (4.39)

MOORING (4.39)

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

4.7 AMPLIFIED NORMAL PROCEDURES (GENERAL)

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

4.9 PREFLIGHT CHECK (4.5a)

The airplane should be given a thorough preflight and walk-around check. The preflight should include a check of the airplane's operational status, computation of weight and C.G. limits, takeoff distance, and in-flight performance. A weather briefing should be obtained for the intended flight path, and any other factors relating to a safe flight should be checked before takeoff.

4.9a Cockpit (4.5a)

Upon entering the cockpit, release the seat belts securing the control wheel.

Set the parking brake by first depressing and holding the toe brake pedals and then pull the parking brake knob.

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

CAUTION

See fuel imbalance limitations, 2.23.

Check the fuel quantity gauges for adequate supply and fuel imbalance (sec. 2.23). Check that the annunciator panel illuminates and that the FUEL PRESS annunciator is ON. If the supplemental oxygen system is installed and its annunciator is lit, the expended canisters must be replaced if oxygen capability is desired for the flight. Press the stall warning test switch and note that the stall warning horn sounds. Extend the flaps for the walk-around inspection. Turn OFF the battery master switch. Check the primary flight controls for proper operation and set the elevator and rudder trim to neutral. Open the static system drain to remove any moisture that has accumulated in the lines. Verify that the alternate static system valve is in the normal position. Check that the emergency exit is in place and securely latched. Check the windows for cleanliness and that the required papers are on board. Properly stow any baggage and secure.

4.9 PREFLIGHT CHECK (4.5a) (Continued)

4.9b Empennage (4.5a)

Begin the walk-around at the left side of the aft fuselage. Check the condition of any antennas located on the fuselage. All surfaces of the empennage must be clear of ice, frost, snow or other extraneous substances. Fairings and access covers should be attached properly. Ensure that the primary static system ports on the left and right side of the aft fuselage and the alternate and pressurization static ports on the underside of the aft fuselage are clear of obstructions. The elevator and rudder should be operational and free from damage or interference of any type. Elevator and rudder static wicks should be firmly attached and in good condition. Check the condition of the tab and ensure that all hinges and push rods are sound and operational. If the tail has been tied down, remove the tiedown rope.

4.9c Right Wing (4.5a)

Check that the wing surface and control surfaces are clear of ice, frost, snow or other extraneous substances. Check the flap, aileron and hinges for damage and operational interference. Static wicks should be firmly attached and in good condition. Check the wing tip and lights for damage.

Open the fuel cap and visually check the fuel color. The quantity should match the indication that was on the fuel quantity gauge. Replace cap securely. The fuel tank vent should be clear of obstructions.

Remove the tiedown and chock.

Next, complete a check of the landing gear. Check the gear strut for proper inflation. There should be 3.44 +/- 0.25 inches of strut exposure under a normal static load. Check for hydraulic leaks. Check the tire for cuts, wear, and proper inflation. Make a visual check of the brake block and disc.

Drain the fuel tank sump through the quick drain located on the lower surface of the wing just inboard of the gear well, making sure that enough fuel has been drained to ensure that all water and sediment is removed. The fuel system should be drained daily prior to the first flight and after each refueling.

CAUTION

When draining any amount of fuel, care should be taken to ensure that no fire hazard exists before starting engine.

4.9 PREFLIGHT CHECK (4.5a) (Continued)

4.9d Nose Section (4.5a)

Check the general condition of the nose section; look for oil or fluid leakage and that the cowling is secure. Drain the fuel filter sump located on the lower fuselage aft of the cowling. Check the windshield and clean if necessary. The propeller and spinner should be checked for detrimental nicks, cracks, or other defects. The air inlets should be clear of obstructions. The landing light should be clean and intact.

Remove the chock and check the nose gear strut for proper inflation. There should be 1.65 +/- 0.25 inches of strut exposure under a normal static load. Check the tire for cuts, wear, and proper inflation. Check the engine baffle seals. Check the oil level; maximum endurance flights should begin with 12 quarts of oil. Make sure that the oil filler/dipstick cap has been properly seated and secured, and that the cowl oil door is closed. Ensure that the tow bar is secured in the nose baggage area.

Close and secure the nose baggage door.

4.9e Left Wing (4.5a)

The wing surface should be clear of ice, frost, snow, or other extraneous substances. Drain the left fuel tank sump in the same manner as the right wing. Remove the tiedown and chock. Check the main gear strut for proper inflation: there should be 3.44 +/- 0.25 inches of strut exposure under a normal static load. Check for hydraulic leaks. Check the tire and the brake block and disc.

If installed, remove the cover from the pitot head on the underside of the wing. Make sure the holes are open and clear of obstructions.

Open the fuel cap and visually check the fuel color. The quantity should match the indication that was on the fuel quantity gauge. Replace cap securely. The fuel tank vent should be clear of obstructions.

Check the wing tip and lights for damage. Check the aileron, flap, and hinges for damage and operational interference and that the static wicks are firmly attached and in good condition.

4.9 PREFLIGHT CHECK (4.5a) (Continued)

4.9f Miscellaneous (4.5a)

Enter the cockpit and, if installed, check oxygen masks and hoses.

Turn the battery master switch ON and retract the flaps. Check the interior lights by turning ON the necessary switches. After the interior lights are checked, turn ON the pitot heat, stall warning heat, and the exterior light switches. Next, perform a walk-around check on the exterior lights and check the heated pitot head and stall warning vane for proper heating.

CAUTION

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

Reenter the cockpit and turn all switches OFF. When all passengers are on board, the pilot should check that the cabin door is properly closed and latched, and visually check that all four door pin indicators are green.

WARNING

Do not initiate any flight if all four door pin indicators are not green and/or the DOOR AJAR annunciator is lit.

Seats should be adjusted and locked in position. Seat belts on empty seats should be snugly fastened. All passengers should fasten their seat belts and shoulder harnesses. A pull test of the inertia reel locking restraint feature should be performed.

4.11 BEFORE STARTING ENGINE (4.5b)

Before starting the engine, the parking brake should be set and the propeller control moved to the full INCREASE position. The fuel selector should then be moved to the desired tank. Check to make sure all the circuit breakers are in and the radios are OFF. Turn the alternator switches ON.

4.11 BEFORE STARTING ENGINE (4.5b) (Continued)

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

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

4.13 ENGINE START (4.5c)

4.13a Engine Start - General (4.5c)

CAUTION

Do not attempt flight if there is no indication of alternator output.

CAUTION

The STARTER ENGAGED annunciator will illuminate during engine cranking. If the annunciator remains lit after the engine is running, stop the engine and determine the cause.

CAUTION

If a positive oil pressure is not indicated within 30 seconds following an engine start, stop the engine and determine the trouble. In cold weather it will take a few seconds longer to get a positive oil pressure indication.

NOTE

Starter manufacturer recommends starter cranking periods be limited to 10 seconds with a 20 second rest period between cranking periods. Maximum of 6 start periods allowed. If start is not achieved on sixth attempt allow starter to cool for 30 minutes before attempting additional starts.

4.13 ENGINE START (4.5c) (Continued)

4.13b Normal Start - Cold Engine (4.5c)

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

NOTE

The amount of prime depends on engine temperature. Familiarity and practice will enable the operator to estimate the amount of prime required.

Turn both magneto switches ON and engage the starter. When the engine fires advance the mixture control to full RICH. Move the throttle to the desired setting and check the oil pressure for a positive indication. Confirm that the alternators are on by checking the ammeters for output. Check the gyro suction gauge for a positive indication and that the flow buttons are retracted.

4.13c Normal Start - Hot Engine (4.5c)

Open the throttle 1 inch. Turn the battery master switch ON and check that the emergency (EMERG) fuel pump is OFF. Verify the mixture control is at idle cut-off. Turn both magneto switches ON and engage the starter. When the engine fires, slowly advance the mixture control. Move the throttle to the desired setting and check for a positive indication of oil pressure. Confirm that the alternators are on by checking the ammeters for output. Check the gyro suction gauge for a positive indication and that the flow buttons are retracted.

4.13d Engine Start When Flooded (4.5c)

The throttle lever should be full open. Turn the battery master switch ON and check that the emergency (EMERG) fuel pump is OFF. Verify the mixture control is at idle cut-off. Turn both magneto switches ON and engage the starter. When the engine fires, advance the mixture control, retard the throttle, and check for a positive indication of oil pressure. Confirm that the alternators are on by checking the ammeters for output. Check the gyro suction gauge for a positive indication and that the flow buttons are retracted.

4.13 ENGINE START (4.5c) (Continued)

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

An optional feature allows the operator to use an external power source to crank the engine without having to gain access to the airplane's battery.

Turn the battery master and alternator switches OFF and turn all electrical equipment OFF. If using an auxiliary power unit, plug the unit into the socket located inside the forward baggage door. If using an external battery, connect the RED lead of the jumper cable to the POSITIVE (+) terminal of an external 24-volt battery and the BLACK lead to the NEGATIVE (-) terminal. Insert the plug of the jumper cable into the socket located inside the forward baggage door. Note that, after the plug is inserted, the airplane's electrical system is ON. Proceed with the normal starting technique.

NOTE

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

After the engine has started, retard the throttle to the lowest possible rpm to reduce sparking. Disconnect the external power source from the aircraft and secure the baggage door. Turn the battery master and alternator switches ON and check the voltmeter and ammeters for an indication of output.

When the engine is firing evenly, advance the throttle to 1000 rpm and check for a positive indication of oil pressure. Check gyro suction gauge for a positive indication, and that the flow buttons are retracted.

4.15 BEFORE TAXIING (4.5d)

CAUTION

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

Warm up the engine at 1000 to 1200 rpm. Avoid prolonged idling at low rpm, as this practice may result in fouled spark plugs. Turn the radio master switch ON, and set environmental system as desired. Set the supplemental heater as desired (refer to paragraph 4.47).

Takeoff may be made as soon as the ground check is completed and the engine is warm.

Care should be taken not to run up the engine over a surface containing loose stones, gravel, or any loose material that may cause damage to the propeller blades.

4.17 TAXIING (4.5e)

Non-pilot personnel should not attempt to taxi the airplane until they have been instructed in taxiing procedures and technique by a qualified person authorized by the owner.

Determine that the propeller back blast and taxi areas are clear.

Release the parking brake by first depressing and holding the toe brake pedals and then push in on the parking brake knob. Taxi with the propeller control set to full INCREASE. Power should be applied slowly to start the taxi roll. Taxi a few feet forward and apply the brakes to determine their effectiveness. While taxiing, make slight turns to ascertain the effectiveness of the steering and to check the flight instruments.

Observe wing clearances when taxiing near buildings or other stationary objects. If possible, station an observer outside the airplane.

Avoid holes and ruts when taxiing over uneven ground.

Do not operate the engine at high rpm when taxiing over ground containing loose stones, gravel, or any loose material that may cause damage to the propeller blades.

4.19 GROUND CHECK (4.5f)

CAUTION

Alternate air is unfiltered. Use of alternate air during ground or flight operations when dust or other contaminants are present may result in damage from particle ingestion.

NOTE

If flight into icing conditions (in visible moisture below +5°C) is anticipated, conduct a preflight check of the icing systems per Supplement No. 6 - Ice Protection System.

Set the parking brake. The magnetos should be checked at 2000 rpm with the propeller control set at full INCREASE. Drop off on either magneto should not exceed 175 rpm and the difference between the magnetos should not exceed 50 rpm. Operation on one magneto should not exceed 10 seconds. Conduct a preflight check of the ice protection systems for proper operation.

Check the suction gauge; the indicator should read 4.8 to 5.2 in. Hg at 2000 rpm. Check that both red flow buttons are pulled in.

Check the voltmeter and ammeters for proper voltage and alternator outputs. Check oil temperature and oil pressure. The temperature may be low for some time if the engine is being run for the first time of the day.

The propeller control should be moved through its complete range to check for proper operation and then placed in full INCREASE rpm for takeoff. Do not allow a drop of more than 500 rpm during this check. In cold weather, the propeller control should be cycled from high to low rpm at least three times before takeoff to make sure that warm engine oil has circulated.

Check that the fuel flow gauge is functioning, then retard the throttle. Check the annunciator panel lights with the press-to-test button.

Drain the manifold pressure line by running the engine at 1000 rpm and depressing the drain valve, located on the left side of the control pedestal under the instrument panel, for 5 seconds. Do not depress the valve when the manifold pressure exceeds 25 inches Hg.

4.21 BEFORE TAKEOFF (4.5g)

Ensure that the battery master and alternator switches are ON. Check that the cabin pressurization controls are properly set. Check and set all of the flight instruments as required. Check the fuel selector to make sure it is on the proper tank. Ensure emergency (EMERG) fuel pump is ON. Check all engine gauges. The induction air should be in the PRIMARY position.

NOTE

If flight into icing conditions (in visible moisture below +5°C) is anticipated or encountered during climb, cruise or descent, activate the aircraft ice protection system, including the pitot heat, as described in supplement no. 6 - ice protection system.

Turn pitot, stall warning, windshield, and propeller heat ON if necessary.

NOTE

Prolonged operation of the stall warning vane heater in temperatures greater than 5°C will reduce the operational life of the stall warning vane.

Seats should be adjusted and locked in position. All seat backs should be erect and armrests stowed.

The mixture control should be set to full RICH and propeller control should be set to full INCREASE. Seat belts and shoulder harnesses should be fastened. Fasten the seat belts snugly around the empty seats.

Set the flaps and trim. Ensure proper flight control movement and response. The door should be properly latched and the door ajar annunciator light out. The air conditioner must be OFF to ensure normal takeoff performance. Release the parking brake.

4.23 TAKEOFF (see charts in Section 5) (4.5h)

NOTE

Takeoffs are normally made with full throttle. However, under some off standard conditions, the manifold pressure indication can exceed its indicated limit at full throttle. Limit manifold pressure to 42 in. Hg maximum. (See Section 7.)

4.23 TAKEOFF (see charts in Section 5) (4.5h) (Continued)

NOTE

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

Takeoffs are normally made with flaps 0° to 10°. For short field takeoffs or takeoffs affected by soft runway conditions or obstacles, total distance can be reduced appreciably by lowering the flaps to 20°.

4.23a Normal Technique (4.5h) (Continued)

When the available runway length is well in excess of that required and obstacle clearance is no factor, the normal takeoff technique may be used. The flaps should be in the 0° to 10° position and the pitch trim set slightly aft of neutral. Align the airplane with the runway, apply full power, and accelerate to 80-85 KIAS.

Apply back pressure to the control wheel to lift off at 80-85 KIAS, then control pitch attitude as required to attain the desired climb speed of 90-95 KIAS. Retract the landing gear when a straight-ahead landing on the runway is no longer possible. Retract the flaps.

4.23b 0° Flaps Takeoff Performance (4.5h)

Retract the flaps in accordance with the Takeoff Ground Roll, 0° Flaps and Takeoff Distance Over 50 Ft. Obstacle, 0° Flaps charts in Section 5. Set maximum power before brake release and accelerate the airplane to 78 KIAS for liftoff. After liftoff, adjust the airplane attitude as required to achieve the obstacle clearance speed of 91 KIAS passing through 50 feet of altitude. Once immediate obstacles are cleared, retract the landing gear and establish the desired enroute climb configuration and speed.

4.23c Short Field Takeoff Performance (4.5h)

NOTE

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

4.23c Short Field Takeoff Performance (4.5h) (Continued)

For departure from short runways or runways with adjacent obstructions, a short field takeoff technique with flaps set at 20° should be used in accordance with the Takeoff Ground Roll, 20° Flaps and Takeoff Distance Over 50 Ft. Obstacle, 20° Flaps charts. Maximum power is established before brake release and the airplane is accelerated to 69 KIAS for liftoff. After liftoff, control the airplane attitude to accelerate to 80 KIAS passing through the 50-foot obstacle height. Once clear of the obstacle, retract the landing gear and accelerate through 90 KIAS while retracting the flaps. Then establish the desired enroute climb configuration and speed.

4.25 CLIMB (4.5i)

4.25a Maximum Continuous Power Climb (4.5i)

The best rate of climb at gross weight and maximum continuous power will be obtained at 110 KIAS. The best angle of climb may be obtained at 81 KIAS. The recommended procedure for climb is to use maximum continuous power with the mixture full RICH. Under some off standard conditions, the manifold pressure indication will exceed its indicated limits at full throttle. Adjust power to remain within limits. Set the cabin pressurization controls in accordance with paragraph 4.45. The emergency (EMERG) fuel pump should be OFF when reaching a safe altitude.

NOTE

For maximum engine life it is recommended to transition to Cruise Climb once a safe altitude is attained.

4.25b Cruise Climb (4.5i)

For reduced enroute fuel consumption in climb at a higher enroute climb speed of 125 KIAS, reduce the manifold pressure to 35 in. Hg, use 2500 rpm, and lean the mixture to produce a fuel flow of 32 gph. Set the cabin pressurization controls in accordance with paragraph 4.45. The emergency (EMERG) fuel pump should be OFF when reaching a safe altitude. Turn OFF the landing light and use the recognition lights as required. Turn ON the TAS. Above 24000 feet, reduce MAP to 34" or below. This slightly reduced power setting combined with higher climb speed provides better engine cooling.

NOTE

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

4.25b Cruise Climb (4.5i) (Continued)

NOTE

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

4.27 CRUISE (4.5j)

WARNING

Operation above 25,000 feet is not approved.

CAUTION

To maintain lateral balance, alternate between right and left fuel tanks. See paragraphs 2.23 and 7.17.

The cruising speed is determined by many factors, including power setting, altitude, temperature, loading, and equipment installed on the airplane. When leveling off at cruise altitude, the pilot may reduce to a cruise power setting in accordance with the *Power Setting Table in Section 5 of this manual. The higher RPM setting for the desired power should be used when operating above 20,000 feet. Proper leaning during cruise is essential for smooth engine operation and optimum fuel economy. This is especially important during power reductions, such as level off, to prevent rough engine operation. For cruise, mixture should be leaned to peak TIT. Always use the TIT gauge for leaning.

NOTE

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

*To obtain the performance presented in the Performance Section of this handbook, all conditions listed on the performance charts must be met.

4.27 CRUISE (4.5j) (Continued)

NOTE

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

NOTE

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

Following level-off for cruise, the airplane should be trimmed and the pressurization system checked.

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

The emergency (EMERG) fuel pump should always be turned ON before switching tanks, and should be left on for a short period thereafter. To preclude making a hasty selection, and to provide continuity of flow, the selector should be changed to another tank before fuel is exhausted from the tank in use.

4.27 CRUISE (4.5j) (Continued)

NOTE

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

During cruise, use the following procedure to maintain lateral balance, and stay within the fuel imbalance limitations of 2.23:

- (a) When starting with a symmetrical fuel load, use the left tank first until 10 gallons are burned, then alternate tanks at approximately one hour intervals.
- (b) When starting with an unsymmetrical fuel load, care must be taken not to allow the fuel imbalance to exceed 10 gallons.

The emergency (EMERG) fuel pump should normally be OFF so that any malfunction of the engine driven fuel pump is immediately apparent. Loss of fuel pressure to the fuel injector is indicated by the illumination of the FUEL PRESS annunciator. If signs of fuel starvation should occur at any time during flight, fuel exhaustion should be suspected, at which time the fuel selector should be immediately positioned to the fullest tank and the emergency (EMERG) fuel pump switched to the ON position. If excessive fuel vapor is suspected, usually indicated by fluctuating fuel flow, turn the emergency (EMERG) fuel pump ON until the fuel flow indications are smooth.

The pilot should monitor weather conditions while flying, and be alert for meteorological conditions which might lead to icing. Even aircraft equipped with a complete deicing option are not approved for flight in heavy icing, heavy snow, or freezing rain. (See Section 9.) Immediate steps shall be taken to exit any area where such icing conditions are inadvertently encountered. Saturated air accelerating through the induction system filter can form ice although ambient temperatures are above freezing. If induction system icing is suspected, place the induction air control in the ALTERNATE position. Alternate air should also be selected before entering clouds. Manifold pressure may decrease significantly when alternate air is selected depending on altitude, power setting, and other factors. This loss of manifold pressure can exceed 8 inches of Hg. when selecting alternate air at cruise power settings during icing conditions. If ice is forming on the filter manifold pressure could continue to deteriorate after selecting alternate air. When manifold pressure stabilizes attempt to regain cruise power with throttle and or RPM adjustments. The primary filter may retain ice after leaving icing conditions, making the selection of PRIMARY induction air impractical until ice melts or sublimates.

4.27 CRUISE (4.5j) (Continued)

There are no mechanical uplocks in the landing gear system. In the event of a hydraulic system malfunction, check valves should prevent the gear from extending. However, some hydraulic system malfunctions may cause the gear to free-fall to the gear down position. The true airspeed with gear down is approximately 70% of the gear retracted airspeed for any given power setting. Allowances for the reduction in airspeed and range should be made when planning extended flight between remote airfields or flight over water.

4.29 DESCENT (4.5k)

The recommended procedure for descent is to leave the engine controls at the cruise settings and increase the airspeed to give the desired rate of descent. Monitor the manifold pressure and adjust to maintain the cruise setting. Leave the mixture leaned to the cruise setting. This will prevent rapid engine cooling which may damage the engine. Should additional rate of descent be required, power can be reduced to 20 in. Hg. while maintaining cabin pressurization. At reduced power maintain at least 135°F TIT in order to keep engine temperatures from cooling too rapidly. If descending with the gear retracted does not provide the desired rate of descent the gear may be extended at speeds up to 165 KIAS and the aircraft operated at speeds up to 195 KIAS with the gear extended. This procedure will significantly increase rate of descent.

4.29 DESCENT (4.5k) (Continued)

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

Set the altimeter. Adjust the windshield defrost, pitot head and stall warning heat as required during descent.

NOTE

Prolonged operation of the stall warning vane heater in temperatures greater than 5°C will reduce the operational life of the stall warning vane.

4.31 APPROACH AND LANDING (See charts in Section 5) (4.5m)

Accomplish the Landing Checklist early in the landing approach.

The fuel selector should be on the fullest tank. Seats should be adjusted and locked in position. Seat backs must be fully erect, armrests stowed, and seat belts and shoulder harnesses fastened and properly adjusted. The emergency (EMERG) fuel pump should be ON. Check to ensure that the cabin is depressurized. The mixture should be RICH and propeller control should be set. The landing gear may be lowered at speeds up to 165 KIAS and the flaps at speeds as follows:

10° 165 KIAS maximum
20° 130 KIAS maximum
36° 116 KIAS maximum

4.31 APPROACH AND LANDING (4.5m) (Continued)

NOTE

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

Set the rudder trim to neutral in preparation for landing.

The air conditioner should be OFF to ensure maximum rate of climb in the event of a go-around. Pump toe brakes to ensure that the system is capable of uniform braking during landing rollout.

WARNING

After pumping several times, if one or both toe brakes are inoperative, DO NOT attempt landing on a short field.

Depending on the field length and other factors, the following procedures are appropriate:

NOTE

In crosswind conditions, the nosewheel may not be aligned with the runway as the wheel touches down because of opposite rudder input. To prevent swerving in the direction the nosewheel is offset, the rudder must be promptly centered just as the nosewheel touches down.

4.31a Normal Technique (4.5m)

Landings may be made with any flap setting. Normally, full flaps are used. The aircraft should be flown down the final approach course at 80 - 85 KIAS with full flaps extended (95 KIAS with flaps retracted), and power as required to maintain the desired approach angle. When descending through 50 feet agl, reduce power to idle. Make normal landing, and brake as required during ground roll.

4.31b Short Field Technique (4.5m)

For landings on short runways, or runways with adjacent obstructions, a short field landing technique with full flaps should be used in accordance with the Landing Ground Roll Distance or the Landing Distance Over 50 FT Obstacle charts in Section 5. The airplane should be flown down the final approach at 78 KIAS with flaps fully extended with power set to produce a normal 3° descent (approximately 400 ft/min) angle. As the obstacle is cleared, reduce the power to idle and adjust airplane attitude to maintain 78 KIAS to the flare point. After touchdown, apply maximum braking.

4.33 GO-AROUND (4.5n)

To initiate a go-around from a landing approach, the mixture should be set to full RICH, the propeller control should be at full INCREASE, and the throttle should be advanced to full power while the pitch attitude is increased to obtain the balked landing climb speed of 80 KIAS. Retract the landing gear and slowly retract the flaps when a positive climb is established. Allow the airplane to accelerate to the best angle of climb speed (81 KIAS) for obstacle clearance or to the best rate of climb speed (110 KIAS) if obstacles are not a factor. Reset the longitudinal trim as required.

4.35 AFTER LANDING (4.5o)

When clear of the active runway, move the induction air control to PRIMARY, retract the flaps, and turn the air conditioner on as desired. Turn OFF the radar, emergency (EMERG) fuel pump, and strobe lights. Turn OFF the landing and taxi lights as required.

4.37 STOPPING ENGINE (4.5p)

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

The air conditioner should be turned OFF, the propeller control set in the full INCREASE position, and the throttle should be CLOSED until there is a decided decrease in CHT. Increase throttle to 1000 rpm. Maintain speed for approximately 30 seconds to ensure adequate scavenging of turbocharger oil system. Stop the engine by pulling the mixture control back to idle cut-off. After the engine stops, both magneto switches, alternator switches, and battery master switches must be turned OFF.

4.39 MOORING (4.5q)

If necessary, the airplane should be moved on the ground with the aid of the nose wheel tow bar.

The parking brake should be set and the aileron and elevator controls should be secured by looping the safety belt through the control wheel and pulling it snug. The flaps should be fully retracted. Wheel chocks should be positioned in place.

Tiedowns can be secured to the wing tiedown rings and to the tail skid. The rudder is held in position by its connections to the nose wheel steering and normally does not have to be secured.

4.41 STALLS

The stall characteristics of the Malibu are conventional. An approaching stall is indicated by a stall warning horn which is activated between five and ten knots above stall speed. Mild airframe buffeting and pitching may also precede the stall.

The gross weight stalling speed with power off, landing gear extended, and full flaps is 58 KIAS. With the landing gear retracted and flaps up, this speed is increased to 69 KIAS. Loss of altitude during stalls can be as great as 700 feet, depending on configuration and power.

NOTE

The stall warning system is inoperative with the battery and alternator switches OFF.

During preflight, the stall warning system should be checked by turning the battery switch on and pressing the stall warning test switch to determine if the horn is actuated.

4.43 TURBULENT AIR OPERATION

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

4.45 CABIN PRESSURIZATION SYSTEM

Cabin pressurization system controls, gauges and switches are located in the lower left instrument panel. (Refer to Section 7, Figure 7-25.)

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

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

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

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

4.45 CABIN PRESSURIZATION SYSTEM (Continued)

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

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

WARNING

Do not land with aircraft pressurized.

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

4.47 SUPPLEMENTAL ELECTRIC HEATER

AFTER ENGINE START

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

NOTE

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

HEATER OPERATION

VENT DEFOG BLWR Switch.....	ON
AUX CABIN HEAT Switch	ON

For maximum heat:

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

NOTE

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

4.49 NOISE LEVEL

The corrected noise level of this aircraft is 74.7 dB(A).

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

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

4.50 ICING INFORMATION

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

- Visible rain at temperatures below 5 degrees Celsius ambient air temperature.
- Droplets that splash or splatter on impact at temperature below 5 degrees Celsius ambient air temperature.

PROCEDURES FOR EXITING THE SEVERE ICING ENVIRONMENT

These procedures are applicable to all flight phases from takeoff to landing. Monitor the ambient air temperature. While severe icing may form at temperatures as cold as -18 degrees Celsius, increased vigilance is warranted at temperatures around freezing with visible moisture present. If the visual cues specified in the Limitations Section of the AFM for identifying severe icing conditions are observed, accomplish the following:

- Immediately request priority handling from Air Traffic Control to facilitate a route or an altitude change to exit the severe icing conditions in order to avoid extended exposure to flight conditions more severe than those for which the airplane has been certificated.
- Avoid abrupt and excessive maneuvering that may exacerbate control difficulties.
 - Do not engage the autopilot.
 - If the autopilot is engaged, hold the control wheel firmly and disengage the autopilot.
 - If an unusual roll response or uncommanded roll control movement is observed, reduce the angle-of-attack.
- Do not extend flaps when holding in icing conditions. Operation with flaps extended can result in a reduced wing angle-of-attack, with the possibility of ice forming on the upper surface further aft on the wing than normal, possibly aft of the protected area.
 - If the flaps are extended, do not retract them until the airframe is clear of ice.
- Report these weather conditions to Air Traffic Control.

From Supplement for
replaced propeller

3. EMERGENCY PROCEDURES

Malfunction of the propeller pitch control:

If the oil-pressure in the system is decreasing, or the pitch control fails, the propeller will return to low pitch position (take off position).

Hold propeller speed below 2500 RPM by the power lever. Select lower air speed, if applicable. Monitor oil pressure and oil temperature.

Propeller-De-Ice:

The propeller de-ice system may be switched on with a non-rotating propeller, for test purposes, no longer than 10 seconds, because overheating or damage of the de-ice boots may occur.

If the reading of the "PROP DE-ICER" ammeter is not within the green arc, or an unusually high or low reading of the ammeter occurs, turn off the propeller de-ice system with the switch marked "PROP HEAT"!

Uneven deicing may cause propeller imbalance.

Warning:

If there is a malfunction of the de-ice system, flight into known icing conditions is not approved.

4. NORMAL PROCEDURES

Move the propeller lever gently, because the Propeller MTV-14-() is equipped with light weight wood composite blades, reacting quicker to RPM changes than the standard propeller with metal blades.

Propeller-De-Ice System:

An electrical de-ice system may be installed.

The propeller de-ice system may be switched on with a non-rotating propeller, for test purposes, no longer than 10 seconds, because overheating or damage of the de-ice boots may occur.

During flights, switch on "PROP HEAT" at the beginning of icing.

The reading of the "PROP DE-ICER" ammeter must be within the green arc, otherwise switch off the de-icing system! (Uneven de-icing may cause propeller imbalance).

Warning:

If there is a malfunction of the de-ice system, flight into known icing conditions is not approved.

5. PERFORMANCE

No change.

FAA APPROVED

JUN 19 1998
Date _____

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS
SECTION 5
PERFORMANCE

Paragraph No.		Page No.
5.1	General	5-1
5.3	Introduction - Performance and Flight Planning	5-1
5.5	Flight Planning Example	5-3
5.7	Performance Graphs	5-9
	List of Figures.....	5-9

**SECTION 5
PERFORMANCE**

5.1 GENERAL

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

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

5.3 INTRODUCTION - PERFORMANCE AND FLIGHT PLANNING

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

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

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

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

5.3 INTRODUCTION - PERFORMANCE AND FLIGHT PLANNING (CONT.)

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

WARNING

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

5.5 FLIGHT PLANNING EXAMPLE

(a) Aircraft Loading

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

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

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

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

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

(1) Basic Empty Weight	2745 lb
(2) Occupants (4 x 170 lbs)	680 lb
(3) Baggage and Cargo	75 lb
(4) Fuel (6 lb/gal. x 100)	600 lb
(5) Takeoff Weight	4100 lb
(6) Landing Weight	
(a)(5) minus (g)(1),	
(4100 lb minus 400 lb)	3700 lb

The takeoff weight is below the maximum of 4300 lbs and the weight and balance calculations have determined the C.G. position within the approved limits.

5.5 FLIGHT PLANNING EXAMPLE (CONT)

(b) Takeoff and Landing

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

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

Apply the departure airport conditions and takeoff weight to the appropriate Takeoff Ground Roll and Takeoff Distance (Figures 5-13, 5-15, 5-17 and 5-19) to determine the length of runway necessary for the takeoff and/or obstacle clearance.

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

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

	Departure Airport	Destination Airport
(1) Pressure Altitude	1000 ft	1000 ft
(2) Temperature	25°C	25°C
(3) Wind Component (Headwind)	15 KTS	10 KTS
(4) Runway Length Available	3400 ft	5000 ft
(5) Takeoff and Landing		
Distance Required	2230 ft*	1830 ft**

*reference Figure 5-19

**reference Figure 5-39

5.5 FLIGHT PLANNING EXAMPLE (CONT)

NOTE

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

(c) Climb

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

The desired cruise pressure altitude and corresponding cruise outside air temperature values are the first variables to be considered in determining the climb components from the Fuel, Time, and Distance to Climb graph (Figure 5-24). After the fuel, time, and distance for the cruise pressure altitude and outside air temperature values have been established, apply the existing conditions at the departure field to graph (Figure 5-24). Now, subtract the values obtained from the graph for the field of departure conditions from those for the cruise pressure altitude.

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

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

(1) Cruise Pressure Altitude	20000 ft
(2) Cruise OAT	-15° C
(3) Fuel to Climb (14 gal. minus 1 gal.)	13 gal.*
(4) Time to Climb (21.5 min. minus 1 min.)	20.5 min.*
(5) Distance to Climb (54 nautical miles minus 2 nautical miles)	52 nautical miles*

*reference Figure 5-24

5.5 FLIGHT PLANNING EXAMPLE (cont)

(d) Descent

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

Utilizing the cruise pressure altitude and OAT, determine the basic fuel, time, and distance for descent (Figure 5-33). These figures must be adjusted for the field pressure altitude and temperature at the destination airport. To find the necessary adjustment values, use the existing pressure altitude and temperature conditions at the destination airport as variables to find the fuel, time, and distance values from the graph (Figure 5-33). Now, subtract the values obtained from the field conditions from the values obtained from the cruise conditions to find the true fuel, time and distance values needed for the descent segment of the flight plan.

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

- (1) Fuel to Descend

(8 gal. minus 0 gal.)

8 gal.*
- (2) Time to Descend

(23 min. minus 1 min.)

22 min.*
- (3) Distance to Descend

(82 nautical miles minus 4 nautical miles)

78 nautical miles*

(e) Cruise

Using the total distance to be traveled during the flight, subtract the previously calculated distance to climb and distance to descend to establish the total cruise distance. Refer to the appropriate Textron Lycoming Manual and the Cruise Performance Table (refer to page 5-24b) 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 Cruise Speed Vs. Altitude graph (Figure 5-27).

*reference Figure 5-33

5.5 FLIGHT PLANNING EXAMPLE (cont)

Calculate the cruise fuel consumption for the cruise power setting from the information provided by the Textron Lycoming Manual and the Cruise Performance Table (refer to page 5-24b).

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

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

(1) Total Distance	618 nautical miles
(2) Cruise Distance	
(e)(1) minus (c)(5) minus	
(d)(3), (618 nautical miles	
minus 52 nautical miles	
minus 78 nautical miles)	488 nautical miles
(3) Cruise Power	
(lean to peak T.I.T.)	Normal cruise power
(4) Cruise Speed	206 KTS TAS*
(5) Cruise Fuel Consumption	18 gph*
(6) Cruise Time	
(e)(2) divided by (e)(4),	
(488 nautical miles	
divided by 206 KTS)	2.37 hrs
	142 min.
(7) Cruise Fuel	
(e)(5) multiplied by (e)(6)	
(18 gph multiplied by 2.37 hrs)	42.7 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.

*reference Figure 5-27 and Page 5-24b

5.5 FLIGHT PLANNING EXAMPLE (cont)

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

- (1) Total Flight Time
(c)(4) plus (d)(2) plus (e)(6),
(0.3 hrs plus 0.4 hrs plus 2.37 hrs)
(20 min. plus 22 min. plus 142 min.) 3.1 hrs/184 min.

(g) Total Fuel Required

Determine the total fuel required by adding the fuel for start, taxi, and runup (3.0 gal., calculated by allowing 5 minutes of fuel flow at takeoff power), the fuel to climb, the fuel to descend, and the cruise fuel. When the total fuel (in gallons) is determined, multiply this value by 6 lb/gal. to determine the total fuel weight used for the flight.

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

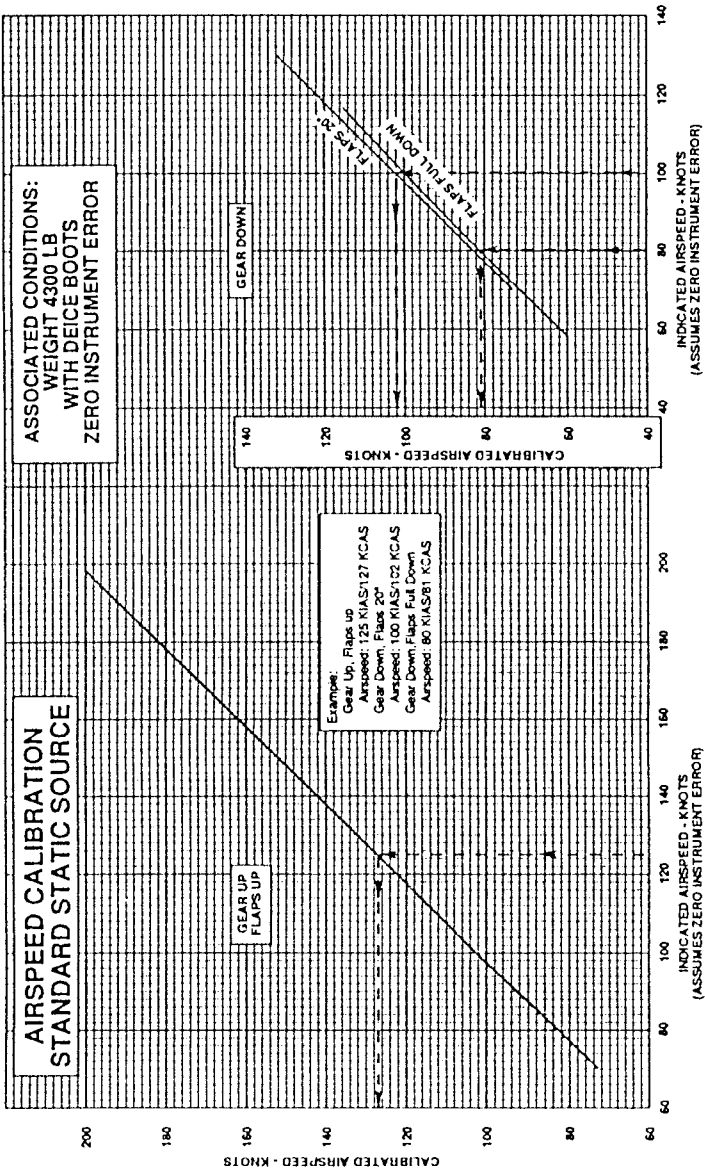
- (1) Total Fuel Required
Fuel for Start, Taxi, and Runup plus
(c)(3) plus (d)(1) plus (e)(7), (3 gal.
plus 13 gal. plus 8 gal. plus 42.7 gal.)
(66.7 gal. multiplied by 6 lb/gal.) 66.7 gal./400 lb

5.7 PERFORMANCE GRAPHS

LIST OF FIGURES

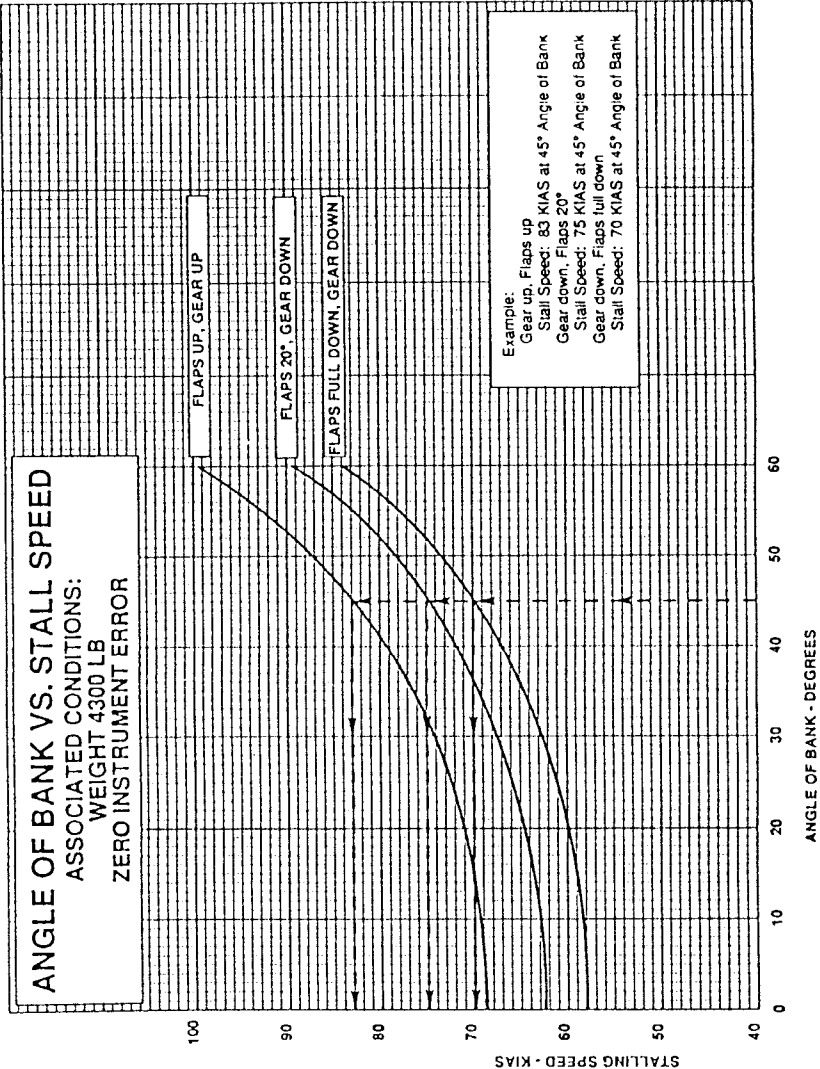
Figure No.		Page No.
5-1	Airspeed Calibration	5-11
5-3	Angle of Bank Vs. Stall Speed	5-12
5-5	Temperature Conversion	5-13
5-7	Pressure Altitude Vs Outside Air Temperature	5-14
5-9	Temperature Rise Due To Ram Recovery	5-15
5-11	Wind Components	5-16
5-13	Takeoff Ground Roll, 0° Flaps	5-17
5-15	Takeoff Ground Roll, 20° Flaps	5-18
5-17	Takeoff Distance Over 50 Ft. Obstacle, 0° Flaps	5-19
5-19	Takeoff Distance Over 50 Ft. Obstacle, 20° Flaps	5-20
5-21	Rate of Climb	5-21
5-23	Maximum Continuous Power Fuel, Time, and Distance to Climb (110 KIAS)	5-22
5-24	Maximum Continuous Power Fuel, Time, and Distance to Climb (125 KIAS)	5-23
5-25	Cruise Climb Fuel, Time, and Distance to Climb	5-24
5-26	Maximum Manifold Pressure Vs. Pressure Altitude	5-24a
	Power Setting Table	5-24b
5-27	Cruise Speed Vs. Altitude	5-25
5-29	Range	5-26
5-31	Endurance	5-27
5-33	Fuel, Time, and Distance to Descend	5-28
5-35	Glide Time and Distance	5-29
5-37	Balked Landing Climb	5-30
5-39	Landing Distance Over 50 Ft. Obstacle	5-31
5-41	Landing Ground Roll	5-32

THIS PAGE INTENTIONALLY LEFT BLANK

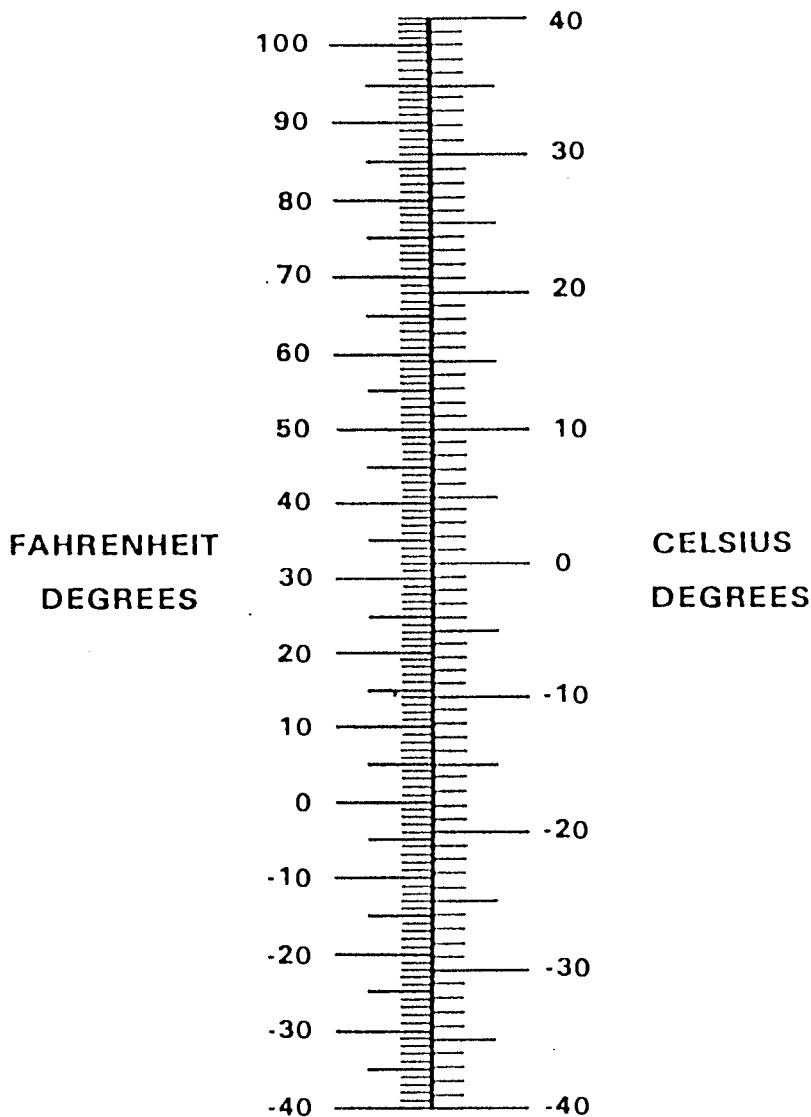


AIRSPEED CALIBRATION

Figure 5-1

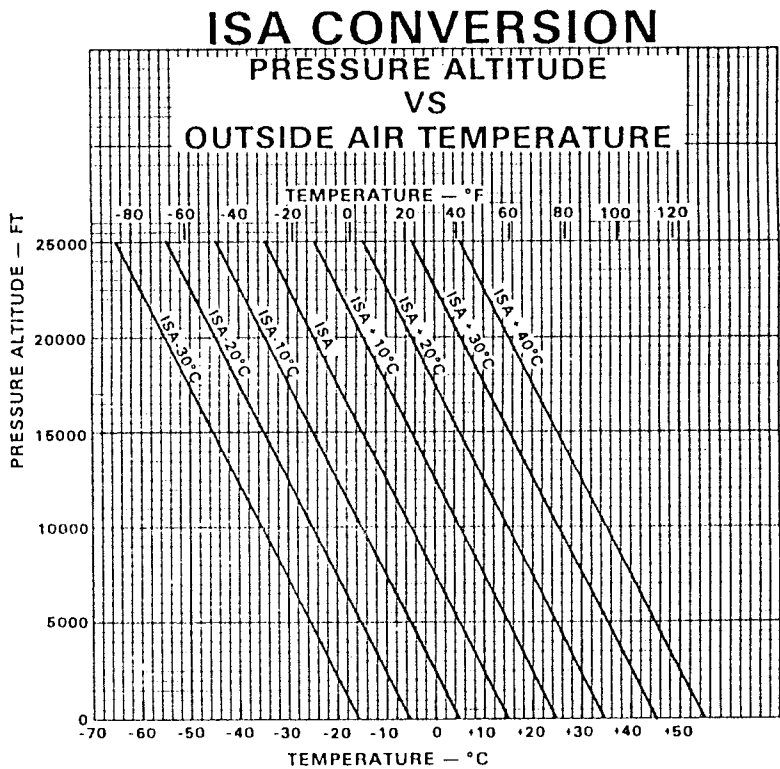


ANGLE OF BANK VS. STALL SPEED
Figure 5-3



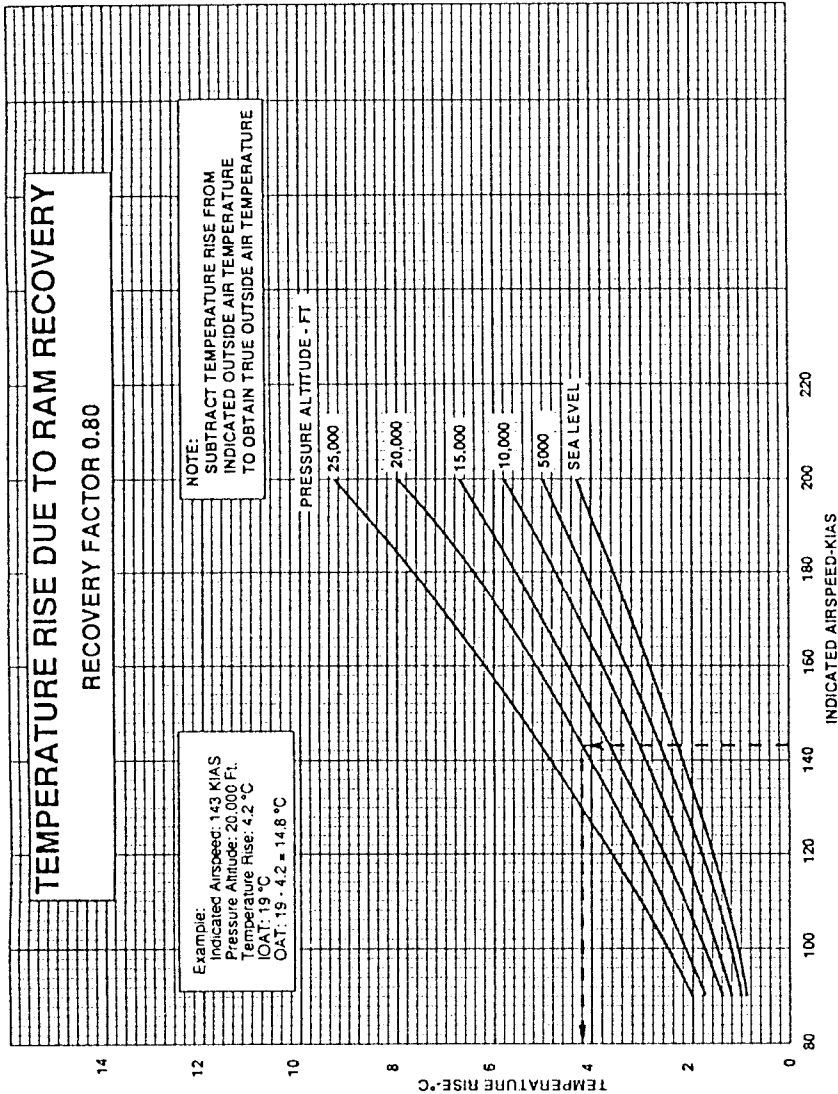
TEMPERATURE CONVERSION

Figure 5-5



PRESSURE ALTITUDE
VS
OUTSIDE AIR TEMPERATURE

Figure 5-7

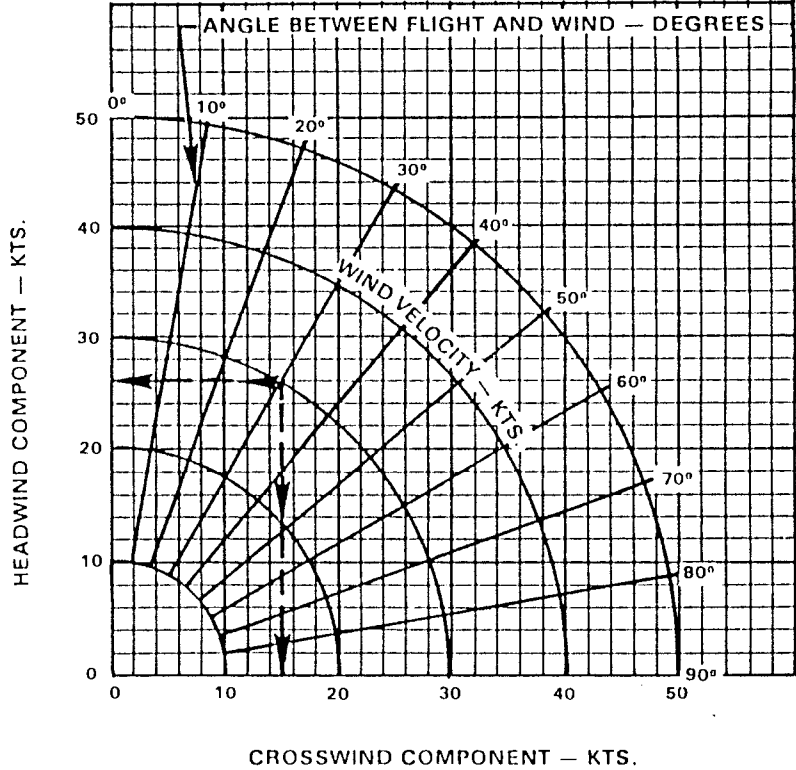


TEMPERATURE RISE DUE TO
RAM RECOVERY

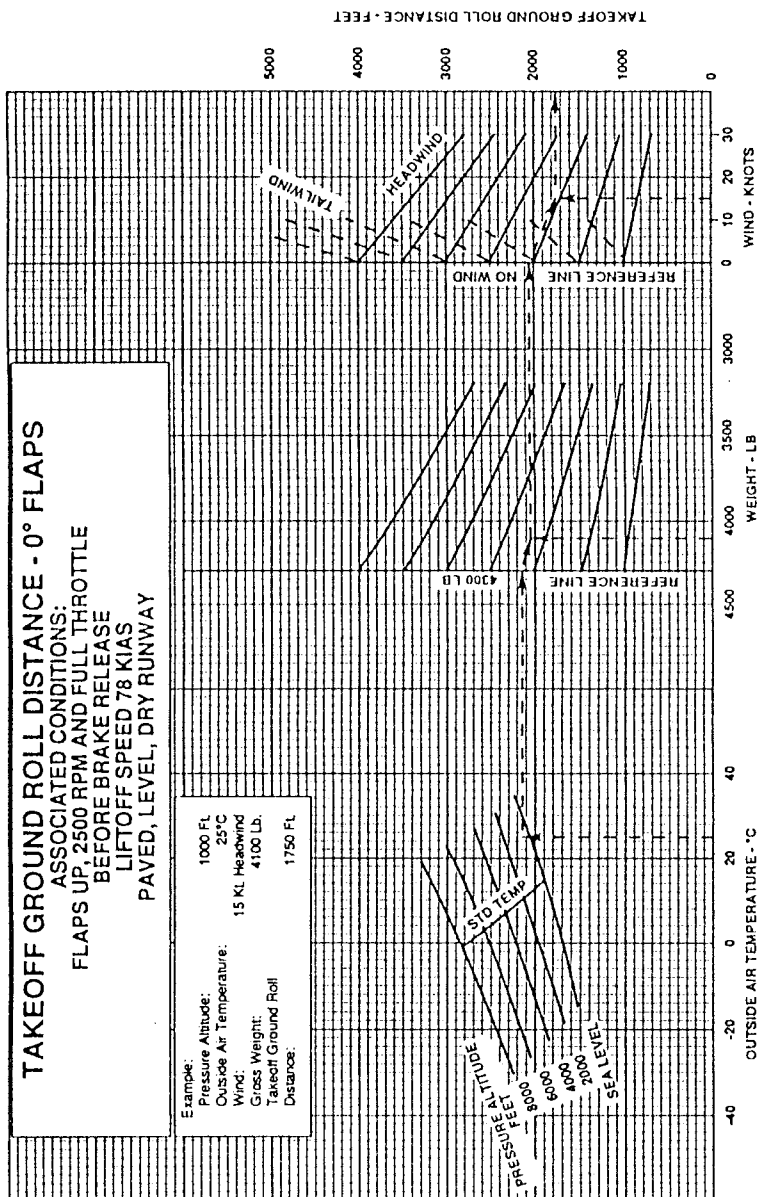
Figure 5-9

WIND COMPONENTS

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

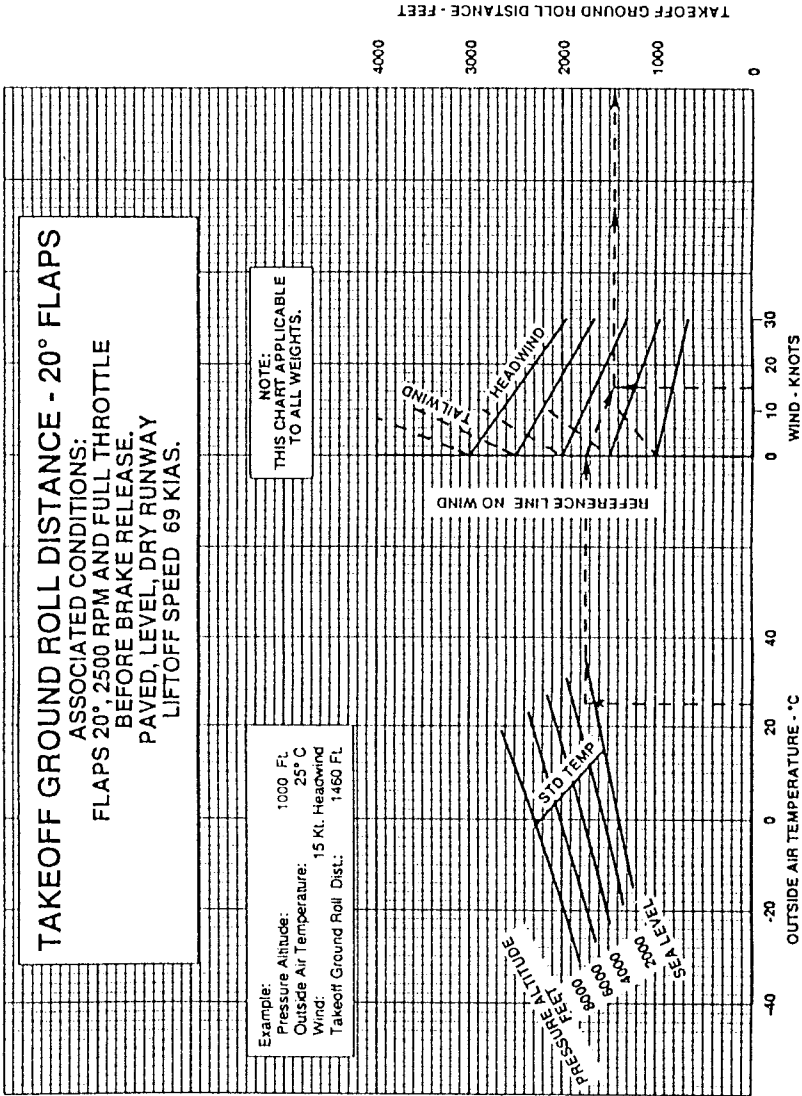


WIND COMPONENTS
Figure 5-11

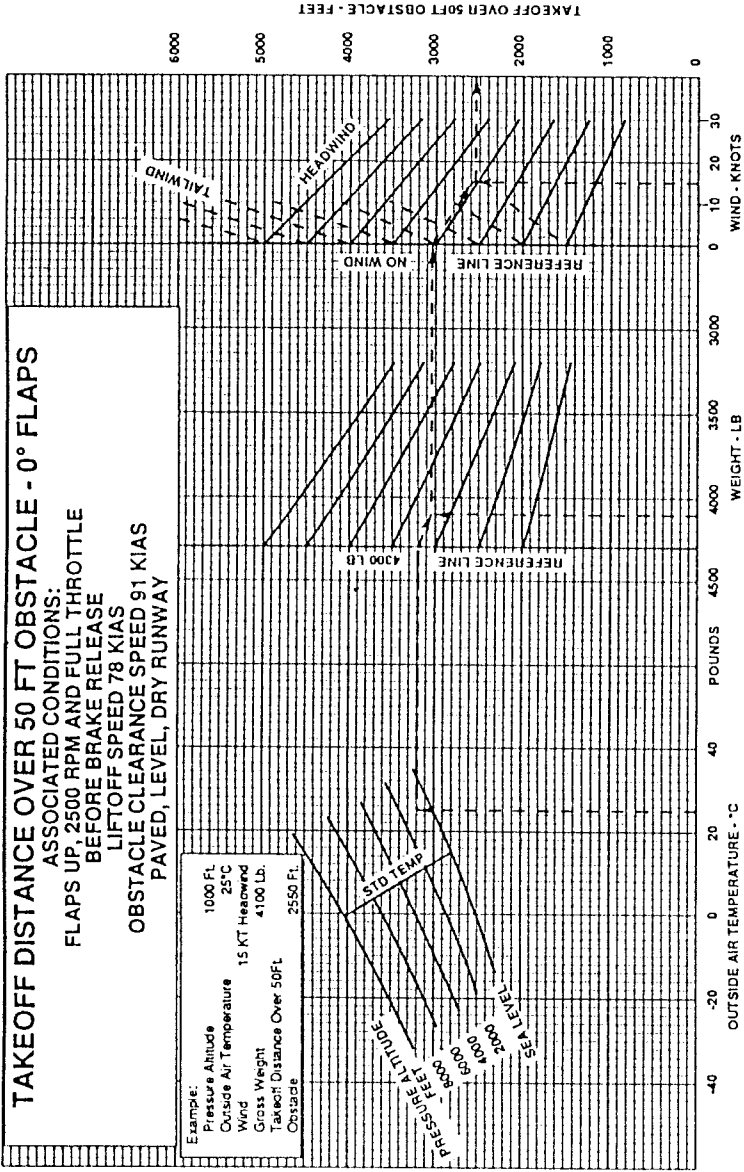


TAKEOFF GROUND ROLL, 0° FLAPS

Figure 5-13

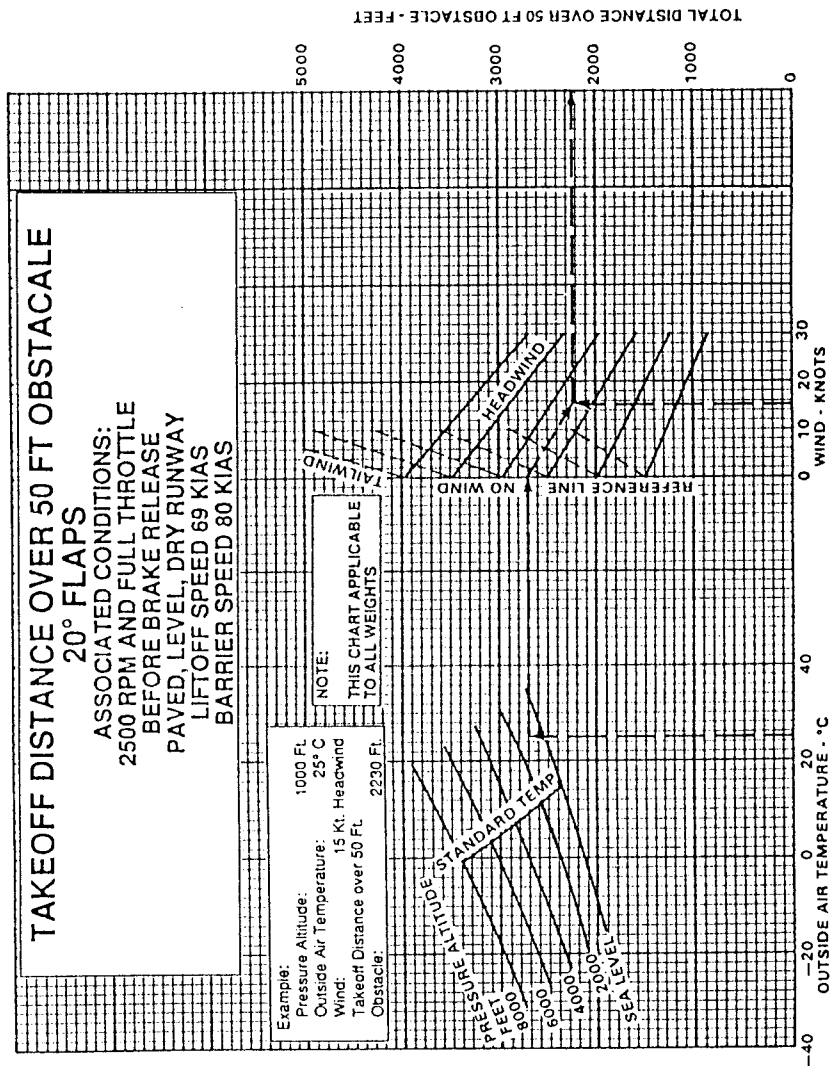


TAKEOFF GROUND ROLL, 20° FLAPS
Figure 5-15

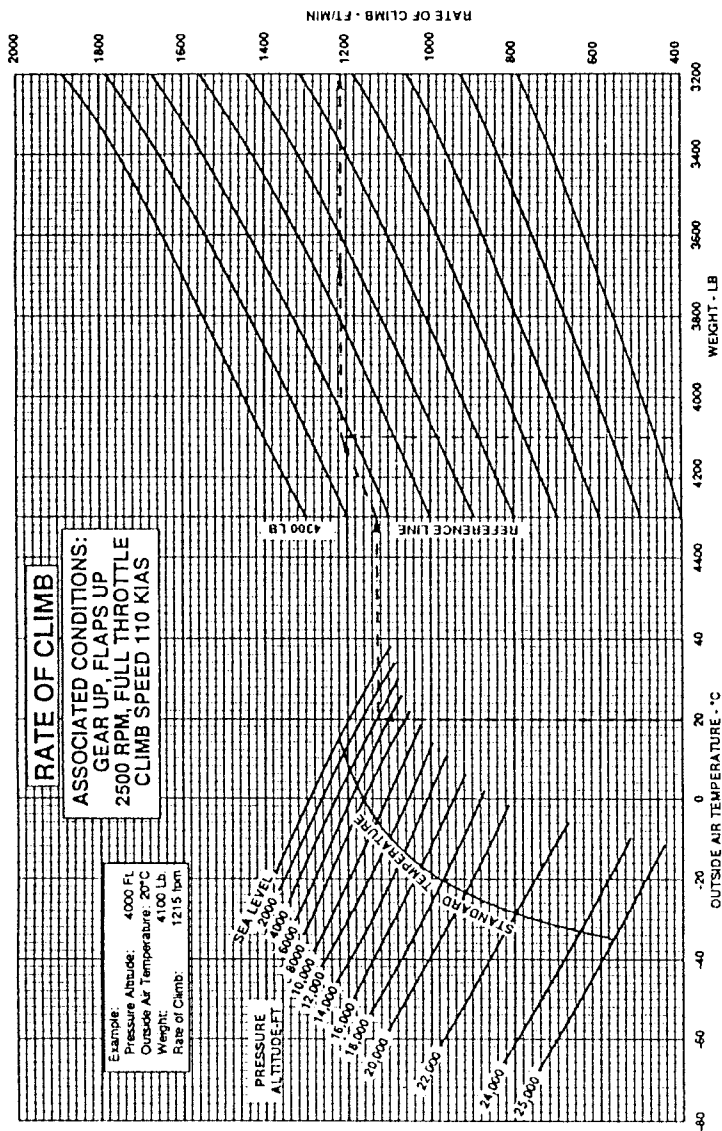


TAKEOFF DISTANCE OVER 50 FT. OBSTACLE, 0° FLAPS

Figure 5-17

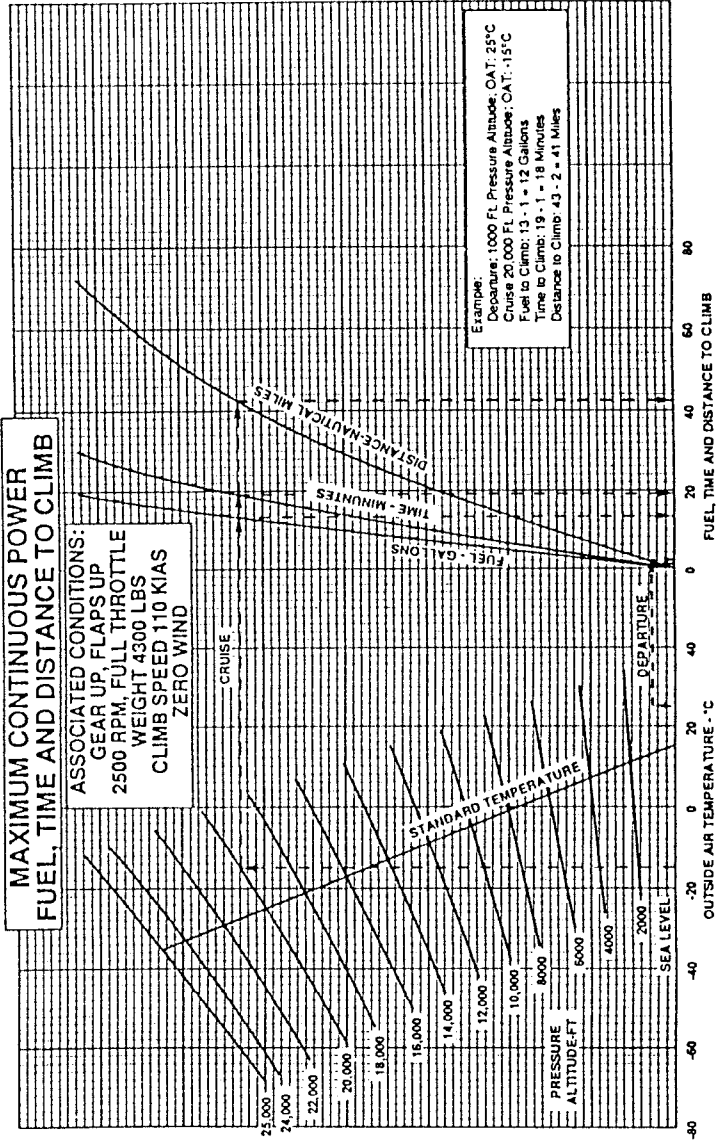


TAKEOFF DISTANCE OVER 50 FT. OBSTACLE, 20° FLAPS
Figure 5-19



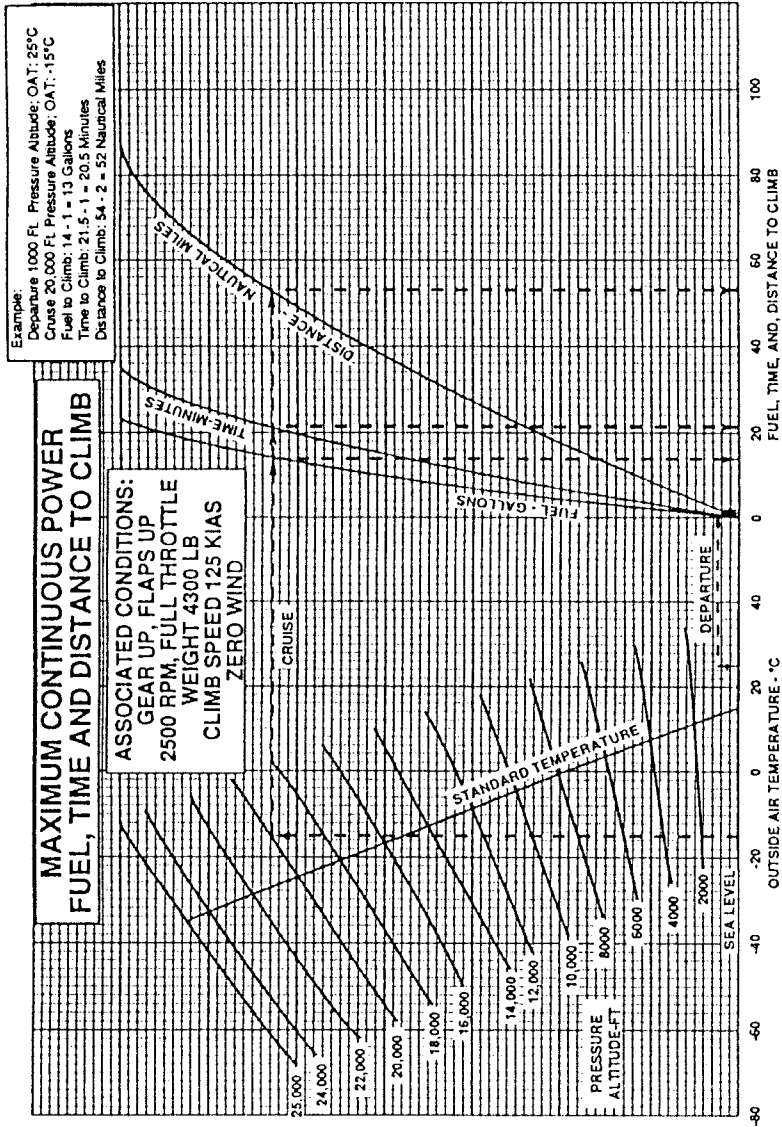
RATE OF CLIMB

Figure 5-21

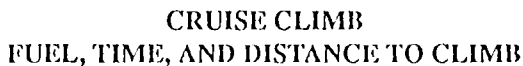


MAXIMUM CONTINUOUS POWER
FUEL, TIME, AND DISTANCE TO CLIMB (110 KIAS)

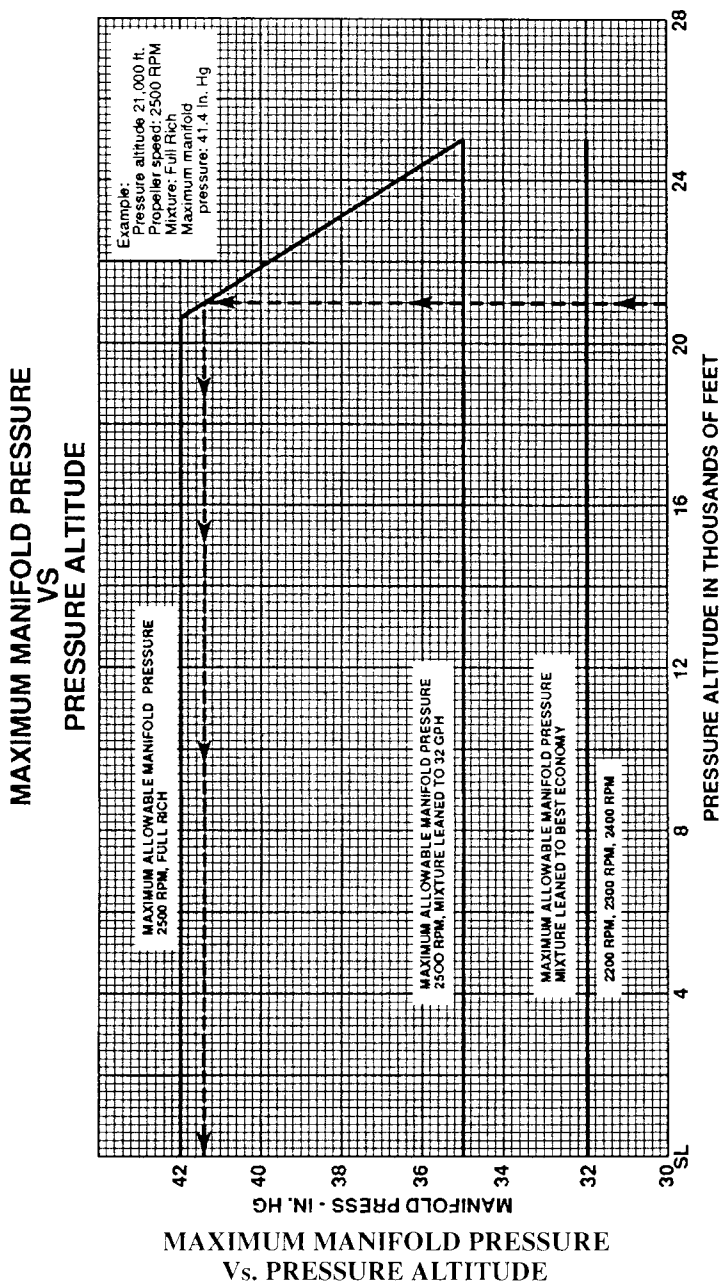
Figure 5-23



MAXIMUM CONTINUOUS POWER
FUEL, TIME, AND DISTANCE TO CLIMB (125 KIAS)
Figure 5-24



ISSUED: JUNE 15, 1988
REVISED: OCTOBER 6, 1989



POWER SETTING TABLE
REFERENCE FIG. 5-27

ASSOCIATED CONDITIONS

	RPM	Man. Press.	Approx. Fuel Flow @ 20,000 ft	TIT
High Speed Cruise	2500	32" Hg	20 GPH	Lean to Peak
Normal Cruise	2500 2400	29" Hg 30" Hg	18 GPH	Lean to Peak
Economy Cruise	2400 2200	25" Hg 26" Hg	15 GPH	Lean to Peak
Long Range Cruise	2200	20" Hg	11 GPH	Lean to Peak

The higher rpm settings should be used at altitudes above 20,000 ft.

The cruise speeds are shown at mid-cruise weight, 3900 pounds. The speed differential for weight is 0.7 knots per 100 pounds, faster at lighter weights and slower at heavier weights.

The leaning procedure is to establish peak T.I.T.

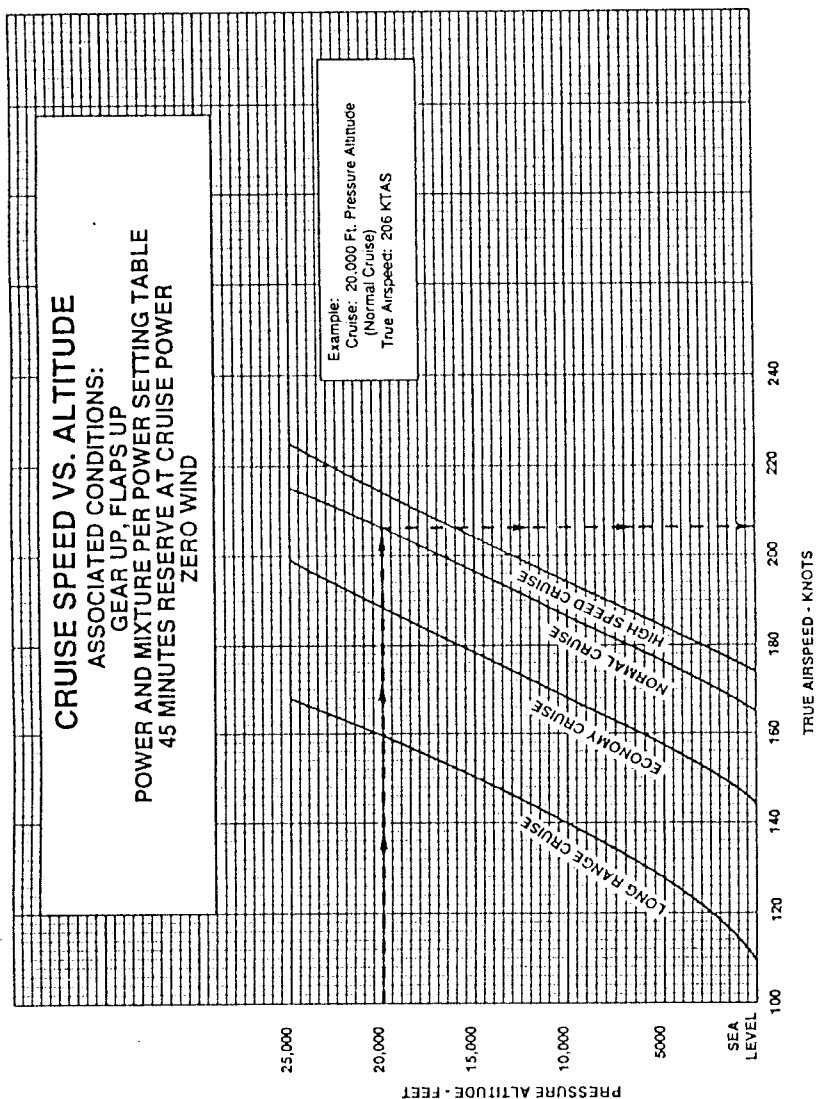
*Example:

Cruise altitude: 20,000 ft
Cruise power: Normal cruise
Cruise weight: 3900 lb
Cruise fuel flow: 18 gph
Cruise speed: 206 KTAS

NOTE

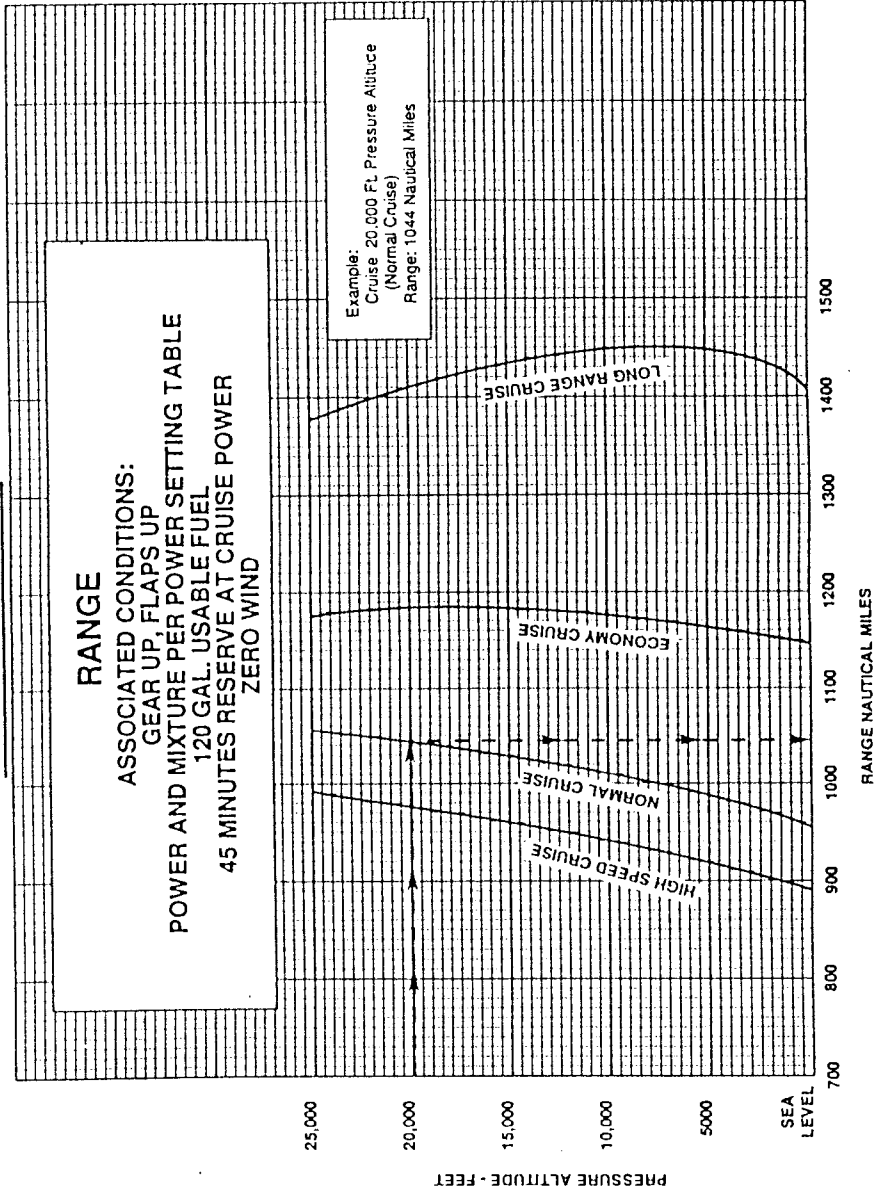
For maximum engine life follow temperature recommendations in 4.25 and 4.27. If operating at higher fuel flows to reduce engine temperatures, range and associated cruise performance will be reduced.

*Reference Figure 5-27

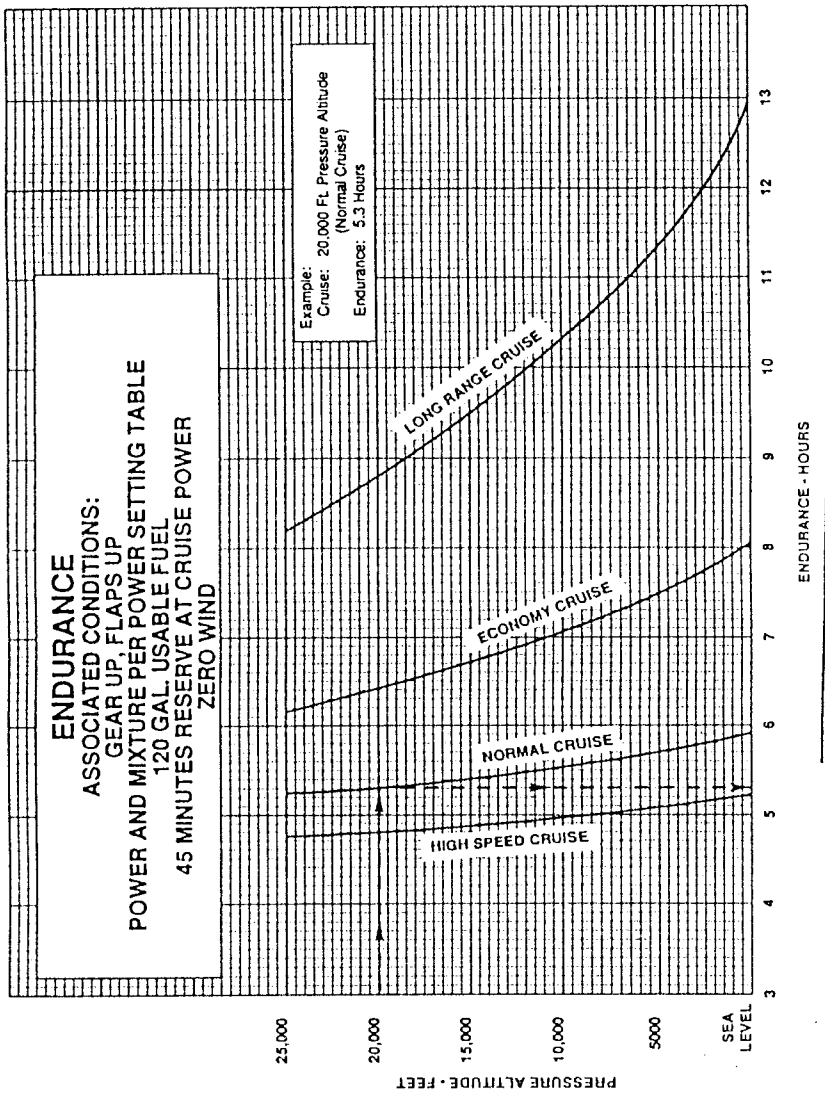


CRUISE SPEED VS. ALTITUDE

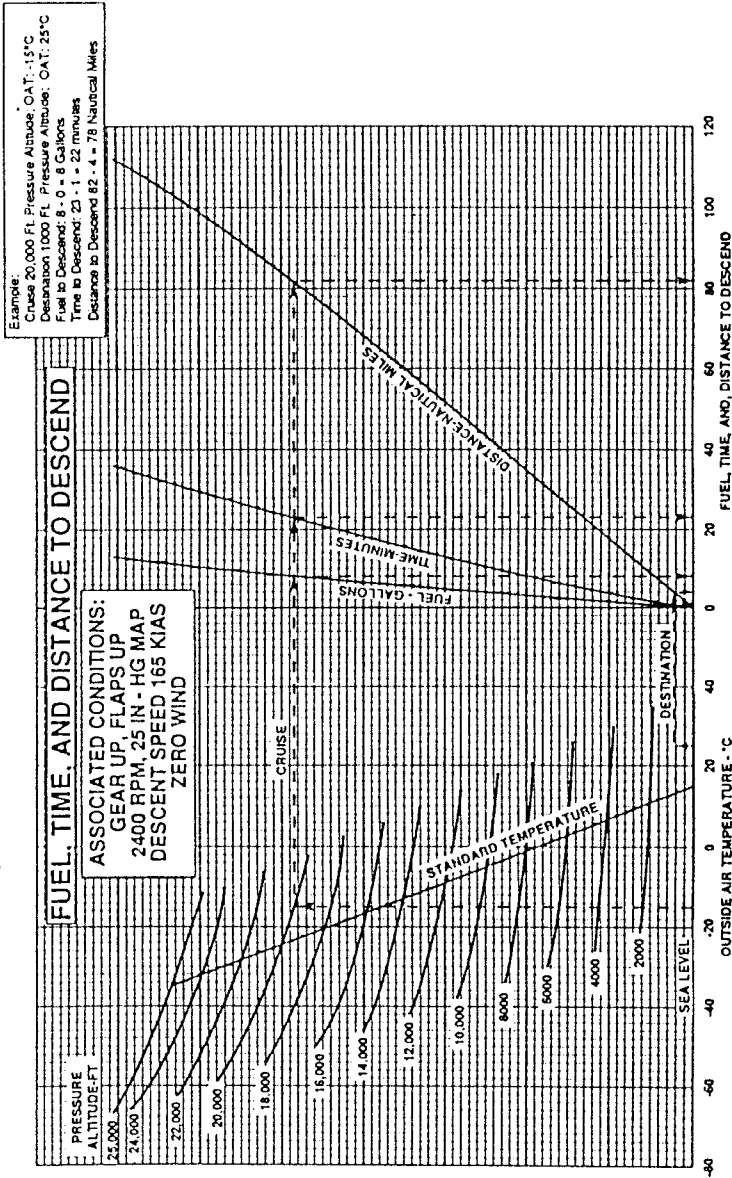
Figure 5-27



RANGE
Figure 5-29

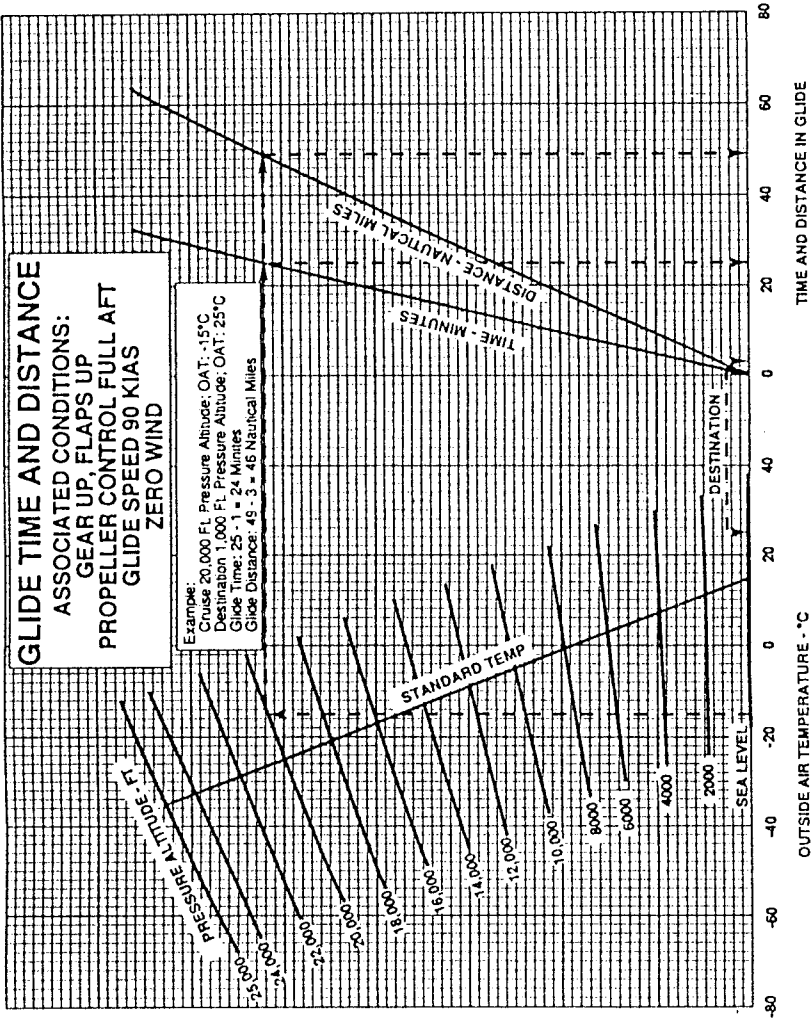


ENDURANCE
Figure 5-31



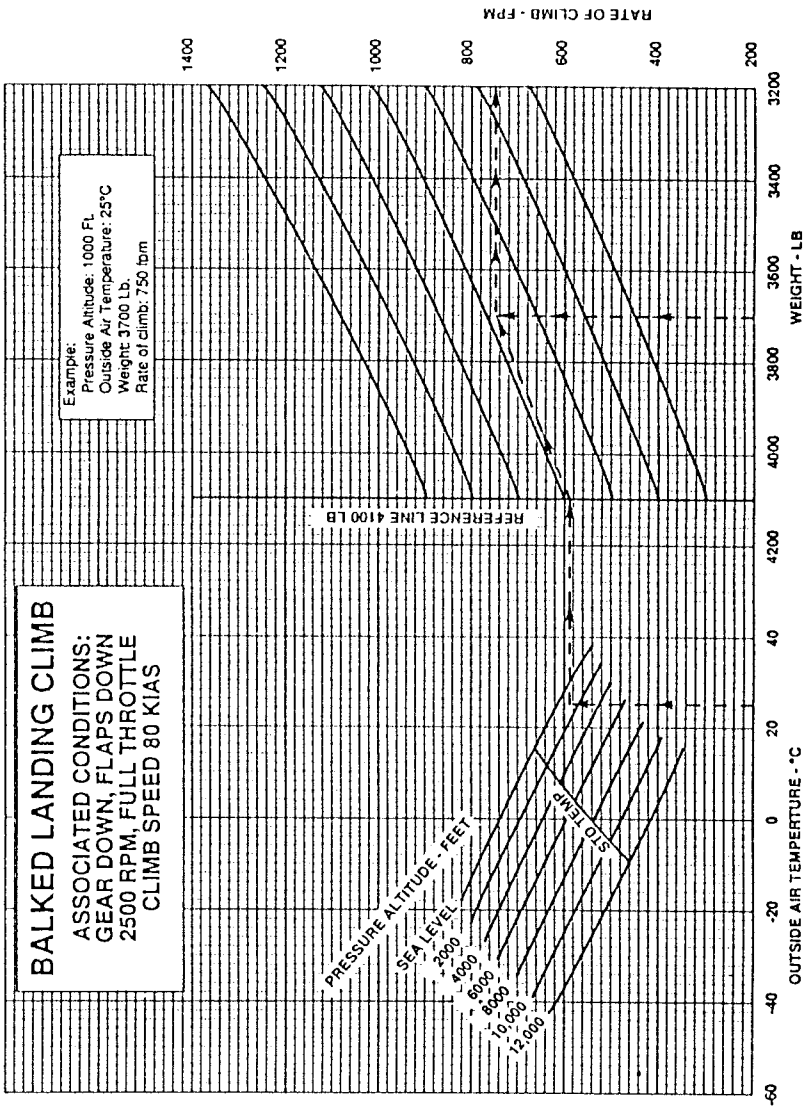
FUEL, TIME, AND DISTANCE TO DESCEND

Figure 5-33

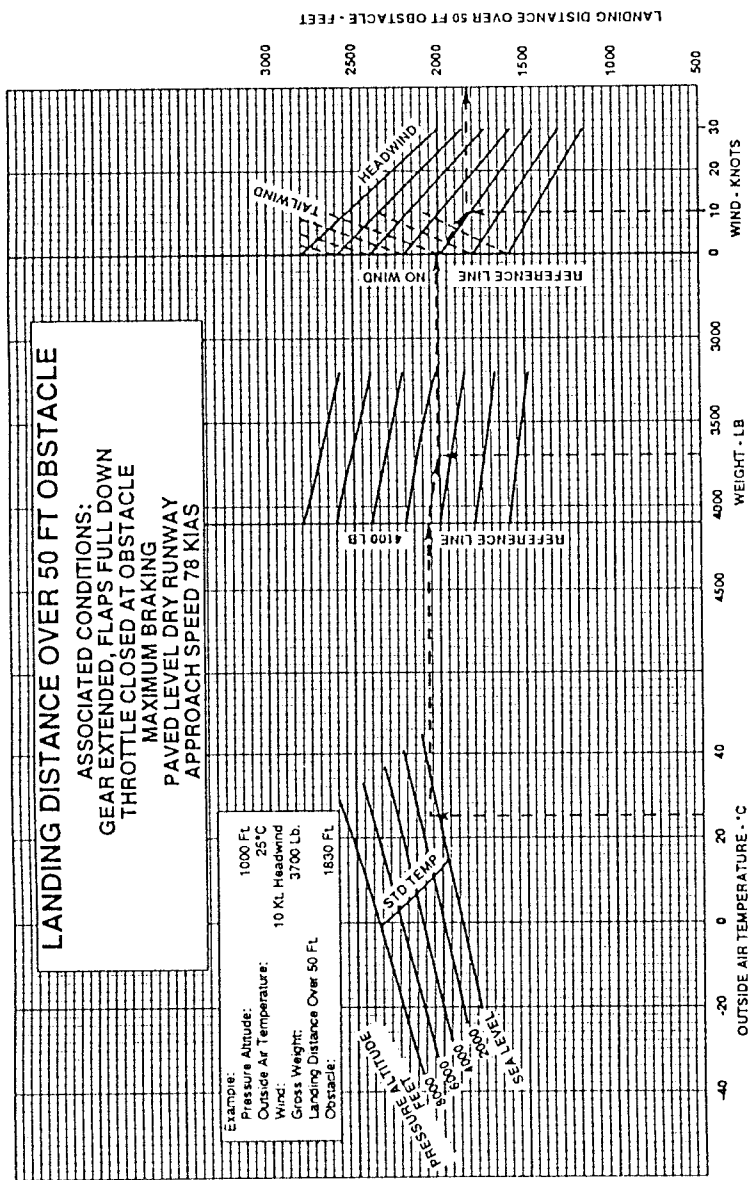


GLIDE TIME AND DISTANCE

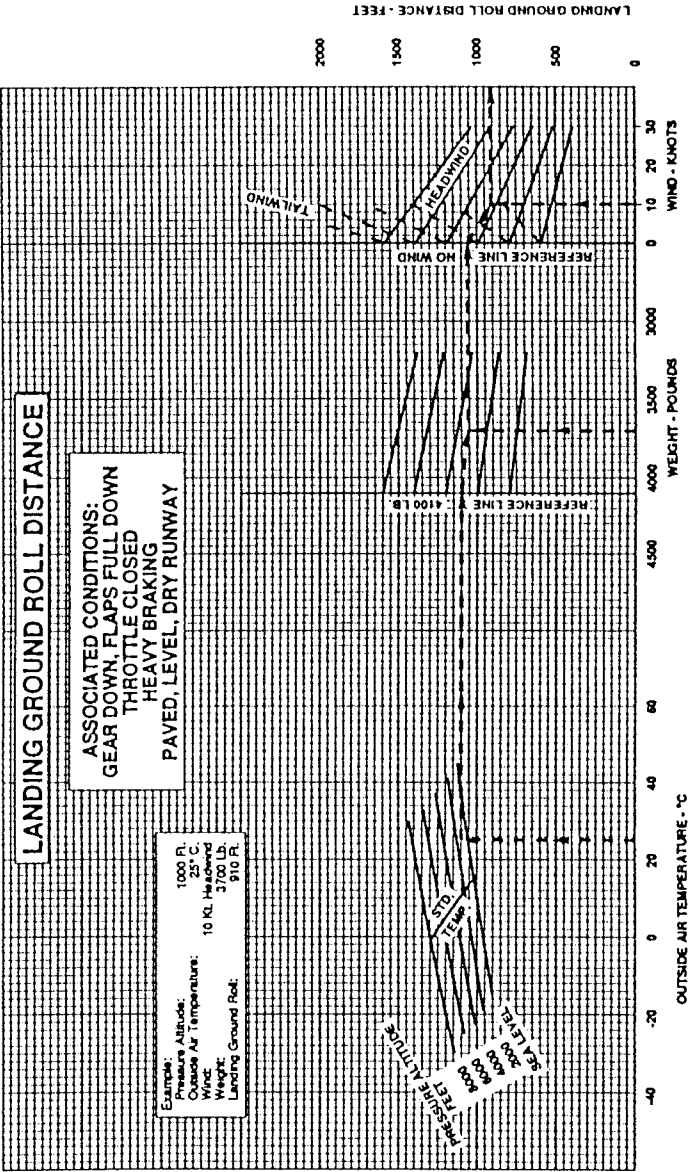
Figure 5-35



BALKED LANDING CLIMB
Figure 5-37



LANDING DISTANCE OVER 50 FT. OBSTACLE
 Figure 5-39



LANDING GROUND ROLL

Figure 5-41

TABLE OF CONTENTS

SECTION 6

WEIGHT AND BALANCE

Paragraph No.		Page No.
6.1	General	6-1
6.3	Airplane Weighing Procedure	6-2
6.5	Weight and Balance Data and Record	6-5
6.7	General Loading Recommendations	6-9
6.9	Weight and Balance Determination for Flight	6-10
6.11	Instructions for Using the Weight and Balance Plotter	6-15
	Equipment List (Form 240-0027)	Supplied with aircraft paperwork

**SECTION 6
WEIGHT AND BALANCE**

6.1 GENERAL

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

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

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

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

6.1 GENERAL (Continued)

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

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

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

6.3 AIRPLANE WEIGHING PROCEDURE

At the time of licensing, Piper 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, and foreign items such as rags and tools, from the airplane before weighing.
- (3) Defuel airplane. Then open all fuel drains until all remaining fuel is drained. Operate engine on each tank until all undrainable fuel is used and engine stops. Then add the unusable fuel (2 gallons total, 1 gallon each wing).

6.3 AIRPLANE WEIGHING PROCEDURE (Continued)

CAUTION

Whenever the fuel system is completely drained and fuel is replenished, it will be necessary to run the engine for a minimum of three minutes at 1000 rpm on each tank to ensure that no air exists in the fuel supply lines.

- (4) Fill with oil to full capacity.
- (5) Place pilot and copilot seats in fifth (5th) notch, aft of forward position. Put flaps in the fully retracted position and all control surfaces in the neutral position. Tow bar should be in the proper location and all entrance and baggage doors closed.
- (6) Weigh the airplane inside a closed building to prevent errors in scale readings due to wind.

(b) Leveling

- (1) With the airplane on scales, insert a 3.4-inch spacer on each of the main gear struts and a 3.0-inch spacer on the nose gear strut.
- (2) Level airplane (refer to Figure 6-3) deflating (or inflating as required) nose wheel tire, to center bubble on level.

(c) Weighing - Airplane Basic Empty Weight

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

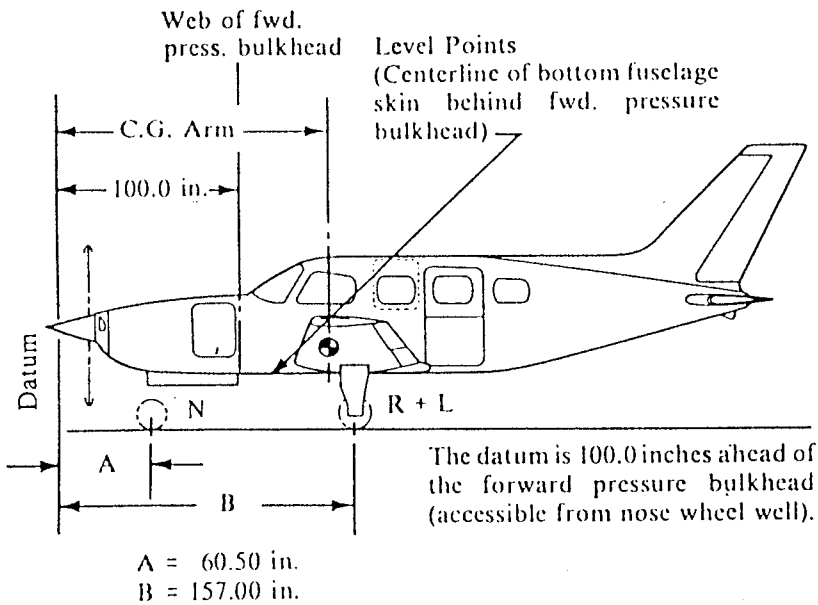
6.3 AIRPLANE WEIGHING PROCEDURE (Continued)

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

WEIGHING FORM
Figure 6-1

(d) Basic Empty Weight Center of Gravity

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



LEVELING DIAGRAM
Figure 6-3

6.3 AIRPLANE WEIGHING PROCEDURE (Continued)

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

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

Where: $T = N + R + L$

6.5 WEIGHT AND BALANCE DATA AND RECORD

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

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

SECTION 6
WEIGHT AND BALANCE

PIPER AIRCRAFT CORPORATION
PA-46-350P, MALIBU

6.5 WEIGHT AND BALANCE DATA AND RECORD (Continued)

MODEL PA-46-350P MALIBU

Airplane Serial Number 4622012

Registration Number N9153W

Date 2/20/89

AIRPLANE BASIC EMPTY WEIGHT

Item	Weight (Lbs)	C.G. Arm (Inches Aft of Datum)	Moment (In-Lbs)
Standard Empty Weight* ~~Computed~~ ^{Actual}	2728.2	131.5	358640
Optional Equipment	225.1	164.0	36906
Basic Empty Weight	2953.3	133.9	395546

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

SUPERCEDED
SEE WEIGHT AND BALANCE

AIRPLANE USEFUL LOAD - NORMAL CATEGORY OPERATION

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

(4318 lbs) - (2953.3 lbs) = 1364.7 lbs. - ^{N2W} 33.7% = 1330.92

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

WEIGHT AND BALANCE DATA FORM

Figure 6-5

6.5 WEIGHT AND BALANCE DATA AND RECORD (Continued)

PA-46-350P	Serial Number	4622012	Registration Number N9153W	Page Number		
				Running Basic Empty Weight		
Date	Item No.	Description of Article or Modification	Added (+) Removed (-)	Weight Change		
				Wt. (Lb.)	Arm (In.)	Moment / 100
2/20/89		As Licensed				2953.3
4/6/89	1	ARMOR INSTALLATION	+	31.0		2984.3
4/14/89	2	Wing Converter	+	2.0	110.5	221.0
4/14/89	3	Cam. Antenna	+	.25	117.0	44.25
4/21/89	4	Wing Mount Radar	+	30.05	134.55	4044.57
4/22/89	5	Antenna Mount Converter	-	2.0	110.5	221.0
			+	2.0	150.0	300.0
5-7-89	6	Replaced Propeller	-	3.3		3016.09
5-10-89	7	Panel Upgrade	-	17.55		2051.86
6-11-89	8	Addition Panel Upgrade	-	6.13		2492.37
						3955.46
						400666.9
						400932.11
						404976.68
						404976.68
						405211.12
						403159.26
						403152.84

WEIGHT AND BALANCE RECORD

Figure 6-7

6.5 WEIGHT AND BALANCE DATA AND RECORD (Continued)

PA-46-350P	Serial Number	Description of Article or Modification	Added (+) Removed (-)	Registration Number			Page Number	
				Wt. (Lb.)	Arm (In.)	Moment / 100	Running Basic Empty Weight	Moment / 100
Date	Item No.							

WEIGHT AND BALANCE RECORD (cont)

Figure 6-7 (cont)

REVISED WEIGHT AND BALANCE REPORT

WORK ORDER # S12-14-0

2375

AIRCRAFT IDENTIFICATION

ENTER AIRCRAFT MAKE AND MODEL

Piper

PA46-350P

ENTER SERIAL NUMBER

4622012

ENTER REGISTRATION NUMBER

N9153W

ENTER AIRCRAFT HOBBS TIME

2271.80

PREVIOUS WEIGHT & BALANCE DATA

ENTER PREVIOUS DATE WEIGHED / CALCULATED

6/11/2014

ENTER PREVIOUS BASIC EMPTY WEIGHT

2992.37 POUNDS

ENTER PREVIOUS MOMENT

403152.84 INCH/POUNDS

ENTER PREVIOUS CENTER OF GRAVITY

134.73 INCHES

EQUIPMENT REMOVED FROM AIRCRAFT

	POUNDS	ARM	MOMENTS
Kelly starter P/N MHB-4016R	17.10	38	641.25
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
TOTAL REMOVED	17.10		641.25

EQUIPMENT ADDED TO AIRCRAFT

	POUNDS	ARM	MOMENTS
Skytec starter P/N149-NL/EC	9.30	38	348.75
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
TOTAL ADDED	9.30		348.75

CURRENT DATA

NEW MOMENT 402860.34 INCH/LBS
 NEW BASIC EMPTY WEIGHT CENTER OF GRAVITY 134.98 INCHES
 NEW BASIC EMPTY WEIGHT 2984.57

APPROVED BY *Daniel P. [Signature]* # 3318983 Aug 28, 2014

Landmark Aviation
 100 Aviation Drive
 Charlottesville, VA 22911
 FAA CRS# HOOR564Y

6.7 GENERAL LOADING RECOMMENDATIONS

For all airplane configurations, it is the responsibility of the pilot in command to make sure that the airplane always remains within the allowable weight vs. center of gravity while in flight.

The following general loading recommendation is intended only as a guide. The charts, graphs, instructions and plotter should be checked to assure that the airplane is within the allowable weight vs. center of gravity envelope.

- (a) Pilot Only
Load rear baggage compartment first.
- (b) 2 Occupants - Pilot and Passenger in Front
Load rear baggage compartment first. Without aft baggage, fuel load may be limited by forward envelope for some combinations of optional equipment.
- (c) 3 Occupants - 2 in front, 1 in rear
Baggage in nose may be limited by forward envelope.
- (d) 4 Occupants - 2 in front, 2 in rear
Fuel may be limited for some combinations of optional equipment.
- (e) 5 Occupants - 2 in front, 1 in middle, 2 in rear
Investigation is required to determine optimum baggage load.
- (f) 6 Occupants - 2 in front, 2 in middle, 2 in rear
With six occupants fuel and/or baggage may be limited by envelope. Load forward baggage compartment first.

NOTE

With takeoff loadings falling near the aft limit, it is important to check anticipated landing loadings since fuel burn could result in a final loading outside of the approved envelope.

Always load the fuel equally between the right and left tanks.

6.9 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT

- (a) Add the weight of all items to be loaded, except fuel, to the basic empty weight to determine zero fuel weight.
- (b) Use the Loading Graph (Figure 6-13) to determine the moment of all items to be carried in the airplane.
- (c) Add the moment of all items to be loaded to the basic empty weight moment.
- (d) Divide the total moment by the total weight to determine the zero fuel weight C.G. location.
- (e) By using the figures of item (a) and item (d) (above), locate a point on the C.G. range and weight graph (Figure 6-15). If the point falls within the C.G. envelope, the loading meets the weight and balance requirements.
- (f) Add the weight of the fuel to be loaded to the total weight calculated for item (a) to determine ramp weight.
- (g) Use the loading graph (Figure 6-13) to determine the moment of the fuel to be loaded and add to the total moment determined for item (c).
- (h) Subtract the weight and moment of the fuel allowance for engine start, taxi, and runup.
- (i) Divide the total moment by the total weight to determine takeoff C.G.
- (j) Locate the takeoff weight center of gravity on the C.G. Range and Weight Graph (Figure 6-15). If the point falls within the C.G. envelope, the loading meets the weight and balance requirements.
- (k) Subtract the Estimated Fuel Burnoff from the Takeoff Weight to determine the Landing Weight C.G.
- (l) Locate the landing weight center of gravity on the C.G. Range and Weight Graph (Figure 6-15). If the point falls within the C.G. envelope, the loading meets the weight and balance requirements.

6.9 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT (Continued)

	Weight (Lb)	Arm Aft of Datum (Inches)	Moment (In.-Lb)
Basic Empty Weight	2745	134.20	368379
Pilot and Front Passenger	340	135.50	46070
Passengers (Center Seats)	170	177.00	30090
Passengers (Rear Seats)	340	218.75	74375
Baggage (Forward) (100 Lb Limit)	100	88.60	8860
Baggage (Aft) (100 Lb Limit)	70	248.23	17376
Zero Fuel Weight (4100 Lb Max.)	3765	144.79	545150
Fuel (120 Gal./720 Lb Max. Usable)	552	150.31	82971
Ramp Weight (4318 Lb Max.)	4317	145.99	628121
Fuel Allowance for Engine Start, Taxi, & Runup (3 Gal./18 Lb Max.)	-18	150.31	-2706
Takeoff Weight (4300 Lb Max.)	4299	145.48	625415

The center of gravity (C.G.) for the takeoff weight of this sample loading problem is at 145.48 inches aft of the datum line. Locate this point (145.48) on the C.G. range and weight graph (Figure 6-15). Since this point falls within the weight - C.G. envelope, this loading meets the weight and balance requirements.

Takeoff Weight	4299	145.48	625415
Minus Estimated Fuel Burn-off (climb & cruise) @ 6.0 Lb/Gal.	-480	150.31	-72149
Landing Weight	3819	144.87	553266

Locate the center of gravity of the landing weight on the C.G. range and weight graph (Figure 6-15). Since this point falls within the weight - C.G. envelope, the loading is acceptable for landing.

IT IS THE SOLE RESPONSIBILITY OF THE PILOT IN COMMAND TO ENSURE THAT THE AIRPLANE IS LOADED PROPERLY AT ALL TIMES.

SAMPLE LOADING PROBLEM (NORMAL CATEGORY)

Figure 6-9

6.9 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT
(Continued)

	Weight (Lb)	Arm Aft of Datum (Inches)	Moment (In.-Lb)
Basic Empty Weight			
Pilot and Front Passenger		135.50	
Passengers (Center Seats)		177.00	
Passengers (Rear Seats)		218.75	
Baggage (Forward) (100 Lb Limit)		88.60	
Baggage (Aft) (100 Lb Limit)		248.23	
Zero Fuel Weight (4100 Lb Max.)			
Fuel (120 Gal./720 Lb Max. Usable)		150.31	
Ramp Weight (4318 Lb Max.)			
Fuel Allowance for Engine Start, Taxi, & Runup (3 Gal./18 Lb Max.)	-20	150.31	-3006
Takeoff Weight (4300 Lb Max.)			

The center of gravity (C.G.) for the takeoff weight of this sample loading problem is at 145.48 inches aft of the datum line. Locate this point (145.48) on the C.G. range and weight graph (Figure 6-15). Since this point falls within the weight - C.G. envelope, this loading meets the weight and balance requirements.

Takeoff Weight			
Minus Estimated Fuel Burn-off (climb & cruise) @ 6.0 Lb/Gal.		150.31	
Landing Weight			

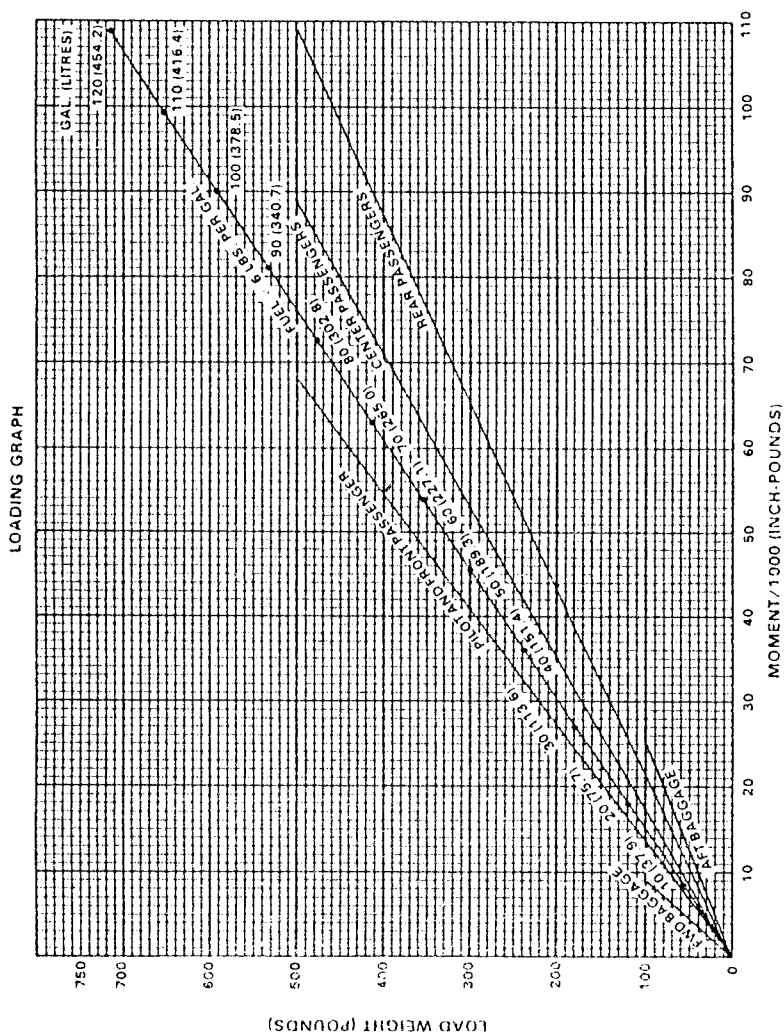
Locate the center of gravity of the landing weight on the C.G. range and weight graph (Figure 6-15). Since this point falls within the weight - C.G. envelope, the loading is acceptable for landing.

IT IS THE SOLE RESPONSIBILITY OF THE PILOT IN COMMAND
TO ENSURE THAT THE AIRPLANE IS LOADED PROPERLY AT ALL
TIMES.

WEIGHT AND BALANCE LOADING FORM
(NORMAL CATEGORY)

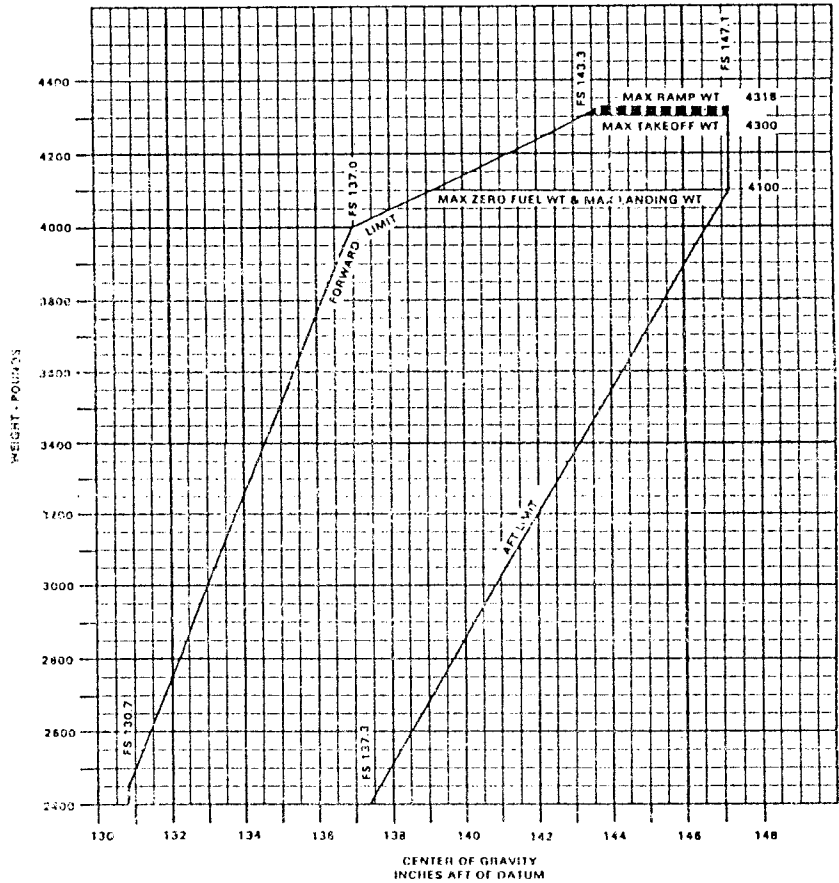
Figure 6-11

6.9 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT (Continued)



LOADING GRAPH
Figure 6-13

6.9 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT
(Continued)



C.G. RANGE AND WEIGHT GRAPH
Figure 6-15

6.11 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 the load if the 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 and Center of Gravity" location is taken from the Weight and Balance Data 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 of in the baggage compartments.

To use the plotter, 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, except fuel, have been drawn in this manner, the end of the segmented line locates the load and the C.G. position of the airplane for zero fuel weight. If this point is not within the allowable envelope, it will be necessary to remove baggage or passengers, and/or to rearrange baggage and passengers to get the point to fall within the envelope.

Position the zero fuel weight end of the fuel slot over this point and draw a line representing fuel load. The end of the segmented line locates the load and C.G. position of the airplane for Ramp Weight. If this is not within the allowable envelope, it will be necessary to remove fuel, baggage, or passengers and/or rearrange baggage and passengers to get this final point to fall within the envelope.

Fuel allowance for engine start, taxi, and runup is 18 pounds.

Subtract the Estimated Fuel Burnoff from the Takeoff Weight to determine the Landing Weight C.G.

Gear movement does not significantly affect the center of gravity.

**6.11 INSTRUCTIONS FOR USING THE WEIGHT AND BALANCE
PLOTTER (Continued)**

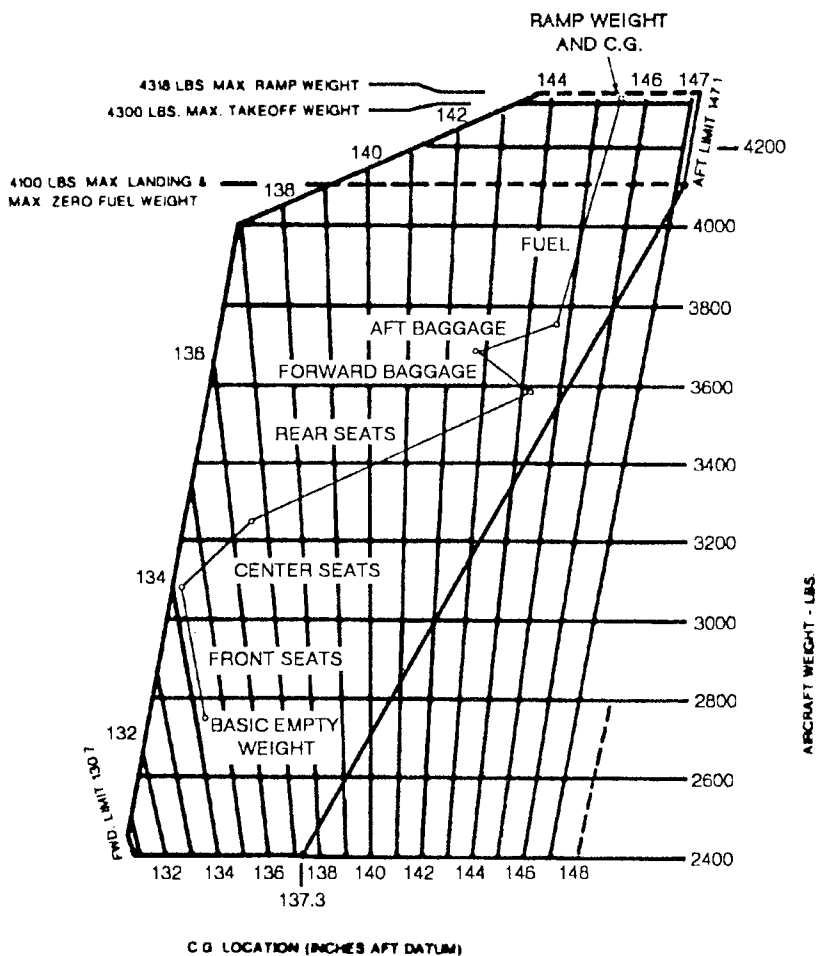
SAMPLE PROBLEM

A sample problem will demonstrate the use of the weight and balance plotter. Assume a basic weight and C.G. location of 2745 pounds at 134.20 inches respectively. We wish to carry one pilot and four passengers: the pilot and one passenger will occupy the front seats, one passenger will occupy a center seat, and the other two passengers will occupy the rear seats. Each occupant weighs 170 pounds. We wish to carry 100 pounds of baggage in the forward baggage compartment and 70 pounds in the rear baggage compartment. We wish to carry 92 gallons of fuel. Will we be within the safe envelope?

- (1) Place a dot on the plotter grid at 2745 pounds and 134.20 inches to represent the basic airplane (see Figure 6-17).
- (2) Slide the slotted plastic into position so that the dot is under the slot for the forward seats (pilot and front passenger) at zero weight.
- (3) Draw a line up the slot to the 340 pound position ($170 + 170$) and place a dot.
- (4) Slide the slotted plastic into position so that the zero end of the center seat slot is over this dot.
- (5) Draw a line up the slot to the 170 pound position and place the third dot.
- (6) Slide the slotted plastic again to get the zero end of the rear seat slot over this dot.
- (7) Draw a line up this slot to the 340 pound position ($170 + 170$) and place the fourth dot.
- (8) Continue moving the plastic and plotting points to account for weight in the forward baggage compartment (100 pounds), rear baggage compartment (70 pounds), and fuel tanks (552 pounds; 92 gallons).
- (9) As can be seen from Figure 6-17, the final dot shows the total weight to be 4317 pounds with the C.G. at 145.99 inches. This point is within the weight and C.G. limits.
- (10) Fuel allowance for engine start, taxi, and runup is 18 pounds.

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

6.11 INSTRUCTIONS FOR USING THE WEIGHT AND BALANCE PLOTTER (Continued)



SAMPLE PROBLEM

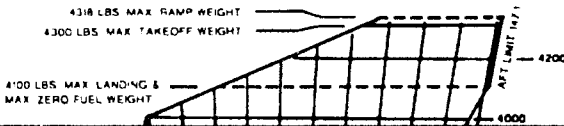
Figure 6-17

6.11 INSTRUCTIONS FOR USING THE WEIGHT AND BALANCE PLOTTER (Continued)

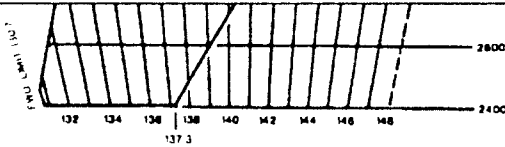
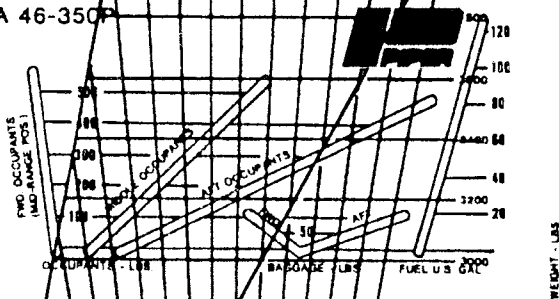


MODEL PA46-350P
WEIGHT AND BALANCE PLOTTER

PIPER CONSIDERS THIS PLOTTER AN AID AND NOT A SUBSTITUTE FOR THE COMPUTATION METHOD TO DETERMINE THAT THE WEIGHT AND BALANCE OF AN AIRCRAFT IS WITHIN ITS ALLOWABLE LIMITS FOR FLIGHT OPERATION



PA 46-350P



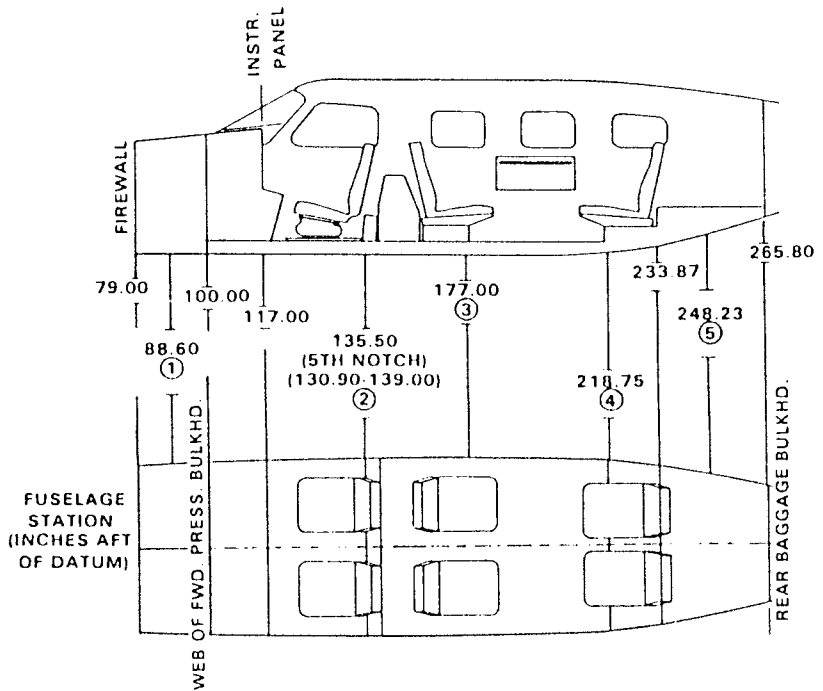
C.G. LOCATION (INCHES AFT DATUM)

DO NOT EXPOSE PLOTTER TO DIRECT RAYS OF SUN OR EXCESSIVE HEAT.

WEIGHT AND BALANCE PLOTTER

Figure 6-19

6.11 INSTRUCTIONS FOR USING THE WEIGHT AND BALANCE PLOTTER (Continued)



- 1 CENTROID OF FORWARD BAGGAGE AREA
- 2 PILOT AND PASSENGER C.G. ON HORIZONTALLY ADJUSTABLE SEATS POSITIONED FOR AVERAGE OCCUPANT. NUMBERS IN PARENTHESES INDICATE FORWARD AND AFT LIMITS OF OCCUPANT C.G.
- 3 C.G. OF CENTER OCCUPANTS
- 4 C.G. OF REAR OCCUPANTS
- 5 CENTROID OF REAR BAGGAGE AREA

LOADING ARRANGEMENTS

Figure 6-21

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

SECTION 7

DESCRIPTION AND OPERATION
OF THE AIRPLANE AND ITS SYSTEMS

Paragraph No.		Page No.
7.1	The Airplane.....	7-1
7.3	The Airframe.....	7-1
7.5	Engine and Propeller.....	7-2
7.6	Air Induction System	7-7
7.7	Engine Controls.....	7-7
7.9	Hydraulic System	7-10
7.11	Landing Gear.....	7-12
7.13	Brake System.....	7-15
7.15	Flight Control System	7-16
7.17	Fuel System	7-17
7.19	Electrical System.....	7-21
7.21	Instrument Panel.....	7-28
7.23	Pitot Static System	7-32
7.25	Environmental System	7-34
7.27	Bleed Air, Conditioning And Pressurization System.....	7-38
7.29	Vacuum System	7-41
7.31	Cabin Features.....	7-44
7.33	Baggage Area	7-46
7.35	Finish.....	7-46
7.37	Stall Warning	7-46
7.39	Emergency Locator Transmitter.....	7-47
7.41	External Power	7-50
7.43	Radar	7-51

SECTION 7

DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

7.1 THE AIRPLANE

The PA-46-350P Malibu is a single engine, all metal, retractable landing gear, low wing, turbocharged airplane. It has a pressurized cabin with seating for six occupants and two separate luggage compartments.

7.3 THE AIRFRAME

The primary airframe is of aluminum alloy construction, with a steel combination engine mount - nose gear support structure. The nose cowl is also made of aluminum. The rear section of the dorsal fairing is fiberglass.

The fuselage is an all metal, semi-monocoque structure with flush riveted skin. The skin has internally bonded doublers and is butt jointed at all seams not in the airflow direction. There are three basic fuselage sections: the forward baggage section, the pressurized cabin section, and the tail cone section. The cabin section is sealed to maintain pressurization.

The seating arrangement includes two crew seats and four passenger seats. The forward passenger seats face aft, and all passenger seats have adjustable backs with built-in headrests. An inside baggage area is provided aft of the rear passenger seats.

Cabin access is through the main cabin door, located on the left side, aft of the wing. The main door is a horizontally split door with retractable steps in the lower half. The upper half is held open by a gas spring. A plug type, inward releasing, emergency egress door is located on the right side adjacent to the aft facing seat.

Windows include a two-piece windshield, pilot and copilot windows, a storm window in the pilot's window, and three passenger windows on each side.

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

7.3 THE AIRFRAME (Continued)

The wing is in effect a three section structure. The center section built-up main spar extends through the lower fuselage and outboard of each main landing gear. This section has a forward spar and a rear spar which are pin jointed at the fuselage sides. The main landing gear retracts inward into recesses located aft of the main spar. The outboard section of each wing, to within approximately 18 inches of the tip, is a sealed integral fuel cell. Portions of the wing structure are adhesively bonded, and skins are butt jointed and flush riveted for a smooth airfoil surface.

The all-metal flaps are electrically actuated through a mechanical linkage. The flaps extend aft and down on three tracks and have four preselect positions.

The all-metal ailerons are mass balanced and operated by a cable system mounted on the aft wing spar.

Tiedown rings are installed on the bottom of each wing outboard of the main landing gear. The rings, which pivot about their forward edge, are spring loaded to retract into the lower wing surface when not in use. When retracted, a small ring protuberance extends below the wing surface. Applying a slight forward pulling force to the protrusion will extend the ring.

The empennage is of conventional fin and rudder, stabilizer and elevator design with aerodynamic and mass balanced control surfaces. Surfaces are of all-metal construction and the single-piece elevator assembly carries a center-mounted trim tab. This tab operates to combine anti-servo and trim functions.

Various access panels on the fuselage, wings and empennage are removable for service or inspection purposes.

Electrical bonding is provided to ensure good electrical continuity between components. Lightning strike protection is provided in accordance with presently accepted practices. Anti-static wicks are provided on trailing edges of ailerons, elevator and rudder to discharge static electricity that might cause avionics interference.

7.5 ENGINE AND PROPELLER

ENGINE

The Malibu is powered by a Textron Lycoming TIO-540-AE2A engine. It is a direct drive, horizontally opposed, overhead valve, fuel injected, air cooled, turbocharged-intercooled engine with variable absolute pressure controller. Maximum rated power is 350 HP 2500 rpm and 42.0 in. Hg.

7.5 ENGINE AND PROPELLER (Continued)

manifold pressure. Accessories include a starter, two magnetos, a propeller governor, two belt driven alternators, two gear driven vacuum pumps, a belt driven air conditioner compressor, an oil filter, and an air/oil separator in the crankcase breather system.

Turbocharging (Figure 7-1) is accomplished by two Garrett - A.I.D. turbo-compressors, one located on each side of the engine. Turbochargers extract energy from engine cylinder exhaust gases and use this energy to compress engine induction air. This allows the engine to maintain rated manifold pressure at altitude. When engine induction air is compressed by the turbocharger, the air temperature is increased. The elevated air temperature is reduced by air intercoolers located on each side of the engine. This aids in engine cooling and improves engine power and efficiency.

Each turbocharger extracts exhaust energy from its respective bank of cylinders to pressurize the induction air. Air flows through the induction inlet louvers into the induction air box, where it is filtered and divided for distribution to the left and right turbo compressors. At the compressor, air pressure and temperature are increased. Pressure increases air density making a greater mass of air available to the engine cylinders on each intake stroke. Air then flows through an intercooler where air temperature is reduced, further increasing the density of air available to each cylinder. Downstream the intercoolers, air flow joins at the "Y" junction of intake tubes at the lower back of the engine, then passes through the fuel injector, into the intake manifold, where it is divided to individual intake pipes flowing to each cylinder. Metered fuel is injected into the cylinder head, upstream of the intake valve. After the fuel burns in the cylinder, exhaust gases flow into the exhaust manifold and then to turbocharger turbines where exhaust energy is extracted to drive the compressor.

Turbo compressed air is throttled across the throttle butterfly valve as set by the throttle lever. A control system monitors pressure and uses engine oil pressure to automatically position the waste gate valve. The waste gate bleeds excess exhaust gas from the exhaust manifold crossover pipe and out the left exhaust stack, bypassing the turbocharger. Thus the controller automatically maintains manifold pressure.

The engine is well protected against overboost damage from excessive manifold pressure. The waste gate controller senses manifold pressure and will continually adjust turbocharger output, maintaining the manifold pressure set by the throttle. The controller automatically protects the engine

REPORT: VB-1332
7-4



TURBO-INDUCTION SYSTEM
Figure 7-1

7.5 ENGINE AND PROPELLER (continued)

from overboost damage by limiting manifold pressure to 42.0 in. Hg. In the event of a controller malfunction, there is a pressure relief valve on the induction manifold which will relieve manifold pressure and prevent an overboost.

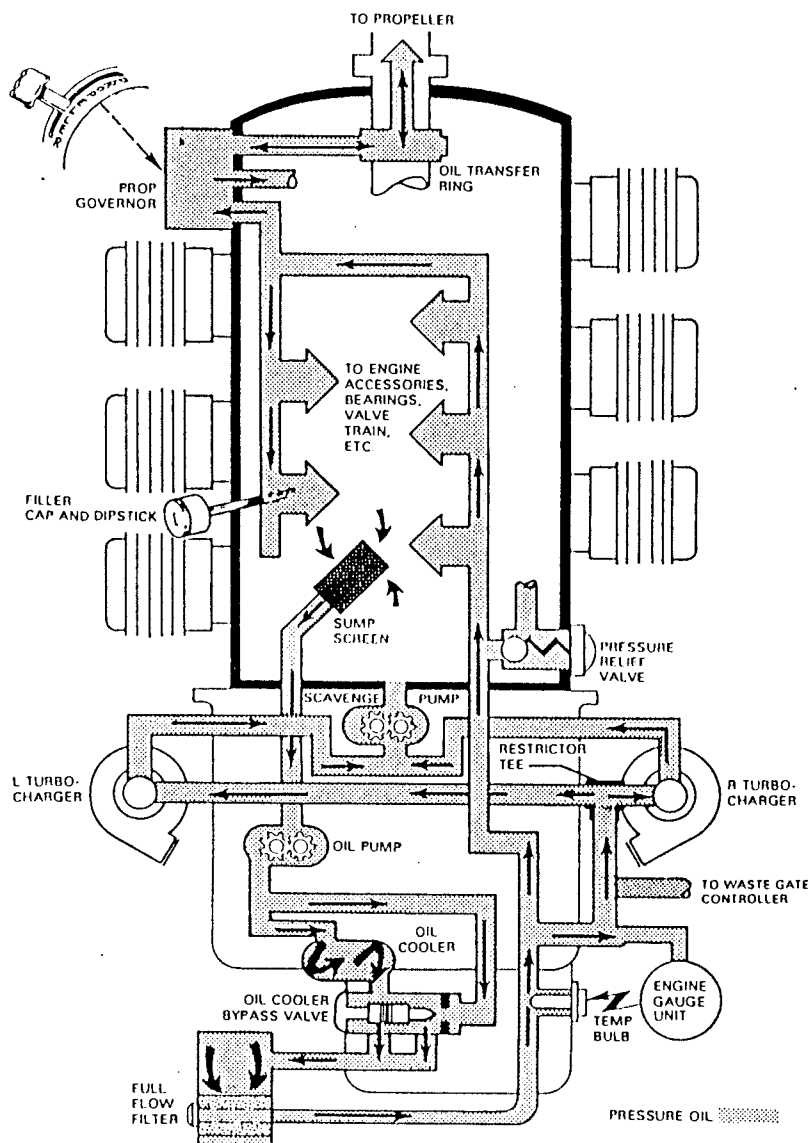
When descending from altitude, care should be exercised to maintain engine power and temperatures (oil, CHT). Turbocharger compressors supply air for cabin pressurization and power reduction below that recommended could cause a decrease in cabin pressure. Sudden cooling or gradual extreme cooling of engine cylinders will accelerate engine wear. Follow normal descent procedures described in Section 4.

The engine is equipped with a Bendix RSA-10ED1 fuel injection system. An engine-driven fuel pump supplies fuel under pressure to the fuel injection regulator, which measures air flow and meters the correct proportion of fuel to a flow divider. The flow divider then directs the fuel to each of the individual cylinder injector nozzles. A fuel vent system provides a common reference vent pressure to the fuel pressure switch, engine-driven fuel pump and injection nozzles. The vent source is taken downstream of the turbochargers to ensure proper vent pressure during turbocharger operation.

The engine employs a full pressure, 12 quart wet sump lubrication system (Figure 7-3). Maximum endurance flights should begin with 12 quarts of oil. The sump is filled through a combination dipstick oil filler cap. Lubricating oil is drawn through the oil sump inlet screen by the engine oil pump and directly to the oil cooler and a thermostatic bypass valve. When engine oil is cold, the thermostatic bypass valve will open allowing oil to flow directly to the full flow oil filter bypassing the cooler. As the oil warms up, the bypass valve will close thereby forcing more oil to circulate through the cooler prior to entering the oil filter. From the oil filter, the oil passes through an oil pressure relief valve which regulates system oil pressure. The regulated oil is then routed to the waste gate actuator, turbochargers, and through the main oil galleries to the various engine bearings, piston oil cooling nozzles, valve mechanisms, and moving parts. Gravity returns the oil to the sump.

The turbochargers are also lubricated by the regulated oil from the engine system. Oil circulated through the turbochargers is returned to the sump by a scavenge pump attached to the hydraulic pump accessory pad. Oil from the oil pump is also supplied directly to the waste gate control system.

7.7 ENGINE CONTROLS (Continued)



ENGINE OIL SYSTEM SCHEMATIC

Figure 7-3

7.5 ENGINE AND PROPELLER (Continued)

Oil temperature and pressure information is available from the combination gauge on the lower right of the pilot's instrument panel. Engine crankcase gases are discharged to an air/oil separator behind the left rear cylinder, and then vented out the left exhaust stack.

PROPELLER

The propeller is a Hartzell, all metal, two blade, constant speed unit with an 80-inch diameter. Constant propeller rotational speed (rpm) is maintained by a balance of air load and engine rotational forces. The Hartzell propeller governor, mounted on the left front of the engine, pressurizes and regulates the flow of engine oil to a piston in the propeller dome. The piston is linked by a sliding rod and fork arrangement to propeller blades. Governor oil pressure against the piston works to increase propeller blade pitch, thus decreasing propeller and engine rpm. Centrifugal twisting moments on the propeller blades work to decrease propeller blade pitch and increase rpm. Simple control of the interaction of these and other forces to maintain a constant rpm is provided by the propeller control lever in the cockpit.

The propeller control lever, linked by cable to the propeller governor, determines a wide range of in-flight rpm. Governor range is more limited during ground operation. Pushing the lever forward selects increased or higher rpm. Pulling the lever aft selects decreased or lower rpm. When in flight the rpm should not fluctuate significantly from that set, regardless of throttle setting.

The propeller may be operated within the full range of rpm indicated by the tachometer, up to the red radial line. In cruise, always use the power setting charts provided. Avoid exceeding maximum rpm and excessive engine stress by moving propeller and throttle levers in smooth deliberate motions. On cold days during run-up, exercise the propeller several times to flow warm oil into the propeller hub. This assures propeller governing for takeoff.

7.6 AIR INDUCTION SYSTEM

CAUTION

Alternate air is unfiltered. Use of alternate air during ground or flight operations when dust or other contaminants are present may result in engine damage from particle injection.

7.6 AIR INDUCTION SYSTEM (Continued)

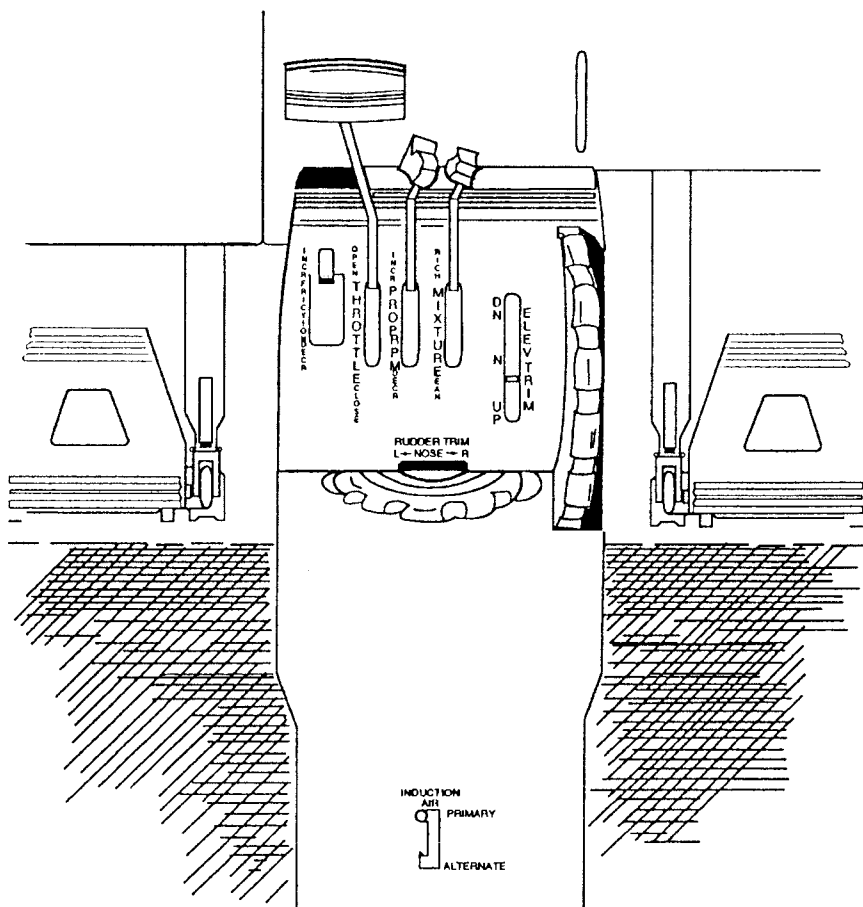
The engine air induction system receives ram air through forward facing ram air louvers located on the lower cowl below the propeller. Air enters these louvers and flows through a removable air filter mounted adjacent to the louvers. The filter removes dust and other foreign matter from the induction air. However, in the event the ram air louvers or the filter should become obstructed by ice or other causes, the pilot must manually select alternate air to provide air to the engine. This alternate air control is located on the center console just below engine control quadrant. When the induction air lever is up, or on primary air, the engine is operating on filtered air drawn through the forward facing ram air louvers. When the lever is down, or on alternate air, the engine is operating on unfiltered air, drawn through the aft facing louvers immediately aft of the ram air louvers. Since the alternate air bypasses the air filter, alternate air should never be used during ground operations, except for checking its operation.

Application of alternate air will result in a loss of manifold pressure when operating with a combination of high altitude and low RPM where the turbocharger wastegate is closed. Loss of manifold pressure of up to 8 inches Hg can result at maximum continuous power, with a possible greater reduction resulting at cruise power settings. Some of this manifold pressure loss may be recovered with throttle and / or RPM adjustment.

7.7 ENGINE CONTROLS

The engine is controlled by throttle, propeller and mixture control levers, located on the control quadrant on the lower central instrument panel (Figure 7-5). The controls utilize teflon-lined control cables to reduce friction and binding. The throttle lever is used to control engine power by simultaneously moving the butterfly valve in the fuel-air control unit and the variable absolute pressure controller, thus adjusting manifold pressure. The throttle lever incorporates a gear-up warning horn switch, which is activated during the last portion of travel of the throttle lever to the low power position. If the landing gear is not locked down, the horn will sound until the gear is down and locked, or until the power setting is increased. This is a safety feature to warn the pilot of an inadvertent gear-up landing. All throttle operations should be made with a smooth, deliberate movement to prevent unnecessary engine wear or damage and to allow time for the turbocharger speed to stabilize.

7.7 ENGINE CONTROLS (Continued)



CONTROL PEDESTAL

Figure 7-5

7.7 ENGINE CONTROLS (Continued)

The friction adjustment lever, located on the far left of the control quadrant, may be adjusted to increase or decrease the friction holding the throttle/propeller and mixture controls.

The propeller control lever is used to adjust engine speed (rpm) at the propeller governor. Propeller speed controls power availability, which is increased by increasing rpm when the lever is moved forward. The lever is moved aft to reduce rpm. Propeller operations should be smooth and deliberate to avoid unnecessary wear.

The mixture control lever is used to adjust the fuel-to-air ratio at the fuel-air control unit. Full forward is rich mixture. Normal engine shutdown is accomplished by placing the mixture in the full aft position.

7.9 HYDRAULIC SYSTEM

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

The electric motor driven hydraulic pump assembly is located aft of the rear baggage compartment and is accessible through the baggage compartment aft closeout panel. The pump assembly has an integral reservoir with filler plug, sight gauge and vent. The pump assembly incorporates pressure switches, bypass relief valves, and thermal relief valves in both the UP and DOWN sides. A shuttle valve is also incorporated to allow for unequal volumes of hydraulic fluid displaced during UP and DOWN gear actuation. Normal system operating pressure is controlled by the pressure switches. Maximum system operating pressure is limited by the bypass relief valves, and maximum system holding or trapped pressure is limited by the thermal relief valves.

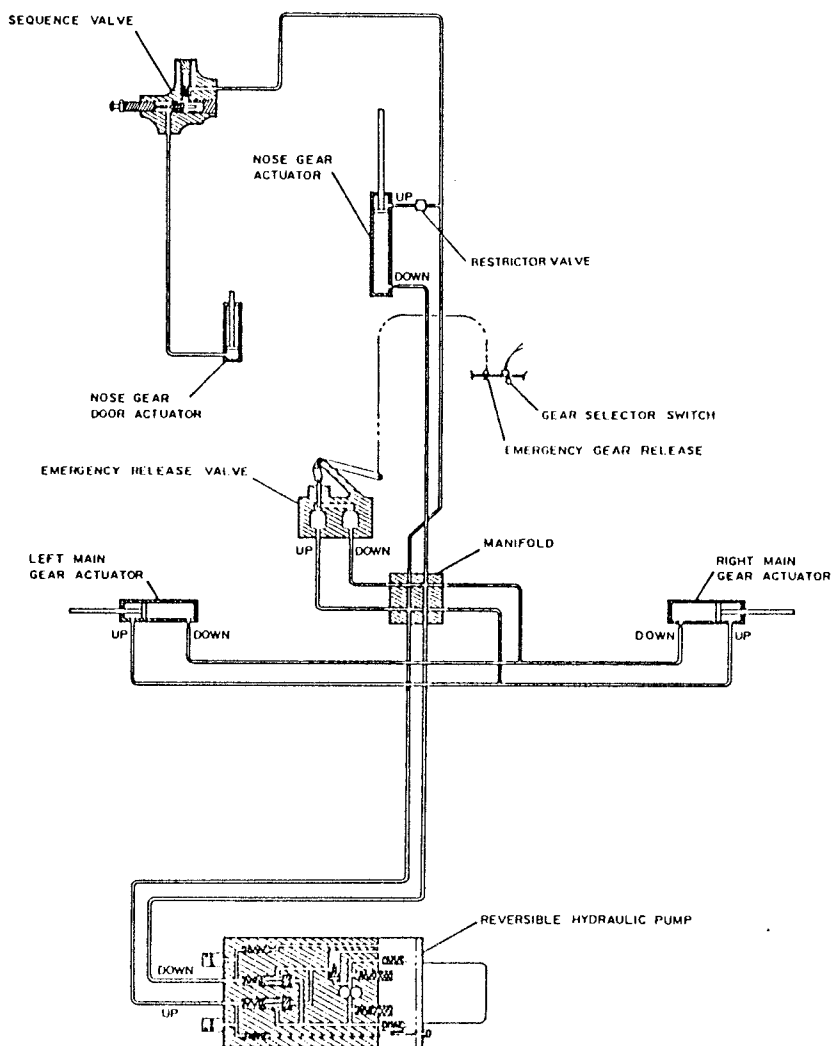
NOTE

Occasional cycling of the hydraulic pump during climb and initial cruise can occur due to variations in system pressure caused by ambient temperature changes.

The motor which drives the hydraulic pump is reversible and runs in one direction to supply gear UP pressure and in the opposite direction to supply gear DOWN pressure. The direction in which the pump runs is controlled electrically by the position of the gear selector switch on the instrument panel.

Other major components of the hydraulic system are the three gear actuators and the emergency gear extension valve. Operation of these components is covered in the landing gear section.

7.9 HYDRAULIC SYSTEM (Continued)



HYDRAULIC SYSTEM

Figure 7-7

7.11 LANDING GEAR

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

Locking-type actuators are used for main and nose gears. The actuator assembly provides mechanical gear-down locking at the fully extended position and is hydraulically unlocked. The actuator also acts as the gear brace in the extended position.

The main gear retracts inboard into the wing root area. A mechanically linked door covers the strut assembly.

Hydraulic pressure for gear operation is furnished by an electrically driven hydraulic pump (refer to Figures 7-7 and 7-11). Gear operation is initiated by a two position selector with a wheel shaped knob located to the left of the engine control quadrant (Figure 7-9). Three green lights, which are individually activated as each gear mechanically locks into the DOWN position are located above the landing gear selector.

NOTE

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

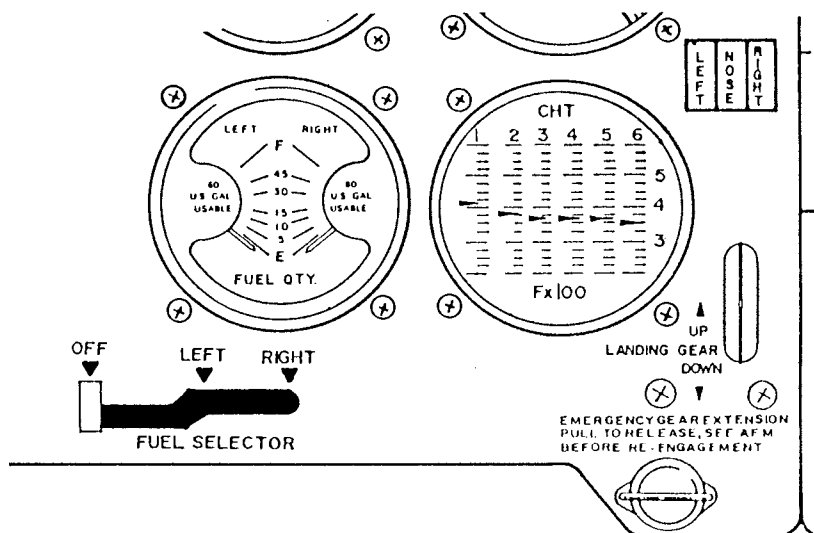
The landing gear selector knob must be pulled outward to release it from a detent in the DOWN position prior to moving it to the UP position. In addition, there is a squat switch on the left main gear which prevents operation of the gear UP electrical circuit when the aircraft weight is on the gear. If the landing gear selector is placed in the UP position with the aircraft weight on the gear, the gear warning horn will sound, and the red GEAR WARN annunciator will illuminate.

The landing gear is held in the UP position by hydraulic pressure which is trapped in the system UP lines by a check valve in the pump assembly. When normal pump operation is stopped by the pressure switch, a check valve in the pump assembly closes to trap fluid pressure in the UP side of the system. Emergency gear extension is accomplished by a manually actuated valve which relieves the pressure in the UP side and bypasses fluid to the DOWN side of the system. The additional fluid required for DOWN operation comes directly from the reservoir.

7.11 LANDING GEAR (continued)

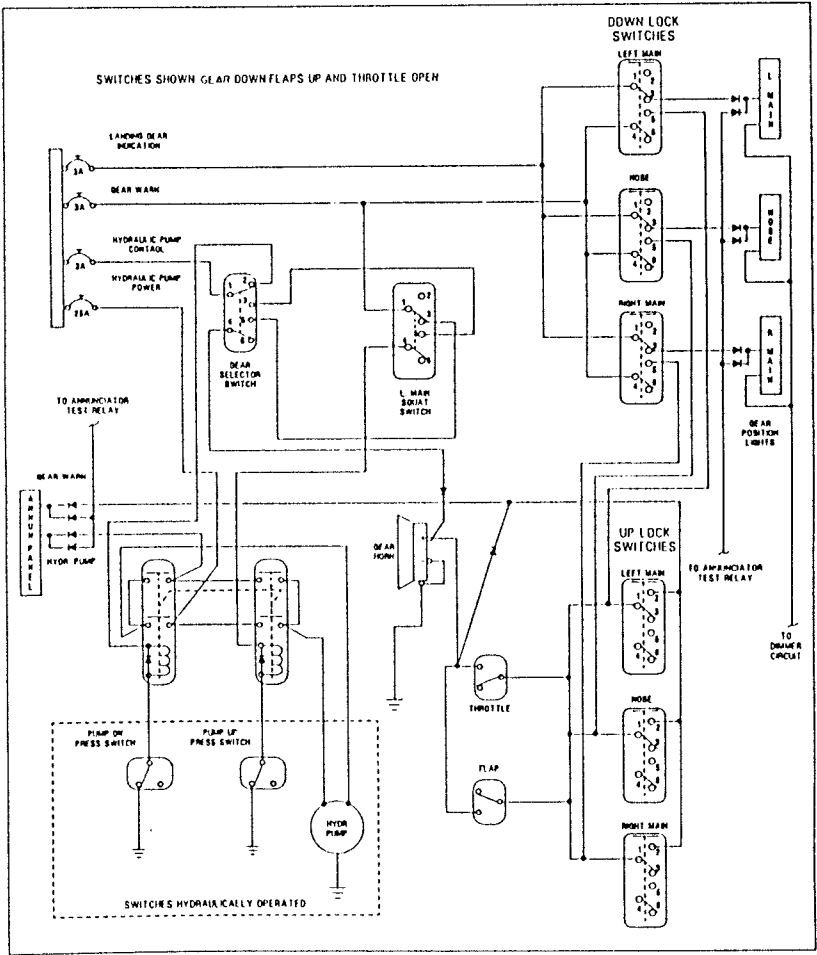
The landing gear is held in the DOWN position by spring loaded mechanical locking mechanisms built into each of the three actuating cylinders. The individual gear safe light switches are also mechanically operated when each mechanism is in the LOCKED position. With the hydraulic pump and system operating normally, hydraulic pressure is also trapped in the DOWN side of the system. This DOWN pressure is not required to mechanically lock the cylinders and is not available if the hydraulic pump is inoperative.

The EMERGENCY GEAR extension system allows the landing gear to free fall, with spring assist on the nose gear, into the extended position where the mechanical locks engage. Approximately 25 pounds of force is required to pull the EMERGENCY GEAR extension control. If a gear system malfunction has been indicated and the EMERGENCY GEAR extension system used, it is recommended that the EMERGENCY GEAR extension control and the HYD PUMP circuit breaker be left in the pulled position until the aircraft is safely on jacks. See the Service Manual for proper landing gear system check-out procedures. If the aircraft is being used for training purposes or a pilot check-out flight the EMERGENCY GEAR extension control and HYD PUMP circuit breaker must be reset in order for hydraulic pressure to be generated in the UP side of the system and the gear retracted.



LANDING GEAR SELECTOR
Figure 7-9

7.11 LANDING GEAR (Continued)



LANDING GEAR ELECTRICAL DIAGRAM

Figure 7-11

7.11 LANDING GEAR (Continued)

The annunciator panel contains two lights pertaining to landing gear operation. A red GEAR WARN annunciator is activated whenever all three gears are not fully down and locked, or not fully up with the gear doors closed. This annunciator comes on during normal gear operation to indicate that the gear is in transit. If it does not go out within approximately 10 seconds during normal gear operation or illuminates steadily during flight with the landing gear selector in the UP position, a system malfunction is indicated. There is also an amber HYD PUMP annunciator which indicates that the hydraulic pump motor is being supplied with electrical power. The annunciator is illuminated during normal landing gear operation for approximately the same duration as the GEAR WARN annunciator. If the light remains on or begins cycling intermittently after gear operation, a system malfunction is indicated.

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

- (a) In flight when the throttle is reduced to the point at which manifold pressure is approximately 14 inches of mercury or below and the landing gear are not in the DOWN position.
- (b) In flight when the flaps are extended more than 10° and the landing gear are not in the DOWN position.
- (c) On the ground when the landing gear selector is in the UP position. The landing gear squat switch activates to prevent operation of the retract side of the hydraulic pump on the ground.

7.13 BRAKE SYSTEM

The brake system is designed to meet all normal braking needs. Two single-disc, double puck brake assemblies, one on each main gear, are actuated by toe brake pedals mounted on both the pilot's and copilot's rudder pedals. A brake system reservoir, independent of the hydraulic system reservoir, is located behind the aft access panel in the forward baggage compartment. Brake fluid should be maintained at the level marked on the reservoir. For further information see BRAKE SERVICE in Section 8 of this handbook.

7.13 BRAKE SYSTEM (Continued)

The parking brake knob is located just below the left control column. To set the parking brake, first depress and hold the toe brake pedals and then pull the parking brake knob. To release the parking brake, first depress and hold the toe brake pedals and then push in on the parking brake knob.

7.15 FLIGHT CONTROL SYSTEM

The primary flight controls are conventional and are operated by dual control wheels and rudder pedals. The control wheel operates the ailerons and elevator. The rudder pedals actuate the rudder and nose wheel steering. The toe brakes, which are an integral part of the pedals, operate the wheel brakes. The ailerons and rudder are interconnected through a spring system, which is activated only when controls are out of harmony. In normal coordinated flight, the system is inactive. All flight control systems are operated by closed circuit cable systems.

Secondary control is by elevator and rudder trim. The controls are located on the pedestal (Figure 7-5). Aileron trim is provided by a fixed, ground-adjustable tab. The elevator trim control wheel is located on the right side of the pedestal. The wheel is rotated forward for nose-down trim and aft for nose-up trim. The rudder trim wheel is located on the aft face of the pedestal. The wheel is rotated to the right (counterclockwise) for nose right and left (clockwise) for nose left. Trim indications for the individual systems are located on the pedestal.

The wing flaps are electrically controlled by a selector lever mounted on the instrument panel immediately to the right of the control pedestal. The flap position indicator is located to the left of the selector lever. The flaps may be set to four positions: up (0°), 10°, 20°, and full down (36°). Each position is detented on the flap selector panel. The flaps will automatically move to the selected position, which can be confirmed by referring to the position indicator. The flaps may be extended to 10 at airspeeds below 165 KIAS, 20° below 130 KIAS, and 36° flap extension is limited to airspeeds below 116 KIAS. When extending the flap with the landing gear retracted, prior to the flap reaching the 20° position, the landing gear warning horn will sound, and the GEAR WARN annunciator will illuminate. A FLAPS annunciator light is provided as part of the annunciator panel located in the upper center section of the instrument panel. If the annunciator light illuminates, it is indicative of a system malfunction in which case the flap protection circuit automatically removes power from the electric flap motor. Resetting of the FLAP WARN circuit breaker will restore normal operating power to the flap motor. If, after resetting, and operation of the flaps, the annunciator illuminates again then a system malfunction is indicated and the flap motor circuit breaker should be pulled.

7.17 FUEL SYSTEM

Fuel is stored in two main integral wing tanks (see Figure 7-13), located outboard of the mid-wing splice. Fuel quantity held by each wing tank is 60 usable gallons with one gallon of unusable fuel, for a total of 122 gallons. The minimum fuel grade is 100 or 100LL aviation grade. Each tank gravity feeds fuel through finger screens into three lines leading to collector/sump tanks located at the root of each wing, just aft of the main spar. During preflight the collector/sump tank and one of the three lines can be inspected in each main wheel well. Collector/sump tanks vent back to the main tanks by a fourth line located forward of the main spar. The main tanks vent to the atmosphere by non-icing vents installed in the most outboard forward access panels of each wing tank. Reverse fuel flow from collector tanks to main tanks is prevented by 2 flapper check valves installed in each collector tank. Collector tank sumps are the lowest points in the fuel system, and each has a drain valve for draining collector and main tanks.

WARNING

Avoid prolonged uncoordinated flight to prevent uncovering of fuel tank outlets and subsequent fuel starvation.

Each tank separately vents air in and fumes out to equalize pressure with ambient conditions. This is accomplished through combination valves in non-icing fuel tank vents located at the most outboard, forward tank access panels.

CAUTION

Do not insert objects into the wing vent as damage to the combination valve could result in fuel leakage.

CAUTION

A plugged vent could result in fuel starvation. If a restricted vent is suspected, select the opposite tank immediately. Monitor the suspect wing and land as soon as possible.

7.17 FUEL SYSTEM (Continued)

NOTE

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

Fuel quantity is indicated by gauges located above the fuel selector handle. Each tank has two sensor sending units. Gauges are electrical and will operate when the battery switch is ON. Fuel tanks can be visually confirmed full if fuel level is up to the filler neck.

NOTE

Removal of the fuel filler cap from a wing tank that is sitting low or from an overfilled tank caused by thermal expansion could result in fuel spillage.

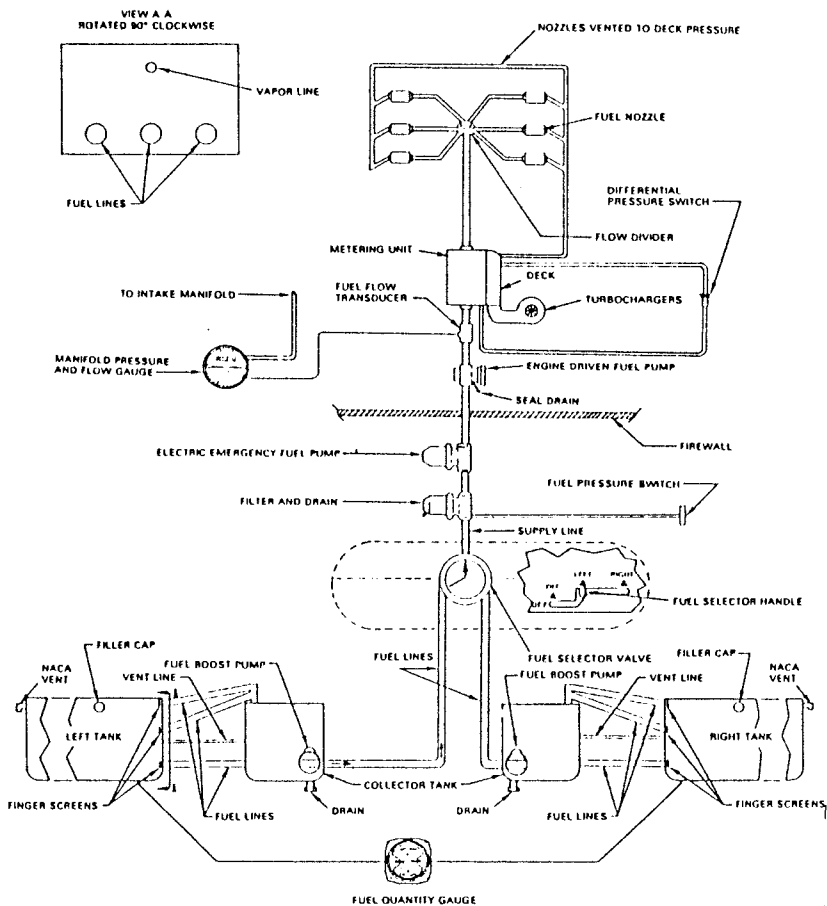
Quantity gauges should be monitored at regular intervals during flight. Fuel tank selection should be alternated accordingly to maintain fuel and wing balance. See fuel imbalance limitations (2.23(e)).

NOTE

Airplane should be fueled symmetrically in a wings level condition. At times, this will require alternate filling of left and right tanks until the full condition is reached.

Each collector/sump tank has a submerged, electrically operated, centrifugal fuel boost pump to suppress fuel vaporization in the fuel lines between the fuel tanks and the engine fuel pump. When the battery master switch is ON, the appropriate boost pump is turned on when the fuel selector is set to the LEFT or RIGHT position. Thus, the boost pump of the selected fuel tank operates continuously during engine start, and normal engine operations on the ground or in flight. Neither pump will operate if the fuel selector is set to OFF, or positioned between the LEFT and RIGHT detents.

7.17 FUEL SYSTEM (Continued)



FUEL SYSTEM SCHEMATIC
Figure 7-13

7.17 FUEL SYSTEM (Continued)

Should the fuel boost pump in the fuel tank being used fail to produce sufficient pressure, the BOOST PUMP light on the annunciator panel will illuminate. In this event, confirm that the fuel selector is properly seated in the detent for the selected tank. If the selector is properly seated, and the annunciator remains lit, select the opposite tank. Since there may be difficulty in obtaining the fuel from the tank with the malfunctioning boost pump, a precautionary landing at the nearest suitable airport should be considered to identify and correct the problem.

Should the engine driven fuel pump fail to produce sufficient pressure to sustain engine performance, the FUEL PRESS light on the annunciator panel will illuminate. Immediately select the emergency fuel pump ON. The FUEL PRESS annunciator will extinguish when adequate fuel pressure is restored. The emergency fuel pump should also be turned ON during takeoff and landing.

Fuel leaving the left or right collector/sump tank flows to a selector valve which is located on the right fuselage side behind the copilot's seat in a non-pressurized compartment. All fuel lines passing through the pressurized cabin are metal tubes surrounded by plastic cushion and encased by a second metal tube. This second tube is sealed from the cabin environment to preclude fuel from entering the cabin area or pressurized cabin air from entering fuel lines in the event of a leak.

The selector valve is cable controlled by a thumbsized handle just below the fuel quantity gauges. The detented selections are OFF, LEFT, RIGHT. LEFT or RIGHT positions direct fuel flow to the engine from the tank selected. To select OFF the fuel selector must be moved to the left tank position, moved down against spring pressure, then moved to the far left, or OFF position.

Fuel flows from the fuel selector forward to the fuel filter located below the baggage floor on the right side. The filter drain is a nylon tube located on the right side of the aircraft, forward of the wing. To drain fuel simply push in the nylon tube. If contaminants clog the filter, an internal relief valve will allow fuel to bypass the filter. This will allow unfiltered fuel to reach the engine and could contaminate the fuel distribution system in the engine.

NOTE

Regular servicing of the filter and examination of fuel samples for contamination is required.

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

7.17 FUEL SYSTEM (Continued)

When beginning flight operations with an equal amount of fuel in each tank, start, taxi, takeoff, and climb on the left tank. When beginning operations with unequal amounts of fuel in each tank, care must be taken not to exceed the fuel imbalance limitations specified in paragraph 2.23(e).

After established in the cruise configuration, the mixture should be leaned. See Section 4 for proper leaning procedure. To maintain lateral balance, it is suggested that alternate tanks be selected in 20 gallon (approximately 60 minute) increments, thus requiring minimal aileron force to keep the wings level. In any case, the fuel imbalance limitations in Section 2 must not be exceeded. The pilot must monitor the fuel gauges and switch tanks as required. Fuel cannot be used from both tanks at the same time.

7.19 ELECTRICAL SYSTEM

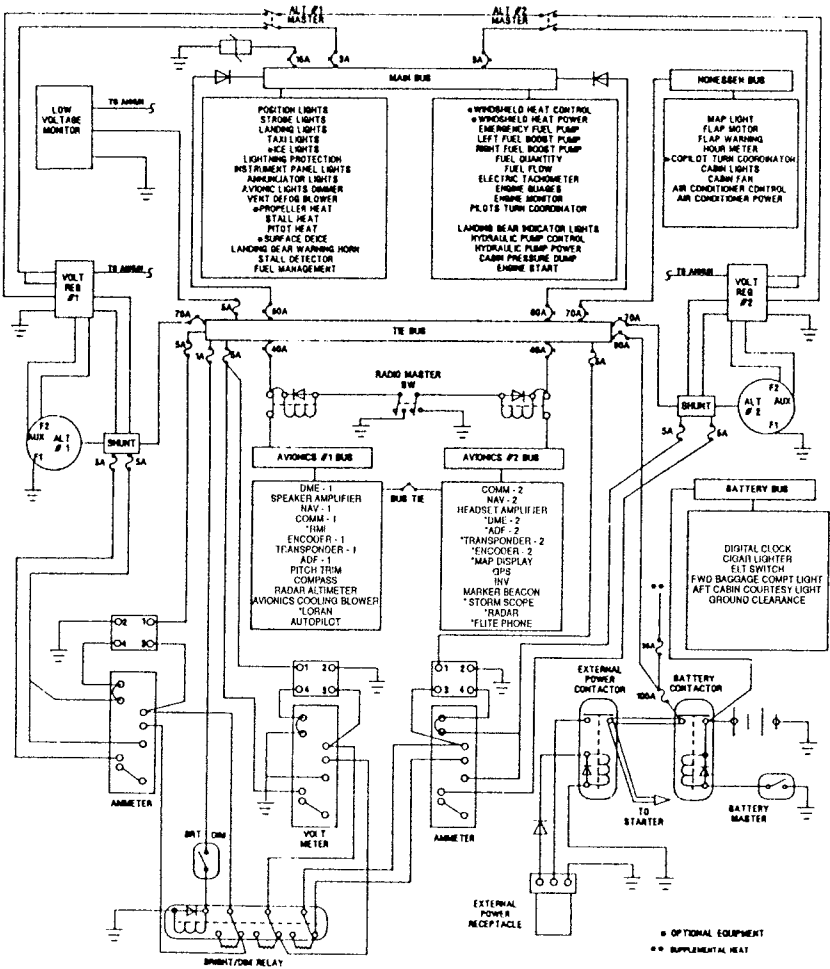
Power for the 28 Vdc, negative ground, dual fed split bus electrical system (Figure 7-15) is supplied by two belt driven, parallel connected, 28 Vdc 70 ampere self exciting alternators mounted on the forward section of the engine. When both alternators are operating and turned ON, a maximum continuous output of 140 amps is available. A 24 Vdc, 10 ampere hour lead acid battery, located beneath the left floor panel of the forward baggage compartment, provides power for engine starting. The battery also serves as a source of emergency electrical power in the event both alternators fail. The battery is vented to the atmosphere via an acid recovery system.

Electrical switches are located in one of four switch panels:

- (a) A main switch panel (Figure 7-17) located on the lower center section of the pilot's instrument panel.
- (b) An avionics switch panel (Figure 7-19a) located on the top center section of the instrument panel just above the radios.
- (c) A deice and anti-ice switch panel (Figure 7-19b) located on the lower left section of the copilot's instrument panel.
- (d) An environmental control switch panel (Figure 7-19c) located on the lower left section of the copilot's instrument panel below the control wheel.

A battery bus, located in the battery compartment, provides a continuous source of power for the digital clock, cigar lighter, ELT switch, ground clearance, forward baggage compartment light, and aft cabin courtesy light. Because the battery bus is connected directly to the battery, power is available for these functions even when the Battery Master switch is OFF. Fuses located on the battery bus are used to protect these circuits.

7.19 ELECTRICAL SYSTEM (Continued)



ELECTRICAL POWER DISTRIBUTION SYSTEM

Figure 7-15

7.19 ELECTRICAL SYSTEM (Continued)

When the Battery Master switch, located on the main switch panel, is turned ON, the battery solenoid contactor closes, enabling current to flow from the battery to both the starter solenoid contactor and the tie bus located on the lower left section of the pilot's instrument panel (Figures 7-23b and 7-25). Should the airplane's battery be depleted, a receptacle located inside the forward baggage compartment door permits using an external 24 Vdc power supply for engine start. With the Battery Master switch OFF, connecting an appropriate external power source completes a circuit that closes the external power solenoid contactor, permitting current to flow from the external source direct to the starter contactor and the tie bus. Whether using the airplane's battery, or external power, tie bus overcurrent protection is provided by the 80 amp tie bus BATTERY circuit breaker and a 100 amp in line current limiter fuse.

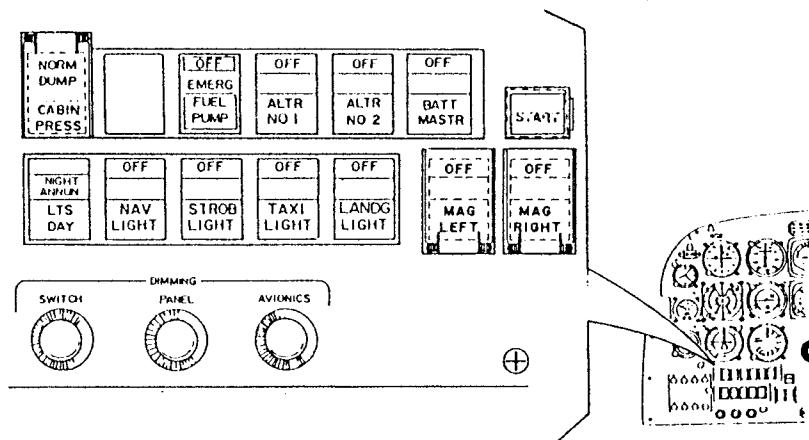
A single 0-30 Vdc voltmeter, located on the lower center section of the instrument panel (Figure 7-25), is connected to the tie bus to indicate battery voltage and system voltage. A low voltage monitor, also connected to the tie bus, will illuminate the LOW BUS VOLTAGE annunciator light when system voltage drops back below 25 ± 0.3 Vdc. Both units are provided overload protection by independent 5 amp fuses located on the tie bus panel.

NOTE

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

Each alternator system is provided an independent ON-OFF switch, located on the main switch panel, and a solid state voltage regulator that automatically regulates alternator field current. When selected ON, the positive output of each alternator is fed through individual shunts to the tie bus. Overcurrent protection is provided by the 70 amp tie bus ALTR 1 and ALTR 2 circuit breakers. Two ammeters, located on the lower center section of the instrument panel (Figure 7-25), are fed from taps on each shunt resistor, and indicate the individual electrical load of each alternator. Should an overvoltage condition occur in either alternator, its voltage regulator will shut off the field winding voltage of that alternator; thus overvoltage relays are not required. Output from either alternator can be shut off manually by turning that alternator's switch OFF. When either alternator fails, or is selected OFF, the appropriate ALTERNATOR INOP annunciator light will illuminate.

7.19 ELECTRICAL SYSTEM (continued)



MAIN ELECTRICAL SWITCH PANEL

Figure 7-17

A main bus and a nonessential bus (Figure 7-21), with associated circuit breakers, are located on the pilot's left side panels. Two avionics buses, with associated circuit breakers (Figure 7-23a), are located on the copilot's right side panel. The two avionics buses are interconnected through the avionics bus 25 amp BUS TIE circuit breaker.

Current is fed from the tie bus to the main bus by two conductors. In line diodes prevent reverse current flow to the tie bus. Two tie bus 60 amp MAIN BUS circuit breakers (Figure 7-23b) protect the main bus from an overload.

Current from the tie bus is fed to each avionics bus through independent solenoid contactors. When the Radio Master switch, located on the avionics switch panel, is selected ON, both solenoid contactors close, permitting current flow to both avionics buses. Avionics bus overload protection is provided by the 40 amp tie bus AVIONICS NO. 1 and AVIONICS NO. 2 circuit breakers (Figure 7-23b). Should the need arise, either avionics bus can be isolated by pulling out the avionics bus BUS TIE circuit breaker and the appropriate tie bus avionics circuit breaker.

The nonessential bus is also fed from the tie bus. Overload Protection is provided by the tie bus 70 amp NON-ESSEN circuit breaker (Figure 7-23b).

7.19 ELECTRICAL SYSTEM (Continued)

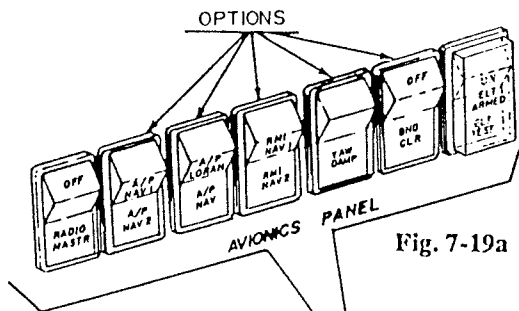


Fig. 7-19a

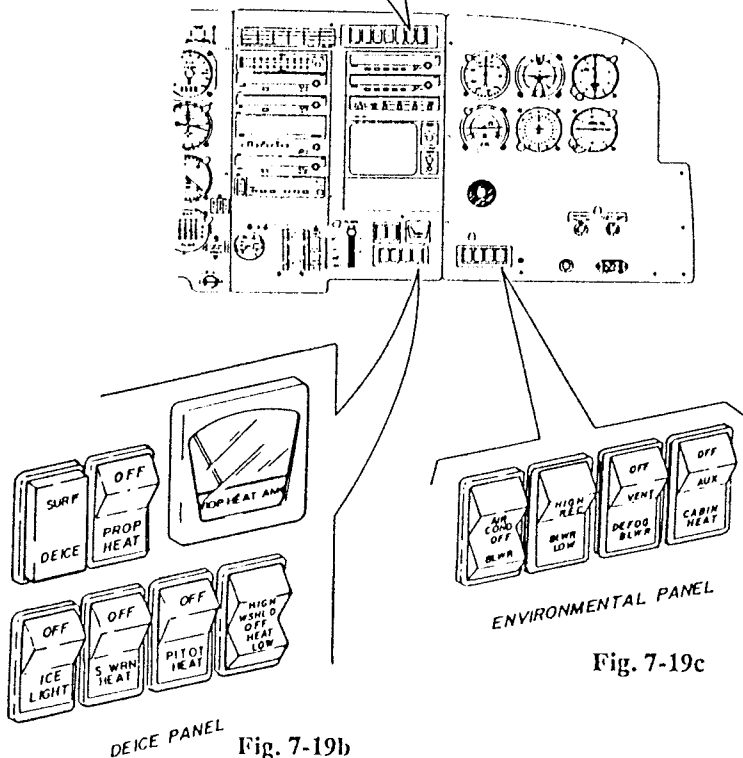


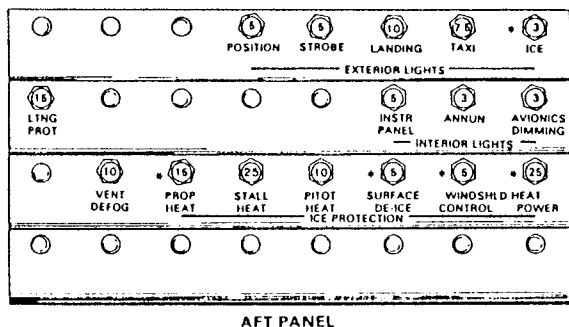
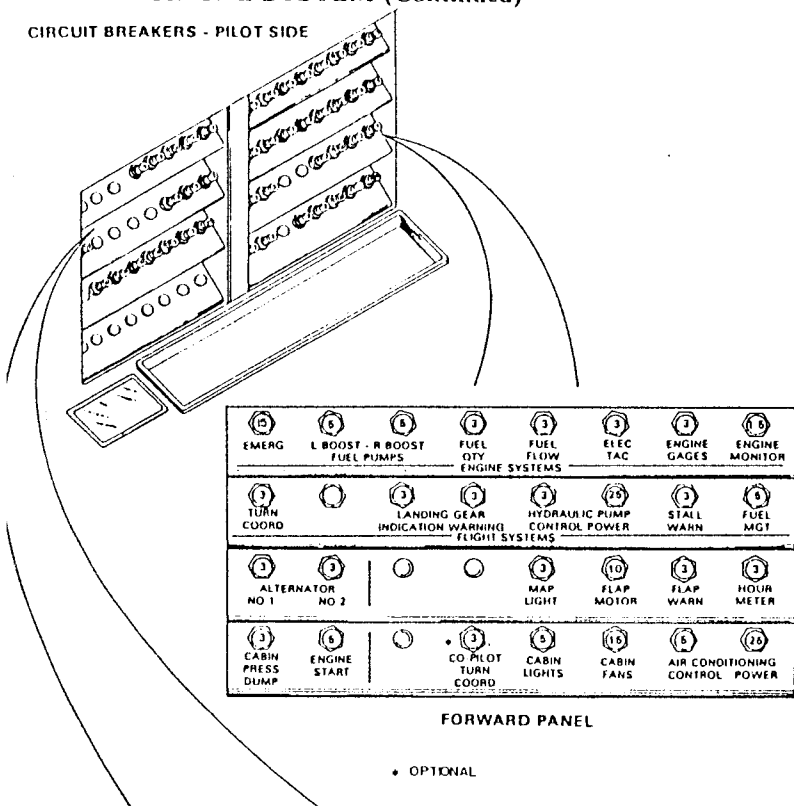
Fig. 7-19c

Fig. 7-19b

AUXILIARY SWITCH PANELS Figure 7-19

7.19 ELECTRICAL SYSTEM (Continued)

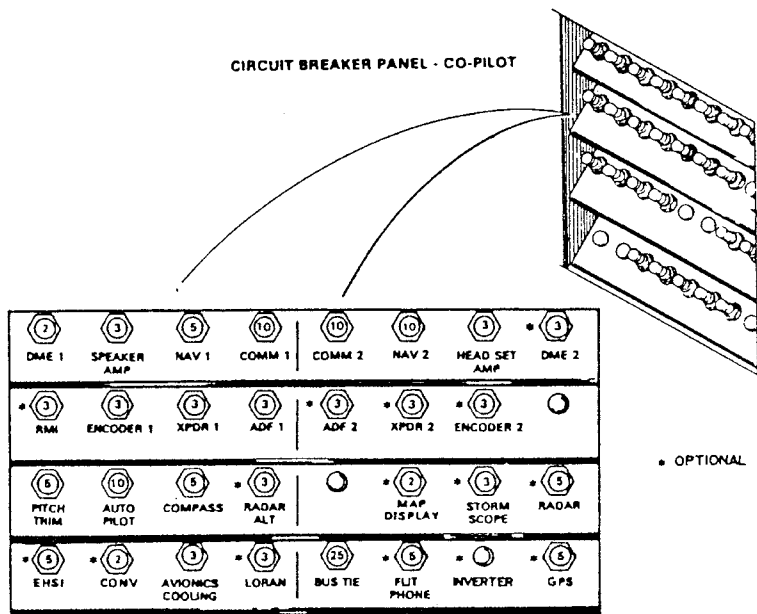
CIRCUIT BREAKERS - PILOT SIDE



MAIN AND NONESSENTIAL C/B PANELS

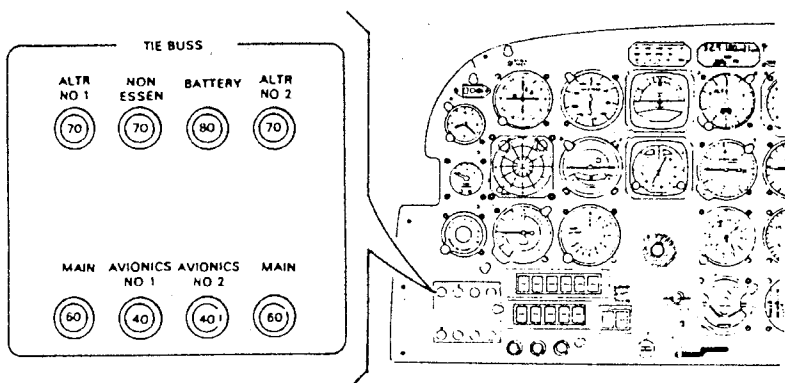
Figure 7-21

7.19 ELECTRICAL SYSTEM (Continued)



AVIONICS - C/B PANEL

Figure 7-23a



TIE BUS - C/B PANEL

Figure 7-23b

7.21 INSTRUMENT PANEL

The instrument panel is designed to accommodate the customary advanced flight instruments and the normally required power plant instruments. The artificial horizon is vacuum operated and located in the center of the left instrument panel. The vacuum gauge is located on the left side of the pilot's instrument panel. The pilot's directional gyro, and turn coordinator, are electrically operated.

Knobs and switches for controlling cabin comfort and windshield defogging are located on the lower right side and lower center section of the copilot's instrument panel. The three-in-one cabin pressure monitoring gauge, providing information on cabin rate of climb, cabin altitude, and cabin differential pressure, along with the cabin pressurization controller, are located to the extreme left of the pilot's control wheel.

The radios are contained in the center section of the panel. The main and nonessential bus circuit breakers are on the left side panels. The tie bus circuit breakers are located on the tie bus C/B panel on the lower left side of the pilot's instrument panel. Circuit breakers for the avionics buses are located on the right side panel. A radio master switch is located on the top of the center instrument panel. It controls the power to all radios through the radio master contactor.

An annunciator panel consisting of a group of warning lights is located across the upper center section of the instrument panel. Monitored functions include: ALTERNATOR #1 INOP, BOOST PUMP, FUEL PRESS, LOW BUS VOLTAGE, CABIN ALTITUDE, STALL WARN FAIL, ALTERNATOR #2 INOP, GEAR WARN, DOOR AJAR, FLAPS, STARTER ENGAGE, ANNUNCIATOR INOP, OXYGEN, VACUUM LOW, OIL PRESS, HYDRAULIC PUMP, SURFACE DE-ICE, and WINDSHIELD HEAT FAIL.

A ground clearance energy saver system is available to provide direct power to Comm #1 and speaker amplifier without turning on the battery switch. The ground clearance switch is located on the top center instrument panel. When the switch is engaged, direct aircraft battery power is applied to Comm #1 and audio amplifier (speaker). The switch must be turned OFF or depletion of the battery could result.

7.21 INSTRUMENT PANEL (Continued)

The manifold pressure line has a drain valve located on the left side of the center console, below and forward of the instrument panel, normally above the pilot's right knee. This allows any moisture which may have collected from condensation to be pulled into the engine. This is accomplished by depressing the valve for 5 seconds while operating the engine at 1000 rpm. The manifold pressure gauge will increase to approximately 30 in. Hg when the valve is depressed.

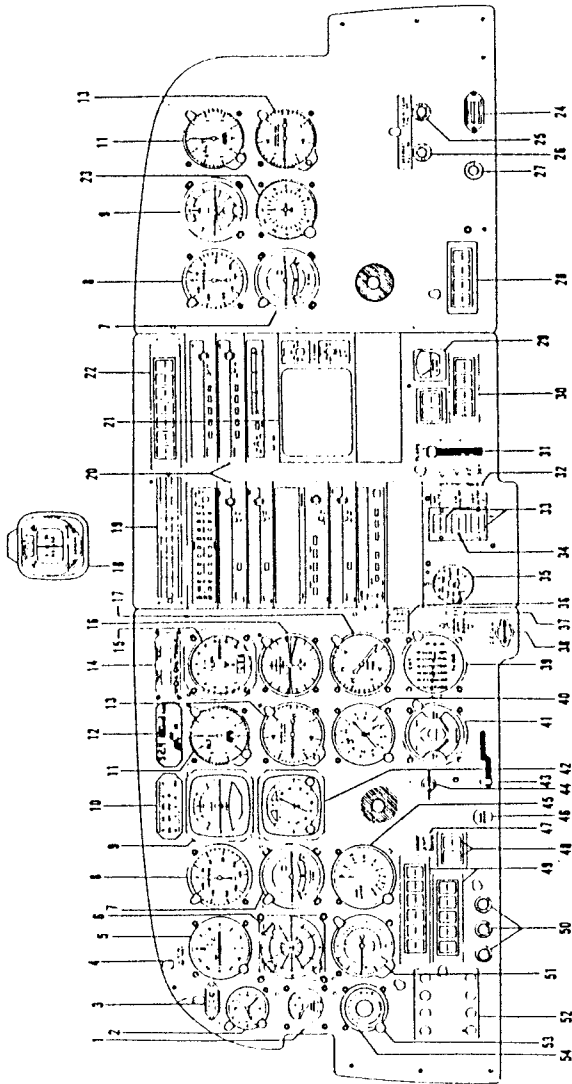
NOTE

Do not depress the valve when manifold pressure exceeds 25 inches Hg.

The column of gauges on the right side of the pilot's panel are engine related instruments. From top to bottom they are turbine inlet temperature (TIT), combination manifold pressure/fuel flow, tachometer (rpm), combination oil pressure, oil temperature, and a six channel cylinder head temperature (CHT). The normal operating range for ground and flight operation is indicated on the instruments by a green arc. Yellow arcs indicate either a takeoff or precautionary range. Red radial lines identify the established maximum or minimum limits. When an instrument needle point touches the edge of the red radial nearest the yellow or green arc, the limit is met.

The standard cylinder head temperature gauge (aircraft ser. no. 4622076 and up) displays only the hottest head. All head temperatures are scanned approximately every 9 seconds and the CHT needle flicks at the end of each scan cycle. The lights below the gauge indicate which CHT is currently being displayed. The adjacent push button switch allows the pilot to step through each cylinder to view its current temperature. If power is lost to the scanner the temperature of only the number 3 cylinder is displayed. An optional cylinder head temperature gauge (standard on aircraft prior to ser. no. 4622076) displays all six cylinders simultaneously.

7.2I INSTRUMENT PANEL (Continued)



INSTRUMENT PANEL
Figure 7-25

7.21 INSTRUMENT PANEL (Continued)

1. GYRO SUCTION	30. DEICE SWITCH PANEL
2. CLOCK	31. FLAP SELECTOR
3. GYRO SLAVING CONTROL	32. FLAP POSITION INDICATOR
4. STALL WARNING TEST	33. AMMETERS
5. VHF NAV NO. 2 INDICATOR	34. VOLTMETER
6. STORMSCOPE	35. OIL PRESS./OIL TEMP.
7. TURN COORDINATOR	36. GEAR INDICATOR LIGHTS
8. AIRSPEED INDICATOR	37. GEAR SELECTOR
9. ALTITUDE INDICATOR	38. EMERGENCY GEAR EXTENSION
10. A/P ANNUNCIATOR	39. COMBUSTION ANALYZER
11. PRESSURE ALTIMETER	40. ADF/RMI
12. DME	41. FUEL QUANTITY GAUGE
13. VERTICAL SPEED INDICATOR	42. HORIZONTAL SITUATION INDICATOR
14. FUEL MANAGEMENT	43. FUEL SELECTOR
15. TURBINE INLET TEMP.	44. CABIN PRESSURE CONTROL
16. MP AND FUEL FLOW	45. RADAR ALTIMETER
17. TACHOMETER	46. PARKING BRAKE KNOB
18. MAGNETIC COMPASS	47. ENGINE START SWITCH
19. ANNUNCIATOR PANEL	48. MAGNETO SWITCHES
20. AVIONICS INSTALLATION	49. MAIN SWITCH PANEL
21. WEATHER RADAR	50. DIMMER CONTROLS
22. AVIONICS SWITCH PANEL	51. TRIPLE INDICATOR
23. HEADING INDICATOR	a. CABIN VERTICAL SPEED
24. HOUR METER	b. CABIN ALTITUDE
25. CABIN TEMP. CONTROL	c. DIFFERENTIAL PRESSURE
26. WSHLD DEFOG CONTROL	52. THE BUS CIRCUIT BREAKERS
27. CIGAR LIGHTER	53. CABIN RATE CHANGE
28. ENVIRONMENTAL SWITCH PANEL	54. CABIN PRESSURE CONTROLLER
29. PROP. HEAT AMMETER	

INSTRUMENT PANEL (cont)

Figure 7-25 (cont)

7.23 PITOT STATIC SYSTEM

Pitot pressure for the airspeed indicator is sensed by a heated pitot head installed on the bottom of the left wing and is carried through lines within the wing and fuselage to the gauge on the instrument panel (refer to Figure 7-27). Static pressure for the altimeter, vertical speed and airspeed indicators is sensed by two static source pads, one on each side of the rear fuselage forward of the elevator. They connect to a single line leading to the instruments. The dual pickups balance out differences in static pressure caused by slight side slips or skids. Static pressure for the pressurization system outflow valve is sensed by a separate static pad located on the aft bottom of the aircraft in close proximity to the alternate static pad.

An alternate static source control valve is located below the instrument panel to the left of the pilot. For normal operation, the lever remains down. To select alternate static source, place the lever in the up position. When the alternate static source is selected the airspeed and altimeter and vertical speed indicator are vented to the alternate static pad on the bottom aft fuselage. During alternate static source operation, these instruments may give slightly different readings. The pilot can determine the effects of the alternate static source on instrument readings by switching from standard to alternate sources at different airspeeds.

If one or more of the pitot static instruments malfunction, the system should be checked for dirt, leaks or moisture. The static lines may be drained by a valve located on the side panel next to the pilot's seat. The pitot system drains through the pitot mast.

WARNING

Do not attempt to drain static system during pressurized flight.

The holes in the sensors for pitot and static pressure must be fully open and free from blockage. Blocked sensor holes will give erratic or zero readings on the instruments.

The heated pitot head, which alleviates problems with icing and heavy rain, is standard equipment and the switch for pitot heat is located on the lower center instrument panel. Static source pads have been demonstrated to be non-icing; however, in the event icing does occur, selecting the alternate static source will alleviate the problem.

7.23 PITOT STATIC SYSTEM (Continued)

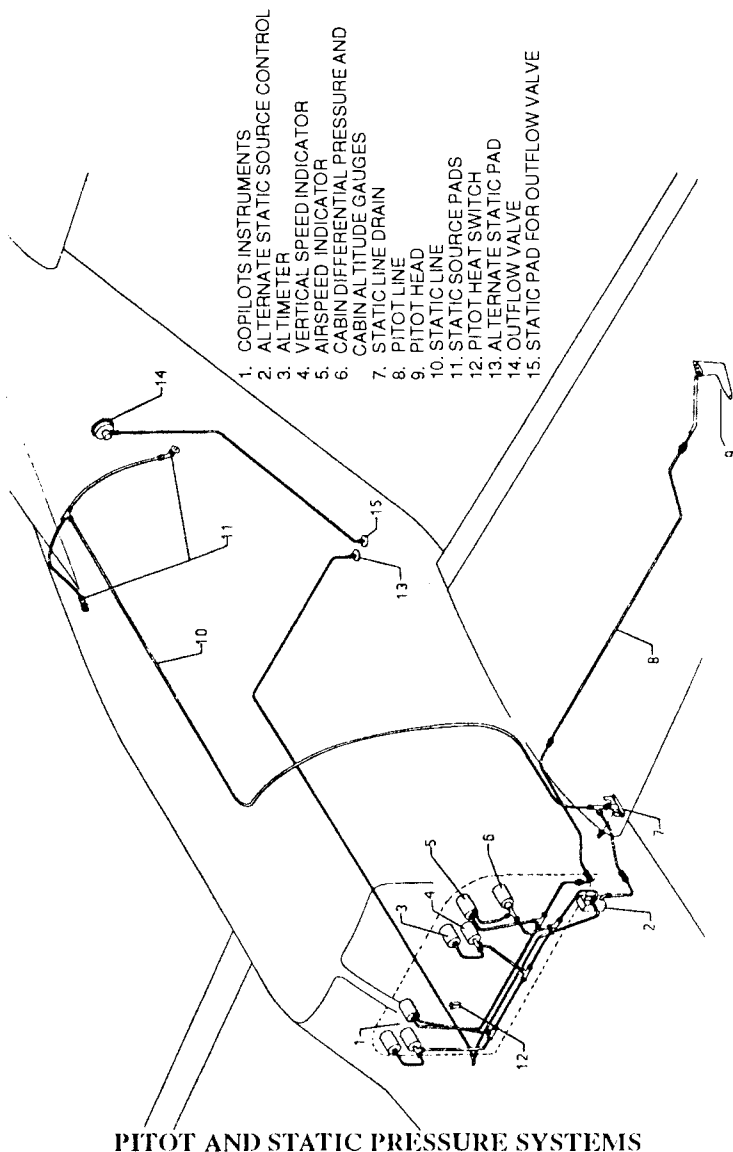


Figure 7-27

7.25 ENVIRONMENTAL SYSTEM (Refer to Figure 7-29)

The environmental system consists of:

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

Switches and push-pull knobs used to control and regulate the various systems except the pressurization system are located below the control wheel on the lower left and lower center sections of the copilot's instrument panel.

Compressor bleed air from the engine turbochargers supplies air for heating the cabin during flight and ground operations and for pressurization. The bleed air is first routed through an air-to-air heat exchanger, and then into the cabin through the lower left and right cabin side panel ducts. The heat exchanger utilizes ambient ram air to cool the bleed air, or hot air from an exhaust shroud to heat the bleed air. Desired cabin comfort is maintained by using the CABIN TEMP push-pull knob to manually adjust a flapper type control valve located forward of the firewall. The position of this valve will allow ambient air, or hot air, or a mixture of both, to enter the heat exchanger.

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

Cabin ventilating air during ground or unpressurized low altitude flight operations is provided by the ambient ram air source to the bleed air heat exchanger. An electric vane-axial ventilation/defog blower, located in the left cabin air inlet duct below the forward baggage compartment floor, is used to produce an air flow to the windshield defogger, and to supplement the inflow of ventilating air during ground operations. The blower is activated by selecting the VENT/DEFOG BLWR switch ON. Incoming ventilating air can be heated by mixing it with hot air from the exhaust shroud.

NOTE

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

7.25 ENVIRONMENTAL SYSTEM (Continued)

The supplemental electric heater consists of a resistance type heat element, a dual hermetically sealed bimetallic type overtemperature protection, a power relay, and a 35 amp in line current limiter fuse. Its function is to provide additional heat for maintaining desired cabin comfort during ground or flight operations under temperature conditions when fully heated bleed air or ventilating air is inadequate. When an external power source is used, the supplemental heater can also be used to preheat the cabin prior to engine start. See Section 2 for limitations on use of the supplemental heater.

The supplemental heater heat element is installed forward of the pressure bulkhead in the left bleed air duct immediately downstream of the ventilation/defog blower. Because the ventilation/defog blower must be operating whenever supplemental heat is used, both the VENT/DEFOG BLWR and AUX CABIN HEAT switches must be ON to supply power to the heating element.

Both the heater control circuit and the vent/defog fan circuit utilize the 10 amp VENT DEFOG circuit breaker located on the ICE PROTECTION circuit breaker panel. Heater element power is supplied from the battery master solenoid through the 35 amp heater fuse and the heater power relay. The 35 amp heater fuse is not accessible to the pilot. The electrical load imposed by the heater and the vent/defog fan is 40.35 amps. Operation is limited to airplanes with both alternators functioning.

Cabin air conditioning is provided by a vapor cycle system. The freon compressor is belt driven by the engine. Condenser cooling airflow is provided by a continuous duty motor driven fan. Cabin air is recirculated across the evaporators to provide cool air at each seat outlet.

The condenser and its cooling air fan are located in the tailcone immediately aft of the rear pressure bulkhead. Cooling air from outside the tailcone is drawn into the cooling air duct through a flush opening in the skin, routed across the condenser coil, and discharged overboard through the tailcone exit opening.

Two recirculation blowers and evaporator assemblies are located aft of each rear seat below the rear baggage compartment floor. The recirculation blowers draw air into each evaporator coil through grills in the floor structure behind the rear seats and discharges it into the upper left and right cabin side panel ducts. Adjustable eyeball outlets are located at each seat in the airplane.

7.25 ENVIRONMENTAL SYSTEM (Continued)

The AIR COND/OFF/BLWR and REC BLWR HI/LO switches, located on the copilot's lower instrument panel to the left of the control wheel, are used to control the air conditioning system.

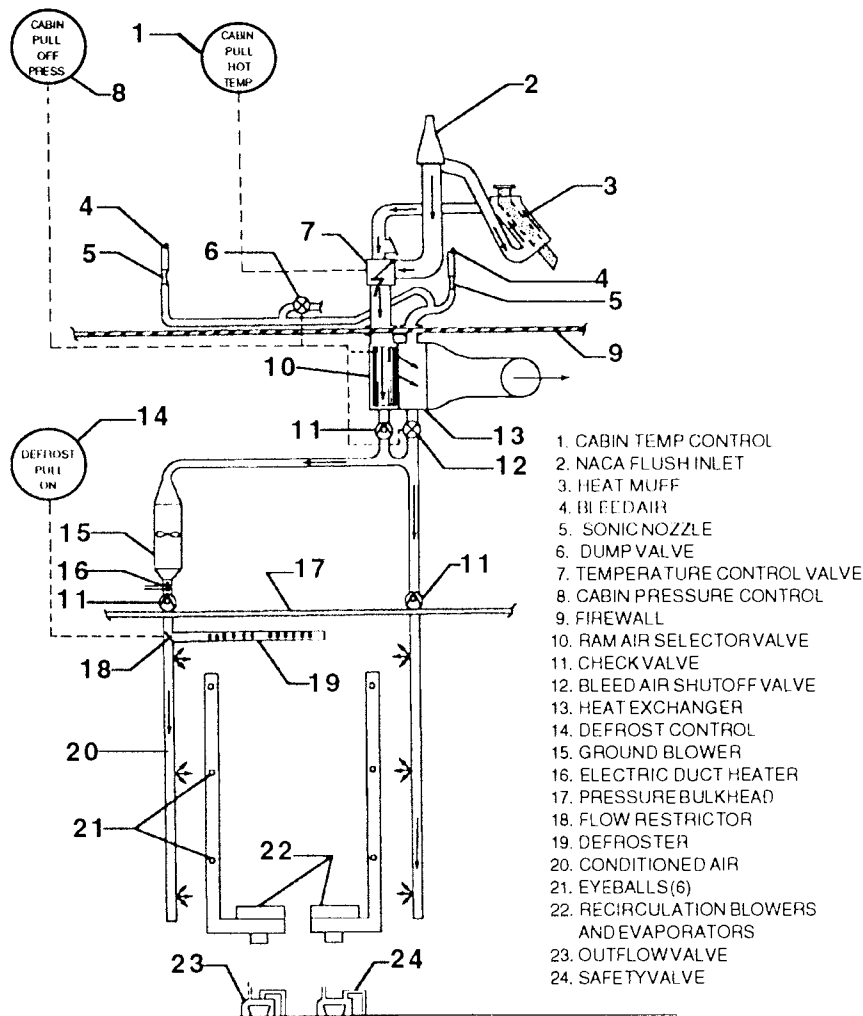
When the AIR COND/OFF/BLWR switch is positioned to AIR COND, the compressor belt drive is electrically clutched, the condenser blower motor relay is closed, and both recirculation blowers are activated. The recirculation blowers can be operated independently of the air conditioner by setting the AIR COND/OFF/BLWR switch to BLWR. In either situation, the REC BLWR switch is used only to select a HI or LO recirculation blower motor speed. The AIR COND/OFF/BLWR switch must be set to the center OFF position to shut off the recirculation blower motors. Overcurrent protection is provided by the 10 amp CABIN BLOWERS, 5 amp AIR CONDITIONER CONTROL, and 25 amp AIR CONDITIONER POWER circuit breakers in the nonessential bus section of the pilot's forward circuit breaker panel.

The freon portion of the system incorporates a receiver dryer, a sight gauge, suction and discharge service valves, and 265 psi high pressure and 40 psi low pressure switches. Should the compressor discharge pressure increase above 265 psi, or decrease below 40 psi, the applicable pressure switch will open, disengaging the freon compressor clutch.

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

Refer to paragraph 7.27, BLEED AIR, CONDITIONING AND PRESSURIZATION SYSTEM, for a more complete description of the pressurization system and use of related controls and switches.

7.25 ENVIRONMENTAL SYSTEM (Continued)



ENVIRONMENTAL SYSTEM

Figure 7-29

7.27 BLEED AIR, CONDITIONING AND PRESSURIZATION SYSTEM

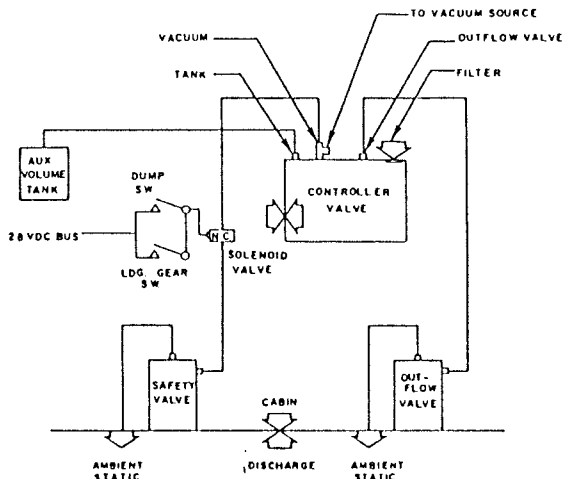
Air for cabin pressure is obtained from the engine turbocharger induction air system through two sonic venturi tubes. Bleed air is routed through the bleed air heat exchanger for the temperature conditioning to provide the desired cabin comfort level. Ram ambient air is routed across the heat exchanger to cool the bleed air, and hot ambient air from the heat muff is routed across the heat exchanger to heat the bleed air. Mixtures of ram ambient and heated ambient air may also be selected.

Cabin air is controlled by a push-pull knob labeled CABIN PRESS located beneath the control wheel on the pilot's instrument panel. Bleed air for pressurizing the cabin is provided when the control is fully in. Unpressurized ambient air is provided for ventilating the cabin when the control is fully out. This control operates three valves: the bleed air shutoff valve, the bleed air dump valve, and the ram air selector valve. When pushed fully in, the bleed air shutoff valve is open, the bleed air dump valve is closed, and the ram air selector valve is positioned to route ambient air across the bleed air heat exchanger. When the control is pulled completely out, the bleed air shutoff valve is closed, the bleed air dump valve is open, and the ram air selector valve is positioned to route ambient air into the conditioned air ducts through the check valve and into the cabin.

Controls and switches needed to operate the cabin pressurization system are located on the lower section of the pilot's instrument panel to the left of and beneath the control wheel, and on the lower right side of the copilot's instrument panel. In addition to the CABIN PRESS and CABIN TEMP controls, they include the cabin pressure and rate controller located just above the tie bus circuit breakers on the pilot's instrument panel, and the CABIN PRESS DUMP/NORM switch located on the pilot's main switch panel.

For pressurized flight, set the cabin pressure controller at 500 feet above the airport pressure altitude. CABIN PRESS control knob full in and the CABIN PRESS DUMP/NORM switch to NORM. The rate of cabin ascent and descent change is controlled with the rate knob (left lower corner of the cabin pressure controller), and may be adjusted between approximately 200 and 2000 feet per minute, as desired. Setting the rate knob arrow to the 9 o'clock position provides a cabin rate of change of approximately 500 feet per minute. This position gives a comfortable rate for normal operations.

7.27 BLEED AIR, CONDITIONING AND PRESSURIZATION SYSTEM (Continued)



PRESSURIZATION CONTROL SCHEMATIC
Figure 7-31

Next to the cabin pressure controller, a triple indicator simplifies monitoring the system's operation. The triple indicator displays the cabin altitude, cabin rate of change and the differential pressure between the cabin and the outside atmosphere. Maximum cabin differential pressure is 5.5 psi.

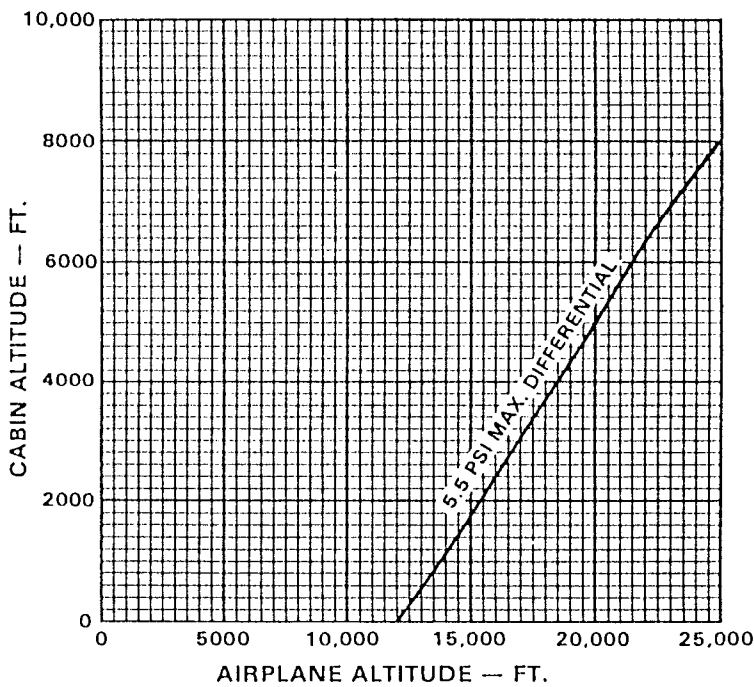
A CABIN ALTITUDE warning light on the annunciator display warns the pilot when the cabin altitude is above 10,000 feet. Cabin pressure is automatically regulated to a maximum of 5.5 psi pressure differential. Should the cabin outflow valve malfunction, the cabin safety valve will maintain a maximum of 5.6 cabin differential pressure. The landing gear squat switch, on the left main landing gear, prevents the cabin from being pressurized while the airplane is on the ground.

For complete instructions on the operation of the cabin pressurization system, refer to Section 4, Normal Procedures.

The CABIN PRESS DUMP/NORM switch, when set to DUMP, electrically opens a solenoid valve allowing vacuum suction pressure to open the safety valve and rapidly dump cabin pressure to ambient pressure.

7.27 BLEED AIR, CONDITIONING AND PRESSURIZATION SYSTEM
(Continued)

CABIN ALTITUDE
VS.
AIRPLANE ALTITUDE



CABIN ALTITUDE VS. AIRPLANE ALTITUDE
Figure 7-33

7.27 BLEED AIR, CONDITIONING AND PRESSURIZATION SYSTEM **(Continued)**

For unpressurized flight the CABIN PRESS control should be pulled fully out. Setting the CABIN PRESS/DUMP/NORM switch to DUMP will provide maximum airflow through the cabin. Cabin temperature will continue to be controlled by the CABIN TEMP control.

For complete instructions on pressurization malfunctions, refer to Section 3 - Emergency Procedures.

7.29 VACUUM SYSTEM

Vacuum for the system is provided by two continuously operating engine driven dry air vacuum pumps; one rotating clockwise and one rotating counterclockwise. Either pump can independently support the system. Also included are two regulators, a low vacuum switch, an inlet air filter, and a manifold that connects the autopilot, attitude indicator, cabin pressure controller, and vacuum solenoid valve. The latter two components are part of the cabin pressurization system.

The two vacuum regulators are mounted on the forward pressure bulkhead in the forward baggage compartment. The total system vacuum, which is displayed on the vacuum gauge, is regulated between 4.5 and 5.2 inches of mercury.

A vacuum gauge, incorporating two red flow buttons, mounted on the left side of the pilot's instrument panel (Figure 7-35), provides information to the pilot regarding the operation of both pumps. When both pumps are operating satisfactorily, neither flow button is visible. The left flow button will protrude should the clockwise rotating pump fail, while the right flow button will protrude should the counterclockwise rotating pump fail.

The low vacuum switch is mounted upstream of the manifold check valve. It illuminates the VACUUM LOW annunciator light when the system vacuum falls to 4.0 +/- 0.25 inches of mercury.

Any decrease in system vacuum may indicate a dirty filter, dirty screens, sticking vacuum regulator, or a leak in the system.

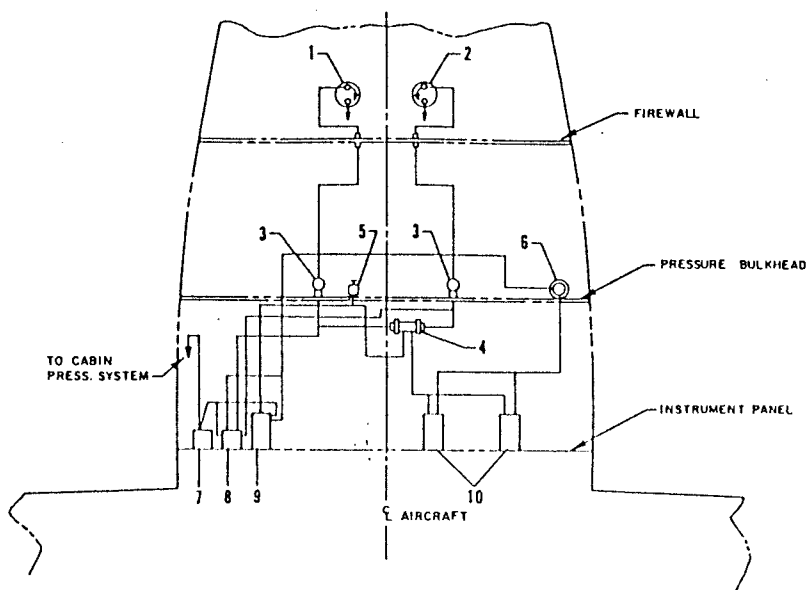
7.29 VACUUM SYSTEM (Continued)

A zero gauge reading, combined with the illumination of the VACUUM LOW annunciator light, indicates both pump drives may have sheared. A zero gauge reading without the VACUUM LOW annunciator illuminating may indicate a defective gauge. Either condition could be caused by a collapsed vacuum line.

Upon completion of the flight, all system abnormalities or malfunctions should be checked by a mechanic, and necessary repairs made, prior to further pressurized flight or flight under IFR.

Operators of airplanes equipped with wing and tail deicers should refer to Section 9, Supplement 6, for additional information concerning the vacuum system.

7.29 VACUUM SYSTEM (Continued)



1. CLOCKWISE ROTATING VACUUM PUMP
2. COUNTERCLOCKWISE ROTATING VACUUM PUMP
3. VACUUM REGULATOR
4. VACUUM MANIFOLD/CHECK VALVE
5. VACUUM PRESSURE SWITCH
6. INLINE FILTER
7. CABIN PRESSURE CONTROLLER
8. VACUUM GAUGE
9. PILOT'S ATTITUDE GYRO
10. COPILOT'S AIR DRIVEN GYROS (OPTIONAL)

VACUUM SYSTEM

Figure 7-35

7.31 CABIN FEATURES

The front seats are adjustable fore and aft and vertically. Pivoting armrests are provided on the inboard side of each seat.

Shoulder harnesses with inertia reels are standard equipment for all seats. The inertia reel should be checked by tugging sharply on the strap. The reel will lock in place under this test and prevent the strap from extending. Under normal movement the strap will extend and retract as required.

The shoulder harness is routed over the shoulder adjacent to the windows and attached to the lap belt buckle.

Shoulder harnesses shall be worn during takeoff, landing and during an emergency situation.

Standard cabin features include a pilot's storm window, ash trays, map pockets, cup holders, a cigar lighter, sun visors, stowage drawers under the aft facing seats and a baggage restraint net behind the rear seats.

Two combination instrument panel flood/map lights are provided forward, and four passenger reading lights are provided aft. A cabin entrance flood light is located above the door.

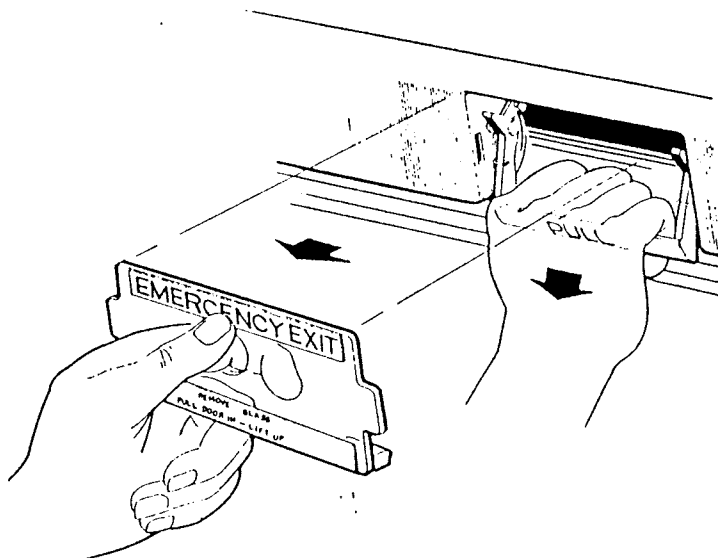
The four passenger seats with folding armrests and headrests are positioned in a club seating arrangement. The center seats face aft. The seat backs recline by pushing a button mounted in the outboard armrest.

An optional conference table located between the right passenger seats is available. The table is extended by pulling in on the upper edge of the leaf and then upward. The leaf is then rotated down into position and unfolded. Reverse this procedure for stowage.

Optional cabinets located behind the pilot seats are available. The right cabinet is designed for Jeppesen manual stowage in the bottom and contains a drawer for general use.

The left cabinet contains a removable ice chest, a tray, space for six canned drinks, and a fold down cup holder in the lower drawer. The upper drawer has space for thermos containers, cups and miscellaneous items.

7.31 CABIN FEATURES (Continued)



EMERGENCY EXIT

Figure 7-37

Optional passenger oxygen generators and masks are available and, if installed, are located in a drawer under the right aft facing seat.

Crew oxygen is located under the copilot's seat, readily available to either crew member. An annunciator light illuminates when any of the three generators have been activated. The light remains illuminated with the battery switch ON, until the system is serviced.

An optional fire extinguisher is available and, if installed, is located either behind the spar or on top of the right cabinet.

The emergency exit is located on the right side of the fuselage, adjacent to the aft facing seat. Instructions for opening the emergency exit are placarded on the cover over the handle. To open, remove the cover and pull the handle. The window releases inward. The cabin must be unpressurized to open the exit.

7.33 BAGGAGE AREA

The airplane has two separate baggage areas each with a 100-pound capacity. A 13-cubic-foot forward baggage compartment, located just aft of the firewall, is accessible through a 19 x 23 inch door on the left side of the fuselage. An aft baggage compartment, which is accessible from inside the cabin, is located behind the back seats.

A forward baggage door annunciation system senses the baggage door latch position. If the baggage door is not closed and latched, the DOOR AJAR annunciator light will illuminate on the annunciator panel.

NOTE

It is the pilot's responsibility to be sure when the baggage is loaded that the airplane's C.G. falls within the allowable C.G. range (refer to Section 6, Weight and Balance).

7.35 FINISH

All exterior surfaces are primed and finished with polyurethane. To keep the finish attractive looking, polyurethane touch-up paint is available from Piper Factory Authorized Service Centers.

7.37 STALL WARNING

An approaching stall is indicated by a stall warning horn sounding a continuous tone, as opposed to the landing gear horn's beeping tone. Mild airframe buffeting may also precede a stall.

The stall warning is activated by a lift transducer installed in the leading edge of the left wing. An onboard computer will distinguish between power on, power off, and flap position conditions during normal stalls, causing the horn to sound five to ten knots above the stall speed.

A graph showing stall speeds at various angles of bank is contained in Section 5.

7.39 EMERGENCY LOCATOR TRANSMITTER

The Emergency Locator Transmitter (ELT) meets the requirements of FAR 91.52. It operates on self-contained batteries and is located in the aft fuselage section. It is accessible through a cover on the bottom right side.

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

NOTE

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

NARCO ELT 10 OPERATION

Located on the ELT unit is a three position switch placarded ON, OFF and ARM. The ARM position sets the ELT so that it will transmit after impact and will continue to transmit until its battery is drained. The ARM position is selected when the ELT is installed in the airplane and it should remain in that position.

To use the ELT as a portable unit in an emergency, remove the cover and unlatch the unit from its mounting base. The antenna cable is disconnected by a left quarter-turn of the knurled nut and a pull. A sharp tug on the two small wires will break them loose. Deploy the self-contained antenna by pulling the plastic tab marked PULL FULLY TO EXTEND ANTENNA. Move the switch to ON to activate the transmitter.

In the event the transmitter is activated by an impact, it can only be turned off by moving the switch on the ELT unit to OFF. Normal operation can then be restored by pressing the small clear plastic reset button located on the top of the front face of the ELT and then moving the switch to ARM.

7.39 EMERGENCY LOCATOR TRANSMITTER (Continued)

A covered three position rocker type switch, located in the avionics switch panel, allows the pilot to remotely activate the ELT transmitter from inside the cabin. The switch is labeled ON and TEST. The cover is labeled ELT ARMED. Normally, the switch is in the center, or ARMED position, with the cover down. Should a test of the transmitter be required, lift the cover and hold the switch in the TEST (down) position. When the test is completed, simply release the switch; it is spring leaded to return to the ARMED (center) position. If continuous operation is desired, lift the cover and select the ON (up) position. Unless the impact switch has been activated, returning the remote switch to the ARMED (center) position will turn the transmitter off.

The ELT should be checked to make certain the unit has not been activated during the ground check. Check by selecting 121.50 MHz on an operating receiver. If there is an oscillating chirping sound, the ELT may have been activated and should be turned off immediately. This requires removal of the access cover and moving the switch to OFF, then press the reset button and return the switch to ARM. Recheck with the receiver to ascertain the transmitter is silent.

NARCO ELT 910 OPERATION

On the ELT unit itself is a three position switch placarded ON, OFF and ARM. The ARM position sets the ELT so that it will transmit after impact and will continue to transmit until its battery is drained. The ARM position is selected when the ELT is installed in the airplane and it should remain in that position.

A pilot's remote switch, placarded ON and ARM, is located on the copilot instrument panel to allow the transmitter to be armed or turned on from inside the cabin. The switch is normally in the ARM position. Moving the switch to ON will activate the transmitter. A warning light, located above the remote switch, will blink continuously whenever the ELT is activated.

NOTE

The warning light will not blink if the ELT is activated by an incident that also results in severance of the airplane's power supply lines.

7.39 EMERGENCY LOCATOR TRANSMITTER (Continued)

NARCO ELT 910 OPERATION

Should the ELT be activated inadvertently it can be reset by either positioning the remote switch to the ON position for two seconds, and then relocating it to the ARM position, or by setting the switch on the ELT to OFF and then back to ARM.

In the event the transmitter is activated by an impact, it can be turned off by moving the ELT switch OFF. Normal operation can then be restored by resetting the switch to ARM. It may also be turned off and reset by positioning the remote switch to the ON position for two seconds, and then to the ARM position.

The transmitter can be activated manually at any time by placing either the remote switch or the ELT switch to the ON position.

The ELT should be checked during postflight to make certain the unit has not been activated. Check by selecting 121.50 MHz on an operating receiver. If a downward sweeping audio tone is heard the ELT may have been activated. Set the remote switch to ON. If there is no change in the volume of the signal, your airplane's ELT is probably transmitting. Setting the remote switch back to ARM will automatically reset the ELT and should stop the signal being received on 121.50 MHz.

ARTEX 110-4 ELT OPERATION

On the ELT unit itself is a two position switch placarded ON and OFF. The OFF position is selected when the transmitter is installed at the factory and the switch should remain in that position whenever the unit is installed in the airplane.

A pilots remote switch, placarded ON and ARM is located on the copilots instrument panel to allow the transmitter to be armed or turned on from inside the cabin. The switch is normally in ARM position. Moving the switch to ON will activate the transmitter. A warning light located above the remote switch will alert you when ever the ELT is activated.

Should the ELT be activated inadvertently it can be reset by either positioning the remote switch to the ON then immediately relocating it to the ARM position, or by setting the switch on the ELT to ON and then back to OFF.

7.37 EMERGENCY LOCATOR TRANSMITTER (Continued)

ARTEX 110-4 ELT OPERATION

In the event the transmitter is activated by an impact, it can be turned off by moving the ELT switch OFF. Normal operation can then be restored by resetting the switch to ARM. It may also be turned off and reset by positioning the remote switch to the ON and then immediately to the ARM position.

The transmitter can be activated manually at any time by placing either the remote switch or the ELT switch to the ON position.

NOTE:

Three sweeps of the emergency tone and an illuminated warning light indicates a normally functioning unit. The warning light must illuminate during the first 3 second test period. If it does not illuminate, a problem is indicated such as a "G" switch failure.

The ELT should be checked during postflight to make certain the unit has not been activated. Check by selecting 121.50 MHz on an operating receiver. If a downward sweeping audio tone is heard the ELT may have been activated. Set the remote switch to ON. If there is no change in the volume of the signal, your airplane's ELT is probably transmitting. Setting the remote switch back to OFF will automatically reset the ELT and should stop the signal being received on 121.50 MHz.

7.41 EXTERNAL POWER

The external power receptacle allows the airplane engine to be started from an external power source without the necessity of gaining access to the airplane battery. The cable from the external power source can be attached to a receptacle, located on the aft side of the forward baggage compartment. Instructions on a placard located on the cover of the receptacle should be followed when starting with external power. For instructions on the use of starting with external power, refer to Starting Engines in Section 4.

7.43 RADAR*

A weather radar system can be installed in the airplane. The basic components of this installation are a Receiver-Transmitter Antenna and a cockpit indicator. The function of the weather radar system is to detect weather conditions along the flight path and to visually display a continuous weather outline on the cockpit indicator. Through interpretation of the advance warning given on the display, the pilot can make an early decision on the most desirable weather avoidance course.

NOTE

When operating weather avoidance radar systems inside of moderate to heavy precipitation, it is advisable to set the range scale of the radar to its lowest scale.

For detailed information on the weather avoidance radar system and for procedures to follow in operating and adjusting the system to its optimum efficiency, refer to Section 9, Supplements, or the appropriate operating and service manuals provided by the radar system manufacturer.

WARNING

Heating and radiation effects of radar can cause serious damage to the eyes and tender organs of the body. Personnel should not be allowed within fifteen feet of the area being scanned by the antenna while the system is transmitting. Do not operate the radar during refueling or in the vicinity of trucks or containers accomodating explosives or flammables. Flashbulbs can be exploded by radar energy. Before operating the radar, direct the nose of the airplane so that the forward 120 degree sector is free of any metal objects such as other aircraft or hangars for a distance of at least 100 yards, and tilt the antenna upward 12 degrees. Do not operate the radar while the airplane is in a hangar or other enclosure.

*Optional Equipment

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

SECTION 8

AIRPLANE HANDLING, SERVICING, AND MAINTENANCE

Paragraph No.		Page No.
8.1	General	8-1
8.3	Airplane Inspection Periods	8-2
8.5	Preventive Maintenance	8-3
8.7	Airplane Alterations	8-3
8.9	Ground Handling	8-4
8.11	Engine Induction Air Filter	8-7
8.13	Brake Service	8-7
8.15	Hydraulic System Service	8-9
8.17	Landing Gear Service	8-9
8.19	Propeller Service	8-10
8.21	Oil Requirements	8-11
8.23	Fuel System	8-12
8.25	Tire Inflation	8-16
8.27	Battery Service	8-16
8.29	Emergency Oxygen System (Optional)	8-16
8.31	Pressurization System	8-16
8.33	Lubrication	8-17
8.35	Cleaning	8-17
8.36	Cleaning and Maintenance of Relief Tube System	8-22

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 8

AIRPLANE HANDLING, SERVICING, AND MAINTENANCE

8.1 GENERAL

This section provides guidelines relating to the handling, servicing, and maintenance of the Malibu Mirage. For complete maintenance instructions, refer to the PA-46-310/350P Maintenance Manual.

Every owner should stay in close contact with an authorized Piper Service Center or Piper's Customer Services Department to obtain the latest information pertaining to their airplane, and to avail themselves of Piper Aircraft's support systems.

Piper Aircraft Corporation takes a continuing interest in having owners get the most efficient use from their airplane and keeping it in the best mechanical condition. Consequently, Piper Aircraft, from time to time, issues service releases including Service Bulletins, Service Letters, Service Spares Letters, and others relating to the airplane.

Piper Service Bulletins are of special importance and Piper considers compliance mandatory. These are sent directly to the latest FAA-registered owners in the United States (U.S.) and Piper Service Centers worldwide. Depending on the nature of the release, material and labor allowances may apply. This information is provided to all authorized Piper Service Centers.

Service Letters deal with product improvements and servicing techniques pertaining to the airplane. They are sent to Piper Service Centers and, if necessary, to the latest FAA-registered owners in the U.S. Owners should give careful attention to Service Letter information.

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

8.1 GENERAL (CONTINUED)

Piper Aircraft Corporation offers a subscription service for Service Bulletins, Service Letters, and Service Spares Letters. This service is available to interested persons such as owners, pilots, and mechanics at a nominal fee, and may be obtained through an authorized Piper Service Center or Piper's Customer Services Department.

Maintenance manuals, parts catalogs, and revisions to both, are available from Piper Service Centers or Piper's Customer Services Department.

Any correspondence regarding the airplane should include the airplane model and serial number to ensure proper response.

8.3 AIRPLANE INSPECTION PERIODS

Piper Aircraft Corporation has developed inspection items and required inspection intervals for the PA-46-350P (see PA-46-310/350P Maintenance and Inspection Manuals). The PA-46-310/350P Inspection Manual contains appropriate forms, and all inspection procedures should be complied with by a properly trained, knowledgeable, and qualified mechanic at an authorized Piper Service Center or a reputable repair shop. Piper Aircraft Corporation cannot accept responsibility for the continued airworthiness of any aircraft not maintained to these standards, and/or not brought into compliance with applicable Service Bulletins issued by Piper Aircraft Corporation, instructions issued by the engine, propeller, or accessory manufacturers, or Airworthiness Directives issued by the FAA.

A programmed Inspection, approved by the Federal Aviation Administration (FAA), is also available to the owner. This involves routine and detailed inspections to allow maximum utilization of the airplane. Maintenance inspection costs are reduced, and the maximum standard of continued airworthiness is maintained. Complete details are available from Piper Aircraft Corporation.

In addition, but in conjunction with the above, the FAA requires periodic inspections on all aircraft to keep the Airworthiness Certificate in effect. The owner is responsible for assuring compliance with these inspection requirements and for maintaining proper documentation in logbooks and/or maintenance records.

8.3 AIRPLANE INSPECTION PERIODS (Continued)

A spectrographic analysis of the engine oil is available from several sources. This inspection, if performed properly, provides a good check of the internal condition of the engine. To be accurate, induction air filters must be cleaned or changed regularly, and oil samples must be taken and sent in at regular intervals.

8.5 PREVENTIVE MAINTENANCE

The holder of a pilot certificate issued under Federal Aviation Regulations (FAR) Part 61 may perform certain preventive maintenance as defined in the FARs. This maintenance may be performed only on an aircraft which the pilot owns and operates, and which is not used in air carrier or air taxi/commercial operations service.

All other aircraft maintenance must be accomplished by a person or facility appropriately certificated by the Federal Aviation Administration (FAA) to perform that work.

Anytime maintenance is accomplished, an entry must be made in the appropriate aircraft maintenance records. The entry shall include:

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

8.7 AIRPLANE ALTERATIONS

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

8.7 AIRPLANE ALTERATIONS (continued)

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

- (a) To be displayed in the aircraft at all times:
 - (1) Aircraft Airworthiness Certificate Form FAA-8100-2.
 - (2) Aircraft Registration Certificate Form FAA-8050-3.
 - (3) Aircraft Radio Station License if transmitters are installed.
- (b) To be carried in the aircraft at all times:
 - (1) Pilot's Operating Handbook.
 - (2) Weight and Balance data plus a copy of the latest Repair and Alteration Form FAA-337, if applicable.
 - (3) Aircraft equipment list.

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

8.9 GROUND HANDLING

- (a) Towing

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

CAUTION

When towing with power equipment, do not turn the nose gear beyond its steering limits and avoid sudden starts and stops. These events may result in damage to the nose gear, aircraft steering mechanism, or engine mount.

CAUTION

Do not tow the airplane when the controls are secured.

In the event towing lines are necessary, ropes should be attached to both main gear struts as high up on the tubes as possible. Lines should be long enough to clear the nose and/or tail

8.9 GROUND HANDLING (continued)

by not less than fifteen feet, and a qualified person should ride in the pilot's seat to maintain control by use of the brakes.

(b) Taxiing

CAUTION

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

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

- (1) Taxi a few feet forward and apply the brakes to determine their effectiveness.
- (2) Taxi with the propeller set in low pitch, high RPM setting.
- (3) While taxiing, make slight turns to ascertain the effectiveness of the steering.
- (4) Observe wing clearance when taxiing near buildings or other stationary objects. If possible, station an observer outside the airplane.
- (5) When taxiing over uneven ground/unpaved surfaces, avoid holes, ruts, and excessive taxi speeds.
- (6) Avoid excessive taxi speed during turns.
- (7) Do not operate the engine at high RPM when running up or taxiing over ground containing loose stones, gravel, or any loose material that may cause damage to the propeller blades.

(c) Parking

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

- (1) To park the airplane, head it into the wind if possible.
- (2) The parking brake knob is located just below the left control column. To set the parking brake, first depress and hold the toe brakes and then pull out on the parking brake knob. To release the parking brake, first depress the brake pedals and then push in on the parking brake knob.

8.9 GROUND HANDLING (continued)

CAUTION

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

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

(d) Mooring

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

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

CAUTION

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

NOTE

Additional preparations for high winds include using tiedown ropes from the nose landing gear and securing the rudder.

8.9 GROUND HANDLING (continued)

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

8.11 ENGINE INDUCTION AIR FILTER

(a) Removing Induction Air Filter

- (1) Remove louvered induction air panel assembly at nose of aircraft by removing screws.
- (2) Remove screws around perimeter of filter on induction air inlet to withdraw inlet and filter.

(b) Cleaning Induction Air Filter

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

To clean the filter:

- (1) Tap filter gently to remove dirt particles. Do not use compressed air or cleaning solvents.
- (2) Inspect filter. If paper element is torn or ruptured or gasket is damaged, the filter should be replaced. The usable life of the filter should be restricted to one year or 500 hours, whichever comes first.
- (3) After cleaning check all components for dirt and damage. Wipe the filter and inlet clean. Do not oil the filter.

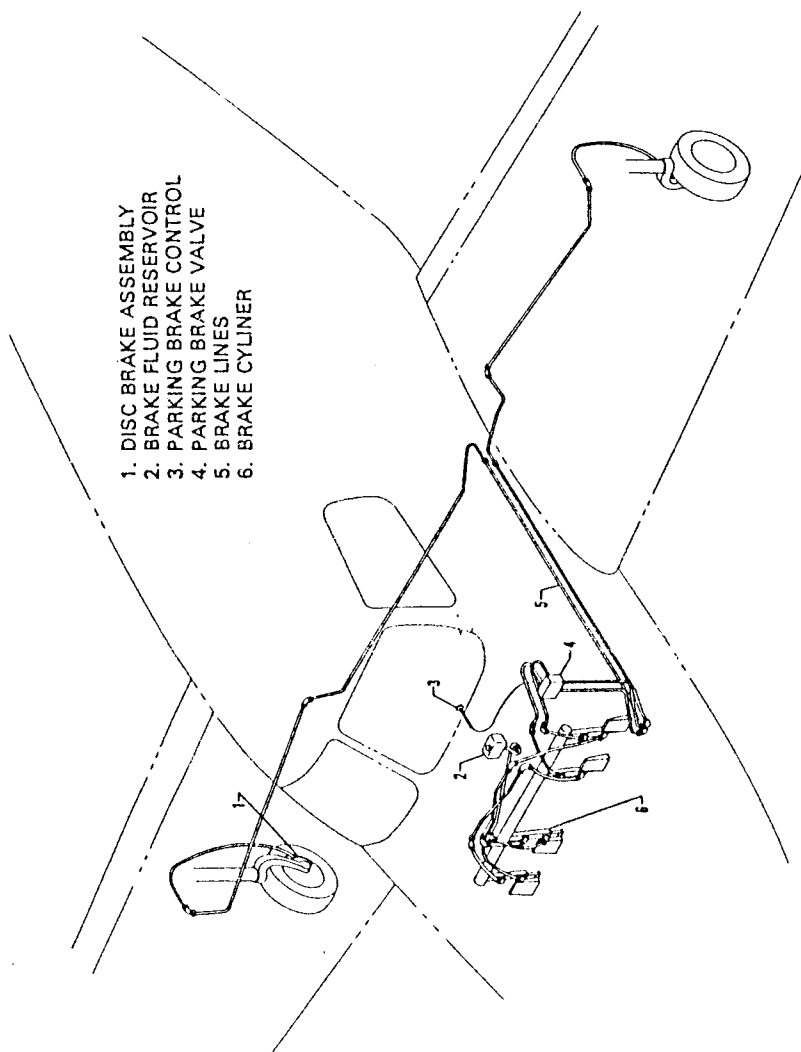
(c) Installation of Induction Air Filter

Replace filter, inlet and screws. Reinstall induction air panel assembly.

8.13 BRAKE SERVICE

The brake system is filled with MIL-II-5606 (petroleum base) hydraulic fluid. The fluid level should be checked periodically or at every 100 hour inspection and replenished when necessary. The brake fluid reservoir is

8.13 BRAKE SERVICE (continued)



BRAKE SYSTEM
Figure 8-1

8.13 BRAKE SERVICE (CONTINUED)

located behind the aft access panel in the forward baggage compartment. If the entire system must be refilled, fill with fluid under pressure from the brake end of the system. This will eliminate air from the system.

No adjustment of the brake clearances is necessary. If, after extended service, brake blocks become excessively worn they should be replaced with new segments.

8.15 HYDRAULIC SYSTEM SERVICE

The hydraulic system reservoir is an integral part of the electric hydraulic pump assembly. It is located aft of the aft cabin baggage compartment and is accessible through the baggage compartment aft closeout panel. Fill the reservoir with MIL-II-5606 hydraulic fluid. The fluid level should be checked periodically or every 100 hour inspection and replenished when necessary. With the landing gear down and the system up to pressure, fill to the FULL line on the sight gauge.

8.17 LANDING GEAR SERVICE

The main landing gear uses Cleveland Aircraft Products 6.00 x 6 wheels with 6.00 x 6, eight-ply rating tires and tubes. The nose wheel uses a McCauley or a Cleveland Aircraft Products 5.00 x 5 wheel with a 5.00 x 5 six-ply rating, type III tire and tube. (Refer to paragraph 8.25.)

Wheels are removed by taking off the hub cap, cotter pin, axle nut, and the two bolts holding the brake segment in place. Mark tire and wheel for reinstallation; then dismount by deflating the tire, removing the three through-bolts from the wheel and separating the wheel halves.

Landing gear oleos should be serviced according to the instructions on the units. The main oleos should be extended under normal static load until 3.44 +/- 0.25 inches of oleo piston tube is exposed, and the nose gear should show 1.65 +/- 0.25 inches. To add air to the oleo struts, attach a strut pump to the valve assembly near the top of the oleo strut housing and pump the oleo to the desired position. To add oil, jack the aircraft, release the air pressure in the strut, remove the valve core and add oil through this opening with the strut extended. After the strut is full, compress it slowly and fully to allow excess air and oil to escape. With the strut still compressed reinsert the valve core and pump up the strut as above.

8.17 LANDING GEAR SERVICE (CONTINUED)

In jacking the aircraft for landing gear or other service, two hydraulic jacks and a tail stand should be used. At least 400 pounds of ballast should be placed on the base of the tail stand before the airplane is jacked up. The hydraulic jacks should be placed under the jack points on the bottom of the wing and the airplane jacked up until the tail skid is at the right height to attach the tail stand. After the tail stand is attached and the ballast added, jacking may be continued until the airplane is at the height desired.

The steering rods from the rudder pedals to the transverse bellcrank in the nose wheel tunnel are factory adjusted and should be readjusted only in accordance with the applicable rigging specification. Nose wheel alignment is accomplished by adjusting the rod end(s) on the steering bungee assembly in such a way that the nose wheel is in line with the fore and aft axis of the plane when the rudder pedals are centered. Alignment of the nose wheel can be checked by pushing the airplane back and forth with the rudder two degrees to the right to determine that the plane follows a straight line. The turning arc of the nose wheel is 30 $\pm$ 1 in either direction and is limited by stops at the trunnion forging or the forward steering contact arm mounted on the engine mount.

NOTE

The rudder is set to 2 right with the rudder pedals neutralized and the nose wheel centered.

8.19 PROPELLER SERVICE

The spinner and backing plate should be cleaned and inspected for cracks frequently. Before each flight the propeller should be inspected for nicks, scratches, and corrosion. Significant damage must be repaired by a qualified mechanic prior to flight. Nicks or scratches cause an area of increased stress which can lead to serious cracks or the loss of a propeller tip. The back face of the blades should be painted when necessary with flat black paint to retard glare. To prevent corrosion, the surface should be cleaned and waxed periodically.

8.21 OIL REQUIREMENTS

The oil capacity of the Textron Lycoming TIO-540-AE2A engine is 12 quarts with an inflight minimum quantity of approximately 2.75 quarts. Maximum endurance flights should begin with 12 quarts of oil. For all shorter flights, it is recommended that oil be added if the quantity falls to 10 quarts. It is recommended that engine oil be drained and renewed every 50 hours, or sooner under unfavorable conditions. Full flow cartridge type oil filters should be replaced each 50 hours of operation. The following grades are required for temperatures:

Average Ambient Temperature	MIL-L-6082B SAE Grade	MIL-L-22851 Ashless Dispersant SAE Grades
All Temperatures	MINERAL OIL NOT APPROVED	15W-50 or 20W-50
Above 80°F		60
Above 60°F		40 or 50
30°F to 90°F		40
0°F to 70°F		30, 40 or 20W-40
Below 10°F		30 or 20W-30

When operating temperatures overlap indicated ranges, use the lighter grade oil.

NOTE

Refer to the latest issued of Lycoming Service Instruction 1014 (Lubricating Oil Recommendations) for further information.

8.23 FUEL SYSTEM

(a) Servicing Fuel System

At every 100 hour inspection or after an extended downtime, the fuel filter strainer must be cleaned. The fuel filter strainer is located below the floor on the lower right side of the forward baggage compartment.

(b) Fuel Requirements (AVGAS ONLY)

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

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

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

FUEL GRADE COMPARISON CHART

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

* -Grade 100LL fuel in some overseas countries is currently colored green and designated as "100L."

** -Commercial fuel grade 100 and grade 100/130 (both of which are colored green) having TEL content of up to 4 ml/U.S. gallon are approved for use in all engines certificated for use with grade 100/130 fuel.

8.23 FUEL SYSTEM (CONTINUED)

The operation of the aircraft is approved with an anti-icing additive in the fuel. When an anti-icing additive is used it must meet the specification MIL-1-27686, must be uniformly blended with the fuel while refueling, must not exceed .15% by volume of the refueled quantity, and to ensure its effectiveness should be blended at not less than .10% by volume. One and one half liquid ounces per ten gallons of fuel would fall within this range. A blender supplied by the additive manufacturer should be used. Except for the information contained in this section, the manufacturer's mixing or blending instructions should be carefully followed.

CAUTIONS

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

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

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

(c) Filling Fuel Tanks

WARNINGS

Do not operate any avionics or electrical equipment on the airplane during refueling. Do not allow open flame or smoking in the vicinity of the airplane while refueling.

During all refueling operations, fire fighting equipment must be available. Two ground wires from different points on the airplane to separate approved grounding stakes shall be used.

8.23 FUEL SYSTEM (CONTINUED)

Observe all safety precautions required when handling gasoline. Fill the fuel tanks through the filler located on the forward slope of the wing. Each wing holds a maximum of 60 U.S. gallons. When using less than the standard 120 gallon capacity, fuel should be distributed equally between each side.

NOTE

Aircraft should be refueled in a wing level condition. At times this will require alternate filling of left and right tanks until the full condition is reached.

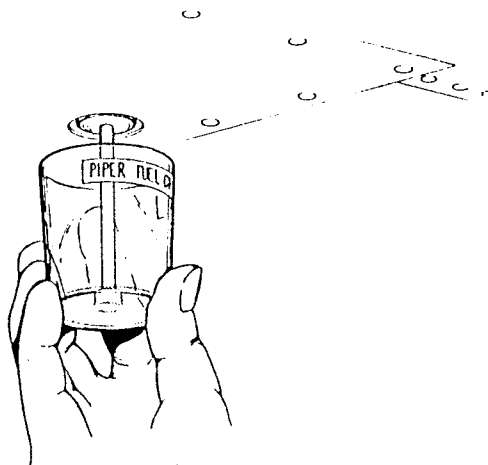
(d) Draining Fuel Strainer, Sumps and Lines

The fuel tank sumps and filter should be drained before the first flight of the day and after refueling. Set fuel selector on left or right tank before draining. The fuel collector/sump tanks, located at the root of each wing, are the lowest points in the system. Each tank drain is accessible through a hole in the bottom wing skin adjacent to the wheel well. The fuel filter drain is located on the right hand side of the fuselage several feet forward of the wing. Sumps and filter should be drained until sufficient fuel has flowed to ensure the removal of any contaminants. When draining sumps, use the end on sampler cup to push in valve, catching fuel in the cup. (Refer to Figure 8-3) To drain filter, hold sampler cup under nylon tube and push in tube. Always inspect fuel for contaminants, water and fuel grade (color). Assure that valves have sealed after draining.

NOTE

Sump drains will lock open if valve is pushed in and turned. Continue turning to release lock.

8.23 FUEL SYSTEM (continued)



FUEL TANK DRAIN

Figure 8-3

(e) Emptying Fuel System

Drain the bulk of fuel at sump tanks. Set fuel selector on left or right tank. Push in sump drain valves and twist $\frac{1}{4}$ turn to lock open. Remaining fuel may be drained through the filter drain. Close sump drain valves before refueling.

CAUTION

Whenever the fuel system is completely drained and fuel is replenished it will be necessary to run the engine for a minimum of three minutes at 1000 rpm on each tank to insure that no air exists in the fuel supply lines.

8.25 TIRE INFLATION

For maximum service, keep tires inflated to the proper pressure: 50 psi for the nose tire and 55 psi for the main tires. All wheels and tires are balanced before original installation, and the relationship of tire, tube, and wheel should be maintained upon reinstallation. Unbalanced wheels can cause extreme vibration in the landing gear; therefore, in the installation of new components, it may be necessary to rebalance the wheels with the tires mounted. When checking tire pressure, examine the tires for wear, cuts, bruises, and slippage.

8.27 BATTERY SERVICE

Access to the 24-volt battery is gained by opening the forward baggage door and removing the left floor of the forward baggage compartment. The battery should be checked for proper fluid level. DO NOT fill the battery above the baffle plates. DO NOT fill the battery with acid - use water only. A hydrometer check will determine the percent of charge in the battery.

Inspect overflow sump for presence of battery fluid. Fluid in the sump is not a normal condition and indicates either a battery or charging system problem. If fluid is present, the electrical system must be serviced to eliminate cause and the neutralizer media in the sump jar replaced.

If the battery is not up to charge, recharge starting at a 3 amp rate and finishing with a 1.5 amp rate. Quick charges are not recommended.

8.29 EMERGENCY OXYGEN SYSTEM (OPTIONAL)

The optional emergency oxygen system must be serviced if used. The canister generators must be replaced with new units to restore the emergency system to a useable condition.

8.31 PRESSURIZATION SYSTEM

The system should be given an operational check before each flight. Should the operational check show any malfunction of the pressurization system, refer to the Malibu Service Manual.

8.33 LUBRICATION

For lubricating instructions, a chart showing lubrication points and types of lubricants to be used, and lubrication methods, refer to the PA-46-310/350P Maintenance Manual.

8.35 CLEANING

(a) Cleaning Engine Compartment

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

CAUTION

Do not spray solvent into the alternators, vacuum pumps, starter, or air intakes.

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

CAUTION

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

- (4) Lubricate the controls, bearing surfaces, etc., in accordance with the Lubrication Chart in the PA-46-310/350P Maintenance Manual.
- (5) Assure that all engine exhaust deposits and stains are removed frequently from bottom of aircraft around exhaust outlets. *Accumulation of exhaust deposits left even over short periods of time will cause corrosion.*

8.35 CLEANING (CONTINUED)

(b) Cleaning Landing Gear

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

CAUTION

Do not brush the micro switches.

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

(c) Cleaning Exterior Surfaces

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

CAUTION

Do not direct any stream of water or cleaning solutions at the openings in the pitot head, static ports, alternate static ports or fuselage belly drains.

- (1) Flush away loose dirt with water.
- (2) Apply cleaning solution with a soft cloth, a sponge or a soft bristle brush.
- (3) To remove exhaust stains, allow the solution to remain on the surface longer.
- (4) To remove stubborn oil and grease, use a cloth dampened with naphtha.
- (5) Rinse all surfaces thoroughly.
- (6) Any good automotive wax may be used to preserve painted surfaces. Soft cleaning cloths or a chamois should be used to prevent scratches when cleaning or polishing. A heavier coating of wax on the leading surfaces will reduce the abrasion problems in these areas.

8.35 CLEANING (CONTINUED)

(d) Cleaning Windshield and Windows

CAUTION

Use only mild soap and water when cleaning the heated windshield. Use of ANY other cleaning agent or material may cause distortion or damage to windshield coatings.

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

CAUTION

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

- (4) After cleaning plastic surfaces, apply a thin coat of hard polishing wax. Rub lightly with a soft cloth. Do not use a circular motion.
- (5) A minor scratch or mar in plastic can be removed by rubbing out the scratch with jeweler's rouge. Smooth both sides and apply wax. Deep scratches may lead to failure when pressurized.
- (6) If a deep scratch or crack is found in any of the windshields or windows, do not pressurize cabin until serviced at authorized repair station.

(e) Cleaning Headliner, Side Panels and Seats

- (1) For normal soiling and smudges, simply use the dry cleaning pad provided. This pad contains an exclusive grit-free powder with unusual power to absorb dirt.

Squeeze and twist the pad so the powder sifts through the meshes and adheres to the cloth. Then rub the soiled part in any direction, as hard as necessary to clean.

Even though the pad eventually becomes soiled, this soil will not transfer back to the headliner.

8.35 CLEANING (CONTINUED)

- (2) For simple stains (e.g. coffee, cola) clean headliner with a sponge and a common household suds detergent (e.g. Tide). Dirty grease stains should be first spot cleaned with a lighter fluid containing Naphtha to remove the solvent soluble matter. Any stain residue should then be shampooed with a household upholstery cleaner (e.g. Carbona upholstery and rug shampoo).

With proper care, your Malibu headliner will provide years of excellent appearance and durability.

CAUTION

Solvent cleaners require adequate ventilation.

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

(f) Cleaning Carpets

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

(g) Cleaning Oxygen Equipment

- (1) Clean the mask assemblies with a suitable oil-free disinfectant.
- (2) Wipe dirt and foreign particles from the unit with a clean, dry, lint-free cloth.

(h) Cleaning Surface Deicing Equipment*

The deicers should be cleaned when the aircraft is washed using a mild soap and water solution.

In cold weather, wash the boots with the airplane inside a warm hangar if possible. If the cleaning is to be done outdoors, heat the soap and water solution before taking it out to the

*Optional equipment

8.35 CLEANING (CONTINUED)

airplane. If difficulty is encountered with the water freezing on boots, direct a blast of warm air along the region being cleaned using a portable ground heater.

Petroleum products are injurious to rubber and their use as cleaning agents should be avoided. Limited use of Mineral Spirits or non-leaded (NOT LOW LEAD) gasoline is not harmful in cleaning the deicers, if the cloth is dampened (not dripping) with solvent, and a dry cloth is used to wipe the deicer before the solvent has time to soak into the rubber.

With the deicer boots properly cleaned, a coating of Agemaster No. 1 should be applied as described in the Malibu Service Manual. This treatment helps protect the boot rubber from ozone attack, aging and weathering.

After the Agemaster coating is dry, a coating of B.F. Goodrich Icxex may be applied to the boots if icing conditions are anticipated. For specific instructions refer to the Malibu Service Manual.

8.36 CLEANING AND MAINTENANCE OF RELIEF TUBE SYSTEM

When the aircraft is equipped with a relief tube system, the corrosive effects of urine or other liquids poured through the system are extreme and require much attention to the cleanliness of this system both inside and outside of the aircraft. From the interior standpoint, the funnel tube assembly, rubber hose and surrounding sheet metal should be cleaned at termination of flight when the system has been used. Likewise, attention to the exterior of the aircraft is equally as important and must be cleaned as described below.

The corrosive affects of urine on painted and unpainted surfaces cannot be understated. Corrosion may appear in surrounding areas if allowed to go uncleaned for one day.

(a) Interior

After each use of the relief tube, the area surrounding the relief tube should be examined for spillage and cleaned according to the cleaning procedures listed in paragraphs 8.35(e) and (f) above. Clean area inside the box and access door, funnel and tube using mild soap and water. After cleaning, assure that no soapy residue remains by flushing with clean water. Dry system thoroughly.

CAUTION

Should spillage extending into the fuselage be evident, maintenance actions must occur which include removing panels to access the floor structure to neutralize urine spillage in the aircraft structure.

Prepare to flush the relief tube assembly by placing a container underneath the relief tube outlet to catch the cleaning solution. Flush tube by pouring a solution of baking soda (10%) and water through the tube, flushing out the entire system. Flush again with at least 1/2 gallon of clear water. (Shop air, at low pressure, may be blown through the relief tube system to dry the system.)

(b) Exterior

Exterior bottom painted surfaces of the aircraft must be cleaned from the firewall to the tip of the tail including the bottom of the tail surfaces, at termination of each flight when the relief tube system has been used. Cleaning should occur in accordance with paragraph 8.35(c) with the following exception: After completion of washing, a solution of baking soda (10%) and water should be applied to the entire area and allowed to remain for a few minutes. The area then must be thoroughly rinsed with clean water. The area should be thoroughly dried and observed for paint chips and corrosion, with touch up as necessary.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

SECTION 9

SUPPLEMENTS

Paragraph/Supplement No.		Page No.
9.1	General	9-1
1	King KNS-80 Area Navigation System(14 Pages)	9-3
2	King KNS-81 Area Navigation System(12 Pages)	9-17
3	Minneapolis Honeywell WeatherScout Weather Radar System(6 Pages)	9-29
4	Emergency Oxygen System(6 Pages)	9-35
5	Propeller Heat, Heated Windshield, and Wing Ice Detection Light(6 Pages)	9-41
6	Ice Protection System(16 Pages)	9-47
7	King 150 Series Flight Control (DELETED per Rev. 8) System(30 Pages)	9-63
8	King KAS 297B Vertical Speed and Altitude Selector(8 Pages)	9-93
9	Northstar M1 Loran C Navigator with KAP/KFC 150 Autopilot System(4 Pages)	9-101
10	II Morrow, Inc. Apollo II, Model 612, Loran C Navigation System with KAP/KFC 150 Autopilot System(6 Pages)	9-105
11	Shadin Fuel Management System(6 Pages)	9-111
12	3M (Series II) Stormscope, WX-1000/1000+(4 Pages)	9-117
13	King KHF-950 HF Transceiver.....(2 Pages)	9-121

TABLE OF CONTENTS (cont)

SECTION 9 (cont)

SUPPLEMENTS

Paragraph/Supplement No.		Page No.
14	Bendix/King RDS 81 Digital Weather Radar.....(6 Pages)	9-123
15	Bendix/King RDS 82/82VP Digital Weather Radar.....(8 Pages)	9-129
16	Bendix/King KLN 88 Loran C Navigation System With KAP/KFC 150 Autopilot System(6 Pages)	9-137
17	Bendix/King EHI 40 Electronic Horizontal Situation Indicator(30 Pages)	9-145
18	Bendix/King KLN 90 GPS Navigation System with KAP/KFC 150 Autopilot System.....(4 Pages)	9-171
19	Shadin Fuel Managment System MINIFLO L.....(6 pages)	9-175
20	Bendix/King KLN 90A GPS Navigation System with KAP/KFC 150 Autopilot System.....(4 Pages)	9-181
21	Bendix/King RDR 2000 Vertical Profile Weather Radar System(10 Pages)	9-185
22	ARGUS 5000 Moving Map Display(8 Pages)	9-195
23	Bendix/King KLN 90B GPS Navigation System with KAP/KFC 150 Autopilot System.....(12 Pages)	9-203

**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.

THIS PAGE INTENTIONALLY LEFT BLANK

GARMIN International, Inc.
1200 E. 151st Street
Olathe, Kansas 66062 U.S.A.

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for the

GARMIN G500 PRIMARY FLIGHT AND
MULTIFUNCTION DISPLAY SYSTEM
as installed in

PIPER PA46-350P

Make and Model Airplane

Registration Number: N9153W Serial Number: 4622012

This document serves as an Airplane Flight Manual Supplement or as a Supplemental Airplane Flight Manual when the aircraft is equipped in accordance with Supplemental Type Certificate SA02015SE-D for the installation and operation of the Garmin G500 PFD/MFD System. This document must be carried in the airplane at all times.

The information contained herein supplements or supersedes the information made available to the operator by the aircraft manufacturer in the form of clearly stated placards or markings, or in the form of an FAA approved Airplane Flight Manual, only in those areas listed herein. For limitations, procedures and performance information not contained in this document, consult the basic placards or markings, or the basic FAA approved Airplane Flight Manual.

FAA APPROVED BY: _____



Michael Warren
ODA STC Unit Administrator
GARMIN International, Inc
ODA-240087-CE

Date: FEB. 4, 2014

LOG OF REVISIONS

Revision Number	Page Number	Description	FAA Approval
1	All	Complete Supplement	David Armstrong ODA STC Unit Administrator GARMIN International, INC ODA-240087-CE Date: 07/30/2009
2	9 10 14	Remove requirement for standby ADI for VFR operations/installations. Add maximum airspeed limitation section.	Robert Grove ODA STC Unit Administrator GARMIN International, INC ODA-240087-CE Date: 12/10/2009
3	All	Correct page numbering.	Robert Grove ODA STC Unit Administrator GARMIN International, INC ODA-240087-CE Date: 07/30/2010
4	None	Rerelease document.	Robert Grove ODA STC Unit Administrator GARMIN International, INC ODA-240087-CE Date: 08/24/2010
5	All	Changed GPS/WAAS to GPS/SBAS. Corrected typographical errors.	Robert Grove ODA STC Unit Administrator GARMIN International, Inc ODA-240087-CE Date: 02/23/2011
	7	Updated section 1.1 for new features.	
	10	Added new feature descriptions to sections 1.7, 1.8, and 1.9.	
	11, 12	Updated block diagrams for new features.	
	14	Updated section 2.2 for applicability to this AFMS revision. Removed GPS navigator software table.	
	14, 15	Updated section 2.3 with limitation on use of helicopter databases and SD card usage with GSR 56 datalink. Added information on airport directory database.	

LOG OF REVISIONS			
Revision Number	Page Number	Description	FAA Approval
	16	Updated section 2.8 to reflect current airspeed tape behavior.	
	18	Updated section 2.14 to better describe the terrain awareness function. Updated section 2.16 for GFDS weather function.	
	23	Corrected description of heading and AHRS failures.	
	24	Corrected description of ADC failure.	
	26	Corrected table entry for AHRS ALIGN.	
	28	Added new section 4.4 for altitude alerter configuration.	
	29	Added detail to section 4.6 regarding GAD 43 interface. Corrected description of autopilot interfaces in section 4.6.1.	
	31	Corrected altitude alerter description in section 4.6.6.	
	32	Added Caution and Note regarding GAD 43 AP TEST function in section 4.6.7.	
6	All	Changed GNS navigator references to GPS/SBAS navigator references.	Robert Grove ODA STC Unit Administrator GARMIN International, Inc ODA-240087-CE Date: 04/01/2011
	11	Inserted new section 1.10 for HSDB interface description.	
	15	Inserted new section 2.3 for moving map limitations.	
	24	Moved rate-of-turn failure description from section 3.3.1 to section 3.3.2.	
	29	Added checkbox for disabled altitude alerter in section 4.4.	

LOG OF REVISIONS			
Revision Number	Page Number	Description	FAA Approval
7	All	Re-issue complete supplement.	Robert Grove ODA STC Unit Administrator GARMIN International, Inc ODA-240087-CE Date: 08-18-2011
		Revised section 2.14 limitation on GPS/SBAS vertical coupling.	
		Added attitude/air data interface to section 4.6.	
		Added GDU 620 as an autopilot attitude source to section 4.6.1.	
		Clarified dual autopilot interface in section 4.6.9.	

LOG OF REVISIONS			
Revision Number	Page Number	Description	FAA Approval
8	All	Re-issue complete supplement.	Michael Warren ODA STC Unit Admin. Garmin Int'l, Inc. ODA-240087-CE Date: 12/26/2012
		Revised information on system power sources in section 1.2	
		Revised audio panel description in section 1.6.	
		Updated block diagrams in sections 1.11 and 1.12.	
		Updated System Software Requirements in section 2.2.	
		Revised Moving Map limitation in Section 2.3.	
		Revised SafeTaxi and Airport Directory descriptions in section 2.4.	
		Clarified applicability of section 2.11.	
		Updated autopilot interface information in section 2.14.	
		Revised external TAWS annunciation information in section 2.16.	
		Added limitation for KFC 275/325 interface in section 2.21.	
		Added ESI-1000 limitation in section 2.22.	
		Added EFB limitation in Section 2.23.	
		Added Surface Operations limitation in Section 2.24.	
		Added MFD Video limitation in Section 2.25.	
		Emergency Procedures reorganized into Section 3.1.	
		Abnormal Procedures reorganized into Section 3.2.	
		Added MISCOMP and NO AP DATA annunciations in section 3.3.2.	
		Added airspeed bug description in Section 4.1.	
		Removed Altitude Alerter section 4.4.	
		Added electric standby attitude indicator procedure as new section 4.4.	
		Updated autopilot procedures throughout section 4.6.	

LOG OF REVISIONS			
Revision Number	Page Number	Description	FAA Approval
9	All	Re-issue complete supplement.	See Page 1
		Corrected navigation radio information in Section 1.1.	
		Updated applicable system software in Section 2.2.	
		Corrected Auto Slew description in Section 2.12.	
		Updated Bendix/King Altitude Preselect functionality in Section 4.6.6.3.	

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
SECTION 1. GENERAL.....	9
1.1 GARMIN G500 PRIMARY FLIGHT / MULTI-FUNCTION DISPLAY SYSTEM	9
1.2 SYSTEM POWER SOURCES.....	9
1.3 NAVIGATION SOURCES	10
1.4 SYNTHETIC VISION TECHNOLOGY	10
1.5 AUTOPILOT INTERFACE.....	11
1.6 AUDIO PANEL.....	12
1.7 TRAFFIC AND WEATHER SYSTEMS	12
1.8 VIDEO SOURCES.....	12
1.9 RADAR ALTIMETER	12
1.10 HIGH SPEED DATA BUS INTERFACE	12
1.11 SINGLE G500 OPERATIONAL BLOCK DIAGRAM.....	13
1.12 DUAL G500 OPERATIONAL BLOCK DIAGRAM.....	14
1.13 DEFINITIONS.....	15
SECTION 2. LIMITATIONS.....	16
2.1 COCKPIT REFERENCE & PILOT'S GUIDE	16
2.2 SYSTEM SOFTWARE REQUIREMENTS	16
2.3 MOVING MAP	16
2.4 DATABASE CARDS.....	16
2.5 AHRS OPERATIONAL AREA	17
2.6 MAGNETIC VARIATION OPERATIONAL AREA	17
2.7 NAVIGATION ANGLE	18
2.8 AHRS NORMAL OPERATING MODE.....	18
2.9 AIRSPEED LIMITATIONS AND INDICATOR MARKINGS.....	18
2.10 AEROBATIC MANEUVERS	18
2.11 ELECTRIC STANDBY ATTITUDE GYRO.....	18
2.12 COURSE POINTER AUTO SLEWING	19
2.13 SYNTHETIC VISION TECHNOLOGY.....	19
2.14 AUTOPILOT INTERFACE.....	19
2.15 TERRAIN PROXIMITY FUNCTION	20
2.16 TAWS ANNUNCIATIONS ON THE PFD [FROM A GARMIN NAVIGATOR]	20
2.17 DATALINKED WEATHER DISPLAY (XM OR GFDS WEATHER)	20
2.18 TRAFFIC DISPLAY	20
2.19 ACTIVE WEATHER RADAR	21
2.20 KINDS OF OPERATIONS	22
2.21 KFC 275/325 ALTITUDE PRESELECT	22
2.22 L-3 ESI-1000 ELECTRONIC STANDBY INSTRUMENT.....	23
2.23 ELECTRONIC FLIGHT BAG (EFB) APPLICATIONS.....	23
2.24 SURFACE OPERATIONS	23
2.25 MFD VIDEO DISPLAY	23
SECTION 3. EMERGENCY PROCEDURES.....	24
3.1 EMERGENCY PROCEDURES	24
3.2 ABNORMAL PROCEDURES.....	27
3.3 WARNINGS, CAUTIONS, AND ADVISORIES	29
SECTION 4. NORMAL PROCEDURES.....	32
4.1 PFD KNOB & PFD SOFT KEYS	32
4.2 MFD KNOBS & MFD SOFT KEYS.....	32

4.3 ALTITUDE SYNCHRONIZATION..... 33

4.4 ELECTRIC STANDBY ATTITUDE GYRO 33

4.5 SYNTHETIC VISION TECHNOLOGY 33

4.6 AUTOPILOT OPERATIONS WITH THE G500 SYSTEM 34

SECTION 5. PERFORMANCE 40

SECTION 6. WEIGHT AND BALANCE..... 40

SECTION 7. SYSTEM DESCRIPTIONS 40

Section 1. GENERAL

1.1 Garmin G500 Primary Flight / Multi-Function Display System

The G500 PFD/MFD System consists of a Primary Flight Display (PFD) and Multi-Function Display (MFD) housed in a single Garmin Display Unit (GDU), plus an Air Data Computer (ADC) and Attitude and Heading Reference System (AHRS). The G500 interfaces with other installed systems in the aircraft, including Garmin GPS/SBAS navigators, VHF navigation radios, Garmin GDL 69 data link radios, Garmin GSR 56 Iridium transceivers, and various weather radars, audio panels, video sources, radar altimeters, traffic systems and ADF navigators.

The primary function of the PFD is to provide attitude, heading, air data and navigation information to the pilot. The primary function of the MFD is to provide mapping, terrain, and flight plan information.

The standby instruments (altimeter, airspeed, attitude, and magnetic compass) are completely independent from the PFD and will continue to operate in the event the PFD is not usable. These standby instruments should be included in the pilot's normal instrument scan and may be referenced if the PFD data is in question. A second G500 system installed on the co-pilot's side does not require additional standby instruments.

1.2 System Power Sources

The G500 system depends on electrical power to maintain proper operation. The Garmin Display Unit (GDU), Attitude and Heading Reference System (AHRS), and Air Data Computer (ADC) are directly tied to the aircraft's main or essential bus and energized when the aircraft master switch is turned on. Other systems, like the navigation equipment, weather datalink, autopilot and Adapter (GAD) are typically located on the avionics bus and may not be operable during engine start.

The major components of the G500 are circuit breaker protected with resettable type breakers available to the pilot. These breakers are located at the main or essential bus circuit breaker panel and labeled as follows:

1. PFD - Garmin Display Unit (PFD/MFD), GDU 620
2. AHRS - Attitude and Heading Reference System, GRS 77
3. ADC - Air Data Computer, GDC 74A
4. GAD - Garmin Adapter, GAD 43/43e (optional)
5. STBY ATT- Electric Standby Attitude Gyro

In dual installations the pilot side equipment is suffixed with the number 1 and the copilot side equipment is suffixed with the number 2. For example: PFD 1 and PFD 2.

Equipment that receives power from two different circuit breakers will be suffixed with the letters A and B. For example: PFD 1A and PFD 1B, or PFD 2A and PFD 2B.

1.3 Navigation Sources

The G500 requires at least one Garmin GPS/SBAS navigation unit to ensure the integrity of the Attitude and Heading Reference System. The AHRS will still operate in a reversionary mode if the GPS fails, and the PFD attitude display will still be presented, see Paragraph 2.8. The G500 HSI can be selected to display course deviation information from up to four independent sources: two GPS, and two VHF NAV. In addition, the HSI can display two simultaneous bearing pointers sourced from GPS, VHF NAV, or ADF.

1.4 Synthetic Vision Technology

SVT uses an internal terrain database and GPS location to present the pilot with a synthetic view of the terrain in front of the aircraft. The purpose of the SVT system is to assist the pilot in maintaining situational awareness with regard to the terrain and traffic surrounding the aircraft. A typical SVT display is shown below:



SVT provides additional features on the G500 primary flight display (PFD) which display the following information:

- **Synthetic Terrain**; an artificial, database derived, three dimensional view of the terrain ahead of the aircraft within a field of view of approximately 25 degrees left and 25 degrees right of the aircraft heading.
- **Obstacles**; obstacles such as towers, including buildings over 200 AGL that are within the depicted synthetic terrain field of view.
- **Flight Path Marker (FPM)**; an indication of the current lateral and vertical path of the aircraft. The FPM is always displayed when synthetic terrain is selected for display.
- **Traffic**; a display on the PFD indicating the position of other aircraft detected by a traffic system interfaced to the G500 system.
- **Horizon Line**; a white line indicating the true horizon is always displayed on the SVT display.
- **Horizon Heading**; a pilot selectable display of heading marks displayed just above the horizon line on the PFD.
- **Airport Signs**; pilot selectable “signposts” displayed on the synthetic terrain display indicating the position of nearby airports that are in the G500 database.
- **Runway Highlight**; a highlighted presentation of the location and orientation of the runway(s) at the destination airport.

The synthetic terrain depiction displays an area approximating the view from the pilot’s eye position when looking directly ahead out the windshield in front of the pilot. Terrain features outside this field of view are not shown on the display. The synthetic terrain display is intended to aid the pilot awareness of the terrain and obstacles in front of the airplane. It may not provide either the accuracy or fidelity, or both, on which to solely base decisions and plan maneuvers to avoid terrain or obstacles. The synthetic vision elements are not intended to be used for primary aircraft control in place of the primary flight instruments.

1.5 Autopilot Interface

The G500 may be interfaced to an optional autopilot. The G500 typically provides course and heading datum to the autopilot based on the data selected for display on the HSI. For multiple GPS/NAV systems, the G500 acts as a selection hub for the autopilot’s NAV mode, and the G500 may also provide GPS Steering data. Some autopilots may provide Flight Director capabilities which can be displayed on the G500 Attitude Indicator as a Single Cue Flight Director.

1.6 Audio Panel

The G500 PFD/MFD system should be interfaced into the aircraft audio panel to provide aural altering generated by the G500 (required for SVT installations).

1.7 Traffic and Weather Systems

The G500 PFD/MFD system supports TIS traffic via the Garmin GTX Series Mode-S Transponders. The system also supports TAS/TCAS/TIS traffic from various active traffic awareness systems. The information from these systems is available and controllable on the MFD.

The G500 PFD/MFD system supports XM datalink weather via the Garmin GDL69 and GDL69A receivers. If an optional XM datalink receiver is installed, the pilot will be able to access graphical and text weather products on the MFD and control the audio entertainment data from the MFD while listening via an appropriately installed audio panel.

Datalink weather is also available via the Garmin GSR 56 Iridium Transceiver. The control and display of Iridium satellite weather on the MFD is similar to XM weather.

Control and display of various airborne weather radars is optionally available on the MFD. The G500 supports Garmin GWX weather radar, as well as certain 3rd-party weather radars.

1.8 Video sources

The G500 Avionics Display System can display images from up to 2 video inputs. Video images are displayed on the MFD. The G500 does not provide a means to control the video source; however the digital images from the video source can be adjusted using the G500.

1.9 Radar Altimeter

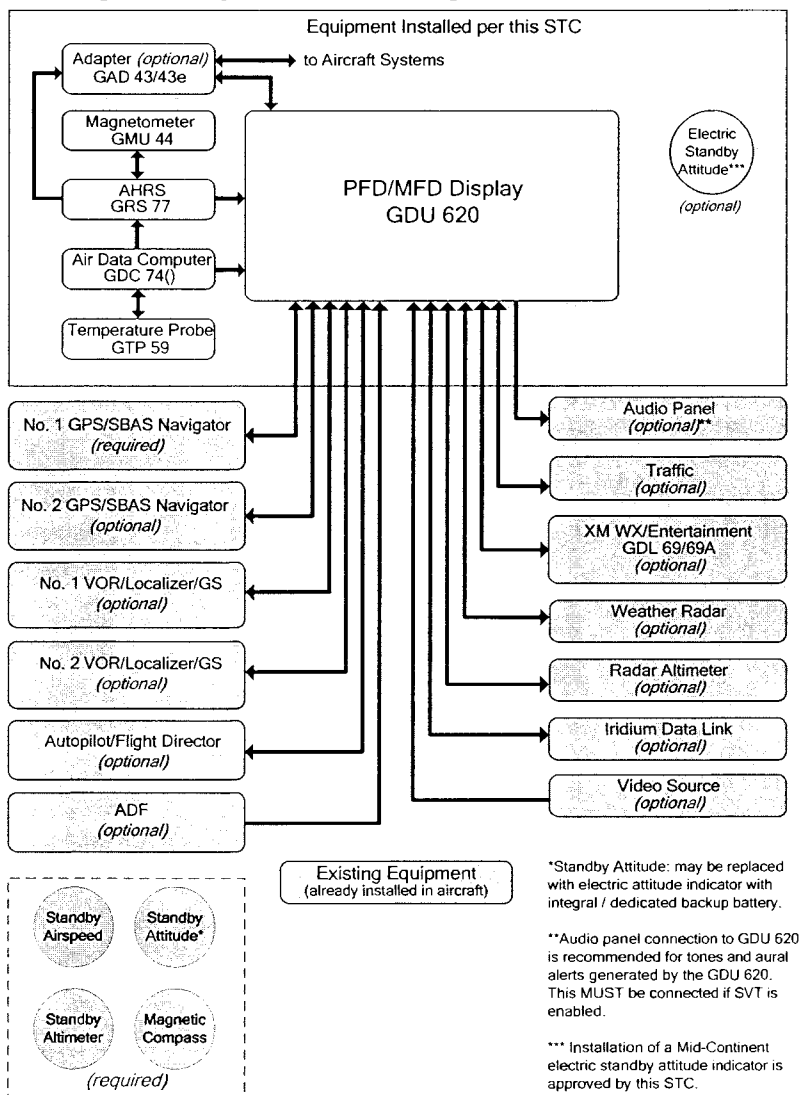
The G500 supports the display of radar altitude on the PFD from supported radar altimeters.

1.10 High Speed Data Bus Interface

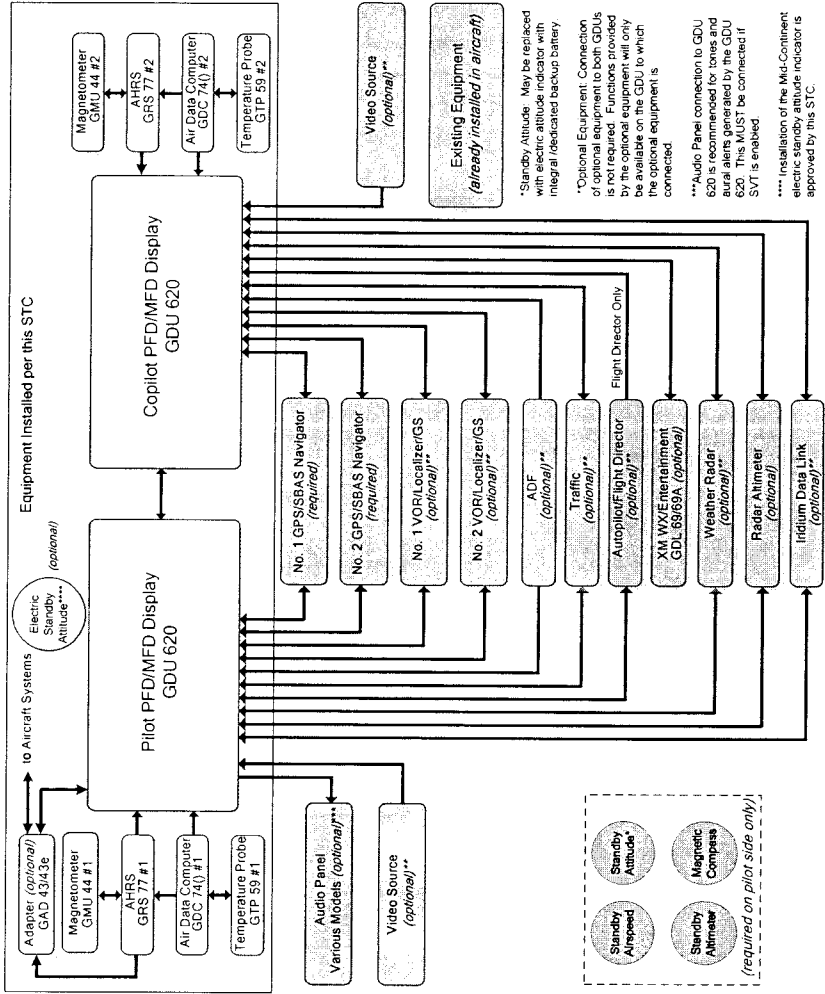
Some Garmin equipment connected to the G500 system utilizes the High Speed Data Bus (HSDB) interface. HSDB is similar to an Ethernet bus and provides a high-speed interface between Garmin avionics. Like Ethernet, data between two units may be passed through intermediate “hub” units. Interfaced equipment that uses HSDB includes the GTN 6XX/7XX navigators, GDL 69 datalink receiver, GWX 68, and GTS 8XX traffic systems.

The HSDB interfaces are installed to so that maximum data path redundancy is achieved. However, depending on the number of HSDB units installed, failure of one HSDB unit may result in loss of data on the G500 from “downstream” HSDB units. Any loss of data will be annunciated on the G500.

1.11 Single G500 Operational Block Diagram



1.12 Dual G500 Operational Block Diagram



1.13 Definitions

The following terminology is used within this document:

ADC:	Air Data Computer
ADF:	Automatic Direction Finder
AHRS:	Attitude & Heading Reference System
AUX:	Auxiliary
BARO:	Barometric Pressure
BRG:	Bearing
CDI:	Course Deviation Indicator
CRS:	Course
FD:	Flight Director
FPM:	Flight Path Marker
GDU:	Garmin Display Unit
GPS:	Global Positioning System
GPSS:	GPS Roll Steering
HDG:	Heading
HSI:	Horizontal Situation Indicator
IFR:	Instrument Flight Rules
IMC:	Instrument Meteorological Conditions
LOI:	Loss of Integrity
MFD:	Multi Function Display
PFD:	Primary Flight Display
SBAS:	Space-based Augmentation System
SD:	Secure Digital
SVT:	Synthetic Vision Technology
TAS:	Traffic Awareness System
TAWS:	Terrain Awareness and Warning System (a TSO-C151b function)
TCAS:	Traffic Collision and Avoidance System
TIS:	Traffic Information Service
VFR:	Visual Flight Rules
VMC:	Visual Meteorological Conditions
V/S:	Vertical Speed

Section 2. LIMITATIONS

2.1 Cockpit Reference & Pilot’s Guide

The Garmin G500 Cockpit Reference Guide P/N 190-01102-03, Revision A or later appropriate revision must be immediately available to the flight crew.

Garmin also provides a detailed G500 Pilot’s Guide P/N 190-01102-02. This reference material is not required to be on board the aircraft but does contain a more in depth description of all the functions and capabilities of the G500.

2.2 System Software Requirements

The G500 must utilize the following or later FAA approved software versions for this AFMS revision to be applicable:

Component	Identification	Software Version
GDU 620	PFD/MFD	6.21
GRS 77	AHRS	3.04

2.3 Moving Map

The moving map on the MFD is advisory in nature and is not approved for course guidance. The moving map on the MFD must be cross checked for correctness against the PFD HSI, published charts, or other approved sources of navigation information.

2.4 Database Cards

Databases identified as intended for helicopter use must not be used. These databases may be identified by the word “HELI” or “HELICOPTER” in their title.

The G500 utilizes several databases. Database titles display in yellow if expired or in question (Note: the G500 receives the calendar date from the GPS, but only after acquiring a position fix.). Database cycle information is displayed at power up on the MFD screen, but more detailed information is available on the AUX pages. Internal database validation prevents incorrect data from being displayed.

The upper Secure Digital (SD) data card slot is typically vacant as it is used for software maintenance and navigational database updates. The lower data card slot should contain a data card with the system’s terrain / obstacle information and optional data including Safe Taxi, FliteCharts and ChartView electronic charts.

CAUTION

When interfaced with a GSR56 Iridium transceiver only one SD card may be present in the GDU620 and it must be in the lower slot.

The terrain databases are updated periodically and have no expiration date. Coverage of the terrain database is between North 75° latitude and South 60° latitude in all longitudes. Coverage of the airport terrain database is worldwide.

The obstacle database contains data for obstacles, such as towers, that pose a potential hazard to aircraft. Obstacles 200 feet and higher are included in the obstacle database. It is very important to note that not all obstacles are necessarily charted and therefore may not be contained in the obstacle database. Coverage of the obstacle database includes the United States and Europe. This database is updated on a 56-day cycle.

The Garmin SafeTaxi database contains airport diagrams for selected airports. This database is updated on a 56-day cycle.

The Garmin FliteCharts database contains procedure charts for the coverage area purchased. This database is updated on a 28-day cycle. If not updated within 180 days of the expiration date, FliteCharts will no longer function.

The Jeppesen ChartView electronic charts database contains procedure charts for the coverage area purchased. An own-ship position icon will be displayed on these charts. This database is updated on a 14-day cycle. If not updated within 70 days of the expiration date, ChartView will no longer function.

The airport directory database contains information on landing facilities, such as operating hours, services available, and transportation/lodging resources. Airport directory information may be available from multiple sources and coverage areas. This database is updated on a 56-day cycle.

2.5 AHRS Operational Area

The AHRS used in the G500 is limited in its operational area: IFR Operations are prohibited north of 72°N and south of 70°S latitudes. In addition, IFR operations are prohibited in the following four regions:

- 1) North of 65° North latitude between longitude 75° W and 120° W
- 2) North of 70° North latitude between longitude 70° W and 128° W
- 3) North of 70° North latitude between longitude 85° E and 114° E
- 4) South of 55° South latitude between longitude 120° E and 165° E

Loss of the G500 heading and attitude may occur near the poles, but this will not affect the GPS track or standby attitude indicator.

2.6 Magnetic Variation Operational Area

IFR operations are prohibited in areas where the magnetic variation is greater than 99.9 degrees East or West.

2.7 Navigation Angle

The GDU 620 Navigation Angle can be set to either True or Magnetic on the AUX page. The Navigation Angle defines whether the GDU 620 headings are referenced to True or Magnetic North. The Navigation Angle set in the GDU 620 must match that which is set on all GPS/SBAS navigators interfaced to the unit.

2.8 AHRS Normal Operating Mode

The Attitude and Heading Reference System integrity monitoring features require the availability of GPS and Air Data. Although the attitude will remain valid if one of these systems becomes inoperative, IFR flight is not authorized unless both integrity systems are fully operational. The G500 monitors these integrity systems automatically and will alert the pilot when the AHRS is not receiving GPS or Air Data. Note: In dual GPS installations, only one GPS needs to be available for IFR use.

2.9 Airspeed Limitations and Indicator Markings

The original type design approved airspeed limitations remain in effect. The airspeed limitations imposed by the AFM/POH, standby airspeed indicator and/or airspeed limitation placards must be observed.

The G500 airspeed tape displays red/white striping to indicate the maximum allowable airspeed ($V_{NE}/V_{MO}/M_{MO}$). This maximum allowable airspeed display is configured to indicate the appropriate maximum allowable airspeed for the airplane, including variations for altitude or Mach number.

The G500 airspeed tape displays a red low-speed awareness band at the lower range of the airspeed tape. This low-speed awareness band is configured to a fixed value. It does not indicate an actual or calculated stall speed and does not adjust with variations in aircraft weight or other factors.

All other G500 airspeed tape indications are configured to indicate the original type design limitations. The G500 airspeed tape does not adjust these additional markings (including V_{NO} , landing gear, or flap speed limitations) for variations with aircraft weight, altitude, or other factors.

2.10 Aerobatic Maneuvers

Conducting aerobatic maneuvers may cause the attitude information displayed on the G500 to be incorrect or temporarily removed from the display.

2.11 Electric Standby Attitude Gyro

If an electric standby attitude gyro is installed, the gyro operates from the aircraft electrical system with a dedicated emergency battery specific to the electric gyro. The electric attitude gyro battery capacity may vary considerably depending on temperature, charge status, and battery life condition. Low temperatures below 32°F will temporarily degrade battery capacity. Internal chemistry will slowly degrade battery capacity over several years of operation even when correctly maintained. A poorly maintained battery will suffer

accelerated degradation. Extended storage in a discharged state and over-charging will permanently damage the battery. Complete charging is required to bring the battery up to full capacity if it has been unused for more than four months or partially discharged.

2.12 Course Pointer Auto Slewing

The G500 HSI will auto slew, i.e. automatically rotate the GPS course pointer to the desired course defined by each GPS leg. The system will also auto slew the VHF NAV course pointer when the CDI transitions to a LOC setting if an ILS, LOC, LOC BC, LDA, or SDF approach is loaded in the GPS/SBAS navigator.

The VHF NAV (green) course pointer will only auto slew if the approach is loaded in the navigator, a LOC frequency is loaded in the active NAV frequency, and *then* the HSI source is changed to the corresponding VHF NAV for the approach. Back Course approaches will auto slew to the reciprocal course.

The system is not capable of automatically setting the inbound VHF NAV course pointer if an approach is not loaded in the GPS/SBAS Navigation System.

The pilot should always double check the inbound course pointer prior to initiating any transition on any VHF NAV approach. Auto slewing the VHF NAV course pointer to the correct selected course is a database dependent function.

2.13 Synthetic Vision Technology

The use of the synthetic vision display elements alone for aircraft control without reference to the G500 primary flight instruments or the aircraft standby instruments is prohibited.

The use of the synthetic vision display alone for navigation, or obstacle, terrain, or traffic avoidance is prohibited.

2.14 Autopilot Interface

The G500 acts as a navigation source switching hub to an interfaced autopilot when multiple navigation sources are available. The autopilot will only couple to the heading, navigation, altitude, and vertical speed selections on PFD 1. Some autopilots may have navigation source selection integral to their system; this feature is overridden by the G500 navigation source selection described herein. Changing the navigation sources displayed on the HSI (by pressing the CDI button or the I-2 button) may result in some autopilots disconnecting or entering a wings level mode.

The autopilot will not couple to the pre-selected altitude or vertical speed if not properly configured or supported by the installation. Refer to the autopilot operators manual or Airplane Flight Manual Supplement for the proper operation of that system.

Not all autopilot systems are approved for GPS vertical coupling; therefore consult the AFMS for the GPS/SBAS system and/or the autopilot system.

Flight director commands on PFD 2 are repeated from PFD 1. When utilizing the flight director display on PFD 2, ensure that the CDI source and BARO settings on PFD 2 match those on PFD 1.

For installations where the GAD 43 provides attitude information to the autopilot, the GAD 43 autopilot disconnect mechanism must be tested and operational before flight using the autopilot. Refer to Section 4.6.9.

2.15 Terrain Proximity Function

The G500 terrain configuration is indicated on the dedicated terrain page of the MAP group. “TERRAIN PROXIMITY” will be displayed as the page title if this function is configured. The G500 terrain and obstacle information appears on the MFD display as red and yellow tiles or towers, and is depicted for advisory only. Aircraft maneuvers and navigation must not be predicated upon the use of the terrain display. Terrain unit alerts are advisory only and are not equivalent to warnings provided by TAWS.

2.16 TAWS Annunciations on the PFD [from a Garmin navigator]

The G500 can display TAWS (Terrain Awareness and Warning System) annunciations on the PFD if the G500 is interfaced to a Garmin navigator with integrated TAWS. The required TAWS annunciations appear in the upper right of the PFD. These annunciations include PULL UP (red), TERRAIN (yellow), TERR N/A (white), TERR INHB (white). These annunciations are not relative to the terrain displayed on the MFD or the yellow/red terrain shading of the Synthetic Vision displayed on the PFD of the G500 system. Refer to the Garmin navigator Airplane Flight Manual Supplement for proper pilot action and information on these alerts.

TAWS alerts on the PFD of the G500 System are only displayed from the GPS/TAWS navigator interfaced as GPS 1 and are displayed regardless of the system 1-2 setting, which drives all other PFD and MFD data used by the G500.

2.17 Datalinked Weather Display (XM or GFDS weather)

Datalink weather data is provided by an optional GDL 69 (XM) or GSR 56 (GFDS) interface. The weather information display on the MFD of the G500 is limited to supplemental use only and may not be used in lieu of an official weather data source. Use of the datalink weather display for hazardous weather (e.g thunderstorm) penetration is prohibited. The datalink weather display is intended for use as an aid to situational awareness only.

2.18 Traffic Display

Traffic may be displayed on the G500 System when connected to an approved optional TCAS, TAS, or TIS traffic device. These systems are capable of providing traffic monitoring and alerting to the pilot. Traffic shown on the display may or may not have traffic alerting available. The display of traffic is an aid to visual acquisition and may not be utilized for aircraft maneuvering.

2.19 Active Weather RADAR

RADAR is broadcasting energy while in Weather or Ground mapping modes. If the G500 system is configured to control an airborne weather radar unit, observe all safety precautions, including:

- Do not operate in the vicinity of refueling operations.
- Do not operate while personnel are in the vicinity (approximately 20 feet) of the radar sweep area.

WARNING

If a radar system is installed, it generates microwave radiation and improper use, or exposure, may cause serious bodily injury. Do not operate the radar equipment until you have read and carefully followed the safety precautions and instructions in the user manual.

2.20 Kinds of Operations

Unless placarded as limited to VFR only operations, G500 equipment installed in an appropriately certified aircraft is approved for Day and Night / VFR and IFR operations in accordance with 14 Code of Federal Regulations Part 91, Part 121, and Part 135 when appropriately maintained.

The table below lists the minimum fully functional G500 System Elements** required for IFR flight operations:

Equipment	Number installed	VFR	IFR
Primary/Multi Flight Display	1 or 2	1a*	1
Garmin GPS/SBAS Navigator	1 or 2	-	1
Attitude / Heading Unit (AHRS)	1 or 2	-	1
Air data computer (ADC)	1 or 2	1a*	1
Magnetometer (GMU)	1 or 2	-	1
Standby Attitude Indicator	1	-	1
Standby Airspeed Indicator	1	1b	1
Standby Altimeter	1	1b	1
Magnetic Compass	1	1	1

* For VFR operations under 14 CFR Part 91, the aircraft must have one source of altitude and airspeed information. This may be from either the PFD or the standby instruments. (i.e. all “1a” items or all “1b” items from the table above)

** For IFR flight a fully functional G500 system should not generate system alerts, which indicate faults within the system or any interfaced equipment.

2.21 KFC 275/325 Altitude Preselect

When the altitude preselect option is installed with KFC 275/325 autopilots, SOFT RIDE (SR) mode must be disengaged during altitude capture mode (ALTC). The following placard must be installed near the autopilot mode controller or above PFD 1:

DISENGAGE SOFT RIDE DURING ALTITUDE CAPTURE (ALTC)

2.22 L-3 ESI-1000 Electronic Standby Instrument

The independent power source for the L-3 ESI-1000 must be verified to be operational before flight, or the ESI-1000 must be considered inoperative. For the verification procedure, refer to the approved Airplane Flight Manual and/or Instructions for Continued Airworthiness for the independent power source.

2.23 Electronic Flight Bag (EFB) Applications

Class 3 EFB applications have not been evaluated as part of this STC. Use of the system for EFB applications (such as the moving map or electronic charts) may require additional evaluation or operational approval.

2.24 Surface Operations

Do not use SafeTaxi or Chartview functions as the basis for ground maneuvering. SafeTaxi and Chartview functions do not comply with the requirements of AC 20-159 and are not qualified to be used as an airport moving map display (AMMD). SafeTaxi and Chartview are to be used by the flight crew to orient themselves on the airport surface to improve flight crew situational awareness during ground operations.

2.25 MFD Video Display

Video images displayed on the MFD are intended for use as an aid to situational awareness only. Aircraft maneuvering based solely on the MFD video display is prohibited.

Section 3. EMERGENCY PROCEDURES

3.1 Emergency Procedures

3.1.1 PFD 1 Failure

PFD 1 failure is indicated by the loss of displayed information on the PFD, including blank, frozen, or unresponsive display.

1. Use standby flight instruments for attitude, airspeed, altitude, and heading reference.
2. Refer directly to navigation source for navigation information (such as GPS).

If autopilot is engaged:

3. Verify autopilot mode and cross check against standby flight and navigation data.

3.1.2 AHRS Failure

Attitude and Heading Reference System (AHRS) failure is indicated by removal of the sky/ground presentation, a red X, and a yellow “ATTITUDE FAIL” on the PFD. Rate-of-turn information (heading trend vector) will not be available. A heading failure will also occur as described in Section 3.2.1.



1. Use Standby Attitude Indicator.
2. Seek VFR conditions or land as soon as practical.

3.1.3 Air Data Computer (ADC) Failure

Air Data Computer failure is indicated by a red X and yellow text over the airspeed, altimeter, vertical speed, TAS and OAT displays. Some derived functions, such as true airspeed and wind calculations will also be lost. If valid GPS data is available, the PFD will automatically revert to display GPS calculated altitude relative to mean sea level. This GPS altitude is displayed above the altitude tape.

1. Use Standby Airspeed Indicator and Altimeter
2. Seek VFR conditions or land as soon as practical

If ADC 1 has failed and PFD 1 AIR DATA switch is installed:

3. PFD 1 AIR DATA switch – Select ADC 2

NOTE

ALT NO COMP and IAS NO COMP alerts will be present.

3.1.4 Loss of Electrical Power

In the event of a total loss of electrical power, the G500 system will cease to operate and the pilot must utilize the standby instruments to fly the aircraft.

3.1.5 Loss of Electrical Power to 3-inch Electric Standby Attitude Indicator (flashing amber STBY PWR light)

When a 3-inch electric standby attitude indicator is installed, loss of primary electrical power to the attitude indicator is annunciated by a flashing amber light on the indicator. The attitude indicator is operating on backup battery power, and pilot action is required for the gyro to continue operating.

1. Press STBY PWR button on the indicator one time.
2. Verify that the flashing amber light extinguishes.
3. Verify that the red gyro warning flag is not displayed.
4. Seek visual meteorological conditions (VMC) or land as soon as practical (operation of standby attitude indicator is limited by battery life).

WARNING

Do not press the STBY PWR button a second time after the flashing amber light extinguishes. This will turn off the backup battery and the red gyro warning flag will be displayed. If the STBY PWR button is inadvertently pressed and the red gyro warning flag is displayed, press the STBY PWR button again to return to battery power operation (red gyro warning flag should not be displayed).

3.1.6 Loss of Electrical Power to 2-inch Electric Standby Attitude Indicator (flashing or steady amber STBY text)

When a 2-inch electric standby attitude indicator is installed, loss of primary electrical power to the attitude indicator is annunciated by amber STBY text on the Annunciation Control Unit. The attitude indicator is operating on backup battery power, and pilot action may be required for the gyro to continue operating.

If the amber STBY text is flashing (manual operation):

1. Press the STBY PWR button one time.
2. Verify that the amber STBY text is steadily illuminated.
3. Verify that the red gyro warning flag is not displayed.
4. Seek visual meteorological conditions (VMC) or land as soon as practical (operation of standby attitude indicator is limited by battery life).

If the amber STBY text is steadily illuminated (automatic operation):

1. Verify that the red gyro warning flag is not displayed.
2. Seek visual meteorological conditions (VMC) or land as soon as practical (operation of standby attitude indicator is limited by battery life).

WARNING

Do not press the STBY PWR when the amber STBY text is steadily illuminated. This will turn off the backup battery and the red gyro warning flag will be displayed. If the STBY PWR button is inadvertently pressed and the red gyro warning flag is displayed, press the STBY PWR button again to return to battery power operation (red gyro warning flag should not be displayed).

3.2 Abnormal Procedures

3.2.1 Heading Failure

Heading failure is indicated by replacement of the digital heading display with amber “HDG” text and a red X.



If valid GPS ground track is available, it will automatically be displayed in place of heading. The HSI heading bug and course pointer will continue to function normally, using GPS ground track as a reference instead of magnetic heading.



If GPS track is not available:

1. Use standby compass for heading reference.
2. Verify selected course using “CRS” button and PFD knob.

CAUTION

No directional references will be displayed on HSI. The heading bug will be removed, and the course pointer will remain fixed at the top of the HSI regardless of aircraft heading. Course deviation indications will behave similar to a traditional CDI. VOR deviations will be relative the selected course with a TO/FROM indication. Localizer deviations will not be affected by the selected course, and reverse sensing will occur when tracking inbound on a localizer back course.

3.2.2 GPS Data Failure

GPS data failure may be indicated by any or all of following:

- Loss of GPS course deviation information on HSI
 - Amber “LOI” text on the HSI
 - Amber “NO GPS POSITION” text on the MFD moving map
 - Loss of waypoint bearing or distance information
1. Select alternate GPS source, if available, by pressing “1-2” softkey on PFD.

If alternate GPS source is not available:

2. Select alternate navigation source using “CDI,” “1-2,” or “BRG” softkeys on PFD, or refer directly to external navigation data.

3.2.3 Navigation Data Failure (VOR/LOC/GS/ADF)

Navigation data failure may be indicated by any or all of following:

- Loss of course deviation information on HSI
 - Loss of glideslope/glidepath information on PFD
 - Loss of bearing pointer on HSI
1. Select alternate navigation source using “CDI,” “1-2,” or “BRG” softkeys on PFD, or refer directly to external navigation data.

3.2.4 Synthetic Vision (SVT) Failure

Several data sources are required to display SVT on the PFD (GPS, terrain database, attitude information, etc.). If any of these required data sources become unreliable or unavailable, SVT will automatically be removed, and the PFD will revert to the standard display of blue sky over brown ground. If there is a discrepancy between the SVT display and the actual terrain around the aircraft, SVT should be turned off manually.

To turn off SVT:

1. Press the “PFD” softkey on the PFD.
2. Press the “SYN VIS” softkey to turn off SVT.

3.2.5 Electrical Load Shedding

The following equipment is considered non-essential. If it becomes necessary to reduce electrical load (for example, during loss of generators or alternators), power to these units may be removed in the order listed.

1. PFD 2 circuit breaker(s) [if installed] – PULL
2. AHRS 2 circuit breaker(s) [if installed] – PULL
3. ADC 2 circuit breaker(s) [if installed] – PULL
4. GAD circuit breaker(s) [if installed] – PULL

3.3 Warnings, Cautions, and Advisories

The following tables show the color and significance of the warning, caution, and advisory messages which may appear on the G500 displays.

NOTE

The G500 Cockpit Reference Guide and the G500 Pilot's Guide contain detailed descriptions of the annunciator system and all warnings, cautions and advisories.

3.3.1 Warning annunciations – Red		
<i>Annunciation</i>	<i>Pilot Action</i>	<i>Cause</i>
ATTITUDE FAIL	Use Standby Attitude.	Display system is not receiving attitude reference information from the AHRS; accompanied by the removal of sky/ground presentation and a red X over the attitude area.
AIRSPEED FAIL	Use Standby Airspeed.	Display system is not receiving airspeed input from the air data computer; accompanied by a red X through the airspeed display.
ALTITUDE FAIL	Use Standby Altitude.	Display system is not receiving altitude input from the air data computer; accompanied by a red X through the altimeter display.
VERT SPD FAIL	Cross check instruments.	Display system is not receiving vertical speed input from the air data computer; accompanied by a red X through the vertical speed display.
HDG	Use Standby Magnetic Compass or GPS track information.	Display system is not receiving valid heading input from the AHRS; accompanied by a red X through the digital heading display.
Red X	Reference the data source or alternate equipment.	A red X through any display field, indicates that display field is not receiving data or is corrupted.

3.3.2 Caution annunciations – Yellow		
<i>Annunciation</i>	<i>Pilot Action</i>	<i>Cause</i>
CHECK ATTITUDE Autopilot will automatically disconnect. Note: Only appears with the installation of an optional GAD 43 adapter	Fly the aircraft manually and crosscheck GDU 620 attitude indication with standby attitude indicator and other sources of attitude information (airspeed, heading, altitude, etc.)	The GDU 620 attitude monitors have detected an AHRS malfunction, or the inability to actively monitor the AHRS output.
MISCOMP (flag displayed on PFD attitude, airspeed, or altitude indicators)	Cross-check the flagged information against other sources to identify erroneous information.	Difference detected between displayed attitude, airspeed, or altitude (dual installations only).
AHRS ALIGN – Keep Wings Level	Limit aircraft attitude to $\pm 10^\circ$ bank and $\pm 5^\circ$ pitch as AHRS Aligns - OK to taxi.	Attitude and Heading Reference System is aligning. AHRS may not align with excessive pitch/bank angles.
NO GPS POSITION	If the system is configured with dual GPS, press the 1-2 button.	GPS data on the selected system is no longer valid. The Moving Map and associated data are not updating.
TRAFFIC	Visually acquire the traffic to see and avoid.	The configured traffic system has determined that nearby traffic may be a threat to the aircraft.
No Traffic Data	Use vigilance, as the traffic sensor is not able to detect traffic.	The configured traffic system is not able to detect traffic and / or provide the pilot with any traffic awareness.
NO AP DATA	Verify autopilot mode of operation using alternate means.	Autopilot mode of operation is not available.

3.3.3 Advisories – White	
<i>Annunciation</i>	<i>Pilot Action</i>
Various Alert Messages may appear under the MFD - ALERTS soft key.	View and understand all advisory messages. Typically, they indicate communication issues within the G500 System. Refer to the G500 Cockpit Reference for appropriate pilot or service action.

Section 4. NORMAL PROCEDURES

Refer to the Garmin G500 PFD/MFD System Cockpit Reference Guide P/N 190-01102-03 or G500 Pilot's Guide P/N 190-01102-02, presented in Paragraph 2.1 of this document, for normal operating procedures. This includes all Primary Flight Display and Multi-Function Display information.

Although intuitive and user friendly, the G500 PFD/MFD System requires a reasonable degree of familiarity to avoid becoming too engrossed at the expense of basic instrument flying in IMC and basic see-and-avoid procedures in VMC. Pilot workload will be higher for pilots with limited familiarity in using the unit in an IFR environment, particularly without the autopilot engaged. Garmin provides excellent training material with the Cockpit Reference Guide and the detailed Pilot's Guide. Pilots should take full advantage of these training tools to enhance system familiarization.

4.1 PFD Knob & PFD Soft Keys

The basic PFD controls are on the side and bottom of the PFD, next to and beneath the PFD display. The rotary knob performs the function annunciated on the display just to the upper left of the HSI: HDG, CRS, ALT, V/S, or BARO. If no function is annunciated then the knob is providing a HDG function. Assigning the function of the knob is done by pressing/releasing one of the dedicated function buttons to the left of the display. The knob defaults back to HDG if it is not rotated for a period of 10 seconds. The Garmin G500 PFD/MFD System Cockpit Reference describes each function and its operation.

The soft keys at the bottom of the PFD display are used to configure the course data displayed in the HSI (CDI button, 1-2 button) and select the optional bearing pointers (BRG1 and BRG2 button) which are may be overlaid in the HSI presentation on the PFD. The soft keys operate by press and release. Note: In Dual G500 installations, the CDI key located on the GNS units is not operational Consult the Garmin G500 PFD/MFD System Cockpit Reference for a complete description.

The units and markings on the PFD are not user configurable. They match the units as specified in the aircraft's FAA approved Airplane Flight Manual and standby instruments. Display and control of the airspeed references (V_R , V_X , V_Y , and GLIDE) are made via the AUX page of the MFD; consult the Garmin G500 Cockpit Reference Guide for description and operation of these references.

4.2 MFD Knobs & MFD Soft Keys

The MFD controls are on the side and bottom of the MFD, next to and beneath the MFD display. The rotary knobs scroll through various page groups and pages of the MFD and manipulate data and settings by pressing the knob to activate a cursor.

Soft keys at the bottom of the display allow for some quick functions to be performed on each page. The soft keys operate by press and release. More detailed configuration is typically available by pressing the MENU button, which is on the right side of the display.

Pressing and holding down the CLR key is a shortcut to get back to the main map page on the MFD. This can be used as a quick way back, or when the pilot has selected a submenu within the system. The functions available under the MFD are explained in the Garmin G500 Cockpit Reference Guide.

4.3 Altitude Synchronization

The pilot must synchronize the PFD BARO setting and the Standby Altimeter Kollsman window with the local altimeter setting as appropriate. In dual installations if synchronization between the units is enabled, setting either PFD will adjust both PFDs, but the standby must still be set by the pilot. Reference the Garmin G500 Cockpit Reference Guide for a complete description and the usage of synchronization in dual installations.

4.4 Electric Standby Attitude Gyro

When an electric standby attitude gyro is installed, test the backup battery before takeoff.

1. Apply power to electric standby attitude gyro and allow the gyro to reach operating speed (approximately 5 minutes).
2. Verify that the red gyro flag is not in view.
3. Press and hold the STBY PWR button until the amber annunciator begins to flash.
4. Verify that the green annunciator is displayed continuously and the red annunciator is not displayed for the duration of the test (approximately 1 minute).

CAUTION

The standby attitude gyro must be considered inoperative if the red annunciator is displayed during the test.

4.5 Synthetic Vision Technology

The SVT system may be turned on or off, as desired. To access the synthetic vision system softkey menu, press the PFD softkey on the GDU 620, followed by the SYN VIS softkey. Synthetic vision terrain, horizon headings, and airport signs can be toggled on and off from this menu. Press the BACK softkey to return to the root PFD menu.

4.6 Autopilot Operations with the G500 System

The G500 PFD/MFD System offers various integration capabilities dependent mainly upon the type of autopilot installed in a particular aircraft.

The G500 installation in this aircraft provides the following autopilot integration capabilities:

- ☐ This installation *does not* interface with the autopilot (basic wing leveling autopilot or no autopilot is installed in the aircraft).
- ☒ Course / NAV Selection coupling to the autopilot.
- ☒ Heading Bug coupling capability to the autopilot.
- ☒ Roll Steering emulated via heading mode.
- ☐ Roll Steering capable autopilot.
- ☒ Altitude Pre-Selector integrated with the autopilot.
- ☒ Vertical speed bug integrated with the autopilot.
- ☒ Flight Director display driven from external autopilot or FD computer.
 - ☐ Flight Director is not available with Synthetic Vision enabled.
- ☒ A GAD 43 Adapter is installed in this aircraft
 - ☒ GAD 43 provides attitude to the autopilot
 - ☒ GAD 43 provides yaw rate to the yaw damper
 - ☐ GAD 43 provides baro correction to the altitude preselector
- ☐ GDU 620 provides attitude / air data to autopilot

4.6.1 Attitude and Rate Based Autopilots

Attitude-based autopilots may be driven by the standby gyro, a remote mounted gyro, the GDU 620, or the GAD 43 adapter. If the GDU 620 or GAD 43 is providing attitude to the autopilot, it will be indicated in section 4.6 above. Otherwise, if the attitude-based autopilot is receiving attitude from the standby or a remote gyro, the autopilot attitude input is independent of the attitude displayed on the PFD.

Rate-based autopilots are driven by a turn coordinator gyro which may be mounted in the instrument panel or remotely mounted. The autopilot rate input is independent of the G500 system.

The pilot must understand the autopilot system inputs to detect faults and capabilities with inoperative equipment. Refer to the autopilot flight manual for operational information.

4.6.2 Course / NAV Selection coupling to the autopilot

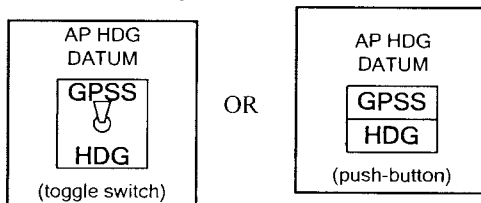
When operating the autopilot in NAV mode, the deviation information from the installed navigation sources (i.e. GPS1, GPS2, NAV1, NAV2) is switched via the G500 PFD display. Whatever is displayed on the HSI is the NAV source the autopilot is following. Most autopilots also use the course datum to determine the best intercept angles when operating in NAV mode.

4.6.3 Heading Bug coupling capability to the autopilot

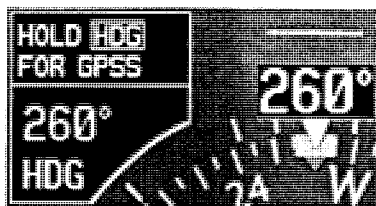
When operating the autopilot in HDG mode, the difference between the HDG bug location on the HSI and the actual aircraft heading creates an error signal which the autopilot will minimize by turning in the direction of the bug. If the bug is turned more than 180 degrees, the autopilot may turn the airplane in the opposite direction of the desired turn.

4.6.4 Roll Steering emulated via HDG mode

For autopilots that do not support digital GPSS signals, GPSS functionality may be emulated by operating the autopilot in HDG mode and selecting GPSS on the PFD. Depending on the installation, GPSS mode may be toggled via an external switch located near the autopilot control panel, or by pressing and holding the HDG button on the PFD. If an external switch is installed, it will be either a toggle or push-button switch as depicted below.



If the installation uses the HDG button on the PFD, the PFD Knob Mode Indicator is expanded to label the button function.



GPSS OFF



GPSS ON

When GPSS is selected on the PFD, the heading bug on the HSI changes to a hollow outline and a crossed-out heading bug appears in the PFD Knob Mode Indicator, indicating that the autopilot is not coupled to the heading bug. The bug is still controllable and may still be used by the pilot for reference.

When GPSS is selected on the PFD, GPSS is annunciated in the lower left portion of the PFD. The GPSS mode annunciation depends on the location of the NAV STATUS information, as shown below.



NOTE

GPSS mode is selectable from PFD 2, but GPSS is not annunciated on PFD 2. The GPSS commands to the autopilot are based on the GPS source displayed on PFD 1.

When GPSS is selected on the PFD, GPSS turn commands are converted into a heading error signal to the autopilot. When the autopilot is operated in HDG mode, the autopilot will fly the turn commands from the GPS navigator selected on PFD 1.

If the GPSS data is invalid (for example, if there is no active GPS leg) or the selected HSI source on PFD 1 is not GPS, the annunciated GPSS text will be yellow and a zero turn command will be sent to the autopilot.

4.6.5 Roll Steering capable autopilots

If the autopilot is already designed to receive Roll Steering information, the data is transmitted via a digital communications bus from the G500 to the autopilot. The G500 receives this data from the GPS. In dual GPS installations, the G500 sends Roll Steering information for the GPS which is currently selected for use via the PFD 1-2 button.

4.6.6 Selected Altitude Bug Coupling

When installed appropriately, certain autopilots may be coupled to the PFD selected altitude bug for altitude preselect and capture. Except as described in this section, refer to the autopilot AFMS and/or Pilot's Guide for autopilot system operation.

4.6.6.1 S-Tec Autopilots

To preselect and capture a selected altitude:

1. Select the desired altitude with the PFD selected altitude bug.
2. Press/hold VS then press ALT on the autopilot programmer computer to arm altitude hold mode.

4.6.6.2 Collins Autopilots

To preselect and capture a selected altitude:

1. Select the desired altitude with the PFD selected altitude bug.
2. Select ALT SEL mode on the autopilot flight control panel.

CAUTION

Changing the selected altitude bug while ALT SEL mode is selected may result in autopilot mode changes. Verify the autopilot mode after changing the selected altitude.

4.6.6.3 Bendix/King Autopilots

To preselect and capture a selected altitude:

1. Select the desired altitude with the PFD selected altitude bug.
2. Press and hold the ALT button on the PFD to arm or disarm the selected altitude.

NOTE

When the selected altitude is armed for capture, ALT is displayed in white text in the upper right corner of the PFD. When altitude capture mode is engaged, ALTC is displayed in green text in the upper right corner of the PFD. When a KA 315 annunciator panel is installed, the "ALT ARM" annunciator on this panel will not be operative.

NOTE

KFC 200/250 autopilots will inhibit glideslope (GS) mode if altitude capture (ALTC) mode is engaged during glideslope intercept.

CAUTION

Changing the selected altitude bug while ALTC mode is engaged will result in cancellation of ALTC mode. Verify the autopilot mode after changing the selected altitude.

4.6.7 Vertical Speed Bug Coupling

Certain autopilots may be coupled to the PFD vertical speed bug for maintaining a selected vertical speed. Except as described in this section, refer to the autopilot AFMS and/or Pilot's Guide for autopilot system operation.

4.6.7.1 S-Tec Autopilots

To select and maintain a vertical speed:

1. Select the desired vertical speed with the PFD vertical speed bug.
2. Press VS on the autopilot programmer computer to engage vertical speed mode.

NOTE

The selected vertical speed will automatically be reduced towards zero when approaching the selected altitude bug.

AUTO will appear in the vertical speed PFD knob mode indicator when vertical speed is being reduced automatically. Manually changing the selected vertical speed while AUTO is displayed will cancel automatic vertical speed reduction.

4.6.7.2 Bendix/King Autopilots

To select and maintain a vertical speed:

1. Select the desired vertical speed with the PFD vertical speed bug.
2. Press and hold the VS button on the PFD to engage or disengage vertical speed mode.

NOTE

When vertical speed mode is engaged, VS is displayed in green text in the upper right corner of the PFD.

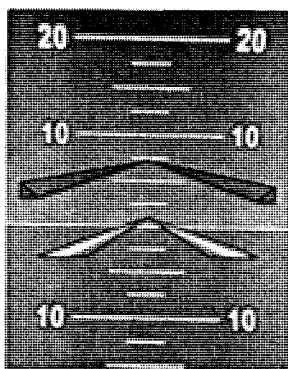
While VS mode is engaged, the vertical speed bug may be changed by:

- Adjust the vertical speed bug with the PFD knob, or
- Press and hold the vertical trim rocker switch on the autopilot in the desired direction, or
- Press the CWS button on the control wheel to synchronize the vertical speed bug to the current vertical speed.

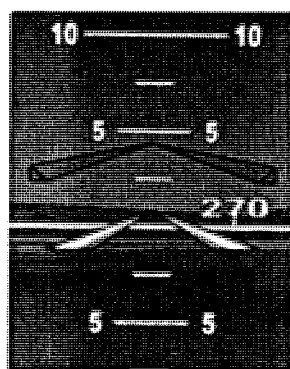
4.6.8 Flight Director Display

If autopilot flight director commands are interfaced to the G500, they will be presented as a single cue flight director on the PFD. Control of the flight director is accomplished via the autopilot/flight director controller; there are no pilot controls or adjustments for the flight director on the G500.

The G500 system limits the distance the flight director pitch commands may deviate from the aircraft attitude icon. In the event that the pitch command provided by the autopilot flight director is greater than the distance allowed by the G500, the command bars will be displayed at the maximum distance allowed by the G500. As the aircraft pitch changes to satisfy the command bars, the bars will continue to be displayed at the maximum distance from the aircraft attitude icon until the aircraft pitch deviation is within the command display limit. In both examples below, the flight director is commanding approximately 7 degrees pitch up. With SVT turned off, the 7 degree pitch up command is displayed with the command bar at 7 degrees pitch up. With SVT turned on, the G500 limits the command bar shown as 4.5 degrees pitch up, which is the maximum deviation that can be displayed. The G500 system will hold the command bars at the same distance from the aircraft icon until the aircraft pitch attitude is within 4.5 degrees of the command.



SVT Off



SVT On

4.6.9 GAD 43 Operation

The GAD 43 Adapter provides attitude, heading, and barometric correction information from the G500 System to the autopilot. The GAD 43 can also be configured to provide synchro heading output to other systems and its attitude output can be used for RADAR stabilization. The GAD 43 has the ability to disconnect the autopilot if an error in the GAD 43 output or GRS 77 is detected. This disconnect mechanism must be tested prior to each flight in the following manner:

1. Upon G500 startup, an AP TEST soft key will be available on the G500 PFD side of the G500 display.
2. Engage the AP while on the ground.
3. Press the AP TEST soft key and verify that the autopilot disconnects.

CAUTION

Do not use the autopilot if the AP TEST key fails to disengage the autopilot normally.

NOTE

Pressing and holding the AP TEST key for longer than 1 second will prevent the test from running and the AP TEST key will remain displayed.

4.6.10 Dual G500 Autopilot Interface

If the installation has dual G500 PFD/MFD systems installed, control of navigation course, heading, or altitude data affecting the autopilot from the co-pilot side can only be made if the systems are synchronized with each other. Refer to the Garmin G500 Cockpit Reference Guide for additional information.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

See current weight and balance data.

Section 7. SYSTEM DESCRIPTIONS

See Garmin G500 PFD/MFD System Cockpit Reference Guide P/N 190-01102-03 for basic operational aspects of the system. For a complete detailed explanation of all the G500's capabilities see the G500 Pilot's Guide P/N 190-01102-02.

J. P Instruments
PO Box 7033
Huntington Beach CA 92646

**FAA APPROVED
AIRPLANE FLIGHT MANUAL SUPPLEMENT OR
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
(FOR THOSE AIRCRAFT WITHOUT A BASIC AIRPLANE FLIGHT
MANUAL)**

EDM-930 PRIMARY ENGINE DATA MANAGEMENT SYSTEM

Airplane Flight Manual Supplement No. 930-0001 Rev. C

For

Reciprocating Engine Powered Aircraft as listed on STC SA01435SE

REG. NO. N9153W

SER. NO. 4622012

This Supplement must be attached to the FAA Approved Airplane Flight Manual when the J.P. Instruments EDM-930 is installed in accordance with Supplemental Type Certificate SA01435SE. For those airplanes without a basic Airplane Flight Manual, this Supplemental AFM must be in the aircraft when the EDM-930 is installed.

The information contained in this Airplane Flight Manual Supplement/ Supplemental Aircraft Flight Manual supplements or supersedes the basic manual/ placards only in those areas listed. For limitations, procedures and performance information not contained in this supplement, consult the basic manuals, markings, and placards.

FAA APPROVED:



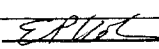
Manager
Seattle Aircraft Certification Office
Federal Aviation Administration
Transport Airplane Directorate

Date: DEC 10 2004

J.P.INSTRUMENTS
PO BOX 7033

EDM-930 Airplane Flight Manual
Supplement No. 930-0001 Rev. C

HUNTINGTON BEACH, CA 92646

Revision	Description	Affected Pages	Approval
C	Complete Flight Manual Supplement for EDM-930	1 thru 4	 ~~REP~~ Manager Seattle Aircraft Certification Office Federal Aviation Administration Date <u>DEC 10 2004</u>

FAA APPROVED Date: DEC 10 2004

HUNTINGTON BEACH, CA 92646

GENERAL

The EDM-930 is a combined electronic indicating system which simultaneously displays to the pilot powerplant and aircraft systems operating parameters. It includes the following indicating systems; replacing all previous primary digital and/or analog instruments (The label of the parameter shown on the instrument is indicated in the first parenthesis);[the acronym shown in the alarm displays is shown in the second parenthesis]:

1. Engine rotational speed (RPM)(RPM)
2. Engine Manifold Pressure (MAP)(MAP)
3. Engine Cylinder Head Temperature (CHT)((CHT)
4. Engine Exhaust Gas Temperature (EGT)(EGT)
5. Engine Oil Temperature(OIL-T) (O-T)
6. Engine Oil Pressure (OIL-P)(O-P)
7. Fuel Pressure(FUEL-P)(F-P)
8. Fuel Flow (FF)(FF)
9. Fuel Quantity (QTY-LF and QTY-RT) (None)
10. Alternator/Generator Output – Volts (VOLTS)(BUS) and Amps(AMPS)(AMP).
11. Outside Air Temperature (OAT)(None)
12. Turbocharger Compressor Discharge Temperature – {Primary on some turbocharged engines} (CDT)(CDT).
13. Turbine Inlet Temperature - {Primary on some turbocharged engines} (TIT)(TIT)
14. Induction Air Temperature (IAT)(IAT) or Carburetor inlet temperature (CARB)(CRB)

Display

Non-primary functions Induction air temperature, carburetor inlet temperature, EGT Span, bus voltage and Amps, Shock Cooling, Fuel Remaining, Fuel Required, Fuel Reserve, MPG, Endurance, and Fuel Used have programmable alarm limits. CHT, TIT, EGT, F-P, FF, and MAP may not be primary on some installations. Any of these non-primary functions are programmable.

The right hand side of the EDM-930 display has 9 vertical scale columns with a digital value below each column. The nine functions are: OIL-T, OIL-P, FUEL-P, OAT, VOLTS (or CDT, for engine installations having a primary compressor discharge temperature), AMPS, FF, and two fuel tank quantities (QTY-LF, QTY-RT). The engine RPM and MAP are presented in the upper left corner of the instrument. The EGT, CHT and TIT are presented in the lower left corner. Below the EGT/CHT columns is a message center that displays the digital values of the EGT/CHT/TIT and additional functions like shock cooling and caution and limit alarm messages.

Specific values for each parameter are displayed digitally above the vertical scale displays of EGT, CHT, and TIT. The highlighted indicator below the columns indicates which cylinder's digital information is presently displayed as an alarm in the message center or when manually or automatically stepping through the parameters.

Programming

Depressing the LF and STEP buttons simultaneously enters the program mode to enter fuel quantities, display scan rate, OAT display to °F or °C, EGT digital display resolution to 1 or 10° and other setup parameters. Exit by depressing STEP. If either the STEP or LF buttons are not pushed for three minutes, the EDM-930 will revert to automatic scan mode. Depressing the STEP button will stop the automatic mode and revert to manual mode. Refer to the EDM-930 Pilot's Guide Rev. B or later for additional operating information. This Pilot's Guide must be available to the pilot for all flight operations.

Remote Alarm Display (RAD)

HUNTINGTON BEACH, CA 92646

The RAD is a 0.2" high, 8 character independent display. The RAD will still function if the main display is inoperable. An alarm such as the CHT on cylinder number 2 is 480 is displayed as 480CHT2. The label CHT2 will flash whenever an over-temperature exists and will extinguish when the temperature falls below the limit temperature. Other alarms would be displayed as, for example: 2780 RPM, 15 O-P, 34 F-P, 240 O-T.

The RAD is located directly in front of the pilot and displays digital caution and limit exceedances when any of the parameters has reached its preset trigger point. Whenever limit alarms are not triggered, the RAD continuously displays MAP and RPM.

On initial startup or whenever power is turned on, the words "EDM-930 PRIMARY" is displayed, followed by the make and model of the aircraft for which the primary limits are set.

Alarm Limits

Whenever a parameter reaches the programmed *caution* trigger point, the main display will flash the *amber colored* word ALERT and the parameter acronym. Tapping the STEP button extinguishes these warnings.

Similarly, whenever a parameter reaches a programmed *limit* value, the display and the RAD will flash the *red colored* word ALERT and the acronym. Tapping the STEP button will extinguish the red display warnings on the main display but the RAD will also continue to flash the acronym until the parameter is not at or beyond the limit value.

Primary alarm *limits* for each specific aircraft model are set by JPI and are not programmable by the pilot. These include some or all of the following: CHT, CDT, EGT, O-T, O-P, F-P, QTY-LF, QTY-RT, MAP, RPM, FF, IAT, CARB, and TIT. The primary functions for your installation are shown on the Primary label on the back of the instrument and are identical to those specified in the FAA Approved Airplane Flight Manual/Pilot's Operating Handbook.

For caution alarms, primary digits and acronyms are flashed in *amber* at the original manufacturer's published caution points or, if none is specified, at a specific temperature below the programmed limit. For example, O-T and CDT alarms will flash 20°F before the actual factory limit. CHT will flash 40°F below, and TIT 50°F below the programmed limits. Fuel and oil pressure caution alarms will only flash if there is a published caution range.

When a *caution* range is reached, the pilot can momentarily depress the STEP button to extinguish the particular flashing alarm acronyms. If another parameter has also reached its limit, that label will then begin to flash. The pilot should continue to monitor the affected functions as he would if a conventional analog display had reached a limit. The bar graph functions of CHT, EGT, and TIT remain displayed at all times.

Dimming

Automatic dimming is provided to dim both the panel display and the remote alarm display. Dimming can also be accomplished manually. Tapping the far right hand button (labeled Brightness) decreases brightness. Continuously holding this button increases brightness. Manual dimming overrides the automatic dimming feature. When switching electrical power off and on, the system defaults to automatic dimming.

HUNTINGTON BEACH, CA 92646

II. OPERATING LIMITATIONS

- a. The EDM-930 may replace any existing RPM, MAP, EGT, CHT, CDT, TIT, O-T, O-P, F-P, FF, and Fuel Quantity indicators required by the aircraft type design or operating limits.
- b. The EDM-930 cannot be used as primary if the RAD is not working.

III. EMERGENCY PROCEDURES

- A. Loss of individual display element:
 1. Continue normal engine operation by referring to the remaining parameters displayed.
- B. Loss of all displays (Electrical Failure):
 1. Avoid high engine power settings and rapid power changes;
 2. Enrichen Mixture to maintain smooth engine operation;
 3. Arrange to terminate the flight safely and as soon as practicable.

IV. NORMAL PROCEDURES

a. PRIMARY FUNCTIONS

Before each flight, verify that the RAD is working. Whenever main electrical power is turned on the EDM-930 performs a self-test procedure which identifies by the message center any inoperative parameters. During engine start, there may be a power interruption to the EDM-930 while the starter is engaged.

b. ENGINE MIXTURE LEANING

After establishing desired cruise-power depress the LF button to activate the Lean Find Mode. As the mixture is leaned, one cylinder's column will begin blinking; indicating the EGT for that cylinder has peaked. Continue with the leaning procedure, enriching as recommended by the aircraft manufacturer while monitoring the primary engine instruments. Once the leaning procedure has been completed, depress the STEP button briefly to exit the Lean Find Mode and enter the Monitor Mode.

CAUTION

Comply with manufacturer's Airplane Flight Manual leaning procedure.
Do not exceed applicable engine or aircraft limitations.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 5
FOR
PROPELLER HEAT, HEATED WINDSHIELD AND
WING ICE DETECTION LIGHT

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when any or all of the following equipment is installed per the appropriate Piper Drawing: Prop Heat - Dwg. No. 89664, Heated Windshield - Dwg. No. 82288 and Wing Ice Detection Light - Dwg. No. 83978.

The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED



D. H. TROMPLER

D.O.A. NO. SO.-1

PIPER AIRCRAFT CORPORATION

VERO BEACH, FLORIDA

DATE OF APPROVAL August 26, 1988

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional propeller heat, heated windshield, and wing ice detection light are installed in accordance with FAA Approved Piper data.

SECTION 2 - LIMITATIONS

- (a) This aircraft is not approved for flight in icing conditions.
- (b) Under no circumstances should the heated windshield be turned on for a period exceeding 20 seconds unless the aircraft is in flight.

SECTION 3 - EMERGENCY PROCEDURES

No change.

SECTION 4 - NORMAL PROCEDURES

The equipment should be functionally checked for proper operation prior to flight.

A check of the heated propeller can be performed by turning the PROP HEAT switch ON and feeling the deice pads. The pads should become warm to the touch.

CAUTION

To avoid possible windshield damage during ground operations, or during testing, do not position the WSHLD HEAT switch to HIGH for more than 20 seconds.

An operational check of the heated windshield may be done only if the ambient temperature of the windshield is less than 115F (46C), and the engine is running. To accomplish the check, turn one alternator OFF. Then, while observing the operating alternator's ammeter, position the WSHLD HEAT switch, first to LOW, and then to HIGH. A load increase of approximately 13 amps when set to LOW, with an approximate 10 amp *additional* increase when set to HIGH, indicates normal operation.

When in visible moisture at temperatures at or below +5°C and icing conditions are anticipated, set the windshield heat switch to LOW. If low windshield heat is inadequate or if icing is encountered at temperatures at or below -15°C, set the windshield heat switch to HIGH.

NOTE

Depending on ambient temperatures, when switching from HIGH to LOW windshield heat, a WINDSHIELD HEAT FAIL annunciation may occur until the windshield surface temperature cools to the low heat temperature range.

CAUTION

The "Windshield Heat Fail" annunciator light will illuminate when a failure in the temperature sensor has occurred. As a result of this failure a possible over temp. of the windshield may result with windshield heat switch in either the HIGH or LOW position. In the event of the illumination of this annunciator the windshield heat switch should IMMEDIATELY be placed in the OFF position. Failure to select windshield heat OFF could result in severe damage to the windshield.

Windshield heat may be used to help clear the windshield during descent from high altitude.

SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT AND BALANCE

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

SECTION 7 - DESCRIPTION AND OPERATION OF PROPELLER HEAT, HEATED WINDSHIELD, AND WING ICE DETECTION LIGHT

The presence of one or more items of deicing equipment does not imply the capability to fly into forecast or known icing. The equipment is provided to enlarge the options available to the pilot as he takes appropriate action to avoid icing that is inadvertently encountered.

Controls for the components are located to the right of the control quadrant on the deice switch panel (Figure 7-1).

WING ICE DETECTION LIGHT

Wing icing conditions may be detected during night flight by use of an ice detection light installed on the left side of the forward fuselage. The light is controlled by an ICE LIGHT switch (Figure 7-1) located on the deice switch panel. Circuit protection is provided by an ICE circuit breaker located in the EXTERIOR LIGHTS section of the pilot's aft circuit breaker panel.

PROPELLER HEAT

Electrothermal propeller heat pads are bonded to a portion of the leading edges of the propeller blades. The system is controlled by an ON-OFF type PROP HEAT switch (Figure 7-1) located on the deice switch panel. Power for the propeller heat is supplied by the aircraft electrical system through a PROP HEAT circuit breaker on the pilot's aft circuit breaker panel. When the PROP HEAT switch is actuated, power is applied to a timer through the PROP HEAT ammeter which monitors the current through the propeller heat system.

Power from the timer is cycled to brush assemblies which distribute power to slip rings. The current is then supplied from the slip rings directly to the electrothermal propeller heat pads.

The Hartzell propeller is heated in a cycle which applies power to the heat pads for approximately 90 seconds and then shuts off for approximately 90 seconds. Once begun, cycling will proceed in the above sequence and will continue until the system is turned off. The PROP HEAT ammeter should indicate within the green shaded area during the portion of the cycle when power is being applied. This indicates proper operation of the system.

The propeller designation is: HC-12YR-1B1/F8074K

ELECTRIC HEATED WINDSHIELD

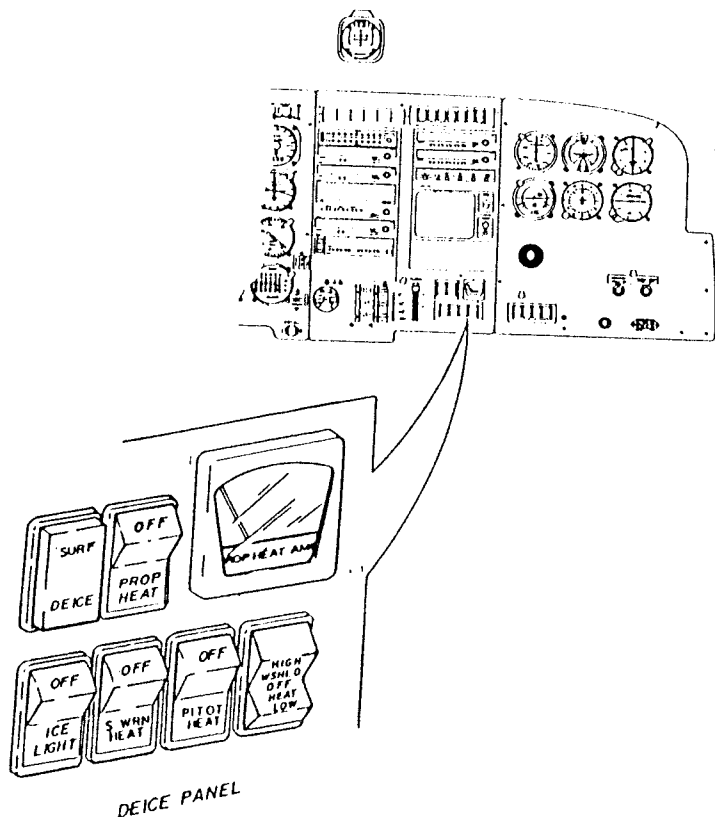
WARNING

Flight into known or forecast icing is not approved. If icing is encountered, take avoidance action immediately.

The electrically heated left windshield is controlled by a HIGH-OFF-LOW rocker type switch located on the deice switch panel. Circuit protection is provided by the windshield CONTROL and POWER breakers in the ICE PROTECTION section of the pilot's aft circuit breaker panel.

CAUTION

To avoid possible windshield distortion during ground operations, or during testing, do not position the WSHLD HEAT switch to HIGH for more than 20 seconds.



DEICE SWITCH PANEL

Figure 7-1

A pre-takeoff operational check of the heated windshield may be done only if the ambient temperature of the windshield is *less* than 115° F (46° C), and the engine is running. To accomplish the check, turn one alternator OFF. Then, while observing the operating alternator's ammeter, position the WSHLD HEAT switch, first to LOW, and then to HIGH. A load increase of approximately 13 amps when set to LOW, with an approximate 10 amp *additional* increase when set to HIGH, indicates normal operation.

THIS PAGE INTENTIONALLY LEFT BLANK

**PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL
SUPPLEMENT NO. 6
FOR
ICE PROTECTION SYSTEM
(APPROVED FOR FLIGHT INTO KNOWN ICING CONDITIONS)**

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when Ice Protection System, per Piper Drawing No. 89695-2, is installed. The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED



D. H. TROMPLER

D.O.A. NO. SO.-1

PIPER AIRCRAFT CORPORATION

VERO BEACH, FLORIDA

DATE OF APPROVAL August 26, 1988

SECTION 1 - GENERAL

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

SECTION 2 - LIMITATIONS

- (a) The ice protection system was designed and tested for operation in the meteorological conditions of FAR 25, Appendix C, for continuous maximum and intermittent maximum icing conditions. **The ice protection system was not designed or tested for flight in freezing rain and/or mixed conditions or for icing conditions more severe than those of FAR 25, Appendix C. Therefore, flight in those conditions may exceed the capabilities of the ice protection system.**
- (b) Equipment required for flight into known or forecast icing:
 - (1) Pneumatic wing and empennage boots and SURF DEICE annunciation.
 - (2) Wing ice detection light.
 - (3) Electrothermal propeller deice pads on the propeller blades.
 - (4) Electrically heated windshield and WSHLD HEAT annunciation.
 - (5) Heated lift detector.
 - (6) Heated pitot head.
 - (7) Dual alternators.
 - (8) Dual vacuum pumps.
 - (9) Alternate static source.
 - (10) All equipment required for night IFR flight.
- (c) If all the equipment listed is not installed and operative, the following placard must be installed in full view of the pilot.

WARNING

THIS AIRCRAFT IS NOT APPROVED FOR
FLIGHT IN ICING CONDITIONS.

SECTION 3 - EMERGENCY PROCEDURES

WARNING

The malfunction of any required deice equipment requires immediate action to exit icing conditions. Depending on the severity of the icing encounter, failure to take immediate positive action can lead to performance losses severe enough to make level flight impossible. Therefore, upon verification of a system malfunction or failure, climb or descend out of icing conditions if this provides the shortest route. If exit must be made in level flight, consider the use of maximum power and exit by the most direct route. The effect of the additional fuel burned at higher power settings on aircraft range must be considered and an alternate airport chosen if necessary.

ALTERNATOR FAILURE IN ICING CONDITIONS (ALTERNATOR #1 INOP or ALTERNATOR #2 INOP annunciator light illuminated)

NOTE

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

Verify failure.....CHECK AMMETER
Electrical load (if Low Bus Voltage
annunciator illuminated) Reduce until load is less
than 70 amps & LOW BUS
VOLTAGE annunciator extinguished.
Failed ALTR switch.....OFF
Failed ALTR circuit breaker.....CHECK and RESET
as required
Failed ALTR switch (after OFF at
least one second) ON
If power not restored:
Failed ALTR switch.....OFF
Ammeter.....Monitor and maintain
below 70 amps

While one alternator will supply sufficient current for minimum required avionics and cockpit lighting, use of deicing equipment, particularly windshield or propeller heat, may be limited. Immediate action should be taken to avoid or exit icing conditions. Under no circumstances may the total electrical load exceed 70 amps. The electric cabin heater, cabin recirculation blowers, and position, strobe, and landing lights should not be used unless absolutely necessary.

SINGLE VACUUM PUMP FAILURE IN ICING CONDITIONS (Reduced suction pressure and left or right flow button extended)

- Gyro Suction Gauge Check 4.8 to
5.2 in. Hg.
- Operative Pump Flow Button Retracted

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

PROPELLER HEAT SYSTEM MALFUNCTION

Excessive vibration may be an indication that the propeller heat is not functioning properly.

- Propeller control exercise
- Propeller heat ammeter check for proper indications:
(a) ON (needle in green arc)
for approx. 90 seconds
(b) OFF for approx. 90 seconds

A reading below the green arc during the ON cycle is an indication that the propeller blades may not be deicing properly.

- PROP HEAT switch OFF if failure is indicated

WARNING

It is imperative that the PROP HEAT switch be turned OFF if vibration persists. This can be a symptom of uneven blade deicing which can lead to propeller unbalance and engine failure.

Immediate action should be taken to exit icing conditions.

SURFACE DEICE MALFUNCTION

If SURFACE DE-ICE annunciator light remains illuminated more than 30 seconds, pull the surface deice circuit breaker. Immediate action should be taken to exit icing conditions.

WINDSHIELD ANTI-ICE HEAT MALFUNCTION

If WINDSHIELD HEAT FAIL annunciator illuminates, immediately select WSHLD HEAT switch to OFF. Take immediate action to exit icing conditions.

SECTION 4 - NORMAL PROCEDURES

The Piper Malibu is approved for flight into known icing conditions when equipped with the complete Piper Ice Protection System. Operating in icing conditions of Continuous Maximum and Intermittent Maximum as defined in FAR 25, Appendix C has been substantiated; however, there is no correlation between these conditions and forecasts of reported "Light, Moderate and Severe" conditions. **Flight into severe icing is not approved.**

Icing conditions can exist in any clouds when the temperature is below freezing; therefore it is necessary to closely monitor outside air temperature when flying in clouds or precipitation. Clouds which are dark and have sharply defined edges usually have high water content and should be avoided whenever possible. **Freezing rain must always be avoided.**

Pneumatic boots must be cleaned regularly for proper operation in icing. The exterior surfaces of the aircraft should be checked prior to flight. **Do not attempt flight with frost, ice or snow adhering to the exterior surfaces of the aircraft or landing gear.**

Prior to dispatch into forecast icing conditions all ice protection equipment should be functionally checked for proper operation.

PREFLIGHT

CAUTION

To avoid possible windshield distortion during ground operations, or during testing, do not position the WSHLD HEAT switch to HIGH for more than 20 seconds.

- (a) A check of the heated propeller should be performed by turning the PROP HEAT switch ON and feeling the deice pads. The pads should become warm to the touch.

CAUTION

Care should be taken when an operational check of the heated pitot head and heated lift detector is being performed. The units become very hot.

- (b) A check of the heated pitot head and lift detector should be performed by turning the S. WRN HEAT and PITOT HEAT switches ON and touching the units.

- (c) The surface boots should be checked prior to flight for damage and cleanliness. If necessary, damage should be repaired and boots cleaned prior to flight. An operational check of the boot system should be performed during engine run-up at 2000 RPM as follows:
 - (1) Actuate the momentary SURF DE-ICE switch - the boots will inflate through three phases: empennage, lower wing and upper wing with a duration of approximately six seconds per phase. The surface boot system then remains off until the switch is activated again. A green SURFACE DE-ICE annunciator light will remain on for approximately eighteen seconds.
 - (2) Visually check to insure that the boots have fully deflated to indicate proper operation of the vacuum portion of the pneumatic boot pump system.
- (d) An operational check of the heated windshield may be done only if the ambient temperature of the windshield is *less* than 115°F (46°C), and the engine is running. To accomplish the check, turn one alternator OFF. Then, while observing the operating alternator's ammeter, position the WSHLD HEAT switch, first to LOW, and then to HIGH. A load increase of approximately 13 amps when set to LOW, with an approximate 10 amp *additional* increase when set to HIGH, indicates normal operation.
- (e) Check the operation of both alternators by observing that both ammeters indicate an output.
- (f) During engine run-up, check that both vacuum pumps are operating by observing that both the left and right red flow buttons on the gyro suction gauge are retracted.

IN FLIGHT

Icing conditions of any kind should be avoided whenever possible, since any minor malfunction which may occur is potentially more serious in icing conditions. Continuous attention of the pilot is required to monitor the rate of ice build-up in order to effect the boot cycle at the optimum time. Boots should be cycled when ice has built to between 1/4 and 1/2 inch thickness on the leading edge to assure proper ice removal. Repeated boot cycles at less than 1/4 inch can cause a cavity to form under the ice and prevent removal; boot cycles at thicknesses greater than 1/2 inch may also fail to remove ice.

Before entering probable icing conditions use the following procedures:

- (a) INDUCTION AIR ALTERNATE
- (b) PITOT HEAT switch ON
- (c) S. WRN HEAT switch ON
- (d) WSHLD HEAT switch LOW (on HIGH in actual ice)
- (e) PROP HEAT switch ON
- (f) DEFROST knob OUT
- (g) VENT/DEFOG BLWR switch ON, if additional
defrost is desired
- (h) SURF DEICE switch activate after 1/4 to 1/2
inch accumulation
- (i) Relieve propeller unbalance (if required) by exercising propeller
control briefly. Repeat as required.

WARNING

Do not cycle surface boots with less than 1/4 inch of ice accumulation. Operation of boots with less than 1/4 inch of ice accumulation can result in failure to remove ice. Do not hold the momentary SURF DEICE switch on.

WARNING

Elevator movement should be periodically checked prior to the first surface boot inflation in order to prevent an ice cap from forming between the elevator and stabilizer.

CAUTION

Operation of the pneumatic deice system is not recommended in temperatures below -40°C. Such operation may result in damage to the deicer boots.

NOTE

For accurate magnetic compass readings, turn the WSHLD HEAT, PROP HEAT and PITOT HEAT switches OFF momentarily.

NOTE

Prolonged operation of the stall warning vane heater in temperatures greater than 5°C will reduce the operational life of the stall warning vane.

Both alternator ammeters should be monitored whenever the deice equipment is in use. An excessive indication shows an excessive electrical load, which may cause a battery discharging condition that could eventually lead to battery depletion. Nonessential electrical equipment should be turned off to correct or prevent this condition.

NOTE

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

When ice has accumulated on the unprotected surfaces of the airplane, aerodynamic buffet commences 5 to 19 knots before the stall. A substantial margin of airspeed should be maintained above the normal stall speed, since the stall speed will increase in prolonged icing encounters. For the same reason, stall warning devices are not accurate and should not be relied upon.

If ice is remaining on the unprotected surfaces of the airplane at the termination of the flight, the landing can be made using full flaps and carrying a slight amount of power whenever practical. If ice removal from the protected surfaces cannot be accomplished (ie. due to a failure of the surface deice system) prior to the approach, the flaps must be left in the full up position. Approach speeds should be increased by 10 to 15 knots. Allow for increased landing distance due to the higher approach speeds.

CAUTION

If cruise airspeed drops below 130 knots in icing conditions, increase power to maintain 130 knots. If maximum continuous power is required to maintain 130 knots, immediate action should be taken to exit icing conditions.

NOTE

An icing encounter can render the aircraft radar unreliable due to beam reflection off of the ice layer on the radome. Also, there may be a degradation of communication and navigation equipment due to ice accumulation on antennas.

SECTION 5 - PERFORMANCE

Climb speed should be increased to 130 knots when icing conditions are encountered during climb.

Cruise speeds are reduced approximately 5 knots when the surface boots are installed.

CAUTION

Ice accumulation on the unprotected surfaces can result in significant performance loss. During cruise, loss of airspeed can be as much as 30 knots or more.

NOTE

When icing conditions are encountered, loss of cruise airspeed and increased fuel flow resulting from higher than normal power settings to maintain altitude will reduce the aircraft range significantly. The use of an alternate airport should be considered if fuel quantity appears marginal.

CAUTION

If cruise airspeed drops below 130 knots in icing conditions increase power to maintain 130 knots. If maximum continuous power is required to maintain 130 knots immediate action should be taken to exit icing conditions.

NOTE

For additional general information on inflight icing refer to FAA Advisory Circular 91-51, Airplane Deice and Anti-ice Systems.

SECTION 6 - WEIGHT AND BALANCE

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

SECTION 7 - DESCRIPTION AND OPERATION OF THE ICE PROTECTION SYSTEM AND EQUIPMENT

For flight into known icing conditions (FIKI), a complete ice protection system is required on the Malibu.

The complete ice protection system consists of the following components: Pneumatic wing and empennage boots, wing ice detection light, electrothermal propeller deice pads, electrically heated windshield, heated lift detector, heated pitot head, two operating alternators, two operating vacuum pumps and the alternate static source. Alternator controls are located on the main switch panel on the left side of the instrument panel. Controls for the ice protection components are located to the right of the control quadrant on the deice switch panel (Figure 7-1).

A single component or a combination of components may be installed. However, the warning placard specified in Section 2 of this supplement is required when the complete system is not installed. Such a placard is also required if any component is inoperative.

The aircraft is designed to allow operation in the meteorological conditions of the FAR 25 envelopes for continuous maximum and intermittent maximum icing. **The airplane is not designed to operate for an indefinite period of time in every icing condition encountered in nature.** Activation of the ice protection system prior to entering icing conditions and attempting to minimize the length of the icing encounter will contribute significantly to the ice flying capabilities of the airplane.

WING AND EMPENNAGE BOOTS

Pneumatic deice boots are installed on the leading edges of the wing, the vertical stabilizer and the horizontal stabilizer. During normal operation, when the surface deice system is turned off, the engine driven vacuum pumps apply a constant suction to the boots to provide smooth, streamlined leading edges. The boots are inflated by a momentary ON type SURF DE-ICE switch (Figure 7-1) located on the deice switch panel. Actuation of the SURF DE-ICE switch activates two pressure regulator valves (one for each vacuum pump) which energizes three (tail, lower wing & upper wing) deice flow valves for approximately six seconds. The boot solenoid valves are activated and air pressure is released to the boots, sequentially inflating the surface deicers. A SURFACE DE-ICE indicator light, located on the annunciator panel illuminates when the boots inflate. When the cycle is complete, the deicer solenoid valves permit automatic overboard exhaustion of pressurized air. Suction is then reapplied to the boots.

Circuit protection for the surface deice system is provided by a SURF DEICE circuit breaker located on the pilot's aft circuit breaker panel.

WING ICE DETECTION LIGHT

Wing icing conditions may be detected during night flight by use of an ice detection light installed on the left side of the forward fuselage. The light is controlled by an ICE LIGHT switch (Figure 7-1) located on the deice switch panel. Circuit protection is provided by an ICE circuit breaker located in the EXTERIOR LIGHTS section of the pilot's aft circuit breaker panel.

ELECTRIC PROPELLER DEICE

Electrothermal propeller deice pads are bonded to a portion of the leading edges of the propeller blades. The system is controlled by an ON-OFF type PROP HEAT switch (Figure 7-1) located on the deice switch panel. Power for the propeller deicers is supplied by the aircraft electrical system through a PROP HEAT circuit breaker on the pilot's aft circuit breaker panel. When the PROP HEAT switch is actuated, power is applied to a timer through the PROP HEAT ammeter which monitors the current through the propeller deice system.

Power from the timer is cycled to brush assemblies which distribute power to slip rings. The current is then supplied from the slip rings directly to the electrothermal propeller deice pads.

The Hartzell propeller is deiced in a cycle which applies power to the deice pads for approximately 90 seconds and then shuts off for approximately 90 seconds. Once begun, cycling will proceed in the above sequence and will continue until the system is turned off. The PROP HEAT ammeter should indicate within the green shaded area during the portion of the cycle when power is being applied. This indicates proper operation of the system.

The propeller designation is: HC-12YR-1BF/F8074K.

The heat provided by the deice pads reduces the adhesion between the ice and the propeller so that centrifugal force and the blast of the airstream cause the ice to be thrown off the propeller blades in small pieces.

ELECTRICALLY HEATED WINDSHIELD

The electrically heated left windshield is heated by current from the aircraft electrical system. It is controlled by HIGH-OFF-LOW rocker type switch located on the deice switch panel. Circuit protection is provided by the windshield CONTROL and POWER circuit breakers in the ICE PROTECTION section of pilot's aft circuit breaker panel.

CAUTION

To avoid possible windshield distortion during ground operations, or during testing, do not position the WSHLD HEAT switch to HIGH for more than 20 seconds.

Windshield heat is an anti-ice device, which must be activated prior to entering suspected icing. Sudden penetration into icing conditions, with the heat OFF, will greatly reduce its effectiveness to prevent or eliminate windshield ice. Windshield heat can also be used to prevent windshield fog.

An overtemperature sensor is included as an integral part of the heated windshield. A system failure causing an overtemperature condition will illuminate the WINDSHIELD HEAT FAIL light located in the annunciator panel. In this eventuality the heated windshield should immediately be selected OFF.

HEATED LIFT DETECTOR

A heated lift detector is installed on the left wing. It is controlled by a S. WRN HEAT switch located on the deice switch panel and is protected by a STALL HEAT circuit breaker located in the ICE PROTECTION section of the pilot's aft circuit breaker panel. The lift detector has an in-line resistor activated by the main gear squat switch which limits the ground electrical load to approximately 33 percent of the inflight load. This allows the lift detector to be ground checked and activated prior to flight without damaging the unit.

CAUTION

Prolonged operation of the stall warning vane heater in temperatures greater than 5°C will reduce the operational life of the stall warning vane.

HEATED PITOT HEAD

A heated AN type head is installed under the the wing. It is controlled by an ON-OFF type PITOT HEAT switch located on the deice switch panel and is protected by a PITOT HEAT circuit breaker located in the ICE PROTECTION section of the pilot's aft circuit breaker panel.

CAUTION

Care should be taken when an operational check of the heated pitot head is being performed on the ground. The unit becomes very hot.

DUAL ALTERNATORS

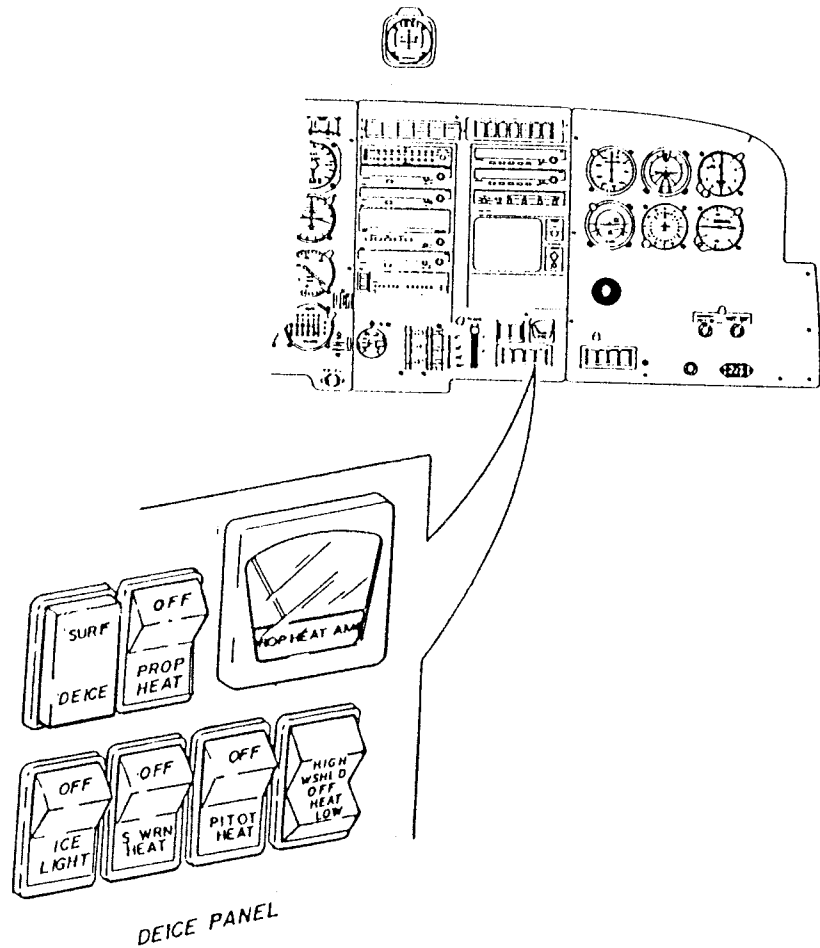
Dual 28 volt, 70 amp alternators are installed as standard equipment. Both alternators must be operational for flight in icing conditions. They are controlled by ON-OFF type switches labeled ALTR NO 1 and ALTR NO 2 located on the main switch panel (Figure 7-2). Circuit protection is provided by similarly labeled circuit breakers located on the TIE BUS circuit breaker panel. During normal operation both alternators must be turned ON. The system is designed so that the alternators will share the total load equally. If either ALTR switch is turned OFF the appropriate annunciator light (ALTERNATOR #1 INOP or ALTERNATOR #2 INOP) will illuminate and remain lit.

DUAL VACUUM PUMPS

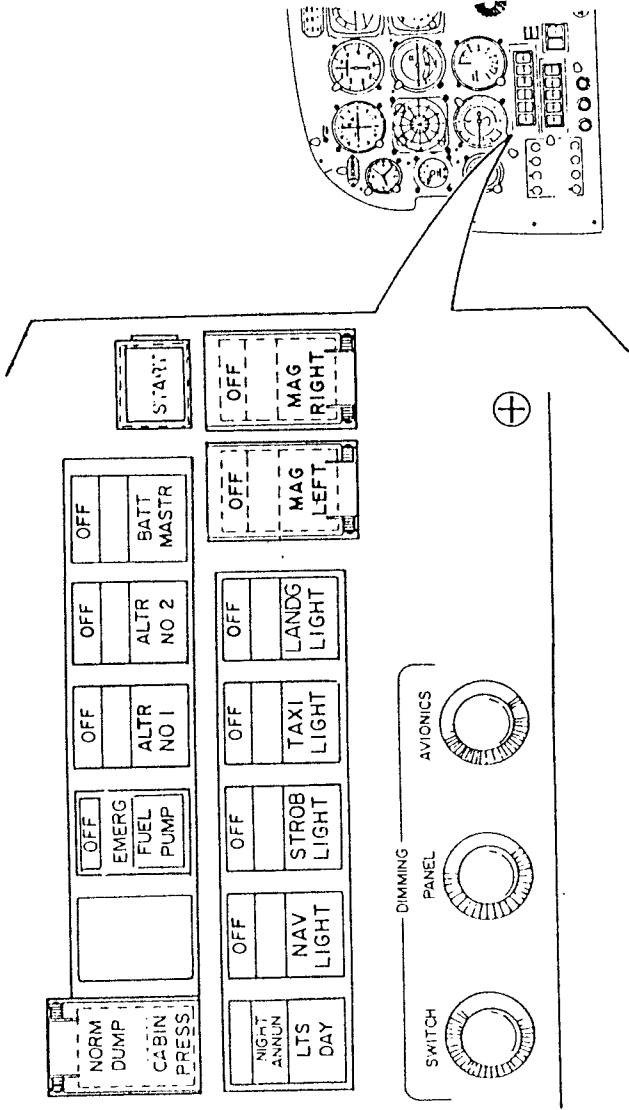
Dual engine driven vacuum pumps are installed as standard equipment. Both pumps operate continuously when the engine is running. While either pump independently is capable of operating the surface deice system, intentional or continued operations in icing conditions with only one operating vacuum pump is not recommended.

ALTERNATE STATIC SOURCE

An alternate static source control valve is located below the instrument panel to the left of the pilot. For normal operation, the lever remains down. To select alternate static source, place the lever in the up position. When the alternate static source is selected the airspeed and altimeter and vertical speed indicator are vented to the alternate static pad on the bottom aft fuselage. During alternate static source operation, these instruments may give slightly different readings. The pilot can determine the effects of the alternate sources at different airspeeds. Static source pads have been demonstrated to be non-icing; however, in the event icing does occur, selecting the alternate static source will alleviate the problem.



DEICE SWITCH PANEL
Figure 7-1



MAIN SWITCH PANEL
Figure 7-2

THIS PAGE INTENTIONALLY LEFT BLANK

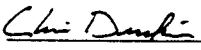
**PILOT'S OPERATING HANDBOOK
SUPPLEMENT NO. 7
FOR
KING 150 SERIES FLIGHT CONTROL SYSTEM**

This supplement has been DELETED as the FAA Approved Operational Supplement to the Bendix/King 150 Series Flight Control System as installed per STC SA1778CE-D. Effective this revision Bendix/King will be responsible to supply and revise the operational supplement. It is permitted to include the Bendix/King supplement in this location of the Pilots Operating Handbook unless otherwise stated by Bendix/King.

(pages 9-64 through 9-92 DELETED)

BENDIX/KING
King Radio Corporation

LOG OF REVISIONS

REV.	PAGE(S)	DESCRIPTION	FAA APPROVED/DATE
1	All Cover 19 9,10,17, 18,28,29	Addition of Piper Model PA-46-350P to footers. Reformatted Entire Manual. Addition of Piper Model PA-46-350P. Reworded fuel imbalance limit. Reworded Note. Text rearranged due to new format and printing technique.	Ralph V. Cole DAS4CE Coordinator Date: 10/19/88
2	19 21	Changed maximum fuel imbalance to 10 Gallons. Deleted sentence from A.4.a.	Chris Durkin DAS4CE Coordinator DATE: 3/6/91
3	21,22	Added item 7 to comply with procedure change requested by Piper Aircraft Corp.	Chris Durkin DAS4CE Coordinator DATE: 8/9/91
4	All 3 4,5,6 7 8 10 17 19,20	Moved system description and operation section from front of manual to back of manual. Entire manual reformatted. KAS 297B Altitude/Vertical Speed Selector supplement incorporated into this manual. Added limitations F, G, H, J, and L. Limitations I and K added with inclusion of altitude/vertical speed selector operation to manual. Revised entire Emergency Procedures section. Changed Caution note to Warning. Added Warning. Turbulence note added (moved from limitations section). Removed note from paragraph C and added as text. Added vertical speed and altitude select section.	 Chris Durkin DAS Coordinator DAS4CE DATE: <u>8-14-92</u>

BENDIX/KING

PIPER MODELS PA-46-310P AND PA-46-350P

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

TABLE OF CONTENTS

<u>SECTION</u>		<u>PAGE</u>
1	General	1
2	Limitations	3
3	Emergency Procedures	4
4	Normal Procedures	7
5	Performance	21
6	System Description and Operation	22

SECTION 1 - GENERAL

This manual is provided to acquaint the pilot with the limitations as well as normal and emergency operating procedures of the King 150 Series Automatic Flight Control Systems. The limitations presented are pertinent to the operation of the 150 System as installed in the Piper Models PA-46-310P and PA-46-350P airplanes; the Flight Control Systems must be operated within the limitations herein specified.

The 150 Series AFCS is certified in this airplane with 2 axis autopilot control, pitch and roll, or 3 axis control if the optional yaw damper is installed. The 3rd axis (Yaw), when installed, provides yaw damping and turn coordination whenever the autopilot is engaged. With the installation of the optional Yaw Damper Switch, yaw damping and turn coordination are available with or without initially engaging the autopilot. Both 2 axis and 3 axis systems are described in this manual.

The KAS 297B vertical speed and altitude selector, when added to a KFC 150 or a KAP 150 Flight Control System provides the pilot with the following features: ability to select vertical speed hold; ability to select, arm and, upon approaching the selected altitude, automatically transfer into Altitude Hold; altitude alerting as specified by F.A.R. 91.51.

The 150 Series AFCS has an electric pitch trim system which provides autotrim during autopilot operation and manual electric trim for the pilot. The trim system is designed to withstand any single inflight malfunction. Trim faults are visually and aurally annunciated.

A lockout device prevents autopilot engagement until the system has been successfully preflight tested.

The following conditions will cause the Autopilot to automatically disengage:

- A. Power failure.
- B. Internal Flight Control System failure.
- C. With the KCS 55A Compass System, a loss of compass valid (displaying HDG flag) disengages the Autopilot when a mode using heading information is engaged. With the HDG flag present, the Autopilot may be re-engaged in the basic wings level mode along with any vertical mode.

BENDIX/KING

SECTION 1 GENERAL

- D. Roll rates in excess of 14° per second will cause the autopilot to disengage except when the CWS switch is held depressed.
- E. Pitch rates in excess of 8° per second will cause the autopilot to disengage except when the CWS switch is held depressed.

The airplane BATT MASTR function is unchanged and can be used in an emergency to shut off electrical power to all flight control systems while the problem is isolated.

The RADIO MASTR switch supplies power to the avionics bus bar of the radio circuit breakers and the autopilot circuit breaker.

The following circuit breakers are used to protect the following elements of the King 150 Series Autopilot:

<u>LABEL</u>	<u>FUNCTION</u>
AUTOPILOT	Supplies power to the KC 192 or the KC 191 Computer, the autopilot pitch and roll servos, the optional KA 185 Annunciator and the Pitch Trim Circuit Breaker. It also applies power to the KC 296 Yaw Computer, the Yaw Servo, and the KAS 297B Altitude/Vertical Speed Selector, when installed.
PITCH TRIM	Supplies power to the autotrim and manual electric pitch trim systems.
COMPASS	Supplies power to the optional KCS 55A Compass System and the optional KRG 331 Yaw Rate Gyro if the airplane is not equipped with an inverter.
ENCODING ALT	Supplies power to the King KEA 130A Altimeter, when installed.

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

SECTION 2 - LIMITATIONS

- A. During autopilot operation, a pilot with seat belt fastened must be seated at the left pilot position.
- B. The autopilot and yaw damper must be OFF during takeoff and landing.
- C. The system is approved for Category I operation only (Approach mode selected).
- D. Autopilot maximum airspeed limitation: 185 KIAS
- E. Maximum fuel imbalance with the autopilot engaged: 10 Gallons.
- F. Continued autopilot or manual electric trim system use is prohibited following abnormal or malfunctioning operation, and prior to corrective maintenance.
- G. The entire preflight test procedure outlined under Section 4, paragraph A of this supplement, including steps 1 through 10, must be successfully completed prior to each flight. Use of the autopilot or manual electric trim system is prohibited prior to completion of these tests.
- H. The PITCH TRIM circuit breaker must be pulled following any inflight illumination of the red TRIM warning light, but only after first completing the Emergency Procedures (Section 3) paragraph A. The manual electric trim and autopilot autotrim systems will be disabled with the PITCH TRIM circuit breaker pulled.
- I. Altitude Select captures below 800 feet AGL are prohibited (when the optional KAS 297B Altitude/Vertical Speed selector is installed).
- J. Do not override the autopilot to change pitch or roll attitude.
- K. The autopilot must be disengaged below 200 feet AGL during approach operations and below 800 feet AGL for all other phases of flight.
- L. Required Placards:
 - 1. Adjacent to autopilot mode controller (KC 191/KC 192):

AUTOPILOT AND ELECTRIC TRIM PREFLIGHT TESTS MUST BE CONDUCTED PRIOR TO EACH FLIGHT

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

SECTION 3 - EMERGENCY PROCEDURES

The five step procedure listed under paragraph A should be among the basic airplane emergency procedures that are committed to memory. It is important that the pilot be proficient in accomplishing all five steps without reference to this manual.

- A. In case of Autopilot, Autopilot Trim, or Manual Electric Trim malfunction (accomplish Items 1 and 2 simultaneously):
1. Airplane Control Wheel - GRASP FIRMLY and regain aircraft control.
 2. A/P DISC/TRIM INTER Switch - PRESS and HOLD throughout recovery.
 3. AIRCRAFT - RETRIM Manually as Needed.
 4. PITCH TRIM Circuit Breaker - PULL.
 5. AUTOPILOT Circuit Breaker - PULL.

NOTE

THE RADIO MASTR SWITCH MAY BE USED AS AN ALTERNATE MEANS OF REMOVING ALL POWER FROM THE AUTOPILOT AND ELECTRIC TRIM SYSTEMS. IF NECESSARY PERFORM STEPS 1 THROUGH 3 ABOVE, THEN TURN THE RADIO MASTR SWITCH OFF BEFORE LOCATING AND PULLING THE AUTOPILOT AND PITCH TRIM CIRCUIT BREAKERS. TURN THE RADIO MASTR SWITCH ON AS SOON AS POSSIBLE TO RESTORE POWER TO ALL OTHER AVIONICS EQUIPMENT. PRIMARY ATTITUDE, AIRSPEED, SLAVED COMPASS, AND ALTITUDE INSTRUMENTS WILL REMAIN OPERATIONAL AT ALL TIMES.

***** WARNING *****
 DO NOT ATTEMPT TO RE-ENGAGE THE AUTOPILOT FOLLOWING AN AUTOPILOT, AUTOTRIM, OR MANUAL ELECTRIC TRIM MALFUNCTION.

Maximum Altitude losses due to autopilot malfunction:

<u>Configuration</u>	<u>Alt Loss</u>
Cruise, Climb, Descent	480'
Maneuvering	80'
APPR	80'

B. Amplified Emergency Procedures

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 for an emergency situation.

1. An autopilot or autopilot trim malfunction occurs when there is an uncommanded deviation in the airplane flight path or when there is abnormal control wheel or trim wheel motion. In some cases, and especially for autopilot trim, there may be little to no airplane motion, yet the red TRIM annunciator may illuminate and an alert tone may sound. The KAP/KFC 150 autopilot incorporates monitors that detect abnormal airplane motion, therefore, if the airplane for any reason is moved rapidly in pitch or roll the autopilot may be disconnected automatically.

The main concern in reacting to an autopilot or autopilot trim malfunction, or to an automatic disconnect of the autopilot, is in maintaining control of the airplane. Immediately grasp the control wheel and press and hold down the A/P DISC/TRIM INTER switch throughout the recovery. Manipulate the controls as required to safely maintain operation of the airplane within all of its operating limitations. Elevator trim should be used as needed to relieve control forces. Once the airplane has been stabilized the A/P DISC/TRIM INTER switch may be released.

With the autopilot mode OFF the servo motors are no longer connected to the airplane's flight controls; autopilot trim will also be isolated from the electric trim system. Finally, the AUTOPILOT and PITCH TRIM circuit breakers must be pulled to completely disable these systems.

***** WARNING *****
DO NOT ATTEMPT TO RE-ENGAGE THE AUTOPILOT FOLLOWING AN
AUTOPILOT/AUTOTRIM MALFUNCTION UNTIL CORRECTIVE SERVICE ACTION
HAS BEEN PERFORMED ON THE SYSTEM.

BENDIX/KING

SECTION 3
EMERGENCY PROCEDURES

2. A manual electric trim malfunction may be recognized by the illumination of a red TRIM fail annunciator accompanied by an alert tone, or by unusual trim wheel motions with the autopilot mode OFF without pilot actuation of the manual electric trim switch. As with an autopilot malfunction, the first concern following a manual electric trim malfunction is regaining control of the airplane. Grasp the control wheel firmly and press and hold down the A/P DISC/TRIM INTER switch. For the Malibu airplane, locate and pull the PITCH TRIM and AUTOPILOT circuit breakers on the left-hand breaker panel. For the Mirage airplane, locate and pull the PITCH TRIM and AUTOPILOT circuit breakers on the right-hand breaker panel. For both airplanes the RADIO MASTR switch may be used as required to remove all power from the Autopilot and Electric Trim systems while the circuit breakers are located and pulled. Return the RADIO MASTR switch to the ON position as soon as possible. With the RADIO MASTR switch off all flight instruments will remain operational, however, communications, navigation, and identification equipment will be inoperable.

***** WARNING *****
DO NOT ATTEMPT TO RE-ENGAGE THE AUTOPILOT OR TO USE THE MANUAL
ELECTRIC TRIM SYSTEM FOLLOWING A MANUAL ELECTRIC TRIM
MALFUNCTION UNTIL CORRECTIVE SERVICE ACTION HAS BEEN PERFORMED
ON THE SYSTEM.

3. Note that the emergency procedure for any malfunction is essentially the same: immediately grasp the control wheel and regain airplane control while pressing and holding the A/P DISC/TRIM INTER switch down, and retrim the airplane as needed. After these steps have been accomplished secure the autopilot or electric trim system using the proper switches and circuit breakers. As with any other airplane emergency procedure, it is important that the 5 steps of the Autopilot/Electric Trim Emergency Procedures located on Page 4 of this supplement are committed to memory.
4. It is important that all portions of the autopilot and electric trim system are preflight tested prior to each flight in accordance with the procedures published herein in order to assure their integrity and continued safe operation during flight.

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

SECTION 4 - NORMAL PROCEDURES

A. PREFLIGHT (Perform prior to each flight)

1. GYROS - Allow 3-4 minutes for gyros to come up to speed.
2. RADIO MASTR - ON
3. PREFLIGHT TEST BUTTON - PRESS momentarily and NOTE:
 - a. All annunciator lights on (TRIM annunciator flashing). All legends and digits are displayed on the KAS 297B Altitude/Vertical Speed Selector (if installed).
 - b. After approximately 5 seconds, all annunciator lights off except AP which will flash approximately 12 times and then remain off.

***** WARNING *****
IF TRIM WARNING LIGHT STAYS ON THEN THE AUTOTRIM DID NOT PASS
PREFLIGHT TEST. THE AUTOPILOT CIRCUIT BREAKER MUST BE PULLED.
MANUAL ELECTRIC TRIM CAN NOT BE USED.

4. MANUAL ELECTRIC TRIM - TEST as follows:

- a. Actuate left side of split switch unit to the fore and aft positions. The trim wheel should not move on its own.
 - b. Actuate right side of split switch unit to the fore and aft positions. Trim wheel should not move on its own and normal trim wheel force is required to move it manually.
 - c. Press the A/P DISC/TRIM INTER switch down and hold. Manual Electric Trim should not operate either nose up or nose down.
5. FLIGHT DIRECTOR (KFC 150 ONLY) - ENGAGE by pressing FD or CWS button.

BENDIX/KING

SECTION 4 NORMAL PROCEDURES

6. **AUTOPILOT/YAW DAMPER - ENGAGE** by pressing **AP ENG** button.
7. **CONTROL WHEEL - HOLD** to keep from moving. Use the vertical trim switch on the Mode Controller to command a pitch **UP**. Observe that the autotrim runs in the nose up direction after approximately four seconds. Depress and hold control wheel steering switch (**CWS**) and verify that autotrim stops; then release vertical trim and **CWS** switches. Use the vertical trim switch on the Mode Controller to command a pitch **DN**. Observe that the autotrim runs in the nose down direction after approximately four seconds. Release Mode Controller vertical trim switch and control wheel.
8. **FLIGHT CONTROLS - MOVE** fore, aft, left & right to verify that the autopilot and yaw damper can be overpowered.
9. **A/P DISC/TRIM INTER Switch - PRESS**. Verify that the autopilot and yaw damper disconnects and all flight director modes are canceled.
10. **TRIM - SET** to take off position manually.

B. AUTOPILOT OPERATION

***** WARNING *****
THE PILOT IN COMMAND MUST CONTINUOUSLY MONITOR THE AUTOPILOT WHEN IT IS ENGAGED, AND BE PREPARED TO DISCONNECT THE AUTOPILOT AND TAKE IMMEDIATE CORRECTIVE ACTION - INCLUDING MANUAL CONTROL OF THE AIRPLANE AND/OR PERFORMANCE OF EMERGENCY PROCEDURES - IF AUTOPILOT OPERATION IS NOT AS EXPECTED OR IF AIRPLANE CONTROL IS NOT MAINTAINED.

DURING ALL AUTOPILOT COUPLED OPERATIONS THE PILOT IN COMMAND MUST USE PROPER AUTOPILOT COMMANDS AND USE THE APPROPRIATE COMBINATION OF ENGINE POWER, WING FLAPS, AND LANDING GEAR TO ENSURE THAT THE AIRPLANE DOES NOT STALL, EXCEED 185 KIAS, OR EXCEED OTHER BASIC AIRPLANE OPERATING LIMITATIONS.

1. Before takeoff
 - a. **A/P DISC/TRIM INTER Switch - PRESS**.
2. Autopilot Engagement

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

BENDIX/KING

SECTION 4
NORMAL PROCEDURES

- a. FD Mode Selector Button (KFC 150 Only) - PRESS.
- b. Verify or set Elevator and Rudder Trim to place the airplane in a trimmed condition prior to Autopilot engagement.

AP ENG Button - PRESS. Note AP AND YD annunciators on. If no other modes are selected the autopilot will operate in wings level and pitch attitude hold.

***** WARNING *****
DO NOT HELP THE AUTOPILOT OR HAND-FLY THE AIRPLANE WITH THE AUTOPILOT ENGAGED AS THE AUTOPILOT WILL RUN THE PITCH TRIM TO OPPOSE YOUR CONTROL WHEEL MOVEMENT. A MISTRIM OF THE AIRPLANE, WITH ACCOMPANYING LARGE ELEVATOR CONTROL FORCES, MAY RESULT IF THE PILOT MANIPULATES THE CONTROL WHEEL MANUALLY WHILE THE AUTOPILOT IS ENGAGED.

3. Climb or Descent

- a. Using CWS
 - 1) CWS Button - PRESS and MOVE aircraft nose to the desired attitude.
 - 2) CWS Button - RELEASE. Autopilot will maintain aircraft pitch attitude up to the pitch limits of +15° or -10°.
- b. Using Vertical Trim
 - 1) VERTICAL TRIM Control - PRESS either up or down to modify aircraft attitude at a rate of .7 deg/sec. up to the pitch limits of +15° or -10°.
 - 2) VERTICAL TRIM Control - RELEASE when desired aircraft attitude is reached. The autopilot will maintain the desired pitch attitude.
- c. Using Vertical Speed Select (if installed).

Refer to paragraphs E.1 and E.2 on Page 19 for Climb or Descent using the Optional Vertical Speed Selector.

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

BENDIX/KING

SECTION 4 NORMAL PROCEDURES

4. Altitude Hold

- a. ALT Mode Selector Button - PRESS. Note ALT mode annunciator ON. Autopilot will maintain the selected pressure altitude.

NOTE

IN ACCORDANCE WITH FAA RECOMMENDATION (AC00-24B), USE OF BASIC "PITCH ATTITUDE HOLD" MODE IS RECOMMENDED DURING OPERATION IN SEVERE TURBULENCE.

b. Change selected altitudes

- 1) Using CWS (recommended for altitude changes greater than 100 ft.)
 - a) CWS Button - PRESS and fly aircraft to desired pressure altitude.
 - b) CWS Button - RELEASE when desired pressure altitude is reached. The autopilot will maintain the desired pressure altitude.
- 2) Using Vertical Trim (Recommended for altitude changes less than 100 ft.)
 - a) VERTICAL TRIM Control - PRESS either up or down. Vertical Trim will seek an altitude rate of change of about 500 fpm.
 - b) VERTICAL TRIM Control - RELEASE when desired pressure altitude is reached. The autopilot will maintain the desired pressure altitude.

5. Heading Changes

a. Manual Heading Changes

- 1) CWS Button - PRESS and MANEUVER aircraft to the desired heading.

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

BENDIX/KING

SECTION 4
NORMAL PROCEDURES

- 2) **CWS** Button - **RELEASE**. Autopilot will maintain aircraft in wings level attitude.

NOTE

AIRCRAFT HEADING MAY CHANGE IN THE WINGS LEVEL MODE DUE TO AN AIRCRAFT OUT OF TRIM CONDITION.

b. Heading Hold

- 1) Heading Selector Knob - **SET BUG** to desired heading.
- 2) **HDG** Mode Selector Button - **PRESS**. Note **HDG** mode annunciator **ON**. Autopilot will automatically turn the aircraft to the selected heading.

c. Command Turns (Heading Hold mode ON)

- 1) **HEADING** Selector Knob - **MOVE BUG** to the desired heading. Autopilot will automatically turn the aircraft to the new selected heading.

6. NAV Coupling

a. When equipped with HSI.

- 1) Course Bearing Pointer - **SET** to desired course.

NOTE

WHEN EQUIPPED WITH NAV 1/NAV 2 SWITCHING AND NAV 2 IS SELECTED, SET OBS TO THE DESIRED COURSE.

- 2) **HEADING** Selector Knob - **SET BUG** to provide desired intercept angle.

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

BENDIX/KING

SECTION 4
NORMAL PROCEDURES

- 3) NAV Mode Selector Button - PRESS.
 - a) If the Course Deviation Bar is greater than 2 to 3 dots: the aircraft will continue in HDG mode (or wings level if HDG not selected) with the NAV annunciator flashing; when the computed capture point is reached the HDG will disengage, the NAV annunciator will illuminate steady and the selected course will be automatically captured and tracked.
 - b) If the D-Bar is less than 2 to 3 dots: the HDG mode will disengage upon selecting NAV mode; the NAV annunciator will illuminate steady and the capture/track sequence will automatically begin.
- b. When equipped with DGR
 - 1) OBS Knob - SELECT desired course.
 - 2) NAV Mode Selector Button - PRESS.
 - 3) Heading Selector Knob - ROTATE BUG to agree with OBS course.

NOTE

WHEN NAV IS SELECTED, THE LATERAL OPERATING MODE WILL CHANGE FROM HDG (IF SELECTED) TO WINGS LEVEL FOR 5 SECONDS. A 45° INTERCEPT ANGLE WILL THEN BE AUTOMATICALLY ESTABLISHED BASED ON THE POSITION OF THE BUG.

- a) If the D-Bar is greater than 2 to 3 dots: the autopilot will annunciate HDG mode (unless HDG not selected) and NAV flashing; when the computed capture point is reached the HDG annunciator will go out, the NAV annunciator will illuminate steady and the selected course will be automatically captured and tracked.

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

BENDIX/KING

SECTION 4 NORMAL PROCEDURES

- b) If the D-Bar is less than 2 to 3 dots: the HDG mode will disengage upon selecting NAV mode; the NAV annunciator will illuminate steady and the capture/track sequence will automatically begin.

7. Approach (APR) Coupling

a. When equipped with HSI

- 1) Course Bearing Pointer - SET to desired course.

NOTE

WHEN EQUIPPED WITH NAV 1/NAV 2 SWITCHING AND NAV 2 IS SELECTED, SET OBS TO THE DESIRED COURSE.

- 2) HEADING Selector Knob - SET BUG to provide desired intercept angle.

- 3) APR Mode Selector Button - PRESS.

- a) If the Course Deviation Bar is greater than 2 to 3 dots: the aircraft will continue in HDG mode (or wings level if HDG not selected) with the APR annunciator flashing; when the computed capture point is reached the HDG mode will disengage, the APR annunciator will illuminate steady and the selected course will be automatically captured and tracked.

- b) If the D-Bar is less than 2 to 3 dots: the HDG mode will disengage upon selecting APR mode; the APR annunciator will illuminate steady and the capture/track sequence will automatically begin.

b. When equipped with DG

- 1) OBS Knob - SELECT desired approach course.
- 2) APR Mode Selector Button - PRESS.

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

BENDIX/KING

SECTION 4 NORMAL PROCEDURES

- 3) Heading Selector Knob - ROTATE Bug to agree with OBS course.

NOTE

WHEN APR IS SELECTED, THE LATERAL OPERATING MODE WILL CHANGE FROM HDG (IF SELECTED) TO WINGS LEVEL FOR 5 SECONDS. A 45° INTERCEPT ANGLE WILL THEN BE AUTOMATICALLY ESTABLISHED BASED ON THE POSITION OF THE BUG.

- a) If the D-Bar is greater than 2 to 3 dots: the autopilot will annunciate HDG mode (unless HDG not selected) and APR flashing; when the computed capture point is reached the HDG annunciator will go out, the APR annunciator will illuminate steady and the selected course will be automatically captured and tracked.
- b) If the D-Bar is less than 2 to 3 dots: the HDG mode will disengage upon selecting APR mode; the APR annunciator will illuminate steady and the capture/track sequence will automatically begin.

8. BC Approach Coupling

a. When equipped with HSI

- 1) Course Bearing Pointer - SET to the ILS front course inbound heading.

NOTE

WHEN EQUIPPED WITH NAV 1/NAV 2 SWITCHING AND NAV 2 IS SELECTED, SET OBS TO THE ILS FRONT COURSE INBOUND HEADING.

- 2) HEADING Selector Knob - SET BUG to provide desired intercept angle.
- 3) BC Mode Selector Button - PRESS.

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

BENDIX/KING

SECTION 4 NORMAL PROCEDURES

- a) If the Course Deviation Bar is greater than 2 to 3 dots: the aircraft will continue in HDG mode (or wings level if HDG not selected) with BC annunciated steady and APR annunciator flashing; when the computed capture point is reached the HDG will disengage, and the BC and APR annunciators will illuminate steady and the selected course will be automatically captured and tracked.
 - b) If the D-Bar is less than 2 to 3 dots: the HDG mode will disengage upon selecting BC mode; the APR BC annunciator will illuminate steady and the capture/track sequence will automatically begin.
- b. When equipped with DG
- 1) OBS Knob - **SELECT** the ILS front course inbound heading.
 - 2) BC Mode Selector Button - **PRESS**.
 - 3) Heading Selector Knob - **ROTATE** Bug to the ILS front course inbound heading.

NOTE

WHEN BC IS SELECTED, THE LATERAL OPERATING MODE WILL CHANGE FROM HDG (IF SELECTED) TO WINGS LEVEL FOR 5 SECONDS. A 45° INTERCEPT ANGLE WILL THEN BE ESTABLISHED BASED ON THE POSITION OF THE BUG.

- a) If the D-Bar is greater than 2 to 3 dots: the autopilot will annunciate HDG (unless HDG not selected) and BC modes with APR flashing; when the computed capture point is reached the HDG annunciator will go out, the BC and APR annunciators will illuminate steady and the selected course will be automatically captured and tracked.

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

BENDIX/KING

SECTION 4
NORMAL PROCEDURES

- b) If the D-Bar is less than 2 to 3 dots: the HDG mode will disengage upon selecting BC mode; the BC and APR annunciators will illuminate steady and the capture/track sequence will automatically begin.

9. Glideslope Coupling

NOTE

GLIDESLOPE COUPLING IS INHIBITED WHEN OPERATING IN NAV OR APR BC MODES. GLIDESLOPE COUPLING OCCURS AUTOMATICALLY IN THE APR MODE.

- a. APR Mode - ENGAGED.
- b. At glideslope centering - NOTE GS annunciator ON.

NOTE

AUTOPILOT CAN CAPTURE GLIDESLOPE FROM ABOVE OR BELOW THE BEAM WHILE OPERATING IN EITHER PITCH ATTITUDE HOLD OR ALT HOLD MODES.

10. Missed Approach

- a. A/P DISC/TRIM INTER Switch - PRESS to disengage AP and YD.
- b. MISSED APPROACH - EXECUTE.
- c. CWS Button - PRESS (KFC 150 only) as desired to activate FD mode during go-around maneuver.
- d. AP ENG Button - PRESS (If AP and YD operation is desired). Note AP and YD annunciators ON.

BENDIX/KING

SECTION 4
NORMAL PROCEDURES

NOTE

IF IT IS DESIRED TO TRACK THE ILS COURSE OUTBOUND AS PART OF THE MISSED APPROACH PROCEDURE, USE THE NAV MODE TO PREVENT INADVERTANT GS COUPLING.

11. Before Landing

- a. A/P DISC/TRIM INTER Switch - PRESS to disengage AP and YD.

C. FLIGHT DIRECTOR OPERATION (KFC 150 Systems Only)

The flight director modes of operation are the same as those used for autopilot operations except the autopilot is not engaged and the pilot must maneuver the aircraft to satisfy the flight director commands.

D. YAW DAMPER OPERATION

1. With Yaw Damper Switch Installed.

- a. Before Take off.

- (1) A/P DISC/TRIM INTER Switch - Press to disengage AP and YD.

- b. Yaw Damper Engagement

- (1) YD Switch - PRESS. Note YD Annunciator on.

NOTE

YAW DAMPER ENGAGEMENT WILL OCCUR AUTOMATICALLY WITH AUTOPILOT ENGAGEMENT. THE YAW DAMPER MAY BE DISENGAGED BY PRESSING THE YD SWITCH.

- c. Before Landing

- (1) AP DISC/TRIM INTER Switch - Press to disengage AP and YD.

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

BENDIX/KING

SECTION 4
NORMAL PROCEDURES

2. Without Yaw Damper Switch Installed.

a. Before Takeoff

- (1) A/P DISC/TRIM INTER Switch Press to disengage AP and YD.

b. Yaw Damper Engagement.

- (1) FD Mode Selector Button (KFC 150 Only) - Press.
- (2) AP ENG Button - Press. Note AP and YD annunciators on.

NOTE

FOR YAW DAMPER OPERATION WITHOUT THE AUTOPILOT, DISENGAGE THE AUTOPILOT BY PRESSING THE AP ENG BUTTON OR MANUAL ELECTRIC TRIM CONTROL SWITCHES.

c. Before Landing

- (1) A/P DISC/TRIM INTER Switch - PRESS to disengage AP and YD.

SECTION 4
NORMAL PROCEDURESE. VERTICAL SPEED AND ALTITUDE SELECTOR OPERATION (IF
INSTALLED)

1. Vertical Speed Select

- a. VERTICAL SPEED SELECT knob - PULL small knob to the "OUT" position.

***** WARNING *****
VERIFY UNIT IS DISPLAYING VERTICAL SPEED SELECT WINDOW PRIOR TO
INITIATING ANY CHANGE IN THE SELECTED VERTICAL SPEED VALUE.

- b. VERTICAL SPEED SELECT knob - ROTATE until desired vertical speed is displayed.
- c. VERTICAL SPEED MODE (ENG) button - PUSH to engage the Vertical Speed Hold mode.

2. Changing Vertical Speed

a. Using CWS

- 1) CWS Button - PRESS and HOLD.
- 2) Airplane - Establish desired vertical speed.
- 3) CWS Button - RELEASE.

b. Using Vertical Trim Control

- 1) VERTICAL TRIM CONTROL - PRESS either up or down to increase or decrease the vertical speed. Displayed vertical speed changes 100 fpm for every second the control is held down.

BENDIX/KING

SECTION 4
NORMAL PROCEDURES

***** WARNING *****
WHEN OPERATING AT OR NEAR THE BEST RATE OF CLIMB AIRSPEED AND USING VERTICAL SPEED HOLD, IT IS EASY TO DECELERATE TO AN AIRSPEED ON THE BACK SIDE OF THE POWER CURVE (A DECREASE IN AIRSPEED RESULTS IN A REDUCED RATE OF CLIMB). CONTINUED OPERATION ON THE BACK SIDE OF THE POWER CURVE IN VERTICAL SPEED HOLD MODE WILL RESULT IN A STALL.

WHEN OPERATING AT OR NEAR THE MAXIMUM AUTOPILOT SPEED, IT WILL BE NECESSARY TO REDUCE POWER IN ORDER TO MAINTAIN THE DESIRED RATE OF DESCENT AND NOT EXCEED THE MAXIMUM AUTOPILOT SPEED.

3. ALTITUDE PRESELECT

- a. ALTITUDE SELECT knob - PUSH small knob to the "IN" position.

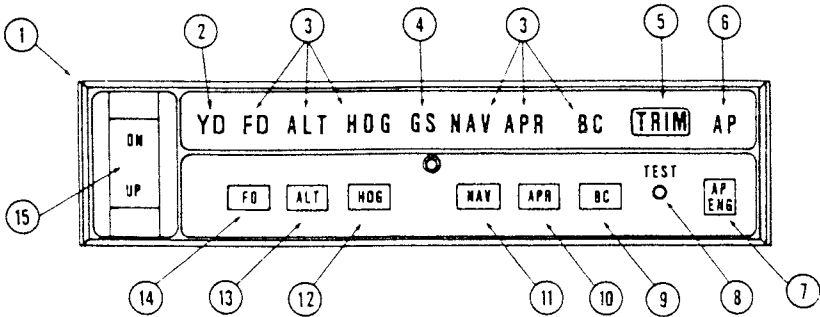
***** WARNING *****
VERIFY UNIT IS DISPLAYING ALTITUDE SELECT WINDOW PRIOR TO INITIATING ANY CHANGE IN THE SELECTED ALTITUDE VALUE.

- b. ALTITUDE SELECT knob - ROTATE until the desired altitude is displayed.
- c. ALTITUDE SELECT MODE (ARM) button - PUSH to arm the Altitude Select Mode.
- d. Airplane - ESTABLISH ATTITUDE necessary to intercept the selected altitude.

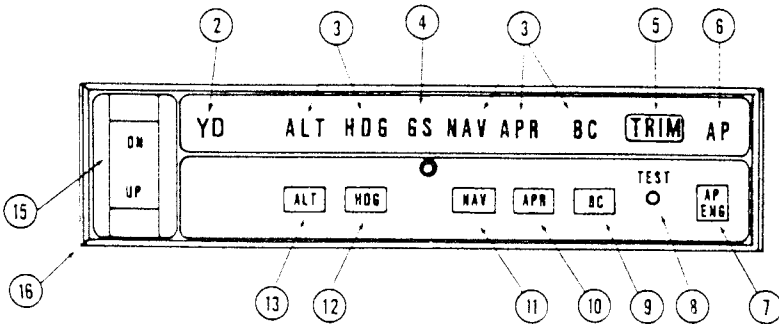
SECTION 5 - PERFORMANCE

No change.

SECTION 6 - SYSTEM DESCRIPTION AND OPERATION



KC 192 AUTOPILOT & FLIGHT DIRECTOR
COMPUTER

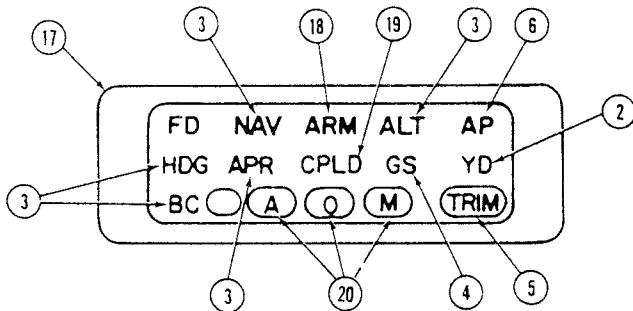


KC 191 AUTOPILOT COMPUTER

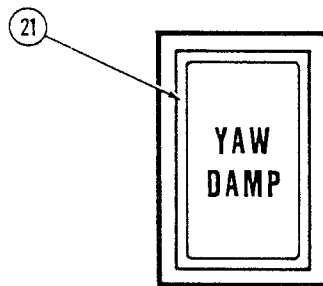
FIGURE 1 KING KAP 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

SECTION 6
SYSTEM DESCRIPTION AND OPERATION



KA 185 REMOTE MODE ANNUNCIATOR
(OPTIONAL)



YAW DAMPER SWITCH (OPTIONAL)

FIGURE 1 KING KAP 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

BENDIX/KING

SECTION 6

SYSTEM DESCRIPTION AND OPERATION

1. KFC 150 SYSTEM KC 192 AUTOPILOT COMPUTER - Complete Flight Director and Autopilot Computer, including system mode annunciators and system controls.
2. YAW DAMPER (YD) ANNUNCIATOR - Illuminates continuously when the optional Yaw Damper is engaged.
3. MODE ANNUNCIATORS - Illuminate when a mode is selected by the corresponding mode selector button (PUSH ON - PUSH OFF).
4. GLIDESLOPE (GS) ANNUNCIATOR - Illuminates continuously whenever the autopilot is coupled to the glideslope signal. The GS annunciator will flash if the glideslope signal is lost (GS flag in CDI or absence of glideslope pointers in KI 525A). The autopilot reverts to pitch attitude hold operation. If a valid glideslope signal returns within six seconds, the autopilot will automatically recouple in the GS mode. If the valid signal does not return within six seconds, the autopilot will remain in pitch attitude hold mode until such time that a valid glideslope returns and the aircraft passes thru the glideslope. At that point GS couple will re-occur.
5. TRIM WARNING LIGHT (TRIM) - Illuminates continuously whenever trim power is not on or the system has not been preflight tested. THE TRIM warning light illuminates and is accompanied by an audible warning whenever a manual trim fault is detected. The Manual Trim System is monitored for the Trim Servo running without a command. The TRIM warning light will illuminate and be accompanied by a steady audible tone whenever an autotrim failure occurs. The autotrim system is monitored for the following failures: trim servo running without a command; trim servo not running when commanded to run; trim servo running in the wrong direction. The Trim Circuit Breaker may be cycled off to silence the continuous tone but the trim fail light will remain on. Manual Electric Trim may be used but the autopilot should not be engaged.

FIGURE 1 KING KAP 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

SECTION 6
SYSTEM DESCRIPTION AND OPERATION

6. AUTOPILOT (AP) ANNUNCIATOR - Illuminates continuously whenever the autopilot is engaged. Flashes approximately 12 times whenever the autopilot is disengaged (an aural alert will also sound for 2 seconds).
7. AUTOPILOT ENGAGE (AP ENG) BUTTON - When pushed, engages autopilot if all logic conditions are met. Also engages the Yaw Damper if installed. If the Yaw Damper is installed without the Yaw Damper Switch option, Yaw Damper operation without the autopilot may be accomplished by first engaging the autopilot (and Yaw Damper) and then disengaging the autopilot by depressing the AP ENG button a second time. The Yaw damper will remain engaged. Momentary activation of manual electric trim also will disengage the autopilot leaving the Yaw Damper engaged.
8. PREFLIGHT TEST (TEST) BUTTON - When momentarily pushed, initiates preflight test sequence which automatically turns on all annunciator lights, tests the roll and pitch rate monitors, tests the autotrim fault monitor, checks the manual trim drive voltage and tests all autopilot valid and dump logic. If the preflight is successfully passed, the AP annunciator light will flash for approximately 6 seconds (an aural tone will also sound simultaneously with the annunciator flashes). The autopilot can not be engaged until the autopilot preflight tests are successfully passed.
9. BACK COURSE APPROACH (BC) MODE SELECTOR BUTTON - When pushed will select the Back Course Approach mode. This mode functions identically to the approach mode except that response to LOC signals is reversed. Glideslope coupling is inhibited in the Back Course Approach mode.

FIGURE 1 KING KAP 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORSPiper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

BENDIX/KING

SECTION 6 SYSTEM DESCRIPTION AND OPERATION

10. APPROACH (APR) MODE SELECTOR BUTTON - When pushed, will select the Approach mode. This mode provides all angle intercept (with HSI) or a fixed angle intercept of 45° (with DG), automatic beam capture and tracking of VOR, RNAV or LOC signals plus Glideslope coupling in the case of an ILS. The tracking gain of the APR mode is greater than the gain in the NAV mode. The APR annunciator on the Autopilot Computer will flash until the automatic capture sequence is initiated. On the KA 185 Remote Mode Annunciator, APR ARM will annunciate until the automatic capture sequence is initiated. At beam capture, APR CPLD will annunciate.
11. NAVIGATION (NAV) MODE SELECTOR BUTTON - When pushed will select the Navigation mode. The mode provides all angle intercept (with HSI) or a fixed angle intercept of 45° (with DG), automatic beam capture and tracking of VOR, RNAV or LOC signals. The NAV annunciator on the Autopilot Computer will flash until the automatic capture sequence is initiated. On the KA 185 Remote Mode Annunciator, NAV ARM will annunciate until the automatic capture sequence is initiated. At beam capture, NAV CPLD will annunciate.
12. HEADING (HDG) MODE SELECTOR BUTTON - When pushed will select the Heading mode, which commands the airplane to turn to and maintain the heading selected by the heading bug on the DG or HSI. A new heading may be selected at any time and will result in the airplane turning to the new heading with a maximum bank angle of about 22°. Selecting HDG mode will cancel NAV, APR or BC track modes.
13. ALTITUDE HOLD (ALT) MODE SELECTOR BUTTON - When pushed will select the Altitude Hold mode, which commands the airplane to maintain the pressure altitude existing at the moment of selection. Engagement may be accomplished in climb, descent, or level flight. In the APR mode, altitude hold will automatically disengage when the glideslope is captured.

FIGURE 1 KING KAP 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

SECTION 6
SYSTEM DESCRIPTION AND OPERATION

14. FLIGHT DIRECTOR (FD) MODE SELECTOR BUTTON - When pushed will select the Flight Director mode (with KC 192 Autopilot Computer only), bringing the Command Bar in view on the KI 256 and will command wings level and pitch attitude hold. The FD mode must be selected prior to Autopilot engagement.
15. VERTICAL TRIM CONTROL - A spring loaded to center rocker switch which will provide up or down pitch command changes: while in ALT will adjust altitude at rate of about 500 fpm; when not in ALT will adjust pitch attitude at a rate of .7 deg/sec. Will cancel GS couple. The aircraft must pass through the glideslope again to allow GS recouple.
16. KAP 150 SYSTEM KC 191 AUTOPILOT COMPUTER - Complete Autopilot computer, including system mode annunciators and system controls.
17. KA 185 REMOTE MODE ANNUNCIATOR (OPTIONAL) - Provides mode annunciation in the pilots' primary scan area as well as three Marker Beacon lights.
18. ARMED (ARM) ANNUNCIATOR - Illuminates continuously along with NAV or APR when either the NAV or APR mode selector button is depressed. The ARM annunciator will continue to illuminate until the automatic capture sequence is initiated at which time ARM will extinguish and CPLD will annunciate.
19. COUPLED (CPLD) ANNUNCIATOR - Illuminates continuously along with NAV or APR at the initiation of automatic beam capture sequence in either the NAV or APR modes. Normally the CPLD condition follows an ARM condition but may be entered into directly if the beam capture criteria is met when NAV or APR is selected.

FIGURE 1 KING KAP 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

BENDIX/KING

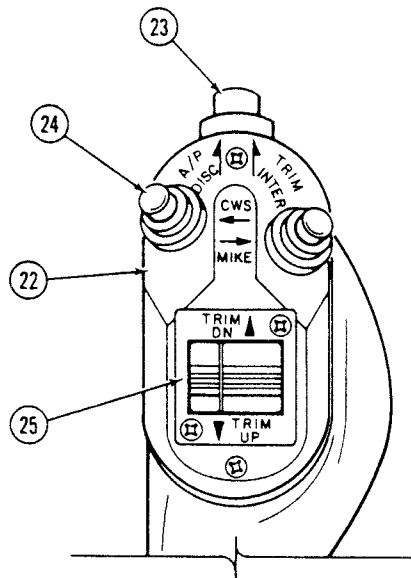
SECTION 6

SYSTEM DESCRIPTION AND OPERATION

20. REMOTE MARKER BEACON LIGHTS - Remote Airway, Outer and Middle Marker Beacon lights driven by the Marker Beacon receiver.
21. YAW DAMPER SWITCH (OPTIONAL) - May be used to engage and disengage the Yaw Damper independent of the autopilot. Illuminates continuously. (This switch is not required for Yaw Damper installation and is a convenience option).
22. AUTOPILOT CONTROL WHEEL SWITCH ASSEMBLY - Switch assembly mounted on the pilot's control wheel associated with the autopilot and manual electric trim systems.
23. AUTOPILOT DISCONNECT/TRIM INTERRUPT (A/P DISC/TRIM INTER) Switch - When depressed will disengage the autopilot and yaw damper and cancel all operating Flight Director modes. When depressed and held will interrupt all electric trim power (stop trim motion), disengage the autopilot and yaw damper and cancel all operating Flight Director modes.
24. CONTROL WHEEL STEERING (CWS) BUTTON - When depressed, allows pilot to manually control the aircraft (disengages the pitch and roll servos) without cancellation of any of the selected modes. Will engage the Flight Director mode if not previously engaged. Automatically synchronizes the Flight Director/Autopilot to the pitch attitude present when the CWS switch is released, or to the present pressure altitude when operating in the ALT hold mode. Will cancel GS couple. The aircraft must pass through the glideslope again to allow GS recouple. The CWS button will not disengage the Yaw Damper Servo.

FIGURE 1 KING KAP 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement



AUTOPILOT CONTROL WHEEL SWITCH CAP

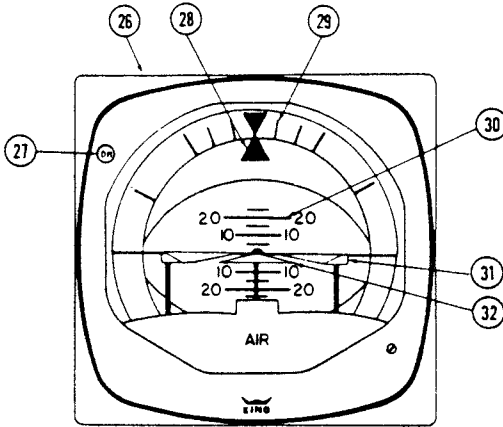
25. MANUAL ELECTRIC TRIM CONTROL SWITCHES - A split switch unit in which the left half provides power to engage the trim servo clutch and the right half to control the direction of motion of the trim servo motor. Both halves of the split trim switch must be actuated in order for the manual trim to operate in the desired direction. When the autopilot is engaged, operation of the manual electric trim will automatically disconnect the autopilot but not the yaw damper.
26. KI 256 FLIGHT COMMAND INDICATOR (FCI) - Displays airplane attitude as a conventional attitude gyro and displays commands for flight director operation. The gyro is air driven.

FIGURE 1 KING KAP 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

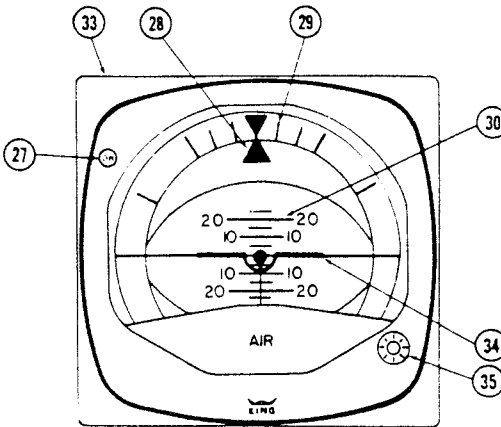
Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

BENDIX/KING

SECTION 6 SYSTEM DESCRIPTION AND OPERATION



KI 256 FLIGHT COMMAND INDICATOR

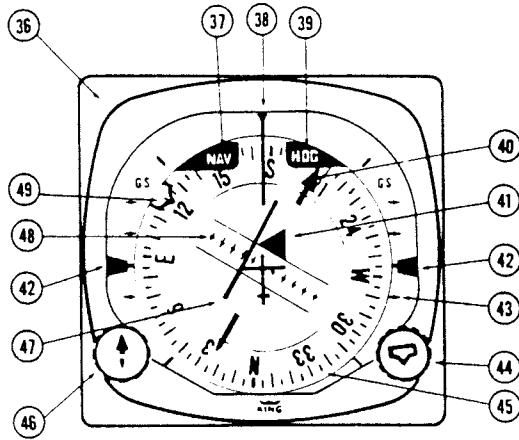


KG 258 VERTICAL GYRO

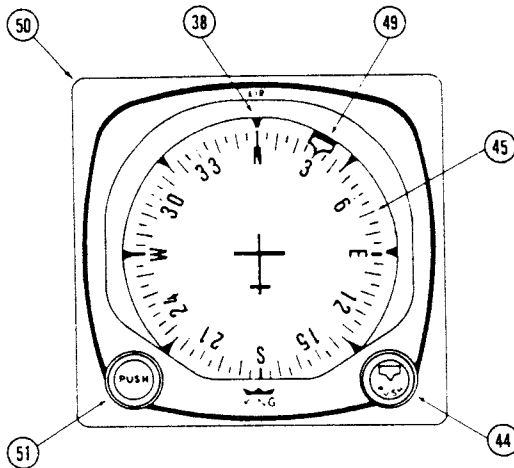
FIGURE 1 KING KAP 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

SECTION 6
SYSTEM DESCRIPTION AND OPERATION



KI 525A HSI



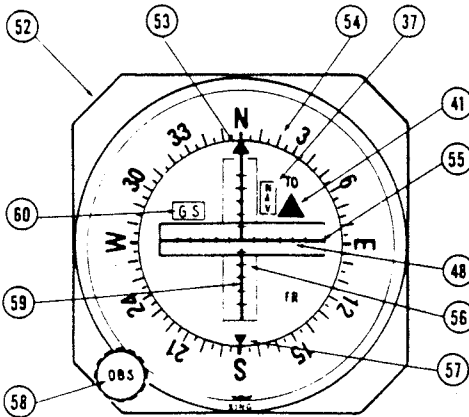
KG 107 DG

FIGURE 1 KING KAP 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

BENDIX/KING

SECTION 6 SYSTEM DESCRIPTION AND OPERATION



KI 204/206 VOR/LOC/GS INDICATOR

27. DECISION HEIGHT (DH) ANNUNCIATOR LIGHT - Optional light for use with the aircraft's optional radar altimeter.
28. ROLL ATTITUDE INDEX - Displays airplane roll attitude with respect to the roll attitude scale.
29. ROLL ATTITUDE SCALE - Scale marked at 0, ± 10 , 20, 30, 60 and 90 degrees.
30. PITCH ATTITUDE SCALE - Moves with respect to the symbolic airplane to present pitch attitude. Scale graduated at 0, ± 5 , 10, 15, 20 and 25 degrees.
31. COMMAND BAR - Displays computed steering commands referenced to the symbolic airplane. The command bar is visible only when FD mode is selected. The command bar will be biased out of view whenever the system is invalid or a Flight Director mode is not engaged.

FIGURE 1 KING KAP 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

SECTION 6
SYSTEM DESCRIPTION AND OPERATION

32. FCI SYMBOLIC AIRPLANE - Airplane pitch and roll attitude is displayed by the relationship between the fixed symbolic airplane and the movable background.
- During flight director operation, the symbolic airplane is flown to align it with the command bar to satisfy the flight director commands.
33. KG 258 VERTICAL GYRO - Displays airplane attitude as a conventional attitude gyro. The gyro is air driven.
34. SYMBOLIC AIRPLANE - Serves as a stationary symbol of the aircraft. Aircraft pitch and roll attitudes are displayed by the relationship between the fixed symbolic aircraft and the movable background.
35. SYMBOLIC AIRCRAFT ALIGNMENT KNOB - Provides manual positioning of the symbolic aircraft for level flight under various load conditions.
36. KI 525A HORIZONTAL SITUATION INDICATOR (HSI) - Provides a pictorial presentation of aircraft deviation relative to VOR radials or localizer beams. It also displays glideslope deviations and gives heading reference with respect to magnetic north.
37. NAV FLAG - Flag is in view when the NAV receiver signal is inadequate. When a NAV flag is present in the navigation indicator (CDI or KI 525A) the autopilot operation is not affected. The pilot must monitor the navigation indicators for NAV flags to insure that the Autopilot and/or Flight Director are tracking valid navigation information.
38. LUBBER LINE - Indicates aircraft magnetic heading on compass card (45).

FIGURE 1 KING KAP 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORSPiper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

BENDIX/KING

SECTION 6 SYSTEM DESCRIPTION AND OPERATION

39. HEADING WARNING FLAG (HDG) - When flag is in view the heading display is invalid. If a HDG flag appears and a lateral mode (HDG, NAV, APR or APR BC) is selected, the Autopilot will be disengaged. The Autopilot may be re-engaged in the basic wings level mode along with any vertical mode. The CWS switch would be used to manually maneuver the aircraft laterally.
40. COURSE BEARING POINTER - Indicates selected VOR course or localizer course on compass card (45). The selected VOR radial or localizer heading remains set on the compass card when the compass card (45) rotates.
41. TO/FROM INDICATOR FLAG - Indicates direction of VOR station relative to selected course.
42. DUAL GLIDESLOPE POINTERS - Indicate on glideslope scale (43) aircraft displacement from glideslope beam center. Glideslope pointers in view indicate a usable glideslope signal is being received.
43. GLIDESLOPE SCALES - Indicate displacement from glideslope beam center. A glideslope deviation bar displacement of 2 dots, represents full scale (0.7°) deviation above or below glideslope beam centerline.
44. HEADING SELECTOR KNOB - Positions heading bug (49) on compass card (45) by rotating the heading selector knob. The Bug rotates with the compass card.
45. COMPASS CARD - Rotates to display heading of airplane with reference to lubber line (38) on HSI or DG.
46. COURSE SELECTOR KNOB - Positions course bearing pointer (40) on the compass card (45) by rotating the course selector knob.

FIGURE 1 KING KAP 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

SECTION 6
SYSTEM DESCRIPTION AND OPERATION

47. COURSE DEVIATION BAR (D-BAR) - The center portion of omni bearing pointer moves laterally to pictorially indicate the relationship of aircraft to the selected course. It indicates degrees of angular displacement from VOR radials and localizer beams, or displacement in nautical miles from RNAV courses.
48. COURSE DEVIATION SCALE - A course deviation bar displacement of 5 dots represents full scale (VOR = $\pm 10^\circ$, LOC = $\pm 2 \frac{1}{2}^\circ$, RNAV = 5NM, RNAV APR = $1 \frac{1}{4}$ NM) deviation from beam centerline.
49. HEADING BUG - Moved by knob (44) to select desired heading.
50. KG 107 NON-SLAVED DIRECTIONAL GYRO (DG) - Provides a stable visual indication of aircraft heading to the pilot. The gyro is air driven.
51. GYRO ADJUSTMENT KNOB (PUSH) - When pushed in, allows the pilot to manually rotate the gyro compass card (45) to correspond with the magnetic heading indicated by the magnetic compass. The unslaved compass card must be manually reset periodically to compensate for precessional errors in the gyro.
52. KI 204/206 VOR/LOC/GLIDESLOPE INDICATOR - Provides rectilinear display of VOR/LOC and Glideslope deviation.
53. COURSE INDEX - Indicates selected VOR course.
54. COURSE CARD - Indicates selected VOR course under course index.
55. GLIDESLOPE DEVIATION NEEDLE - Indicates deviation from ILS glideslope.

FIGURE 1 KING KAP 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORSPiper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

BENDIX/KING

SECTION 6

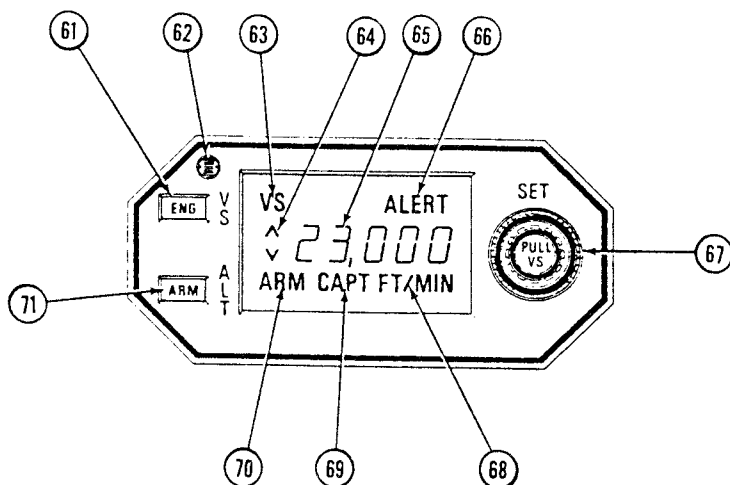
SYSTEM DESCRIPTION AND OPERATION

56. GLIDESLOPE SCALE - Indicates displacement from glideslope beam center. A glideslope deviation needle displacement of 5 dots, represents full scale (0.7°) deviation above or below glideslope beam centerline.
57. RECIPROCAL COURSE INDEX - Indicates reciprocal of selected VOR course.
58. OMNI BEARING SELECTOR (OBS) KNOB - Rotates course card to selected course.
59. COURSE DEVIATION NEEDLE - Indicates course deviation from selected omni course or localizer centerline.
60. GLIDESLOPE (GS) FLAG - Flag is in view when the GS receiver signal is inadequate.

FIGURE 1 KING KAP 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

SECTION 6
SYSTEM DESCRIPTION AND OPERATION



KAS 297B VERTICAL SPEED AND ALTITUDE SELECTOR

61. VERTICAL SPEED MODE (ENG) BUTTON - When pressed will engage the Vertical Speed Hold mode. When pressed a second time will disengage the Vertical Speed Hold mode. When pressed with altitude displayed, will engage the Vertical Speed Hold mode and re-sync the Vertical Speed Hold mode to the current vertical speed of the airplane.
62. PHOTOCELL - Automatically dims display according to the cockpit ambient light.
63. VERTICAL SPEED (VS) ANNUNCIATOR - Illuminates when the Vertical Speed Hold mode is engaged.
64. VERTICAL SPEED UP/DOWN CARETS - Indicates whether the selected vertical speed is up or down.
65. GAS DISCHARGE DISPLAY - Displays selected altitude from 100 to 35,000 feet or the selected vertical speed from 0 to 3,000 feet per minute up or down.

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

SECTION 6

SYSTEM DESCRIPTION AND OPERATION

66. ALTITUDE ALERT (ALERT) ANNUNCIATOR) - The ALERT annunciator is illuminated 1000 ft prior to the selected altitude, goes out 300 ft prior to the selected altitude and illuminates momentarily when the selected altitude is reached. Once the selected altitude is reached the light signifies that the 300 ft "safe band" has been exceeded and will remain on until 1000 ft from the selected altitude. The alert light is accompanied by a 2 second aural tone anytime the light initially comes on or the selected altitude is reached.
67. VERTICAL SPEED/ALTITUDE SELECT KNOB - Concentric knobs which allow easy setting of altitude or vertical speed. The small knob (inner) has an in and out position.
- Altitude is displayed and selected when the small knob is in the "IN" position. When rotated the small knob selects altitude in 100 foot increments with roll over into the 1000 digits. The larger knob (outer) selects altitude in 1000 foot increments with roll over into the 10,000 digits.
- Vertical speed is displayed and selected when the small knob is in the "out" position. When rotated the small knob selects vertical speed in 100 fpm increments. The larger knob selects vertical speed in 1000 fpm increments up to a maximum of 3000 fpm.
68. MODE (FT or FT/MIN) ANNUNCIATOR - Indicates FT/MIN when in the Vertical Speed Hold mode and FT when in the Altitude Select mode.
69. ALTITUDE CAPTURE (CAPT) ANNUNCIATOR - Indicates the KAS 297B has switched the autopilot from Pitch Attitude Hold or Vertical Speed Hold mode into the pitch roundout mode (CAPT). The point, just prior to transfer into Altitude Hold, at which the CAPT mode becomes active varies with the vertical speed, i.e. The higher the rate of climb, the sooner the CAPT mode becomes active; at low rates of climb the activation of the CAPT mode and transfer to altitude hold occur almost simultaneously.

FIGURE 1 KING KAP 150 AUTOPILOT SYSTEM
CONTROLS AND INDICATORS

Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

SECTION 6

SYSTEM DESCRIPTION AND OPERATION

70. ALTITUDE SELECT ARM (ARM) ANNUNCIATOR - Indicates that the Altitude Select mode is armed to capture the selected altitude.
71. ALTITUDE SELECT MODE (ARM) BUTTON - When pressed and the selected altitude is displayed, will arm the Altitude Select mode. The Altitude Select (ARM) mode will cancel altitude hold (ALT) if ALT is already engaged. If Altitude Select (ARM) mode is present when GS couple occurs, the GS mode will cancel Altitude Select (ARM) mode. The engagement of ALT by the pilot's use of the ALT switch will cancel the Altitude Select (ARM) mode. Reselection of a new altitude will also cycle the Altitude Select (ARM) mode off.
72. CONTROL WHEEL STEERING (CWS) BUTTON (Not shown) - When pressed, in addition to the normal autopilot functions the CWS also interfaces with the KAS 297B. When operating in the Vertical Speed Hold mode, the CWS will re-sync the Vertical Speed Hold mode to the current vertical speed of the airplane. If altitude is displayed when the CWS is pressed, the display will automatically display vertical speed as long as the CWS is depressed. CWS does not affect the Altitude Select mode.
73. VERTICAL TRIM CONTROL (Not shown) - When in the Vertical Speed Hold mode this control can be used to slew the vertical speed up or down at 100 fpm for every second the rocker switch is held down. If altitude is being displayed at the time the rocker switch is depressed, vertical speed will be displayed until 1-2 seconds after the rocker switch is released.

BENDIX/KING

SECTION 6
SYSTEM DESCRIPTION AND OPERATION

70. ALTITUDE SELECT ARM (ARM) ANNUNCIATOR - Indicates that the Altitude Select mode is armed to capture the selected altitude.
71. ALTITUDE SELECT MODE (ARM) BUTTON - When pressed and the selected altitude is displayed, will arm the Altitude Select mode. The Altitude Select (ARM) mode will cancel altitude hold (ALT) if ALT is already engaged. If Altitude Select (ARM) mode is present when GS couple occurs, the GS mode will cancel Altitude Select (ARM) mode. The engagement of ALT by the pilot's use of the ALT switch will cancel the Altitude Select (ARM) mode. Reselection of a new altitude will also cycle the Altitude Select (ARM) mode off.
72. CONTROL WHEEL STEERING (CWS) BUTTON (Not shown) - When pressed, in addition to the normal autopilot functions the CWS also interfaces with the KAS 297B. When operating in the Vertical Speed Hold mode, the CWS will re-sync the Vertical Speed Hold mode to the current vertical speed of the airplane. If altitude is displayed when the CWS is pressed, the display will automatically display vertical speed as long as the CWS is depressed. CWS does not affect the Altitude Select mode.
73. VERTICAL TRIM CONTROL (Not shown) - When in the Vertical Speed Hold mode this control can be used to slew the vertical speed up or down at 100 fpm for every second the rocker switch is held down. If altitude is being displayed at the time the rocker switch is depressed, vertical speed will be displayed until 1-2 seconds after the rocker switch is released.

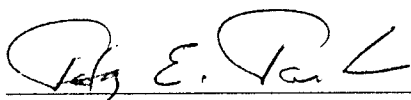
Piper Models PA-46-310P and PA-46-350P
Airplane Flight Manual Supplement

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 23
FOR
BENDIX/KING KLN 90B GPS
NAVIGATION SYSTEM WITH
KAP/KFC 150 AUTOPILOT SYSTEM

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the optional Bendix/King KLN 90B GPS Navigation System is installed per Equipment List. The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED



PETER E. PECK
D.O.A. NO. SO.-1
PIPER AIRCRAFT CORPORATION
VERO BEACH, FLORIDA

DATE OF APPROVAL _____ MAY 25, 1995 _____

SECTION 1 - GENERAL

The KLN 90B GPS panel mounted unit contains the GPS sensor, the navigation computer, a CRT display, and all controls required to operate the unit. It also houses the data base cartridge which plugs directly into the back of the unit.

The data base cartridge is an electronic memory containing information on airports, nav aids, intersections, SID's, STAR's, instrument approaches, special use airspace, and other items of value to the pilot.

Every 28 days, Bendix/King receives new data base information from Jeppesen Sanderson for the North American data base region. This information is processed and downloaded onto the data base cartridges. Bendix/King makes these data base cartridge updates available to KLN 90B GPS users.

Provided the KLN 90B GPS navigation system is receiving adequate usable signals, it has been demonstrated capable of and has been shown to meet the accuracy specifications of:

VFR/IFR en route oceanic and remote, en route domestic, terminal, and instrument approach (GPS, Loran-C, VOR, VOR-DME, TACAN, NDB, NDB-DME, RNAV) operation within the U.S. National Airspace System, North Atlantic Minimum Navigation Performance Specifications (MNPS) Airspace and latitudes bounded by 74° North and 60° South using the WGS-84 (or NAD 83) coordinate reference datum in accordance with the criteria of AC 20-138, AC 91-49, and AC 120-33. Navigation data is based upon use of only the global positioning system (GPS) operated by the United States.

NOTE:

Aircraft using GPS for oceanic IFR operations may use the KLN 90B to replace one of the other approved means of long-range navigation. A single KLN 90B GPS installation may also be used on short oceanic routes which require only one means of long range navigation.

NOTE:

FAA approval of the KLN 90B does not necessarily constitute approval for use in foreign airspace.

SECTION 2 - LIMITATIONS

- A. The KLN 90B GPS Pilot's Guide, P/N 006-08773-0000, dated December, 1994 (or later applicable revision) must be immediately available to the flight crew whenever navigation is predicated on the use of the system. The Operational Revision Status (ORS) of the Pilot's Guide must match the ORS level annunciated on the Self Test page.
- B. IFR Navigation is restricted as follows:
 - 1. The system must utilize ORS level 20 or later FAA approved revision.
 - 2. The data on the self test page must be verified prior to use. Verify valid altitude data is available to the KLN 90B prior to flight.
 - 3. IFR en route and terminal navigation is prohibited unless the pilot verifies the currency of the data base or verifies each selected waypoint for accuracy by reference to current approved data.
 - 4. Instrument approaches must be accomplished in accordance with approved instrument approach procedures that are retrieved from the KLN 90B data base. The KLN 90B data base must incorporate the current update cycle.
 - (a) The KLN 90B Memory Jogger, P/N 006-08785-0000, dated 12/94 (or later applicable revision) must be immediately available to the flight crew during instrument approach operations.
 - (b) Instrument approaches must be conducted in the approach mode and RAIM must be available at the Final Approach Fix.
 - (c) APR ACTV mode must be annunciated at the Final Approach Fix.
 - (d) Accomplishment of ILS, LOC, LOC-BC, LDA, SDF, and MLS approaches are not authorized.
 - (e) When an alternate airport is required by the applicable operating rules, it must be served by an approach based on other than GPS or Loran-C navigation.
 - (f) The KLN 90B can only be used for approach guidance if the reference coordinate datum system for the instrument approach is WGS-84 or NAD-83. (All approaches in the KLN 90B data base use the WGS-84 or the NAD-83 geodetic datums.)
 - 5. The aircraft must have other approved navigation equipment appropriate to the route of flight installed and operational.

**SECTION 3 - EMERGENCY PROCEDURES
ABNORMAL PROCEDURES**

- A. If the KLN 90B GPS information is not available or invalid, utilize remaining operational navigation equipment as required.
- B. If a "RAIM NOT AVAILABLE" message is displayed while conducting an instrument approach, terminate the approach. Execute a missed approach if required.
- C. If a "RAIM NOT AVAILABLE" message is displayed in the en route or terminal phase of flight, continue to navigate using the KLN 90B or revert to an alternate means of navigation appropriate to the route and phase of flight. When continuing to use GPS navigation, position must be verified every 15 minutes using another IFR approved navigation system.
- D. Refer to the KLN 90B Pilot's Guide, Appendices B and C, for appropriate pilot actions to be accomplished in response to annunciated messages.

SECTION 4 - NORMAL PROCEDURES

WARNING:

Familiarity with the en route operation of the KLN 90B does not constitute proficiency in approach operations. Do not attempt approach operations in IMC prior to attaining proficiency in the use of the KLN 90B.

A. OPERATION

Normal operating procedures are outlined in the KLN 90B GPS Pilot's Guide, P/N 006-08773-0000, dated December, 1994, (or later applicable revision). A KLN 90B Memory Jogger, P/N 006-08785-0000 dated 12/94 (or later applicable revision) containing an approach sequence, operating tips and approach related messages is intended for cockpit use by the KLN 90B familiar pilot when conducting instrument approaches.

B. SYSTEM ANNUNCIATORS/SWITCHES/CONTROLS

- 1. HSI NAV presentation (NAV/GPS) switch annunciator - May be used to select data for presentation on the pilot's HSI; either NAV data from the number one navigation receiver or GPS data from the KLN 90B GPS. Presentation on the HSI is also required for autopilot coupling. NAV is green. GPS is blue.
- 2. Message (MSG) annunciator - Will flash to alert the pilot of a situation that requires attention. Press the MSG button on the KLN 90B GPS to view the message. (Appendix B of the KLN 90B Pilot's Guide contains a list of all of the message page messages and their meanings). MSG is amber.

SECTION 4 - NORMAL PROCEDURES (CONT'D)

3. Waypoint (WPT) annunciator - Prior to reaching a waypoint in the active flight plan, the KLN 90B GPS will provide navigation along a curved path segment to ensure a smooth transition between two adjacent legs in the flight plan. This feature is called turn anticipation. Approximately 20 seconds prior to the beginning of turn anticipation the WPT annunciator will flash, going solid upon initialization of the turn, and extinguishing upon turn completion. WPT is amber.

WARNING:

Turn anticipation is automatically disabled for FAF waypoints and those used exclusively in SID/STARS where overflight is required. For waypoints shared between SID/STARS and published en route segments (requiring overflight in the SID/STARS), proper selection on the presented waypoint page is necessary to provide adequate route protection on the SID/STARS.

4. GPS omni bearing or leg (GPS CRS OBS/LEG) course switch/annunciator - Used to select the basic modes of KLN 90B operation, either a) single waypoint with omni - bearing course (OBS) selection through that waypoint (like a VOR) or b) automatic leg sequencing (LEG) between waypoints. GPS CRS is white. OBS may either be white or amber. LEG is green.

NOTE:

Either LEG or OBS will illuminate during system self test depending upon switch position.

5. HSI course control ① knob - Provides analog course input to the KLN 90B in OBS when the NAV/GPS switch/annunciator is in GPS. When the NAV/GPS switch annunciation is in NAV, GPS course selection in OBS mode is digital through the use of the controls and display at the KLN 90B. The HSI course control knob must also be set to provide proper course datum to the autopilot if coupled to the KLN 90B in LEG or OBS.

SECTION 4 - NORMAL PROCEDURES (CONT'D)

NOTE

Manual HSI course centering in OBS using the control knob can be difficult, especially at long distances. Centering the dbar can best be accomplished by pressing  and then manually setting the HSI pointer to the course value prescribed in the KLN 90B displayed message.

6. GPS approach (GPS APR ARM/ACTV) switch/annunciator - Used to a) manually select or deselect approach ARM (or deselect approach ACTV) and b) annunciate the stage of approach operation either armed (ARM) or activated (ACTV). Sequential button pushes if in ACTV would first result in approach ARM and then approach arm canceled. Subsequent button pushes will cycle between the armed state (if an approach is in the flight plan) and approach arm canceled. Approach ACTV cannot be selected manually. GPS APR and ARM are white. ACTV is green.
7. RMI NAV presentation switch - May be used to select data for presentation on the RMI; either NAV 2 data from the number two navigation receiver, or GPS data from the KLN 90B GPS.

C. PILOT'S DISPLAY

Left/right steering information is presented on the pilot's HSI as a function of the NAV/GPS switch position.

D. AUTOPILOT COUPLED OPERATION

The KLN 90B may be coupled to the autopilot by first selecting GPS on the NAV/GPS switch. Manual selection of the desired track on the pilot's HSI course pointer is required to provide course datum to the autopilot. (Frequent manual course pointer changes may be necessary, such as in the case of flying a DME arc.) The autopilot approach mode (APR) should be used when conducting a coupled GPS approach.

NOTE

Select HDG mode for DME arc intercepts. NAV or APR coupled DME arc intercepts can result in excessive overshoots (aggravated by high ground speeds and/or intercepts from inside the arc).

SECTION 4 - NORMAL PROCEDURES (CONT'D)

E. APPROACH MODE SEQUENCING AND RAIM PREDICTION

NOTE

The special use airspace alert will automatically be disabled prior to flying an instrument approach to reduce the potential for message congestion.

1. Prior to arrival, select a STAR if appropriate from the APT 7 page. Select an approach and an initial approach fix (IAF) from the APT 8 page.

NOTES

- Using the right hand outer knob, select the ACT (Active Flight Plan Waypoints) pages. Pull the right hand inner knob out and scroll to the destination airport, then push the inner knob in and select the ACT 7 or ACT 8 page.
 - To delete or replace a SID, STAR or approach, select FPL 0 page. Place the cursor over the name of the procedure, press ENT to change it, or CLR then ENT to delete it.
2. En route, check for RAIM availability at the destination airport ETA on the STA 5 page.

NOTE

RAIM must be available at the FAF in order to fly an Instrument approach. Be prepared to terminate the approach upon loss of RAIM.

3. At 30 nm from the FAF:
 - a. Verify automatic annunciation of APR ARM.
 - b. Note automatic dbar scaling change from $\pm 5.0\text{nm}$ to $\pm 1.0\text{ nm}$ over the next 30 seconds.
 - c. Update the KLN 90B altimeter baro setting as required.
 - d. Internally the KLN 90B will transition from en route to terminal integrity monitoring.

SECTION 4 - NORMAL PROCEDURES (CONT'D)

4. Select Super NAV 5 page to fly the approach procedure.
 - a. If receiving radar vectors, or need to fly a procedure turn or holding pattern, fly in OBS until inbound to the FAF.

NOTE:

OBS navigation is TO-FROM (like a VOR) without waypoint sequencing.

- b. NoPT routes including DME arc's are flown in LEG. LEG is mandatory from the FAF to the MAP.

NOTE:

Select HDG mode for DME arc intercepts.
NAV or APR coupled DME arc intercepts can result in excessive overshoots (aggravated by high ground speeds and/or intercepts from inside the arc).

WARNING:

Flying final outbound from an off airport vortae on an overlay approach; beware of the DME distance increasing on final approach, and the GPS distance-to-waypoint decreasing, and not matching the numbers on the approach plate!

5. At or before 2 nm from the FAF inbound:
 - a. Select the FAF as the active waypoint, if not accomplished already.
 - b. Select LEG operation.
6. Approaching the FAF inbound (within 2 nm.):
 - a. Verify APR ACTV.
 - b. Note automatic dbar scaling change from ± 1.0 nm to ± 0.3 nm over the 2 nm inbound to the FAF.
 - c. Internally the KLN 90B will transition from terminal to approach integrity monitoring.
7. Crossing the FAF and APR ACTV is not annunciated:
 - a. Do not descend.
 - b. Execute missed approach.

SECTION 4 - NORMAL PROCEDURES (CONT'D)

8. Missed Approach:

- a. Climb
- b. Navigate to the MAP (in APR ARM if APR ACTV is not available).

NOTE:

There is no automatic LEG sequencing at the MAP.

- c. After climbing in accordance with the published missed approach procedure, press , verify or change the desired holding fix and press ENT.

GENERAL NOTES

- The data base must be up to date for instrument approach operation.
- Only one approach can be in the flight plan at a time.
- If the destination airport is the active waypoint at the time of the instrument approach selection, the active waypoint will shift automatically to the chosen IAF.
- Checking RAIM prediction for your approach while en route using the STA 5 page is recommended. A self check occurs automatically within 2nm of the FAF. APR ACTV is inhibited without RAIM.
- Data cannot be altered, added to or deleted from the approach procedures contained in the data base. (DME arc intercepts may be relocated along the arc through the SUPER NAV 5 or the FPL 0 pages).
- Some approach waypoints do not appear on the approach plates (including in some instances the FAF)!

SECTION 4 - NORMAL PROCEDURES (CONT'D)

- Waypoint suffixes in the flight plan:
 - i - IAF
 - f - FAF
 - m - MAP
 - h - missed approach holding fix.
- The DME arc IAF (arc intercept waypoint) will be a) on your present position radial off the arc VOR when you load the IAF into the flight plan, or b) the beginning of the arc if currently on a radial beyond the arc limit. To adjust the arc intercept to be compatible with a current radar vector, bring up the arc IAF waypoint in the SUPER NAV 5 page scanning field or under the cursor on the FPL 0 page, press CLR, then ENT. Fly the arc in LEG. adjust the HSI or CDI course pointer with reference to the desired track value on the SUPER NAV5 page (it will flash to remind you). Left/right dbar information is relative to the arc. Displayed distance is not along the arc but direct to the active waypoint. If desired, select NAV 2 page for digital DME arc distance to and radial from the reference VOR. (The ARC radial is also displayed on the SUPERNAV5 page.)
- The DME arc IAF identifier may be unfamiliar. Example: D098G where 098 stands for the 098° radial off the referenced VOR, and G is the seventh letter in the alphabet indicating a 7 DME arc.

SECTION 4 - NORMAL PROCEDURES (CONT'D)

- APR ARM to APR ACTV is automatic provided:
 - a. You are in APR ARM (normally automatic).
 - b. You are in LEG model!
 - c. The FAF is the active ; waypoint
 - d. Within 2 n.m. of the FAF.
 - e. Outside of the FAF.
 - f. Inbound to the FAF.
 - g. RAIM is available.
- Direct-To operation between the FAF and MAP cancels APR ACTV. Fly the missed approach in APR ARM.
- Flagged navigation inside the FAF may usually be restored (not guaranteed) by pressing the GPS APR button changing from ACTV to ARM. Fly the missed approach.
- The instrument approach using the KLN 90B may be essentially automatic starting 30 nm out (with a manual baro setting update) or it may require judicious selection of the OBS and LEG modes.
- APR ARM may be canceled at any time by pressing the GPS APR button. (A subsequent press will reselect it.)

SECTION 5 - PERFORMANCE

No Change.

SECTION 6 - WEIGHT AND BALANCE

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

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 10
OPERATING TIPS**

10.1 GENERAL

This section provides operating tips of particular value in the operation of the Malibu.

10.3 OPERATING TIPS

- (a) Learn to trim for takeoff so that only a very light back pressure on the control wheel is required to lift the airplane off the ground
- (b) The best speed for takeoff is 80 to 85 KIAS under normal conditions. Trying to pull the airplane off the ground at too low an airspeed decreases the controllability of the airplane in the event of engine failure.
- (c) 10° of flaps may be lowered at airspeeds up to 165 KIAS and full flaps up to 116 KIAS, but to reduce flap operating loads, it is desirable to have the airplane at a slower speed before extending the flaps.
- (d) Before attempting to reset any circuit breaker, allow a two to five minute cooling off period.
- (e) Before starting the engine, check that all radio switches, light switches and the pitot heat switch are in the off position so as not to create an overloaded condition when the starter is engaged.
- (f) Anti-collision lights should not be operating when flying through cloud, fog or haze, since reflected light can produce spatial disorientation. Strobe lights should not be used in close proximity to the ground, such as during taxiing, takeoff or landing.

10.3 OPERATING TIPS (continued)

- (g) In an effort to avoid accidents, pilots should obtain and study the safety related information made available in FAA publications, such as regulations, advisory circulars, Aviation News, AIM and safety aids.
- (h) Prolonged slips or skids which result in excess of 2000 feet of altitude loss or other radical or extreme maneuvers which could cause uncovering of the fuel outlet must be avoided as fuel flow interruption may occur when the tank being used is not full.
- (i) Pilots who fly above 10,000 feet should be aware of the need for special physiological training. Appropriate training is available for a small fee at approximately twenty-three Air Force Bases throughout the United States. The training is free at the NASA Center in Houston and at the FAA Aeronautical Center in Oklahoma.

Forms to be completed (Physiological Training Application and Agreement) for application for the training course may be obtained by writing to the following address:

Chief of Physiological Training, AAC-143
FAA Aeronautical Center
P.O. Box 25082
Oklahoma City, Oklahoma 73125

It is recommended that all pilots who plan to fly above 10,000 feet take this training before flying this high and then take refresher training every two or three years.

Garmin International 1200 E. 151st Street
Olathe, KS 66062 USA

AIRPLANE FLIGHT MANUAL SUPPLEMENT or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for STC SA02119SE
GARMIN GDL 88 ADS-B TRANSCEIVER

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for the
Garmin GDL 88 ADS-B Transceiver
as installed in

Piper PA-46-350P
Make and Model Airplane

Registration Number: N9153W Serial Number: 4622012

This document serves as an Airplane Flight Manual Supplement or as a Supplemental Airplane Flight Manual when the aircraft is equipped in accordance with Supplemental Type Certificate SA02119SE for the installation and operation of the Garmin GDL 88 ADS-B Transceiver. This document must be incorporated into the FAA Approved Airplane Flight Manual or provided as an FAA Approved Supplemental Airplane Flight Manual.

The information contained herein supplements the information in the FAA Approved Airplane Flight Manual. For limitations, procedures, loading and performance information not contained in this document, refer to the FAA Approved Airplane Flight Manual, markings, or placards.

FAA APPROVED 28-DEC-2012

Robert Grove

Robert Grove
ODA STC Unit Administrator
GARMIN International, Inc
ODA-240087-CE

Garmin International 1200 E. 151st Street
Olathe, KS 66062 USA

AIRPLANE FLIGHT MANUAL SUPPLEMENT or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for STC SA02119SE
GARMIN GDL 88 ADS-B TRANSCEIVER

LOG OF REVISIONS		
Revision Number	Date	Description
1	12/18/2012	Complete Supplement

Garmin International 1200 E. 151st Street
Olathe, KS 66062 USA

AIRPLANE FLIGHT MANUAL SUPPLEMENT or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for STC SA02119SE
GARMIN GDL 88 ADS-B TRANSCEIVER

Table of Contents

SECTION	PAGE
Section 1. GENERAL	4
1.1 Garmin GDL 88 UAT Transceiver	4
1.2 Capabilities	6
1.3 Installation Configuration	6
Definitions	8
Section 2. LIMITATIONS	9
2.1 Minimum Equipment	9
2.2 ADS-B Out	9
2.3 Anonymous Mode	9
2.4 Applicable System Software	9
2.5 Pressure Altitude Broadcast Inhibit (PABI)	9
2.6 Traffic Alerting	10
Section 3. EMERGENCY PROCEDURES	11
3.1 Emergency Procedures	11
3.2 Abnormal Procedures	11
Section 4. NORMAL PROCEDURES	14
4.1 Unit Power On	14
4.2 Before Takeoff	14
Section 5. PERFORMANCE	15
Section 6. WEIGHT AND BALANCE	15
Section 7. SYSTEM DESCRIPTIONS	16
7.1 Pilot's Guide	16
7.2 Traffic Sources and Alerting	16
7.3 Interfaced Active Traffic System (Optional)	16
7.4 Power	17
7.5 External Switches	17

Section 1. GENERAL

1.1 Garmin GDL 88 UAT Transceiver

The Garmin GDL 88 UAT Transceiver is an ADS-B system comprised of a Garmin TSO-C154c GDL 88, one or two UAT/1090 antenna(s), optional Garmin approved GPS/SBAS antenna, optional Garmin GPS/SBAS position source, and other interfaces as shown in the following block diagram.

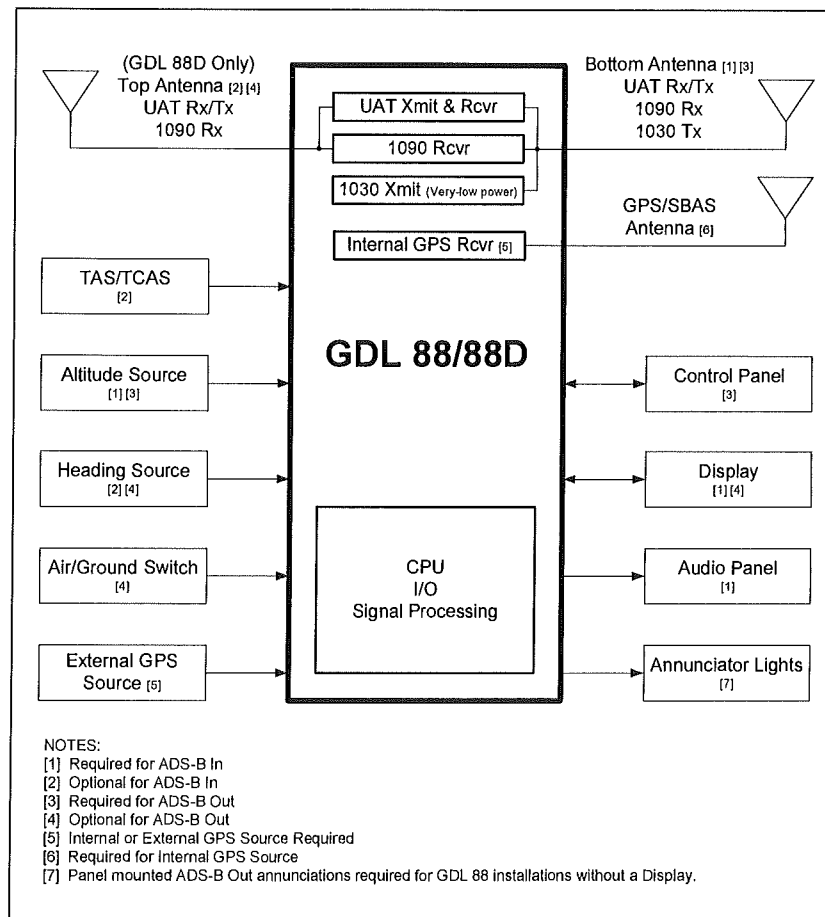


Figure 1 – GDL 88 Block Diagram

The GDL 88 system performs following functions:

- Transmission of ADS-B out data on UAT (978 MHz)
 - Integration of data from internal and external sources to transmit the following data per 14 CFR 91.227
 - GPS Position, Altitude, and Position Integrity
 - Ground Track and/or Heading, Ground Speed, and Velocity Integrity
 - Air Ground Status
 - Flight ID, Call Sign, ICAO Registration Number
 - Capability and Status Information
 - Transponder squawk code, IDENT, and emergency status
 - Anonymous Mode
 - Pressure Altitude Broadcast Inhibit
- Reception of ADS-B In data on UAT (978 MHz)
 - ADS-B (Data directly from another transmitting aircraft)
 - ADS-R (Rebroadcast of ADS-B data from a ground station)
 - TIS-B (Broadcast of secondary surveillance radar (SSR)-derived traffic information from a ground station)
 - FIS-B (Broadcast of aviation data from a ground station)
- Reception of ADS-B In data on 1090 MHz
 - ADS-B (Data directly from another transmitting aircraft)
 - ADS-R (Rebroadcast of ADS-B data from a ground station)
- Provide traffic information and alerting to the pilot via an optional display or annunciator lamp.
 - Correlation and consolidation of traffic data from multiple traffic sources
 - Output of traffic data to an external display
 - Aural and visual traffic alerting
- Provide FIS-B data to the pilot via an optional display
 - Processing and output of FIS-B data to an external display
 - Graphical and textual weather products
 - NEXRAD
 - PIREPs
 - AIRMET/SIGMETs
 - METARs
 - TAFs
 - Winds Aloft
 - Aviation Data
 - TFRs
 - NOTAMs

Garmin International 1200 E. 151st Street
Olathe, KS 66062 USA

AIRPLANE FLIGHT MANUAL SUPPLEMENT or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for STC SA02119SE
GARMIN GDL 88 ADS-B TRANSCEIVER

The GDL 88 may be installed as a stand-alone ADS-B system or, optionally, integrated with a compatible display for the display and control of traffic, FIS-B weather, and aviation data.

1.2 Capabilities

As installed in this aircraft, the Garmin GDL 88 system complies with the requirements of AC 20-165 and meets the equipment performance and functional requirements to comply with 14 CFR 91.227.

The GDL 88 meets the requirements of TSO-C154c for ADS-B Out operation.

Applicable to installations consisting of a GDL 88 interfaced with one or more GTNs with software version 3.00 or later:

The GDL 88 meets the requirements of TSO-C195a Class C1, C2, C3, C5, TIS-B Services TSO-C166b Class A1, and FIS-B TSO-C157a for ADS-B In Operation and AC 20-172A for Airworthiness Approval for ADS-B In Systems and Applications

1.3 Installation Configuration

This aircraft is equipped with a GDL 88 system with the following interfaces/features:

Equipment Installed:

- ☐ GDL 88
- ☐ GDL 88D with dual antennas
- ☐ GDL 88 with internal GPS/SBAS position source
- ☐ GDL 88D with dual antennas and internal GPS/SBAS position source

Interfaced Active Traffic System:

- ☐ None
- ☐ TCAD
- ☐ TAS/TCAS I

Garmin International 1200 E. 151st Street
Olathe, KS 66062 USA

AIRPLANE FLIGHT MANUAL SUPPLEMENT or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for STC SA02119SE
GARMIN GDL 88 ADS-B TRANSCEIVER

Interfaced Transponder(s):

- ☐ Single Transponder serially interfaced to the GDL 88
- ☐ Dual Transponders serially interfaced to the GDL 88
- ☐ Single Transponder interfaced to the GDL 88 via self-interrogation

Interfaced Radio Altimeter(s):

- ☐ Yes
- ☐ No

Interfaced GPS/SBAS Position Source(s):

GPS #1:

- ☐ GNS 4XXW/5XXW
- ☐ GTN 6XX/7XX
- ☐ None

GPS #2:

- ☐ GNS 4XXW/5XXW
- ☐ GTN 6XX/7XX
- ☐ None

Garmin International 1200 E. 151st Street
Olathe, KS 66062 USA

AIRPLANE FLIGHT MANUAL SUPPLEMENT or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for STC SA02119SE
GARMIN GDL 88 ADS-B TRANSCEIVER

Definitions

The following terminology is used within this document:

ADS-B:	Automatic Dependent Surveillance-Broadcast
ADS-R:	Automatic Dependent Surveillance-Rebroadcast
CSA:	Conflict Situational Awareness
FIS-B:	Flight Information Service-Broadcast
GDL:	Garmin Datalink
GPS:	Global Positioning System
GTN:	Garmin Touchscreen Navigator
LRU:	Line Replaceable Unit
PABI:	Pressure Altitude Broadcast Inhibit
SBAS:	Satellite-Based Augmentation System
TAS:	Traffic Awareness System
TCAD:	Traffic Collision Avoidance Device
TCAS:	Traffic Collision Avoidance System
TIS-B:	Traffic Information Service-Broadcast
UAT:	Universal Access Transceiver
VFR:	Visual Flight Rules

Section 2. LIMITATIONS

2.1 Minimum Equipment

The GDL 88 must have the following system interfaces fully functional in order to be compliant with the requirements for 14 CFR 91.227 ADS-B Out operations:

	Interfaced Equipment	Number Installed	Number Required
O R	External ADS-B Annunciators	2 lamps	2 lamps (NO POSN and FAULT)
	Interfaced Display	1	1
	GPS SBAS Position Source	1 or more	1
	Transponder	1 or more	1

Table 1 – Required Equipment

2.2 ADS-B Out

The GDL 88 only complies with 14 CFR 91.227 for ADS-B Out when all required functions are operational as indicated by external annunciators not illuminated or interfaced display ADS-B messages not being present.

2.3 Anonymous Mode

Anonymous Mode must only be operated while operating under VFR while squawking a VFR code. If requested by Air Traffic Control, Anonymous Mode must be turned off.

2.4 Applicable System Software

This AFMS/SAFM is applicable to the software versions shown in Table 2.

The Main software version is displayed on the External LRU page available on some interfaced display devices.

Software Item	Software Version (or later FAA Approved versions for this STC)
Main SW Version	2.01

Table 2 - Software Versions

2.5 Pressure Altitude Broadcast Inhibit (PABI)

While operating within airspace requiring an ADS-B Out compliant transmitter, per 14 CFR 91.227, Pressure Altitude Broadcast Inhibit shall only be enabled when requested by Air Traffic Control.

Garmin International 1200 E. 151st Street
Olathe, KS 66062 USA

AIRPLANE FLIGHT MANUAL SUPPLEMENT or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for STC SA02119SE
GARMIN GDL 88 ADS-B TRANSCEIVER

2.6 Traffic Alerting

Traffic alerting is an aid to visual acquisition and may not be used as the sole basis for aircraft maneuvering.

Section 3. EMERGENCY PROCEDURES

3.1 Emergency Procedures

None.

3.2 Abnormal Procedures

3.2.1 Abnormal Indications

The loss of an interfaced input GDL 88 may cause the GDL 88 to stop transmitting ADS-B Out data or providing ADS-B In function.

Depending on the nature of the fault or failure, the GDL 88 may no longer be transmitting all of the required data in the ADS-B Out messages and Traffic Alerts may not be provided by the system.

- For No Display installations:

If the GDL 88 detects any internal faults or failures, the GDL 88 will annunciate this event via the two external annunciators on the ADS-B annunciator panel. Using these two lights, three messages/states are capable of being conveyed to the flight crew: NO POSN, FAULT, and TX FAIL.

When the GDL 88 annunciates NO POSN, the GDL 88 has detected that it does not have a valid position from the internal or any of the external GPS/SBAS sources. (See Section 3.2.3 for further information.)

When the GDL 88 annunciates FAULT to the flight crew, the GDL 88 has detected a loss of an input or internal fault resulting in the GDL 88 not transmitting full ADS-B information or degradation in performance.

When both annunciator lights on the ADS-B annunciator panel are illuminated, the GDL 88 is annunciating TX FAIL. When the GDL 88 annunciates TX FAIL to the flight crew, the GDL 88 has detected a loss of required input or an internal failure resulting in the GDL 88 being unable to either transmit or receive ADS-B data.

When a GDL 88 NO POSN, FAULT, or TX FAIL annunciation is received, verify proper operation of all interfaced equipment (refer to Section 1.3) as the failure of one of these devices could be the cause of the abnormal indication.

Garmin International 1200 E. 151st Street
Olathe, KS 66062 USA

AIRPLANE FLIGHT MANUAL SUPPLEMENT or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for STC SA02119SE
GARMIN GDL 88 ADS-B TRANSCEIVER

When the GDL 88 is interfaced to a transponder via self-interrogation, the FAULT annunciator will illuminate if the GDL 88 has not received communication from the transponder when the aircraft transitions from on the ground to airborne.

- For Display Installations:

**Reference Display Device documentation for applicable
annunciations.**

3.2.2 LOSS OF AIRCRAFT ELECTRICAL POWER GENERATION

Loss of electrical power generation.....**REMOVE POWER FROM GDL 88**

If the GDL 88 is load shed due to a loss of electrical power generation, ADS-B Out, ADS-B In, and the display of interfaced traffic system data will no longer be available.

NOTE

This guidance is supplementary to any guidance provided in the POH or AFM for the installed aircraft for loss of power generation.

Garmin International 1200 E. 151st Street
Olathe, KS 66062 USA

AIRPLANE FLIGHT MANUAL SUPPLEMENT or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for STC SA02119SE
GARMIN GDL 88 ADS-B TRANSCEIVER

3.2.3 LOSS OF GPS/SBAS NAVIGATION DATA

When the GPS/SBAS receiver is inoperative or GPS position information is not available or invalid, the GDL 88 will no longer be transmitting ADS-B Out data and ADS-B traffic alerting functions will be unavailable.

- For No Display installations:

NO POSN annunciator illuminated:

Interfaced GPS position sources.....**VERIFY VALID
POSITION**

- For Display Installations:

**Reference Display Device documentation for applicable
annunciation:**

Interfaced GPS position sources.....**VERIFY VALID
POSITION**

3.2.4 VISUAL/AURAL TRAFFIC ALERT

Traffic Alert Annunciation and Aural

Traffic.....**VISUALLY ACQUIRE**

Garmin International 1200 E. 151st Street
Olathe, KS 66062 USA

AIRPLANE FLIGHT MANUAL SUPPLEMENT or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for STC SA02119SE
GARMIN GDL 88 ADS-B TRANSCEIVER

Section 4. NORMAL PROCEDURES

The procedures described below are specific only to the GDL 88. Cockpit Reference Guides and Pilot Guides for interfaced displays will provide additional operating information specific to the displays or other traffic systems.

4.1 Unit Power On

GDL 88 Annunciations **CONSIDERED**

NOTE

The GDL 88 Annunciators (or associated display annunciations) may illuminate as the unit powers on and begins to receive input from external systems, to include the SBAS position source.

The GDL 88 only complies with 14 CFR 91.227 for ADS-B Out when all required functions are operational as indicated by external annunciators not illuminated.

4.2 Before Takeoff

GDL 88 Annunciations **CONSIDERED**

Garmin International 1200 E. 151st Street
Olathe, KS 66062 USA

AIRPLANE FLIGHT MANUAL SUPPLEMENT or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for STC SA02119SE
GARMIN GDL 88 ADS-B TRANSCEIVER

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

See current weight and balance data.

Section 7. SYSTEM DESCRIPTIONS

7.1 Pilot's Guide

The Garmin GDL 88 Pilot's Guide, part number and revision listed below, contain additional information regarding GDL 88 system description, control, and function. Cockpit Reference Guides and Pilot Guides for interfaced displays provide additional operating information.

- GDL 88 Pilot's Guide P/N 190-01122-03 Rev A or later

7.2 Traffic Sources and Alerting

The GDL 88 is capable of receiving ADS-B, ADS-R, and TIS-B traffic reports in order to track traffic around the aircraft and provide alerts to the flight crew to aid in visual acquisition and avoidance.

Traffic alerting is provided via an installed visual annunciator and audio callouts for these alerts. The audio callout will include any available information regarding the intruder, to include direction, range, and relative altitude (high, low, same altitude).

Due to the nature of TIS-B, its service volumes, and incomplete equipage/adoption of ADS-B Out equipment, not all traffic will be tracked by the GDL 88. This is much like an active traffic system and does not track non-transponder equipped aircraft. The flight crew must use "see and avoid" procedures to visually acquire and avoid other aircraft.

7.3 Interfaced Active Traffic System (Optional)

When an active traffic system is interfaced with a GDL 88, the GDL 88 receives traffic from the active traffic system and attempts to correlate – or match – this traffic with ADS-B traffic the GDL 88 has received and is already tracking. When a correlation is made, the active traffic system or ADS-B target with the most accurate information is displayed to the flight crew. Any active traffic system or ADS-B traffic that is not correlated will also be displayed for the flight crew. The correlation of traffic by the GDL 88 ensures that only the most accurate, and no duplicate, traffic targets are displayed for the flight crew's situational awareness.

In addition, the GDL 88 will use its air-ground logic or inputs to automatically switch the active traffic from Standby to Operate when transitioning from ground to air, and from Operate to Standby when transitioning from air to ground.

Garmin International 1200 E. 151st Street
Olathe, KS 66062 USA

AIRPLANE FLIGHT MANUAL SUPPLEMENT or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for STC SA02119SE
GARMIN GDL 88 ADS-B TRANSCEIVER

If the GDL 88 fails then external traffic device data is no longer sent to the display, however aural traffic alerts from these traffic systems may continue to be received.

When interfaced to an active traffic system, traffic alerts are provided as follows:

TCAS Target Correlated With ADS-B Target	TAS/TCAS Alert Active?	CSA Alert Active?	Aural Alert Source	Visual Alert Source
Yes	Yes	N/A	TCAS/TAS	TCAS/TAS
Yes	No	N/A	None	None
No	Yes	Yes	TCAS/TAS (prioritized) GDL 88	TCAS/TAS GDL 88
No	No	Yes	GDL 88	GDL 88

Table 3 – GDL 88 Traffic Alerting with Interfaced Active Traffic System

The optional interfaced display's Pilot's Guides and supplements provide additional information regarding the functionality and control of the traffic device.

7.4 Power

Power to the GDL 88 is provided through a circuit breaker labeled "ADS-B."

7.5 External Switches

External switches may be installed in conjunction with the GDL 88. Table 4 lists the switches and function they perform:

Switch Label	Function
ALTITUDE REPORTING	Enables and disables Pressure Altitude Broadcast Inhibit functionality.
ANONYMOUS	Enables and disables Anonymous Mode functionality.
TRAFFIC MUTE	Acknowledges and mutes a currently playing aural Traffic Alert.
BRT/DIM	Enables GDL 88 annunciators to be dimmed appropriately for lighting conditions.

Table 4 – External Switches

(

(

(

Garmin International, Inc.
1200 E. 151st Street
Olathe, Kansas 66062 U.S.A.

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for the

Garmin GTN 625, 635, 650, 725, or 750 GPS/SBAS Navigation System
as installed in

Piper PA46-350P

Make and Model Airplane

Registration Number: N9153W Serial Number: 4622012

This document serves as an Airplane Flight Manual Supplement or as a Supplemental Airplane Flight Manual when the aircraft is equipped in accordance with Supplemental Type Certificate SA02019SE-D for the installation and operation of the Garmin GTN 625, 635, 650, 725, or 750 GPS/SBAS Navigation System. This document must be incorporated into the FAA Approved Airplane Flight Manual or provided as an FAA Approved Supplemental Airplane Flight Manual.

The information contained herein supplements the information in the FAA Approved Airplane Flight Manual. For limitations, procedures, loading and performance information not contained in this document, refer to the FAA Approved Airplane Flight Manual, markings, or placards.

FAA Approved By:



Michael Warren
ODA STC Unit Administrator
Garmin International, Inc.
ODA-240087-CE

Date: 18-DEC-2012

LOG OF REVISIONS

Revision Number	Page		Description	FAA Approved
	Date	Number		
1	03/18/11	All	Complete Supplement	<i>Robert Grove</i> Robert Grove ODA STC Unit Administrator GARMIN International, Inc. ODA-240087-CE Date: <u>3/18/11</u>
2	12/18/12	6 8 10 10 12 12	<u>Table 1</u> - Added new functions <u>Section 1.2</u> - Added capabilities checkboxes - Added GPS approaches without vertical - Added reference to EASA AMC 20-4 <u>Section 1.3</u> - Removed suggestion for secondary charts - Changed to Type B Software in accordance with AC 120-76B. <u>Section 1.4</u> - Added ADS-B, AEG, FIS-B, NOTAM, TFR <u>Section 2.2</u> - Removed VFR only limitation <u>Section 2.3</u> - Clarified secondary navigation source requirement	See Page 1

LOG OF REVISIONS				
Revision Number	Page		Description	FAA Approved
	Date	Number		
		18	<u>Section 2.14</u> Modified datalinked weather limitations	
		18	<u>Section 2.16</u> Modified limitation	
		19	<u>Section 2.17</u> Modified limitation	
		19	<u>Section 2.21</u> New limitation	
		24 & 25	<u>Section 3.2.8 and 3.2.9</u> Modified section title	
		25	<u>Section 3.2.10</u> New section	
		26	<u>Section 4.1</u> Added telephone audio deactivation	
		27	<u>Section 4.3</u> Modified caution statement	
		27	<u>Section 4.4</u> Added caution statement	
		29	<u>Section 4.6</u> New section	
		31	<u>Section 7.7</u> Added TCAD and GDL 88 as optional traffic systems	
		32	<u>Section 7.8</u> Modified Heading Not Available operation	
		34 - 35	<u>Sections 7.12 – 7.16</u> New sections	

Table of Contents

SECTION	PAGE
Section 1. GENERAL	6
1.1 Garmin GTN Navigators	6
1.2 System Capabilities	8
1.3 Electronic Flight Bag	10
1.4 Definitions	10
Section 2. LIMITATIONS	12
2.1 Cockpit Reference Guide	12
2.2 Kinds of Operation	12
2.3 Minimum Equipment	12
2.4 Flight Planning	13
2.5 System Use	15
2.6 Applicable System Software	15
2.7 SD Card	15
2.8 Navigation Database	15
2.9 Ground Operations	16
2.10 Approaches	16
2.11 Autopilot Coupling	17
2.12 Terrain Proximity Function (All Units)	17
2.13 TAWS Function (Optional)	17
2.14 Datalinked Weather Display (Optional)	18
2.15 Traffic Display (Optional)	18
2.16 StormScope® Display (Optional)	18
2.17 Flight Planner/Calculator Functions	19
2.18 Glove Use / Covered Fingers	19
2.19 Demo Mode	19
2.20 Active Weather Radar	19
2.21 Telephone Audio	19
Section 3. EMERGENCY PROCEDURES	20
3.1 Emergency Procedures	20
3.2 Abnormal Procedures	21
Section 4. NORMAL PROCEDURES	25
4.1 Unit Power On	25
4.2 Before Takeoff	25
4.3 HSI and EHSI Operation	26
4.4 Autopilot Operation	26
4.5 Coupling the Autopilot during approaches	27
4.6 Telephone & SMS Text (Optional)	28
Section 5. PERFORMANCE	28
Section 6. WEIGHT AND BALANCE	28
Section 7. SYSTEM DESCRIPTIONS	29
7.1 Pilot's Guide	29
7.2 Leg Sequencing	29
7.3 Auto ILS CDI Capture	29

7.4	Activate GPS Missed Approach	29
7.5	Terrain Proximity and TAWS	30
7.6	GMA 35 Audio Panel (Optional)	30
7.7	Traffic System (Optional)	30
7.8	StormScope® (Optional)	31
7.9	Power	31
7.10	Databases	31
7.11	External Switches	32
7.12	Airspace Depiction and Alerts	33
7.13	GDL 88 ADS-B Traffic System Interface (Optional)	33
7.14	GWX 70 Weather Radar (Optional)	34
7.15	Charts (Optional)	34
7.16	Transponder Control (Optional)	34

Section 1. GENERAL

1.1 Garmin GTN Navigators

The Garmin GTN navigation system is a GPS system with a Satellite Based Augmentation System (SBAS), comprised of one or more Garmin TSO-C146c GTN 625, 635, 650, 725, or 750 navigator(s) and one or more Garmin approved GPS/SBAS antenna(s). The GTN navigation system is installed in accordance with AC 20-138A.

GTN system functions are shown in Table 1.

	GTN 625	GTN 635	GTN 650	GTN 725	GTN 750
GPS SBAS Navigation: - Oceanic, enroute, terminal, and non-precision approach guidance - Precision approach guidance (LP, LPV)	X	X	X	X	X
VHF Com Radio, 118.00 to 136.990, MHz, 8.33 or 25 kHz increments		X	X		X
VHF Nav Radio, 108.00 to 117.95 MHz, 50 kHz increments			X		X
LOC and Glideslope non-precision and precision approach guidance for Cat 1 minimums, 328.6 to 335.4 MHz tuning range			X		X
Moving map including topographic, terrain, aviation, and geopolitical data	X	X	X	X	X
Display of datalink weather products, SiriusXM, FIS-B, Connex (all optional)	X	X	X	X	X
Control and display of airborne weather radar (optional)				X	X
Display of terminal procedures data (optional)				X	X
Display of traffic data, including ADS-B (optional)	X	X	X	X	X
Display of StormScope® data (optional)	X	X	X	X	X
Display of marker beacon annunciators (optional)				X	X
Remote audio panel control (optional)				X	X
Remote transponder control (optional)	X	X	X	X	X
Remote audio entertainment datalink control (optional)	X	X	X	X	X
TSO-C151b Class B TAWS (optional)	X	X	X	X	X
Supplemental calculators and timers	X	X	X	X	X
Control of GSR 56 Iridium Satellite Phone and SMS Text	X	X	X	X	X

Table 1 – GTN Functions

The GPS navigation functions and optional VHF communication and navigation radio functions are operated by dedicated hard keys, a dual concentric rotary knob, or the touchscreen.

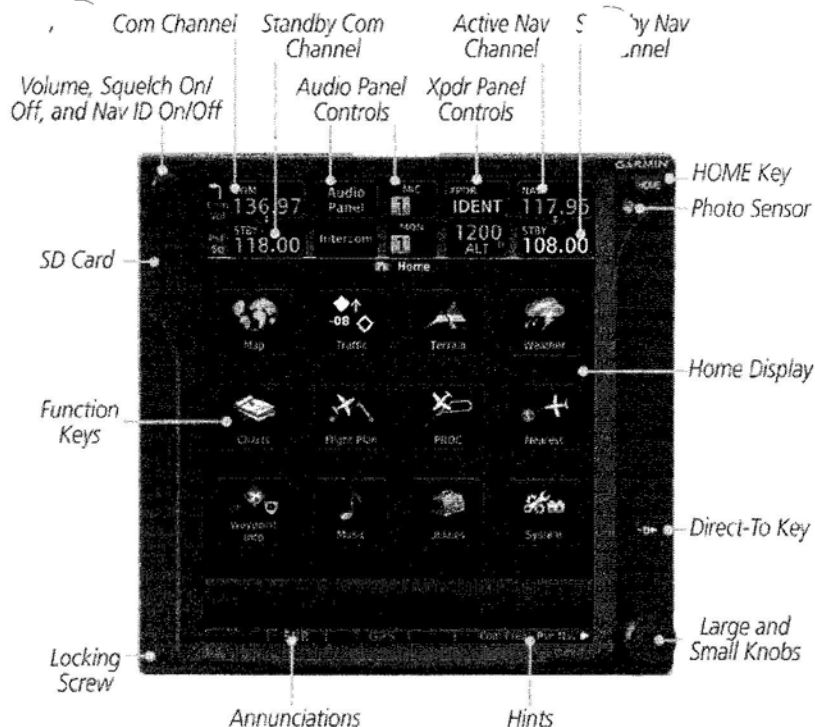


Figure 1 - GTN 750 Control and Display Layout

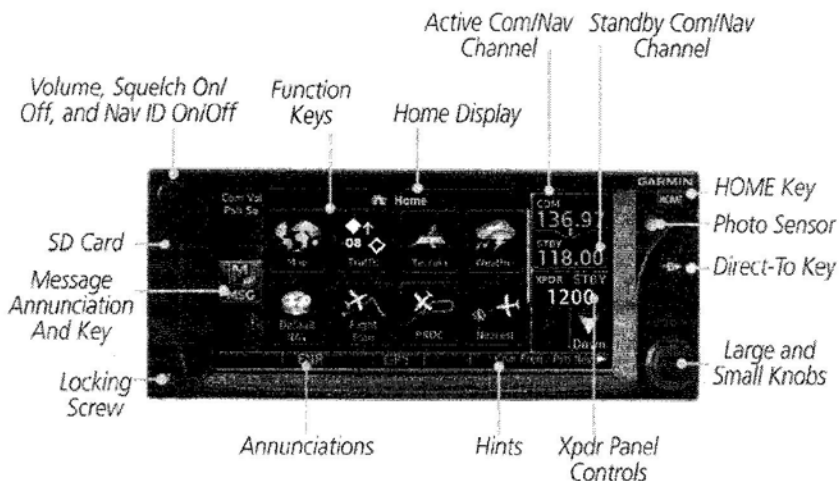


Figure 2 - GTN 635/650 Control and Display Layout

1.2 System Capabilities

The GTN system and associated navigation interface in this aircraft have the following capabilities, in addition to the core multifunction display capability:

- ☐ VHF Communication Radio
- ☐ Primary VHF Navigation
- ☐ Primary GPS Navigation (Enroute) and Approach Capability (LP/LNAV) – See below
- ☐ Primary GPS Approach Capability with Vertical Guidance (LNAV/VNAV, LPV) – See below
- ☐ TSO-C151b Terrain Awareness and Warning System – See section 2.13

GPS/SBAS TSO-C146c Class 3 Operation

The GTN complies with AC 20-138A and has airworthiness approval for navigation using GPS and SBAS (within the coverage of a Satellite Based Augmentation System complying with ICAO Annex 10) for IFR en route, terminal area, and non-precision approach operations (including those approaches titled “GPS”, “or GPS”, and “RNAV (GPS)” approaches). The Garmin GNSS navigation system is composed of the GTN navigator and antenna, and is approved for approach procedures with vertical guidance including “LPV” and “LNAV/VNAV” and without vertical guidance including “LP” and “LNAV,” within the U.S. National Airspace System.

The Garmin GNSS navigation system complies with the equipment requirements of AC 90-105 and meets the equipment performance and functional requirements to conduct RNP terminal departure and arrival procedures and RNP approach procedures without RF (radius to fix) legs. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval from the FAA.

The Garmin GNSS navigation system complies with the equipment requirements of AC 90-100A for RNAV 2 and RNAV 1 operations. In accordance with AC 90-100A, Part 91 operators (except subpart K) following the aircraft and training guidance in AC 90-100A are authorized to fly RNAV 2 and RNAV 1 procedures. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval from the FAA.

applicable to dual installations consisting of two Garmin GNSS units: The Garmin GNSS navigation system has been found to comply with the requirements for GPS Class II oceanic and remote navigation (RNP-10) without time limitations in accordance with AC 20-138A and FAA Order 8400.12A. The Garmin GNSS navigation system can be used without reliance on other long-range navigation systems. This does not constitute an operational approval.

The Garmin GNSS navigation system has been found to comply with the navigation requirements for GPS Class II oceanic and remote navigation (RNP-4) in accordance with AC 20-138A and FAA Order 8400.33. The Garmin GNSS navigation system can be used without reliance on other long-range navigation systems. Additional equipment may be required to obtain operational approval to utilize RNP-4 performance. This does not constitute an operational approval.

The Garmin GNSS navigation system complies with the accuracy, integrity, and continuity of function, and contains the minimum system functions required for P-RNAV operations in accordance with JAA Administrative & Guidance Material Section One: General Part 3: Temporary Guidance Leaflets, Leaflet No 10 (JAA TGL-10 Rev 1). The GNSS navigation system has one or more TSO-C146c Class 3 approved Garmin GTN Navigation Systems. The Garmin GNSS navigation system complies with the accuracy, integrity, and continuity of function, and contains the minimum system functions required for B-RNAV operations in accordance with EASA AMC 20-4. The Garmin GNSS navigation system complies with the equipment requirements for P-RNAV and B-RNAV/RNAV-5 operations in accordance with AC 90-96A CHG 1. This does not constitute an operational approval.

Garmin International holds an FAA Type 2 Letter of Acceptance (LOA) in accordance with AC 20-153 for database integrity, quality, and database management practices for the navigation database. Flight crew and operators can view the LOA status at FlyGarmin.com then select "Type 2 LOA Status."

Navigation information is referenced to the WGS-84 reference system.

Note that for some types of aircraft operation and for operation in non-U.S. airspace, separate operational approval(s) may be required in addition to equipment installation and airworthiness approval.

1.3 Electronic Flight ;

The GTN 750/725 are operationally suitable as Class 3 Hardware, Type B Software in accordance with AC 120-76B EFB electronic aeronautical information when using current FliteChart or ChartView data.

1.4 Definitions

The following terminology is used within this document:

ADF:	Automatic Direction Finder
ADS-B:	Automatic Dependent Surveillance Broadcast
AEG:	Aircraft Evaluation Group (FAA)
APR:	Approach
CDI:	Course Deviation Indicator
DME:	Distance Measuring Equipment
EFB:	Electronic Flight Bag
EHSI:	Electronic Horizontal Situation Indicator
FIS-B:	Flight Information Services Broadcast
GNSS:	Global Navigation Satellite System
GPS:	Global Positioning System
GPSS:	GPS Roll Steering
GTN:	Garmin Touchscreen Navigator
HSI:	Horizontal Situation Indicator
IAP:	Instrument Approach Procedure
IFR:	Instrument Flight Rules
ILS:	Instrument Landing System
IMC:	Instrument Meteorological Conditions
LDA:	Localizer Directional Aid
LNAV:	Lateral Navigation
LNAV+V:	Lateral Navigation with advisory Vertical Guidance
L/VNAV:	Lateral/Vertical Navigation
LOC:	Localizer
LOC-BC:	Localizer Backcourse
LP:	Localizer Performance
LPV:	Localizer Performance with Vertical Guidance
MLS:	Microwave Landing System
NOTAM:	Notice to Airmen
OBS:	Omnibearing Select
RAIM:	Receiver Autonomous Integrity Monitoring

RT:	Remote
RNAV:	Area Navigation
RNP:	Required Navigational Performance
SBAS:	Satellite Based Augmentation System
SD:	Secure Digital
SDF:	Simplified Directional Facility
SUSP:	Suspend
TACAN:	Tactical Air Navigation System
TAS:	Traffic Awareness System
TAWS:	Terrain Awareness and Warning System
TCAS:	Traffic Collision Avoidance System
TFR:	Temporary Flight Restriction
TIS:	Traffic Information Service
VHF:	Very High Frequency
VFR:	Visual Flight Rules
VLOC:	VOR/Localizer
VMC:	Visual Meteorological Conditions
VOR:	VHF Omnidirectional Range
WAAS:	Wide Area Augmentation System
WFDE:	WAAS Fault Data Exclusion
XFR:	Transfer

Section 2. LIMITATIONS

2.1 Cockpit Reference Guide

The Garmin GTN 6XX or GTN 7XX Cockpit Reference Guide, part number and revision listed below (or later revisions), *must* be immediately available to the flight crew whenever navigation is predicated on the use of the GTN.

- GTN 6XX Cockpit Reference Guide P/N 190-01004-04 Rev C
- GTN 7XX Cockpit Reference Guide P/N 190-01007-04 Rev C

2.2 Kinds of Operation

This AFM supplement does not grant approval for IFR operations to aircraft limited to VFR operations.

2.3 Minimum Equipment

The GTN must have the following system interfaces fully functional in order to be used for primary navigation during IFR operations:

Interfaced Equipment	Number installed	Number Required for IFR
External HSI/CDI/EHSI	1 or more	1
External GPS Annunciator	See Note 1	1

Table 2 – Required Equipment

Note 1: Certain installations require an external GPS annunciator panel. If installed, this annunciator must be fully functional to use the GTN GPS navigation for IFR operations.

Single engine piston aircraft under 6,000 lbs maximum takeoff weight:

Required Equipment for IFR operations utilizing GPS navigation: Single GTN Navigator

All other aircraft:

Required Equipment for IFR operations utilizing GPS navigation: Single GTN Navigator plus a second source of GPS navigation or a separate source of VHF navigation. The separate source of VHF navigation must not be the primary GTN, but it may be a secondary GTN.

Operation in remote or oceanic operation requires two sources of GPS navigation.

2.4 Flight Planning

For flight planning purposes, in areas where SBAS coverage is not available, the flight crew must check RAIM availability.

- Within the United States, RAIM availability can be determined using the Garmin WFDE Prediction program, Garmin part number 006-A0154-04 (included in GTN trainer) software version 3.00 or later approved version with Garmin approved antennas or the FAA's en route and terminal RAIM prediction website: www.raimprediction.net, or by contacting a Flight Service Station.
- Within Europe, RAIM availability can be determined using the Garmin WFDE Prediction program or Europe's AUGER GPS RAIM Prediction Tool at <http://augur.ecacnav.com/augur/app/home>.
- For other areas, use the Garmin WFDE Prediction program.

This RAIM availability requirement is not necessary if SBAS coverage is confirmed to be available along the entire route of flight. The route planning and WFDE prediction program may be downloaded from the Garmin website on the internet. For information on using the WFDE Prediction Program, refer to Garmin WAAS FDE Prediction Program, part number 190-00643-01, 'WFDE Prediction Program Instructions'.

For flight planning purposes, for operations within the U.S. National Airspace System on RNP and RNAV procedures when SBAS signals are not available, the availability of GPS RAIM shall be confirmed for the intended route of flight. In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended route of flight, the flight shall be delayed, canceled, or rerouted on a track where RAIM requirements can be met. The flight may also be re-planned using non-GPS based navigational capabilities.

For flight planning purposes for operations within European B-RNAV/RNAV-5 and P-RNAV airspace, if more than one satellite is scheduled to be out of service, then the availability of GPS RAIM shall be confirmed for the intended flight (route and time). In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended flight, the flight shall be delayed, canceled, or rerouted on a track where RAIM requirements can be met.

Applicable to dual installations consisting of two Garmin GNSS units:

For flight planning purposes, for operations where the route requires Class II navigation the aircraft's operator or flight crew must use the Garmin WFDE Prediction program to demonstrate that there are no outages on the specified route that would prevent the Garmin GNSS navigation system to provide GPS Class II navigation in oceanic and remote areas of operation that requires RNP-10 or RNP-4 capability. If the Garmin WFDE Prediction program indicates fault exclusion (FDE) will be unavailable for more than 34 minutes in accordance with FAA Order 8400.12A for RNP-10 requirements, or 25 minutes in accordance

with FAA Ord 00.33 for RNP-4 requirements, then the operation must be rescheduled when FDE is available.

Both Garmin GPS navigation receivers must be operating and providing GPS navigation guidance for operations requiring RNP-4 performance.

North Atlantic (NAT) Minimum Navigational Performance Specifications (MNPS) Airspace operations per AC 91-49 and AC 120-33 require both GPS/SBAS receivers to be operating and receiving usable signals except for routes requiring only one Long Range Navigation sensor. Each display computes an independent navigation solution based on its internal GPS receiver.

Whenever possible, RNP and RNAV routes including Standard Instrument Departures (SIDs), Standard Terminal Arrival (STAR), and enroute RNAV "Q" and RNAV "T" routes should be loaded into the flight plan from the database in their entirety, rather than loading route waypoints from the database into the flight plan individually. Selecting and inserting individual named fixes from the database is permitted, provided all fixes along the published route to be flown are inserted. Manual entry of waypoints using latitude/longitude or place/bearing is prohibited.

It is not acceptable to flight plan a required alternate airport based on RNAV(GPS) LP/LPV or LNAV/VNAV approach minimums. The required alternate airport must be flight planned using an LNAV approach minimums or available ground-based approach aid.

Navigation information is referenced to the WGS-84 reference system, and should only be used where the Aeronautical Information Publication (including electronic data and aeronautical charts) conform to WGS-84 or equivalent.

2.5 System Use

In installations with two GTNs and an external GPS annunciator (See Table 2) the GTN connected to the external GPS annunciator must be used as the navigation source for all IFR operations.

The only approved sources of course guidance are on the external CDI, HSI, or EHSDI display. The moving map and CDI depiction on the GTN display are for situational awareness only and are not approved for course guidance.

2.6 Applicable System Software

This AFMS/AFM is applicable to the software versions shown in Table 3.

The Main and GPS software versions are displayed on the start-up page immediately after power-on. All software versions displayed in Table 3 can be viewed on the System – System Status page.

Software Item	Software Version (or later FAA Approved versions for this STC)
Main SW Version	3.00
GPS SW Version	5.0
Com SW Version	2.10
Nav SW Version	6.02

Table 3 - Software Versions

2.7 SD Card

It is required that the SD card be present in the unit at all times.

2.8 Navigation Database

GPS/SBAS based IFR enroute, oceanic, and terminal navigation is prohibited unless the flight crew verifies and uses a valid, compatible, and current navigation database or verifies each waypoint for accuracy by reference to current approved data.

“GPS”, “or GPS”, and “RNAV (GPS)” instrument approaches using the Garmin navigation system are prohibited unless the flight crew verifies and uses the current navigation database. GPS based instrument approaches must be flown in accordance with an approved instrument approach procedure that is loaded from the navigation database.

Discrepancies that invalidate a procedure should be reported to Garmin International. The affected procedure is prohibited from being flown using data from the navigation database until a new navigation database is installed in the aircraft and verified that the discrepancy has been corrected. Navigation database discrepancies can be reported at FlyGarmin.com by selecting “Aviation Data Error Report.” Flight crew and operators can view navigation database alerts at FlyGarmin.com then select “NavData Alerts.”

If the navigation database will change during flight, the flight crew ensure the accuracy of navigation data, including suitability of navigation facilities used to define the routes and procedures for flight. If an amended chart affecting navigation data is published for the procedure, the database must not be used to conduct the procedure.

2.9 Ground Operations

Do not use SafeTaxi or Chartview functions as the basis for ground maneuvering. SafeTaxi and Chartview functions do not comply with the requirements of AC 20-159 and are not qualified to be used as an airport moving map display (AMMD). SafeTaxi and Chartview are to be used by the flight crew to orient themselves on the airport surface to improve flight crew situational awareness during ground operations.

2.10 Approaches

- a) Instrument approaches using GPS guidance may only be conducted when the GTN is operating in the approach mode. (LNAV, LNAV+V, L/VNAV, LPV, or LP)
- b) When conducting instrument approaches referenced to true North, the NAV Angle on the System -Units page must be set to **True**.
- c) The navigation equipment required to join and fly an instrument approach procedure is indicated by the title of the procedure and notes on the IAP chart. Navigating the final approach segment (that segment from the final approach fix to the missed approach point) of an ILS, LOC, LOC-BC, LDA, SDF, MLS, VOR, TACAN approach, or any other type of approach not approved for GPS, is not authorized with GPS navigation guidance. GPS guidance can only be used for approach procedures with GPS or RNAV in the procedure title. When using the Garmin VOR/LOC/GS receivers to fly the final approach segment, VOR/LOC/GS navigation data must be selected and presented on the CDI of the pilot flying.
- d) Advisory vertical guidance deviation is provided when the GTN annunciates LNAV + V. Vertical guidance information displayed on the VDI in this mode is only an aid to help flight crews comply with altitude restrictions. When using advisory vertical guidance, the flight crew must use the primary barometric altimeter to ensure compliance with all altitude restrictions.
- e) Not all published Instrument Approach Procedures (IAP) are in the navigation database. Flight crews planning to fly an RNAV instrument approach must ensure that the navigation database contains the planned RNAV Instrument Approach Procedure and that approach procedure must be loaded from the navigation database into the GTN system flight plan by its name. Users are prohibited from flying any approach path that contains manually entered waypoints.
- f) IFR approaches are prohibited whenever any physical or visual obstruction (such as a throw-over yoke) restricts pilot view or access to the GTN and/or the CDI.

2.11 Autopilot Coupling

The flight crew may fly all phases of flight based on the navigation information presented to the flight crew; however, not all modes may be coupled to the autopilot. All autopilots may be coupled in Oceanic (OCN), Enroute (ENR), and Terminal (TERM) modes.

This installation is limited to:

- ☐ Lateral coupling only for GPS approaches. Coupling to the vertical path for GPS approaches is not authorized.

2.12 Terrain Proximity Function (All Units)

Terrain and obstacle information appears on the map and terrain display pages as red and yellow tiles or towers, and is depicted for advisory use only. Aircraft maneuvers and navigation must not be predicated upon the use of the terrain display. Terrain and obstacle information is advisory only and is not equivalent to warnings provided by TAWS.

The terrain display is intended to serve as a situational awareness tool only. By itself, it may not provide either the accuracy or the fidelity on which to base decisions and plan maneuvers to avoid terrain or obstacles.

NOTE

Terrain and TAWS are separate features and mutually exclusive. If "TAWS B" is shown on the bottom right of the dedicated terrain page, then TAWS is installed.

2.13 TAWS Function (Optional)

Flight crews are authorized to deviate from their current ATC clearance to the extent necessary to comply with TAWS warnings. Navigation must not be predicated upon the use of TAWS.

If an external TAWS annunciator panel is installed in the aircraft, this annunciator panel must be fully functional in order to use the TAWS system.

NOTE

Terrain and TAWS are separate features and mutually exclusive. If "TAWS B" is shown on the bottom right of the dedicated terrain page, then TAWS is installed.

2.14 Datalinked Weather Display (Optional)

This limitation applies to datalinked weather products from SiriusXM via a GDL 69/69A, FIS-B via a GDL 88, and Connex via a GSR 56.

Do not use data link weather information for maneuvering in, near, or around areas of hazardous weather. Information provided by data link weather products may not accurately depict current weather conditions.

Do not use the indicated data link weather product age to determine the age of the weather information shown by the data link weather product. Due to time delays inherent in gathering and processing weather data for data link transmission, the weather information shown by the data link weather product may be significantly older than the indicated weather product age.

Do not rely solely upon data link services to provide Temporary Flight Restriction (TFR) or Notice to Airmen (NOTAM) information. Not all TFRs and NOTAMS can be depicted on the GTN.

2.15 Traffic Display (Optional)

Traffic may be displayed on the GTN when connected to an approved optional TCAS I, TAS, TIS, or ADS-B traffic device. These systems are capable of providing traffic monitoring and alerting to the flight crew. Traffic shown on the display may or may not have traffic alerting available. The display of traffic is an aid to visual acquisition and may not be utilized for aircraft maneuvering.

2.16 StormScope® Display (Optional)

StormScope® lightning information displayed by the GTN is limited to supplemental use only. The use of the StormScope® lightning data on the display for hazardous weather (thunderstorm) penetration is prohibited. StormScope® lightning data on the display is intended only as an aid to enhance situational awareness of hazardous weather, not penetration. It is the flight crew's responsibility to avoid hazardous weather using official weather data sources.

When the GTN StormScope® page is operating without a heading source, as indicated by the "HDG N/A" label at the upper right corner of the StormScope® page, strikes must be cleared after each heading change.

CAUTION

When using the Density Altitude / True Airspeed / Winds page, all data must be entered into the calculator before the calculated data is used. Calculated data may not be correct prior to entering all data.

The Fuel Planning page uses Fuel on Board or Fuel Flow as received from an on board fuel totalizer, as entered by the pilot at system startup, or as entered by the pilot when on the Fuel Planning page. This *is not* a direct indication of actual aircraft fuel flow or fuel on board and those values are only used for the Fuel Planning page. The fuel required to destination is only a calculated and predicted value based on the data entered into the planner. It is not a direct indication of how much fuel the aircraft will have upon reaching the destination. Certain approach leg types will result in the fuel burn incorrectly calculated as zero.

2.18 Glove Use / Covered Fingers

No device may be used to cover fingers used to operate the GTN unless the Glove Qualification Procedure located in the Pilot's Guide/Cockpit Reference Guide has been successfully completed. The Glove Qualification Procedure is specific to a pilot / glove / GTN 725, 750 or GTN 625, 635, 650 combination.

2.19 Demo Mode

Demo mode may not be used in flight under any circumstances.

2.20 Active Weather Radar

Radar is broadcasting energy while in Weather or Ground mapping modes. If the GTN 750/725 system is configured to control an airborne weather radar unit, observe all safety precautions, including:

- Do not operate in the vicinity of refueling operations.
- Do not operate while personnel are in the vicinity (approximately 20 feet) of the radar sweep area.

CAUTION

If a radar system is installed, it generates microwave radiation and improper use, or exposure, may cause serious bodily injury. Do not operate the radar equipment until you have read and carefully followed the safety precautions and instructions in the weather radar user manual and/or pilot's guide.

2.21 Telephone Audio

Telephone audio may not be distributed to the pilot or co-pilot unless a phone call is active.

Section 3. EMERGEN PROCEDURES

3.1 Emergency Procedures

3.1.1 TAWS WARNING

Red annunciator and aural "PULL UP":

Autopilot **DISCONNECT**
Aircraft Controls **INITIATE MAXIMUM POWER CLIMB**
Airspeed **BEST ANGLE OF CLIMB SPEED**

After Warning Ceases:

Power **MAXIMUM CONTINUOUS**
Altitude **CLIMB AND MAINTAIN SAFE ALTITUDE**
Advise ATC of Altitude Deviation, if appropriate.

NOTE

Only vertical maneuvers are recommended, unless either operating in visual meteorological conditions (VMC), or the flight crew determines, based on all available information, that turning in addition to the vertical escape maneuver is the safest course of action, or both.

3.2 Terminal Procedures

3.2.1 LOSS OF GPS/SBAS NAVIGATION DATA

When the GPS/SBAS receiver is inoperative or GPS navigation information is not available or invalid, the GTN will enter one of two modes: Dead Reckoning mode (DR) or Loss Of Integrity mode (LOI). The mode is indicated on the GTN by an amber "DR" or "LOI".

If the Loss Of Integrity annunciation is displayed, revert to an alternate means of navigation appropriate to the route and phase of flight.

If the Dead Reckoning annunciation is displayed, the map will continue to be displayed with an amber 'DR' overwriting the ownship icon. Course guidance will be removed on the CDI. Aircraft position will be based upon the last valid GPS position, then estimated by Dead Reckoning methods. Changes in true airspeed, altitude, heading, or winds aloft can affect the estimated position substantially. Dead Reckoning is only available in Enroute and Oceanic modes. Terminal and Approach modes do not support Dead Reckoning.

If Alternate Navigation Sources (ILS, LOC, VOR, DME, ADF) Are Available:

Navigation.....**USE ALTERNATE SOURCES**

If No Alternate Navigation Sources Are Available:

DEAD RECKONING (DR) MODE:

Navigation.....**USE GTN**

NOTE

All information normally derived from GPS will become less accurate over time.

LOSS OF INTEGRITY (LOI) MODE:

Navigation.....**FLY TOWARDS KNOWN VISUAL CONDITIONS**

NOTE

All information derived from GPS will be removed.

NOTE

The airplane symbol is removed from all maps. The map will remain centered at the last known position. "NO GPS POSITION" will be annunciated in the center of the map.

3.2.2 GPS APPROACH DOWNGRADE

During a GPS LPV, LNAV/VNAV, or LNAV+V approach, if GPS accuracy requirements cannot be met by the GPS receiver, the GTN will downgrade the approach. The downgrade will remove vertical deviation indication from the VDI and change the approach annunciation accordingly from LPV, L/VNAV, or LNAV+V to LNAV. The approach may be continued using the LNAV only minimums.

During a GPS approach in which GPS accuracy requirements cannot be met by the GPS receiver for any GPS approach type, the GTN will flag all CDI guidance and display a system message "ABORT APPROACH-GPS approach no longer available". Immediately upon viewing the message, the unit will revert to Terminal navigation mode alarm limits. If the position integrity is within these limits lateral guidance will be restored and the GPS may be used to execute the missed approach, otherwise alternate means of navigation must be utilized.

3.2.3 LOSS OF COM RADIO TUNING FUNCTIONS

If alternate COM is available:

Communications..... **USE ALTERNATE COM**

If no alternate COM is available:

COM RMT XFR key (if installed)**PRESS AND HOLD FOR 2 SECONDS**

NOTE

This procedure will tune the active COM radio the emergency frequency 121.5, regardless of what frequency is displayed on the GTN. Certain failures of the tuning system will automatically tune 121.5 without flight crew action.

3.2.4 LOSS OF AUDIO PANEL FUNCTIONS (GMA 35 Only)

Audio Panel Circuit Breaker**PULL**

NOTE

This procedure will force the audio panel into fail safe mode which provides only the pilot with communications and only on a single COM radio. If any non GTN 750 COM is installed, communication will be only on that radio. If only a GTN 750 is installed in the aircraft, then the pilot will have only the GTN 750 COM available. No other audio panel functions including the crew and passenger intercom will function.

3.2.5 VS CAUTION (Terrain or Obstacle Ahead) Sink Rate, Don't Sink)

When a TAWS CAUTION occurs, take corrective action until the alert ceases. Stop descending or initiate either a climb or a turn, or both as necessary, based on analysis of all available instruments and information.

3.2.6 TAWS INHIBIT

The TAWS Forward Looking Terrain Avoidance (FLTA) and Premature Descent Alerts (PDA) functions may be inhibited to prevent alerting, if desired. Refer to GTN Cockpit Reference Guide for additional information.

To Inhibit TAWS:

Home Hardkey	PRESS
Terrain Button.....	PRESS
Menu Button	PRESS
TAWS Inhibit Button.....	PRESS TO ACTIVATE

3.2.7 TER N/A and TER FAIL

If the amber **TER N/A** or **TER FAIL** status annunciator is displayed, the system will no longer provide TAWS alerting or display relative terrain and obstacle elevations. The crew must maintain compliance with procedures that ensure minimum terrain and obstacle separation.

3.2.8 DATA SOURCE - HEADING SOURCE INOPERATIVE OR CONNECTION TO GTN LOST MESSAGE

Without a heading source to the GTN, the following features will not operate:

- GPSS will not be provided to the autopilot for heading legs. The autopilot must be placed in HDG mode for heading legs.
- Map cannot be oriented to Heading Up.
- All overlaying traffic data from a TAS/TCAS I or GDL 88 interfaced to an on board traffic system on the main map display. The flight crew must use the dedicated traffic page on the GTN system to display TAS/TCAS I or GDL 88 traffic data.
- All overlaying StormScope® data on the main map display. The flight crew must use the dedicated StormScope® page on the GTN system to display StormScope® data.

StormScope® must be operated in accordance with Section 7.8 when no heading is available.

3.2.9 DATA SOURCE PRESSURE ALTITUDE SOURCE INOPERATIVE OR CONNECTION TO GTN LOST MESSAGE

Without a barometric altitude source to the GTN, the following features will not operate:

- Automatic leg sequencing of legs requiring an altitude source. The flight crew must manually sequence altitude legs, as prompted by the system.

3.2.10 UNRECOVERABLE LOSS OF ALL ELECTRICAL GENERATORS OR ALTERNATORS

Remove power from all equipment which is not necessary for flight, including GTN #2 if installed.

Section 7.1 NORMAL PROCEDURES

Refer to the Cockpit Reference Guide defined in Section 2.1 of this document or the Pilot's Guide defined in Section 7.1 for normal operating procedures and a complete list of system messages and associated flight crew actions. This includes all GPS operations, VHF communication and navigation, traffic, data linked weather, StormScope®, TAWS, and Multi-Function Display information.

The GTN requires a reasonable degree of familiarity to avoid becoming too engrossed at the expense of basic instrument flying in IMC and basic see-and-avoid in VMC. Garmin provides training tools with the Pilot's Guide and PC based simulator. Pilots should take full advantage of these training tools to enhance system familiarization.

4.1 Unit Power On

Database..... **REVIEW EFFECTIVE DATES**

Self Test..... **VERIFY OUTPUTS TO NAV INDICATORS**

Self Test - TAWS Remote Annunciator:

PULL UP.....**ILLUMINATED**

TERR.....**ILLUMINATED**

TERR N/A.....**ILLUMINATED**

TERR INHB.....**ILLUMINATED**

Self Test - GPS Remote Annunciator:

VLOC.....**ILLUMINATED**

GPS.....**ILLUMINATED**

LOI or INTG.....**ILLUMINATED**

TERM.....**ILLUMINATED**

WPT.....**ILLUMINATED**

APR.....**ILLUMINATED**

MSG.....**ILLUMINATED**

SUSP or OBS.....**ILLUMINATED**

Telephone Audio, if equipped:

Pilot, Co-pilot, Passenger..... **DEACTIVATED**

4.2 Before Takeoff

System Messages and Annunciators..... **CONSIDERED**

4.3 HSI and EHSI C ation

If an HSI is used to display navigation data from the GTN the pilot should rotate the course pointer as prompted on the GTN.

If an EHSI is used to display navigation data from the GTN the course pointer may autoslew to the correct course when using GPS navigation. When using VLOC navigation the course pointer will not autoslew and must be rotated to the correct course by the pilot. For detailed information about the functionality of the EHSI system, refer to the FAA approved Flight Manual or Flight Manual Supplement for that system.

CAUTION

The pilot must verify the active course and waypoint for each flight plan leg. The pilot must verify proper course selection each time the CDI source is changed from GPS to VLOC.

4.4 Autopilot Operation

The GTN may be coupled to an optional autopilot, if installed in the aircraft, when operating as prescribed in the LIMITATIONS section of this manual.

Autopilots coupled to the GTN system in an analog (NAV) mode will follow GPS or VHF navigation guidance as they would with existing VOR receivers.

Autopilots that support GPSS or GPS Roll Steering in addition to the analog course guidance will lead course changes, fly arcing procedures, procedure turns, and holding patterns if coupled in GPSS mode.

CAUTION

The GTN cannot provide course deviation to the autopilot for heading legs. Some autopilots do not allow the use of GPSS when course deviation is not provided.

For autopilot operating instructions, refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

4.5 Coupling the Autopilot during approaches

CAUTION

When the CDI source is changed on the GTN, autopilot mode may change. Confirm autopilot mode selection after CDI source change on the GTN. Refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

Analog only autopilots should use APR mode for coupling to LNAV approaches. Autopilots which support digital roll steering commands (GPSS) may utilize NAV mode and take advantage of the digital tracking during LNAV only approaches.

- ☐ This installation prompts the flight crew and requires the pilot to enable the approach outputs just prior to engaging the autopilot in APR mode.

To couple an approach:

Once established on the final approach course with the final approach fix as the active waypoint, the GTN will issue a flashing message indication.

Flashing Message Button..... **PRESS**
“Enable APR Output” Button..... **PRESS**

If coupled, Autopilot will revert to ROL mode at this time.

Autopilot..... **ENGAGE APPROACH MODE**

- ☐ This installation supports coupling to the autopilot in approach mode once vertical guidance is available.

To couple an approach:

Once established on the final approach course with the final approach fix as the active waypoint, the GTN will enable vertical guidance.

Vertical Guidance..... **CONFIRM AVAILABLE**
Autopilot..... **ENGAGE APPROACH MODE**

- ☐ The installation *does not* support any vertical capture or vertical tracking.

4.6 Telephone & SMS Text (Optional)

Audio from the GSR 56 medium datalink is routed through your aircraft's audio panel. Audio from the GSR 56 must be deactivated (turned off) unless making a phone call. The primary indication of an incoming phone call or SMS text are the visual indications on the GTN.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

See current weight and balance data.

7.1 Pilot's Guide

The Garmin GTN 6XX or GTN 7XX Pilot's Guide, part number and revision listed below, contain additional information regarding GTN system description, control and function. The Pilot's Guides *do not* need to be immediately available to the flight crew.

• GTN 6XX Pilot's Guide	P/N 190-01004-03 Rev C or later
• GTN 7XX Pilot's Guide	P/N 190-01007-03 Rev C or later

7.2 Leg Sequencing

The GTN supports all ARINC 424 leg types. Certain leg types require altitude input in order to sequence (course to altitude, for example). If a barometric corrected altitude source is not interfaced to the GTN, a popup will appear prompting the flight crew to manually sequence the leg once the altitude prescribed in the procedure is reached.

- ☐ This installation *has* a barometric corrected altitude source. The GTN will automatically sequence altitude legs.
- ☐ This installation *does not have* a barometric corrected altitude source. The flight crew will be prompted to manually sequence altitude legs.

7.3 Auto ILS CDI Capture

Auto ILS CDI Capture will not automatically switch from GPS to VLOC for LOC-BC or VOR approaches.

7.4 Activate GPS Missed Approach

- ☐ This installation *will* autoswitch from VLOC to GPS when the "Activate GPS Missed Approach" button is pressed.
- ☐ This installation *will not* autoswitch from VLOC to GPS when the "Activate GPS Missed Approach" button is pressed. The pilot must manually switch from VLOC to GPS if GPS guidance is desired after the missed approach point.

7.5 Terrain Proximity and TAWS

- The Obstacle Database has an area of coverage that includes the United States and Europe, and is updated as frequently as every 56 days.
- To avoid unwanted alerts, TAWS may be inhibited when landing at an airport that is not included in the airport database.

NOTE

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

- ☐ This installation supports *Terrain Proximity*. No aural or visual alerts for terrain or obstacles are provided. Terrain Proximity *does not* satisfy the TAWS requirement of 91.223.
- ☐ This installation supports *TAWS B*. Aural and visual alerts *will be* provided. This installation *does* support the TAWS requirement of 91.223.

7.6 GMA 35 Audio Panel (Optional)

The GTN 725 and 750 can interface to a GMA 35 remotely mounted audio panel and marker beacon receiver. Controls for listening to various radios, activating the cabin speaker, clearance playback control, and marker beacon are accessed by pressing the "Audio Panel" button on the GTN display screen. Volume controls for the audio panel are accessed by pressing the "Intercom" button on the GTN display screen.

7.7 Traffic System (Optional)

This system is configured for the following type of traffic system. The Garmin GTN 6XX or GTN 7XX Cockpit Reference Guide or Garmin GTN 6XX or GTN 7XX Pilot's Guide provides additional information regarding the functionality of the traffic device.

- ☐ No traffic system is interfaced to the GTN.
- ☐ A TAS/TCAS I traffic system is interfaced to the GTN.
- ☐ A TIS traffic system is interfaced to the GTN.
- ☐ A TCAD traffic system is interfaced to the GTN.
- ☐ A Garmin GDL 88 ADS-B traffic system is interfaced to the GTN.
- ☐ A Garmin GDL 88 ADS-B traffic system is interfaced to the GTN. The GDL 88 ADS-B traffic system is also interfaced to an on board traffic system.

7.8 StormScope® (Optional)

When optionally interfaced to a StormScope® weather detection system, the GTN may be used to display the StormScope® information. Weather information supplied by the StormScope® will be displayed on the StormScope® page of the GTN system. For detailed information about the capabilities and limitations of the StormScope® system, refer to the documentation provided with that system.

Heading Up mode:

If the GTN system is receiving valid heading information, the StormScope® page will operate in the heading up mode as indicated by the label “HDG UP” presented at the upper right corner of the display. In this mode, information provided by the StormScope® system is displayed relative to the nose of the aircraft and *is* automatically rotated to the correct relative position as the aircraft turns.

Heading Not Available mode:

If the GTN system is not receiving valid heading information, either because a compatible heading system is not installed, or the interfaced heading system has malfunctioned, the StormScope® page will continue to operate without a heading source and indicate “HDG N/A” in the upper right corner of the GTN display. In this mode, information provided by the StormScope® system is displayed relative to the nose of the aircraft but *is not* automatically rotated to the correct relative position as the aircraft turns. When operating in this mode, StormScope® strikes must be cleared after each turn the aircraft performs.

7.9 Power

- Power to the GTN is provided through a circuit breaker labeled NAV/GPS (1/2).
- Power to the optional GTN COM is provided through a circuit breaker labeled COMM (1/2)
- Power to the optional GMA 35 is powered through a circuit breaker labeled AUDIO.

7.10 Databases

Database versions and effective dates are displayed on the start-up page immediately after power-on. Database information can also be viewed on the System – System Status page.

The Obstacle Database coverage area includes the United States and Europe.

7.11 External Switch

External switches may be installed and interfaced to the GTN. These switches may be stand alone, or integrated with a TAWS or GPS annunciator. Table 4 lists the switches and function they perform:

Switch Label	Function
CDI	Toggles between GPS / VLOC sources. This switch may be part of an external annunciator panel.
COM CHAN DN	Toggles down through the preset com frequencies.
COM CHAN UP	Toggles up through the preset com frequencies.
COM RMT XFR	Transfers the com active / standby frequencies.
NAV RMT XFR	Transfers the nav active / standby frequencies.
OBS	Performs an OBS or SUSP function. This switch is part of an external annunciator panel and is placarded with the following: "Green OBS indicates OBS or SUSP mode – GTN annunciator bar indicates which is active. Push OBS button to change OBS or SUSP mode."
OBS/SUSP	Performs an OBS or SUSP function.
TERR INHB	Toggles the TAWS Inhibit function on/off. This switch is part of an external annunciator panel. The terrain display is still presented if TAWS is Inhibited.

Table 4 – External Switches

7.12 **Airspace Depiction and Alerts**

The GTN aides the flight crew in avoiding certain airspace with Smart Airspace and airspace alerts. Smart Airspace de-emphasizes depicted airspace that is not near the aircraft's current altitude. Airspace Alerts provide a message indication to the flight crew when the aircraft's current ground track will intercept an airspace type that has been selected for alerting.

NOTE

Smart Airspace and Airspace Alerts are separate features. Turning on/off Smart Airspace does not affect Airspace Alerts, and vice versa.

7.13 **GDL 88 ADS-B Traffic System Interface (Optional)**

The GDL 88 is an ADS-B traffic system that can interface to the GTN. The *nose* of the ownship symbol on both the GTN main map page and dedicated traffic page serves as the actual location of your aircraft. The *center* of the traffic target icon serves as the reported location for the target aircraft. Motion vectors for traffic may be displayed in either absolute or relative motion. The location of the traffic targets relative to the ownship are the same, regardless of the selected motion vector.

Absolute motion vectors are colored either cyan or white, depending on unit configuration. Absolute motion vectors depict the reported track of the traffic target referenced to the ground. An absolute motion vector pointed towards your ownship symbol *does not* necessarily mean the traffic target is getting closer to your aircraft.

Relative motion vectors are always colored green and depict the motion of the traffic target relative to your ownship symbol. The direction the traffic target is pointed may vary greatly from the motion vector and a target may be getting closer to your aircraft independent of the direction the target is pointed. A green relative motion vector pointed towards your ownship indicates that the traffic target *is* converging on your aircraft.

If more than one target is occupying the same area of the screen, the GTN will combine the two or more traffic targets into one traffic group. The presence of an asterisk to the left of a target indicates that traffic has been grouped. The highest priority traffic target in the group is displayed to the pilot. When applied to airborne targets the asterisk will be displayed in white or cyan depending on the traffic depiction color used in the installation. The asterisk will be brown for grouped ground targets. The asterisk will not turn amber, even if an alerted target is included in the group.

An alerted target may be placed in the same group as non-alerted targets. In this case, the alerted target will be displayed. Two alerted targets will not be placed in the same group. All alerted targets will be displayed on the screen.

Traffic targets displayed on the dedicated traffic page may be selected in order to obtain additional information about a traffic target or to view all targets in a grouped target. When a grouped target is selected, the “Next” button on the dedicated traffic page will cycle through all targets located in close proximity to where the screen has been touched.

7.14 GWX 70 Weather Radar (Optional)

The GWX 70 Weather Radar uses Doppler technology to provide advanced features to the flight crew such as turbulence detection and ground clutter suppression. These features that rely on Doppler technology are only supported by GWX 70 units that have a 12 inch antenna or larger. Turbulence detection is only supported at display ranges 40-160 nautical miles.

NOTE

Turbulence detection does not detect all turbulence, especially that which is occurring in clear air. The display of turbulence indicates the possibility of Severe or greater turbulence, as defined in the Aeronautical Information Manual.

7.15 Charts (Optional)

The GTN 750/725 can display both procedure charts and weather data on the main map page at the same time. When datalinked Nexrad or Precipitation is overlaid on the main map page, the weather data is displayed *below* an overlaid procedure chart. When airborne weather radar is overlaid on the main map page, the radar data is displayed *above* an overlaid procedure chart.

7.16 Transponder Control (Optional)

The GTN can be interfaced to a Garmin transponder for control and display of squawk code, mode, and additional transponder functions. The activation of the “Enable ES” button on the transponder page does not indicate the aircraft is in full compliance with an ADS-B Out solution in accordance with TSO-C166b (1090ES). Consult your transponder documentation for additional information.

V. K. Irving, Inc.
Albert Einstein Airport
Blue Hangar, Gate 5
St. Petersburg, FL 33701

Airplane Flight Manual Supplement
VK E-466E

N9153W
A/C SERIAL 162012
PROP SERIAL 97341

Supplement to the Original Pilot's Operating Handbook

Hydraulic 4-Blade Constant Speed Propeller System

MTV-14-B/195-30a

installed on

Piper PA 46-350P

Serial #4622001 through 4622126

Serial #4622132 and subsequent

This Airplane Flight Manual (AFM) Supplement applies to the airplane noted above when MT Model MTV-14-B/195-30a propeller and associated spinner is installed on the Piper PA-46-350P aircraft in accordance with Supplemental Type Certificate (STC) No. SA01654AT

The information herein supplements or supersedes the information presented in the flight manual and on placards in the airplane. For Limitations, Procedures, and Performance information not contained in the AFM supplement, consult the flight manual or placards in the airplane.

F.A.A. Approved: Eugene L. Bollin

Manager

for Atlanta Aircraft Certification Office
Federal Aviation Administration
Atlanta, GA

Dated: JUN 19 1998

Airplane Flight Manual Supplier
VK E-466E

Rev. #	Description	Approval

Date JUN 12 1999

1. GENERAL

Information concerning the Propeller MTV-14-B/195-30a see section 2.

2. LIMITATIONS

Propeller MTV-14-B/195-30a:

Diameter: 76.77 in (195 cm)
cut off to 74.8 in (190 cm) allowed for repair

Blade Angle: at station 28.74 in (73.0 cm)
low pitch 11.5 plus or minus .2
high pitch 35.0 plus or minus 1.0

Propeller-Governor: According to Piper equipment list.

Propeller-Spinner: MT-Propeller No. P-449

Propeller-De-Ice: An electrical de-ice system according to Piper equipment list and VK Installation Instruction No. VK E-467E may be installed. The propeller de-ice system may be switched on with a non-rotating propeller, for test purposes, no longer than 10 seconds, because overheating or damage of the de-ice boots may occur.

FAA APPROVED

Date 11 19 1991

3. EMERGENCY PROCEDURES

Malfunction of the propeller pitch control:

If the oil-pressure in the system is decreasing, or the pitch control fails, the propeller will return to low pitch position (take off position).

Hold propeller speed below 2500 RPM by the power lever. Select lower air speed, if applicable. Monitor oil pressure and oil temperature.

Propeller-De-Ice:

The propeller de-ice system may be switched on with a non-rotating propeller, for test purposes, no longer than 10 seconds, because overheating or damage of the de-ice boots may occur.

If the reading of the "PROP DE-ICER" ammeter is not within the green arc, or an unusually high or low reading of the ammeter occurs, turn off the propeller de-ice system with the switch marked "PROP HEAT"!

Uneven deicing may cause propeller imbalance.

Warning:

If there is a malfunction of the de-ice system, flight into known icing conditions is not approved.

4. NORMAL PROCEDURES

Move the propeller lever gently, because the Propeller MTV-14-() is equipped with light weight wood composite blades, reacting quicker to RPM changes than the standard propeller with metal blades.

Propeller-De-Ice System:

An electrical de-ice system may be installed.

The propeller de-ice system may be switched on with a non-rotating propeller, for test purposes, no longer than 10 seconds, because overheating or damage of the de-ice boots may occur.

During flights, switch on "PROP HEAT" at the beginning of icing.

The reading of the "PROP DE-ICER" ammeter must be within the green arc, otherwise switch off the de-icing system! (Uneven de-icing may cause propeller imbalance).

Warning:

If there is a malfunction of the de-ice system, flight into known icing conditions is not approved.

5. PERFORMANCE

No change.

FAA APPROVED

JUN 19 1998
Date _____

3. WEIGHT AND BALANCE/LIST OF EQUIPMENT

Propeller weight and arm:

Standard propeller Hartzell HC-12YR-1BF/F8074 with spinner:	weight arm moment	63.4 lbs 29.25 in 1855 in/lbs	28.8 kg .743 m 21.4 kg
Standard propeller Hartzell HC-12YR-1BF/F8074 with spinner and de-ice boots:	weight arm moment	64.8 lbs 29.25 in 1895 in/lbs	29.4 kg .743 m 21.8 kg
Propeller MTV-14-B/195-30a with spinner:	weight arm moment	59.9 lbs 30.03 in 1799 in/lbs	27.2 kg .763 m 20.7 kg
Propeller MTV-14-B/195-30a with spinner and de-ice boots:	weight arm moment	61.5 lbs 30.03 in 1847 in/lbs	27.9 kg .763 m 21.2 kg

When installing the MTV-14-() . . the equipment list has to be amended.

FAA APPROVED
JUN 19 1998
Date _____