DUPLICATE

DAKOTA

PILOT'S OPERATING HANDBOOK

AND

FAA APPROVED AIRPLANE FLIGHT MANUAL

AIRPLANE SERIAL NO. _____

AIRPLANE REGISTRATION. NO. _____

PA-28-236

REPORT: VB-910

DATE OF APPROVAL: JUNE 1, 1978

Ward Evans

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

FAA APPROVED IN NORMAL CATEGORY BASED ON CAR 3. THIS HANDBOOK INCLUDES THE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY CAR 3 AND CONSTITUTES THE APPROVED AIRPLANE FLIGHT MANUAL AND MUST BE CARRIED IN THE AIRPLANE AT ALL TIMES.

PIPER

DUPLICATE (07)

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I-3A (2)
V-BA (2)

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ESC. AV (3)
C.L

PIPER

I-A y V-A B.A

291

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
Piper Aircraft Corporation
Issued: June 1, 1978

FUERZA AÉREA DE CHILE
COMANDO LOGÍSTICO
DIVISIÓN DE MANTENIMIENTO

WARNING

El operador de la aeronave, tanto en vuelo como en tierra, deberá respetar las performances de aterrizaje y carreteo establecidas por el fabricante con el propósito de no dañar el sistema de guiado del tren de nariz y provocar un accidente.

IMPORTANTE

Antes de proceder al aterrizaje, se debe colocar el Trim del Timón de dirección en posición neutral con el propósito que la rueda de nariz quede centrada y no sufra daños mecánicos.

Referencia: R.T. PA28-86-005A


N4300H

APPLICABILITY

Application of this handbook is limited to the specific Piper PA-28-236 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. Page numbers followed by a small letter shall be inserted in direct sequence with the same common numbered page.

II. Identification of Revised Material

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

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

ORIGINAL PAGES ISSUED

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

Title, ii through vii, 1-1 through 1-21, 2-1 through 2-8, 3-1 through 3-16, 4-1 through 4-24, 5-1 through 5-30, 6-1 through 6-47, 7-1 through 7-28, 8-1 through 8-18, 9-1 through 9-18 and 10-1 through 10-2.

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Current Revisions to the PA-28-236 Dakota Pilot's Operating Handbook, REPORT: VB-910 issued June 1, 1978.

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 1 761 689 (PR790115)	1-2	Revised dimensions.	
	1-4	Revised note.	
	2-1	Revised para. 2.1 General.	
	3-4	Revised approach speed.	
	3-6	Corrected spelling.	
	3-11, 4-2, 4-10 & 4-22	Revised approach speed.	
	5-4	Revised item (5) of example flight.	
	5-29	Revised Figure 5-35.	
	6-4	Revised dimensions.	
	6-17	Revised item 31.	
	6-18	Revised item 45.	
	6-19	Revised item 63.	
	6-23	Revised item 117.	
	6-24	Revised item 133 & added item 137.	
	6-25	Revised item 151.	
	6-26	Revised item 163.	
	6-28	Revised item 183.	
	6-31	Revised item 209.	Ward Evans
	6-34	Added item 240.	
	6-36	Revised item 259 & removed item 261.	Ward Evans Jan. 15, 1979

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 2 761 689 (PR790413)	6-i	Revised pg. no.	
	6-43	Revised item 315; added item 316; relocated item 319 to pg. 6-44.	
	6-44	Added item 319 from pg. 6-43; relocated items 401, 403, & 405 to pg. 6-44a.	
	6-44a	Added pg. (added items from pg. 6-44).	
	6-44b	Added pg.	
	7-i	Revised pg. no.	
	7-25, 7-26	Revised para. 7.37.	
	7-27	Added para. 7.37 info.; relocated para. 7.39 to pg. 7-28.	
	7-28	Added info. from pg. 7-27; relocated info. to pg. 7-29.	Ward Evans
	7-29	Added pg. (added info. from pg. 7-28).	Ward Evans April 13, 1979
Rev. 3 761 689 (PR790827)	1-9	Added Demo. X-Wind.	
	2-6, 2-7	Revised para. 2.25.	
	3-i	Added para. 3.22.	
	3-6	Added carburetor icing. Moved info. to pg. 3-7.	
	3-7	Relocated info. from pg. 3-6.	
	3-15	Added para. 3.22; relocated info. to pg. 3-16.	
	3-16	Relocated info. from pg. 3-15.	
	4-i	Added para. 4.28; revised pages.	
	4-3	Added to check list.	
	4-5	Added to check list.	
	4-9	Relocated info. to pg. 4-10.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature Date
Rev. 3 (cont)	4-10	Added Descent to check list; relocated info. from pg. 4-9; relocated info. to pg. 4-10a.	
	4-10a	Added page; relocated info. from pg. 4-10.	
	4-10b	Added page.	
	4-11	Revised paragraph.	
	4-14	Revised para. 4.11.	
	4-21	Added para. 4.28; relocated para. 4.29 to pg. 4-22.	
	4-22	Relocated para. 4.29; relocated para. 4.31 to pg. 4-23.	
	4-23	Relocated para. 4.31; relocated para. 4.35 and para. 4.37 to pg. 4-24.	
	4-24	Relocated para. 4.35 and para. 4.37.	
	5-1	Relocated info. to pg. 5-2.	
	5-2	Relocated info. from pg. 5-1; added Warning.	
	5-3,5-5, 5-6, 5-7	Revised para. 5.5 (a), (c), (d), (e), (f) and (g).	
	5-18	Revised fig. 5-15.	
	5-19	Revised fig. 5-17; revised footnote.	
	5-23 thru 5-28	Revised figs. 5-23, 5-25, 5-27, 5-29, 5-31 and 5-33.	
	6-1, 6-2	Revised para. 6.1.	
	6-3	Added Caution; relocated fig. 6-1 to pg. 6-4.	
	6-4	Relocated fig. 6-1; relocated info. to pg. 6-5.	
	6-5	Relocated info. from pg. 6-4.	
	6-6	Revised fig. 6-5.	
	6-16	Revised item 23.	
	6-28	Removed item 185; relocated item 189 from pg. 6-29.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature Date
Rev. 3 (cont)	6-29	Relocated item 189; added item 192; relocated item 195 from pg. 6-30.	
	6-30	Relocated item 195; removed item 201; added item 202.	
	6-33	Revised items 235 and 237.	
	6-34	Changed item 241 to 242 and item 243 to 244; added items 241 and 243; relocated items 245 and 247 to pg. 6-35.	
	6-35	Relocated items 245 and 247; relocated item 251 to pg. 6-36.	
	6-36	Relocated item 251 from pg. 6-35; added item 252; relocated items 259 and 263 to pg. 6-37.	
	6-37	Relocated items 259 and 263 from pg. 6-36; added item 260; relocated item 271 to pg. 6-38.	
	6-38	Relocated item 271 from pg. 6-37.	
	6-44	Revised item 323.	
	6-45	Revised items 407 and 409.	
	7-12	Added Warning. Added optional light; moved info. to pg. 7-14.	
	7-14	Relocated info. from pg. 7-12.	
	7-16	Revised para. 7.21	
	7-17	Revised fig. 7-15.	
	7-20	Revised para. 7.25	Ward Evans
	7-21	Revised fig. 7-19.	Ward Evans
	8-11	Revised para. 8.15.	Aug. 27, 1979
	10-1	Revised para. 10.3 (f).	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 4 761 689 (PR800801)	1-3	Revised para. 1.7 (c).	
	2-3	Revised fuel grade.	
	2-8	Added placard.	
	3-15	Revised para. 3.22.	
	4-10	Revised Normal Procedures checklist (Descent).	
	5-9	Revised List of Figures, added pgs. 5-31 and 5-32, added new figs. 5-39 and 5-41.	
	5-29	Revised fig. 5-35.	
	5-30	Revised fig. 5-37.	
	5-31	Added pg:, added new fig. 5-39.	
	5-32	Added pg.; added new fig. 5-41.	
	6-i	Revised Table of Contents.	
	6-4	Revised fig. 6-3.	
	6-5	Revised para. 6.3 (d) (2).	
	6-12	Revised fig. 6-15.	
	6-12a	Added pg.; added new info.	
	6-12b	Added pg.; added new info.	
	6-12c	Added pg.; added new info.	
	6-12d	Added pg.	
	6-17	Revised item 31.	
	6-19	Relocated items; added items 49 and 51.	
	6-20	Added items 65 and 67.	
	6-22	Added item 103b.	
	6-23	Added item 119.	
	6-24	Relocated item; added item 129.	
	6-25	Relocated item 151 to pg. 6-26; added item 137 from pg. 6-24.	
	6-26	Added item 151 from pg. 6-25; added new items 153 thru 159; renumbered items.	
	6-27	Relocated items from pg. 6-26; renumbered items.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 4(cont)	6-28	Added item 181 from pg. 6-27.	
	6-32	Relocated item 231 to pg. 6-35; renumbered item; added new item 225.	
	6-33	Relocated items; added new items 235 thru 245.	
	6-34	Relocated items; added new items 247 thru 251.	
	6-35	Relocated items from pg. 6-32 and pg. 6-33; renumbered items.	
	6-36	Relocated items from pg. 6-33 and pg. 6-34; renumbered items.	
	6-37	Relocated items from pg. 6-34 and pg. 6-35; renumbered items.	
	6-38	Relocated items from pg. 6-35 and pg. 6-36; renumbered items.	
	6-39	Relocated items from pg. 6-36 and pg. 6-37; renumbered items; added new items 291 and 293.	
	6-40	Relocated items. from pg. 6-37; revised items 299 and 301; added new item 303; renumbered items.	
	6-41	Relocated items from pg. 6-37 and pg. 6-38; renumbered items.	
	6-42	Relocated items from pg. 6-39; renumbered items.	
	6-43	Relocated items from pg. 6-40; renumbered items.	
	6-44	Relocated items from pg. 6-41; renumbered items.	
	6-44a	Relocated items from pg. 6-42; renumbered items.	
	6-44b	Relocated items from pg. 6-43; renumbered items.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 4 (cont)	6-45	Relocated items from pg. 6-44; renumbered items.	
	6-46	Relocated items from pg. 6-44a; renumbered items; relocated items 407 thru 411 from pg. 6-45.	
	6-47	Relocated items from pg. 6-45 and pg. 6-46.	
	6-48	Added pg.; relocated items 427 and 435 from pg. 6-46; added new items 429 thru 433; renumbered items.	
	6-49	Added pg.; relocated items from pg. 6-47; renumbered items.	
	7-i	Revised Table of Contents.	
	7-9	Revised para. 7.15; relocated info. to pg. 7-10.	
	7-10	Relocated info. from pg. 7-9.	
	7-22	Revised para. 7.27.	
	7-29	Added new para. 7.41.	
	8-12	Revised para. 8.21(b).	
	8-13	Relocated info. to pg. 8-14; added new info. to para. 8.21(b).	
	8-14	Added para. 8.21(c). from pg. 8-13.	
	9-i	Added Supplement 5 (Century 21 Autopilot) and Supplement 6 (Piper Control Wheel Clock Installation).	
	9-19 thru 9-22	Added pgs.; Added Supplement 5 info.	
	9-23 thru 9-24	Added pgs.; Added Supplement	Ward Evans Ward Evans August 1, 1980

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature Date
Rev. 5 761 689 (PR801210)	6-39 9-i 9-25 thru 9-28	Added item 288. Revised Table of Contents. Added pgs. (Added Supplement 7 KNS 80 Navigation System.)	Ward Evans Ward Evans Dec. 10, 1980
Rev. 6 761 689 (PR810202)	3-i	Retitled and added para. and pg. no.	
	3-5	Changed Alternator Failure to Electrical Failures; moved info. to pg. 3-7.	
	3-6	Added Electrical Overload; moved info. to pg. 3-7.	
	3-7	Continued Electrical Overload; relocated info. from pg. 3-5 and 3-6; moved info. to pg. 3-8.	
	3-8	Relocated info. from pg. 3-7.	
	3-14	Retitled and revised para. 3.17; added para. 3.18; moved info. to pg. 3-15.	
	3-15	Continued para. 3.18, relocated info. from pg. 3-14; moved info. to pg. 3-16.	
	3-16	Relocated info. from pg. 3-15; moved info. to pg. 3-17.	
	3-17	New pg., relocated info. from pg. 3-16.	
	6-i	Revised Table of Contents.	
	6-21	Revised items 99 and 101; moved item 101 to pg. 6-22.	
	6-22	Relocated item 101 from pg. 6-21; revised item 103; moved title (g) to pg. 6-23.	
	6-23	Relocated title (g) from pg. 6-22.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 6 (cont)	6-24	Revised item 129.	
	6-25	Relocated title (j).	
	6-30	Added item 206.	
	6-38	Moved item 281 to pg. 6-38a.	
	6-38a	Added item 280; relocated item 281 from pg. 6-38; relocated item 283 from pg. 6-39.	
	6-38b	New page.	
	6-39	Moved item 283 to pg. 6-38a; revised item 293; added item 288.	
	6-41	Revised item 307.	
	6-44b	Added item 342; moved item 349 to pg. 6-45.	
	6-45	Relocated item 349 from pg. 6-44b.	
	6-48	Revised items 429, 431 and 433; moved items 433 and 435 to pg. 6-49.	
	6-49	Relocated items 433 and 435 from pg. 6-48; moved info. to pg. 6-50.	
	6-50	New pg.; relocated info. from pg. 6-49.	
	7-13	Revised Figure 7-11.	
	7-14	Revised para. 7.17; added note; moved info. to pg. 7-16.	Ward Evans Ward Evans Feb. 2, 1981
	7-16	Relocated info. from pg. 7-14.	
	7-22	Revised para. 7.27.	
	9-24	Revised 4 (c).	
Rev. 7 761 689 (PR810624)	ii	Revised Warning.	
	1-4	Revised para. 1.13.	
	6-15	Revised item 17.	
	6-25	Revised item 143.	
	6-33	Revised item 243.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 7 (cont)	6-34	Revised item 251.	
	6-37	Renumbered item; moved item to pg. 6-37b.	
	6-37a	New page.	
	6-37b	New page; added items 274 and 275; relocated re-numbered item from pg. 6-37.	
	6-38a	Added item 282.	
	6-38b	Relocated items 285 thru 289 from pg. 6-39.	
	6-39	Moved items 285 thru 289 to pg. 6-38b; relocated items 295 thru 299 from pg. 6-40.	
	6-40	Moved items 295 thru 299 to pg. 6-39; added item 303.	
	6-50	Removed info.	Ward Evans
	7-12	Revised para. 7.15.	Ward Evans
	8-15	Corrected date.	June 24, 1981
Rev. 8 PR811120)	4-i	Revised Table of Contents.	
	4-5	Revised procedure.	
	4-8	Revised procedure.	
	4-10	Revised procedure.	
	4-14	Added note to para. 4.9.	
	4-18	Added note to para. 4.21; moved para. 4.23 to pg. 4-19.	
	4-19	Relocated para. 4.23 from pg. 4-18; moved info. to pg. 4-20.	
	4-20	Relocated info. from 4-19; moved info. to pg. 4-21.	
	4-21	Relocated info. from pg. 4-20; moved info. and para. 4.28 to pg. 4-22.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description	FAA Approval Signature and Date
Rev. 8 (cont)	4-22	Relocated info. and para. 4.28 from pg. 4-21; added note to para. 4.29; moved info. to pg. 4-23.	
	4-23	Relocated info. from pg. 4.22; moved info. and para. 4.33 to pg. 4-24.	
	4-24	Relocated info. and para. 4.33 from pg. 4-23; moved para. 4.37 and 4.39 to pg. 4.25.	
	4-25	New page; relocated para. 4.37 and 4.39 from pg. 4-24.	
	6-13	Revised para. 6.11.	
	6-38b	Revised items 288 and 289.	
	6-44b	Renumbered item; added new item 343.	Ward Evans
	6-50	Added item 445.	Ward Evans
	7-22	Revised para. 7.27.	Nov. 20, 1981
Rev. 9 761 689 (PR820723)	iii	Revised handbook info.	
	1-i	Removed para. 1.21 - coversion factor reference.	
	1-3	Revised para. 1.7.	
	1-4	Added info. to para. 1.11.	
	2-1	Revised para. 2.1.	
	2-3	Added info. to para. 2.11.	
	3-i	Expanded emerg. procedure index; moved info. to new pg. 3-ii.	
	3-ii	New pg.; relocated info. from pg. 3-i.	
	3-1	Revised para. 3.1.	
	4-i	Expanded normal procedure index; moved info. to new pg. 4-ii.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Page	Description of Revision	FAA Approval Signature and Date
Rev. 9 (cont)	4-ii	New pg.; relocated info. from pg. 4-i.	
	4-I	Revised para. 4.1.	
	4-11	Revised para. 4.7.	
	6-i	Revised index pg.	
	6-6	Revised fig. 6-5 info.	
	6-7	Revised fig. 6-7.	
	6-9	Added info. to fig. 6-9.	
	6-10	Added info. to fig. 6-11.	
	6-12a	Revised para. 6.9.	
	7-2	Revised para. 7.5.	
	7-22	Revised para. 7.27.	
	7-24	Revised para. 7.33.	
	9-i	Updated supplement index pg.	
	9-13	Revised Supplement 3 (pitch trim).	
	9-29 thru 9-48	Added new Supplement 8.	
	9-49 thru 9-74	Added new Supplement 9.	Ward Evans Ward Evans July 23, 1982
Rev. 10 761 689 (PR821122)	1-4	Revised para. 1.11.	
	1-12 thru 1-21	Deleted para. 1.21 and pages.	
	2-3	Revised para. 2.11.	
	5-3 thru 5-7	Revised para. 5.5.	
	6-9	Revised fig. 6-9.	
	6-10	Revised fig. 6-11.	
	7-i	Revised Table of Contents.	
	7-14	Added Caution; moved para. 7.19 to pg. 7-16.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Page	Description of Revision	FAA Approval Signature and Date
Rev. 10 (cont)	7-16	Relocated para. 7.19 from pg. 7-14, moved info. to pg. 7-18.	
	7-18	Relocated info. from pg.7-16.	
	7-22	Revised para. 7.27.	
	8-2	Revised para. 8.3.	
	8-3	Revised para. 8.3 and 8.5, relocated info. from pg. 8-4.	
	8-4	Moved info. to pg. 8-3, relocated info. from pg. 8-5.	Ward Evans
	8-5	Moved info. to pg. 8-4, relocated info. from pg. 8-6.	Ward Evans Nov. 22, 1982
	8-6	Moved info. to pg. 8-5.	
Rev. 11 761 689 (PR830805)	1-9	Deleted MEA.	
	1-12	Deleted pg. 1-12, para. 1.21.	
	2-8	Added GAMA placard.	
	5-3	Revised para. 5.5.	
	6-9	Revised fig. 6-9.	
	8-2	Revised para. 8.3.	Ward Evans
	8-3	Revised para. 8.5.	Ward Evans Aug. 5, 1983
	9-35	Revised Supplement No. 8.	
	9-57	Revised Supplement No. 9.	
Rev. 12 761 689 (PR840713)	vii	Revised Table of Contents.	
	1-3	Revised para. 1.7.	
	2-3	Revised para. 2.7 (g).	
	3-1	Revised para. 3.1.	
	4-4,	Revised para. 4.5 info.	
	4-5,		
	4-7,		
	4-8		
	4-14	Revised para. 4.11.	
	4-16	Revised para. 4.17.	
	4-17	Revised para. 4.19.	
	4-18	Revised para. 4.21.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 12 (cont)	6-1	Revised para. 6.1.	
	6-2	Revised para. 6.3.	
	6-5	Revised para. 6.5.	
	6-15	Revised item 19.	
	7-5	Revised para. 7.9.	
	7-12	Revised para. 7.17.	
	7-22	Revised para. 7.27.	
	7-24	Revised para. 7.33.	
	8-12	Revised para. 8.21 (b).	
	10-i	Revised Table of Contents.	Ward Evans
	10-1	Revised Title; revised para. 10.1 and para. 10.3.	Ward Evans
	10-2	Revised Title.	July 13, 1984
Rev. 13 (PR860830)	7-12	Added Info to para. 7.17	D.H.Trompler Oct 11, 1985 Date
Rev. 14 (PR861014)	9-i	Revised Table of Contents.	
	9-75 thru 9-80	Added new Supplement 10.	
	9-81 thru 9-100	Added new Supplement 11.	D.H.Trompler Dec 11-86 Date
Rev. 15 (PR880701)	8-1	Revised para. 6.1. Relocated info from page 8-2.	
	8-2	Moved info to page 8-1. Relocated info from page 8-3.	
	8-3	Moved info to page 8-2.	
	9-7	Revised Section 3, para. (a).	D.H. Trompler 6/17/88 Date

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 16 (PR900504)	vi-m, vi-n	Added pages to Log of Revisions.	
	5-29	Revised Figure 5-35.	
	7-27	Added Narco ELT 910 info.	
	7-27a	Added page.	
	7-27b	Added page. Added Narco ELT 910 info.	
	8-1	Revised para. 8.1. Moved info. to p. 8-2.	
	8-2	Relocated info. from p. 8-1. Revised paras. 8.1 and 8.3. Moved info. to p. 8-3.	
	8-3	Relocated info. from p. 8-2. Revised para. 8.3.	
	8-12	Revised para. 8.19. Moved info. to p. 8-13.	
	8-13	Relocated info. from p. 8-12. Revised Fuel Grade Comparison Chart.	D. H. Trompler May 11, 1990 Date
Rev. 17 (PR931207)	9-i	Revised Table of Contents	
	9-101 Thru 9-104	Added pgs;Added Supplement No. 12	
	9-105 Thru 9-108	Added pgs;Added Supplement No. 13	W. R. Moreu DEC. 07, 1993 Date

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

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

TABLE OF CONTENTS

TABLE OF CONTENTS

SECTION 1

GENERAL

SECTION 1

GENERAL

1.1 INTRODUCTION

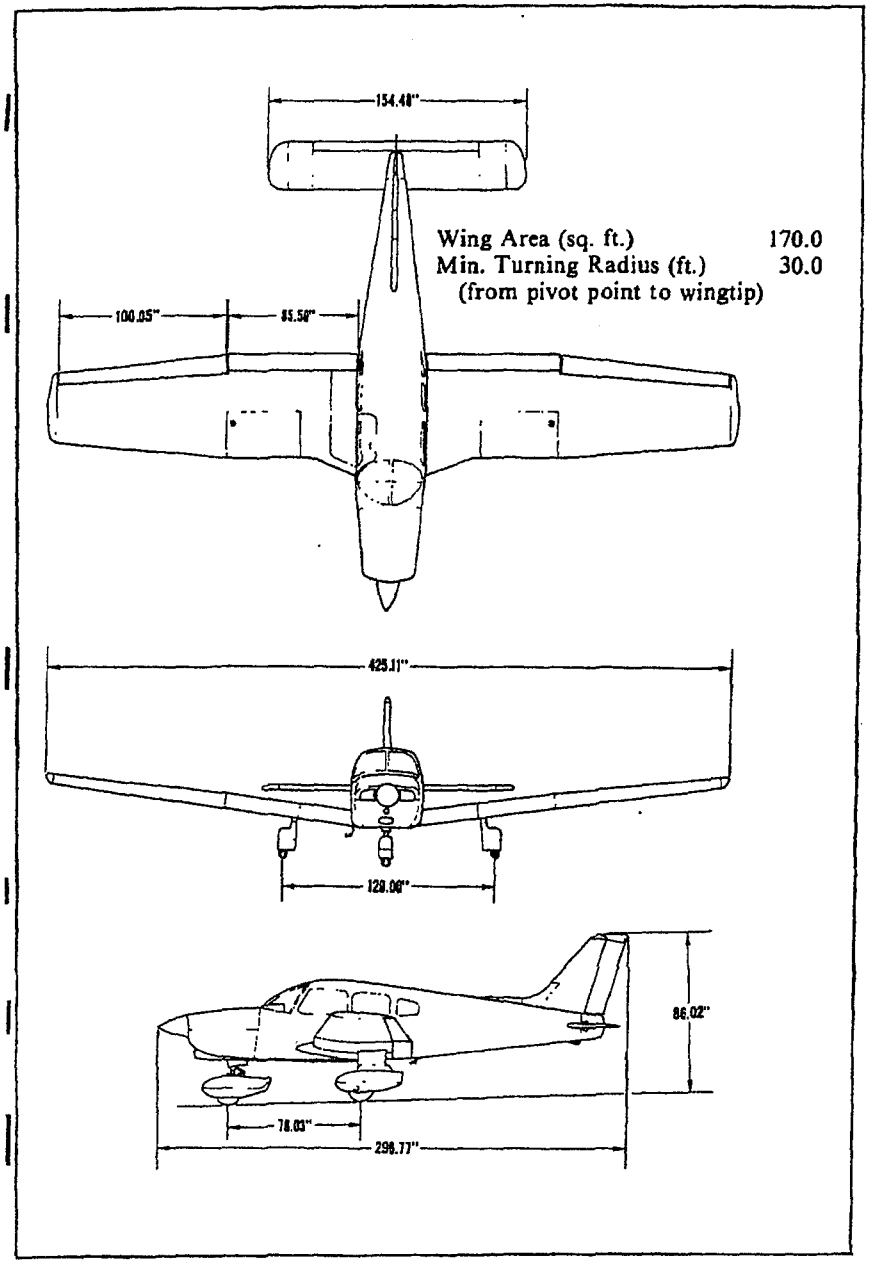
This Pilot's Operating Handbook is designed for maximum utilization as an operating guide for the pilot. It includes the material required to be furnished to the pilot by CAR 3. It also contains supplemental data supplied by the airplane manufacturer.

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

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

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

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



THREE VIEW
Figure 1-1

1.3 ENGINE

(a) Number of Engines	1
(b) Engine Manufacturer	Lycoming
(c) Engine Model Number	O-540-J3A5D
(d) Rated Horsepower	235
(e) Rated Speed (rpm)	2400
(f) Bore (in.)	5.125
(g) Stroke (in.)	4.375
(h) Displacement (cu. in.)	541.5
(i) Compression Ratio	8.5:1
(j) Engine Type	Six Cylinder, Direct Drive, Horizontally Opposed, Air Cooled

1.5 PROPELLER

(a) Number of Propellers	1
(b) Propeller Manufacturer	Hartzell
(c) Blade Model	F8468A-4R
(d) Number of Blades	2
(e) Hub Model	HC-F2YR-1( )F
(f) Propeller Diameter (in.)	
(1) Maximum	80
(2) Minimum	78
(g) Propeller Type	Constant Speed, Hydraulically Actuated

1.7 FUEL

AVGAS ONLY

(a) Fuel Capacity (U.S. gal.) (total)	77
(b) Usable Fuel (U.S. gal.) (total)	72
(c) Fuel	
(1) Minimum Grade	100 Green or 100LL Blue Aviation Grade
(2) Alternate Fuel	Refer to latest issue of Lycoming Instruction No. 1070.

1.9 OIL

(a) Oil Capacity (U.S. qts.)	12
(b) Oil Specification	Refer to latest issue of Lycoming Service Instruction 1014.
(c) Oil Viscosity	Refer to Section 8 - paragraph 8.19.

1.11 MAXIMUM WEIGHTS

(a) Maximum Ramp Weight (lbs.)	3011
(b) Maximum Takeoff Weight (lbs.)	3000
(c) Maximum Landing Weight (lbs.)	3000
(d) Maximum Weights in Baggage Compartment (lbs.)	200

1.13 STANDARD AIRPLANE WEIGHTS

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

1.15 BAGGAGE SPACE

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

1.17 SPECIFIC LOADINGS

(a) Wing Loading (lbs. per sq. ft.)	17.6
(b) Power Loading (lbs. per hp)	12.8

1.19 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.

V_{NE}/M_{NE}	Never Exceed Speed or Mach Number is the speed limit that may not be exceeded at any time.
V_{NO}	Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air and then only with caution.
V_S	Stalling Speed or the minimum steady flight speed at which the airplane is controllable.
V_{SO}	Stalling Speed or the minimum steady flight speed at which the airplane is controllable in the landing configuration.
V_X	Best Angle-of-Climb Speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.
V_Y	Best Rate-of-Climb Speed is the airspeed which delivers the greatest gain in altitude in the shortest possible time.

(b) Meteorological Terminology

ISA	International Standard Atmosphere in which: The air is a dry perfect gas; The temperature at sea level is 15° Celsius (59° Fahrenheit); The pressure at sea level is 29.92 inches Hg (1013 mb); The temperature gradient from sea level to the altitude at which the temperature is -56.5°C (-69.7°F) is -0.00198°C (-0.003566°F) per foot and zero above that altitude.
OAT	Outside Air Temperature is the free air static temperature obtained either from inflight temperature indications or ground meteorological sources, adjusted for instrument error and compressibility effects.

Indicated Pressure Altitude	The number actually read from an altimeter when the barometric subscale has been set to 29.92 inches of mercury (1013 millibars).
Pressure Altitude	Altitude measured from standard sea-level pressure (29.92 in. Hg) by a pressure or barometric altimeter. It is the indicated pressure altitude corrected for position and instrument error. In this handbook, altimeter instrument errors are assumed to be zero.
Station Pressure	Actual atmospheric pressure at field elevation.
Wind	The wind velocities recorded as variables on the charts of this handbook are to be understood as the headwind or tailwind components of the reported winds.

(c) Power Terminology

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

(d) Engine Instruments

EGT Gauge	Exhaust Gas Temperature Gauge

(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 (DEMO. X-WIND)	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.

(f) Weight and Balance Terminology

Reference Datum	An imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Station	A location along the airplane fuselage usually given in terms of distance in inches from the reference datum.
Arm	The horizontal distance from the reference datum to the center of gravity (C.G.) of an item.
Moment	The product of the weight of an item multiplied by its arm. (Moment divided by a constant is used to simplify balance calculations by reducing the number of digits.)

Center of Gravity (C.G.)	The point at which an airplane would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the airplane.
C.G. Arm	The arm obtained by adding the airplane's individual moments and dividing the sum by the total weight.
C.G. Limits	The extreme center of gravity locations within which the airplane must be operated at a given weight.
Usable Fuel	Fuel available for flight planning.
Unusable Fuel	Fuel remaining after a runout test has been completed in accordance with governmental regulations.
Standard Empty Weight	Weight of a standard airplane including unusable fuel, full operating fluids and full oil.
Basic Empty Weight	Standard empty weight plus optional equipment.
Payload	Weight of occupants, cargo and baggage.
Useful Load	Difference between takeoff weight, or ramp weight if applicable, and basic empty weight.
Maximum Ramp Weight	Maximum weight approved for ground maneuver. (It includes weight of start, taxi and run up fuel.)
Maximum Takeoff Weight	Maximum weight approved for the start of the takeoff run.

Maximum Landing Weight	Maximum weight approved for the landing touchdown.
Maximum Zero Fuel Weight	Maximum weight exclusive of usable fuel.

TABLE OF CONTENTS

SECTION 2

LIMITATIONS

SECTION 2

LIMITATIONS

2.1 GENERAL

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

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

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

2.3 AIRSPEED LIMITATIONS

SPEED	KIAS	KCAS
Design Maneuvering Speed (V_A) - Do not make full or abrupt control movements above this speed.		
3000 lbs.	124	122
1761 lbs.	96	94

CAUTION

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

SPEED	KIAS	KCAS
Never Exceed Speed (V_{NE}) - Do not exceed this speed in any operation.	173	171
Maximum Structural Cruising Speed (V_{NO}) - Do not exceed this speed except in smooth air and then only with caution.	137	135
Maximum Flaps Extended Speed (V_{FE}) - Do not exceed this speed with the flaps extended.	102	100

2.5 AIRSPEED INDICATOR MARKINGS

MARKING	IAS
Red Radial Line (Never Exceed)	173 KTS
Yellow Arc (Caution Range - Smooth Air Only)	137 KTS to 173 KTS
Green Arc (Normal Operating Range)	65 KTS to 137 KTS
White Arc (Flap Down)	56 KTS to 102 KTS

2.7 POWER PLANT LIMITATIONS

(a) Number of Engines	1
(b) Engine Manufacturer	Lycoming
(c) Engine Model No.	O-540-J3A5D
(d) Engine Operating Limits	
(1) Maximum Horsepower	235
(2) Maximum Rotation Speed (RPM)	2400
(3) Maximum Oil Temperature	245°F
(e) Oil Pressure	
Minimum (red line)	25 PSI
Maximum (red line)	100 PSI

(f) Fuel Pressure	
Minimum (red line)	0.5 PSI
Maximum (red line)	8 PSI
(g) Fuel (AVGAS ONLY)	
(minimum grade)	100 or 100LL Aviation Grade
(h) Number of Propellers	1
(i) Propeller Manufacturer	Hartzell
(j) Propeller Hub and Blade Model	HC-F2YR-1 ( )F/ F8468A-4R
(k) Propeller Diameter	
Maximum	80 IN.
Minimum	78 IN.
(l) Blade Angle Limits (at 30 inch station)	
Low Pitch Stop	16.25° ± 0.25°
High Pitch Stop	32° ± 2.0°

2.9 POWER PLANT INSTRUMENT MARKINGS

(a) Tachometer	
Green Arc (Normal Operating Range)	500 to 2400 RPM
Red Line (Maximum Continuous Power)	2400 RPM
(b) Oil Temperature	
Green Arc (Normal Operating Range)	75° to 245°F
Red Line (Maximum)	245°F
(c) Oil Pressure	
Green Arc (Normal Operating Range)	60 PSI to 90 PSI
Yellow Arc (Caution Range) (Idle)	25 PSI to 60 PSI
Yellow Arc (Ground Warm-Up)	90 PSI to 100 PSI
Red Line (Minimum)	25 PSI
Red Line (Maximum)	100 PSI
(d) Fuel Pressure	
Green Arc (Normal Operating Range)	0.5 PSI to 8 PSI
Red Line (Minimum)	0.5 PSI
Red Line (Maximum)	8 PSI

2.11 WEIGHT LIMITS

(a) Maximum Ramp Weight	3011 lbs.
(b) Maximum Weight	3000 lbs.
(c) Maximum Baggage	200 lbs.

2.13 CENTER OF GRAVITY LIMITS

Weight Pounds	Forward Limit Inches Aft of Datum	Rearward Limit Inches Aft of Datum
3000	88.5	92.0
2500	82.5	92.0
1900	79.8	92.0

NOTES

Straight line variation between points given.

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

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

2.15 MANEUVER LIMITS

No acrobatic maneuvers including spins approved.

2.17 FLIGHT MANEUVERING LOAD FACTORS

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

2.19 TYPES OF OPERATION

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

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

2.21 FUEL LIMITATIONS

(a) Total Capacity	77 U.S. GAL.
(b) Unusable Fuel The unusable fuel for this airplane has been determined as 2.5 gallons in each wing in critical flight attitudes.	5 U.S. GAL.
(c) Usable Fuel The usable fuel in this airplane has been determined as 36 gallons in each wing.	72 U.S. GAL.
(d) Fuel remaining when a quantity indicator reads zero cannot be used safely in flight.	

2.23 NOISE LEVEL

The noise level of this aircraft is 72.9 d B(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 FAR 36, Noise Standards - Aircraft Type and Airworthiness Certification. This aircraft model is in compliance with all FAR 36 noise standards applicable to this type.

2.25 PLACARDS

In full view of the pilot:

THIS AIRPLANE MUST BE OPERATED AS A NORMAL CATEGORY AIRPLANE IN COMPLIANCE WITH THE OPERATING LIMITATIONS STATED IN THE FORM OF PLACARDS, MARKINGS AND MANUALS.

THIS AIRCRAFT APPROVED FOR NIGHT I.F.R. NON-ICING FLIGHT WHEN EQUIPPED IN ACCORDANCE WITH FAR 91 OR FAR 135.

In full view of the pilot:

TAKEOFF CHECK LIST

Fuel on Proper Tank	Propeller Set
Electric Fuel Pump - On	Fasten Belts/Harness
Engine Gages Checked	Flaps Set
Carburetor Heat Off	Trim Tab Set
Seat Backs Erect	Controls Free
Primer Locked	Door Latched
Mixture Set	Air Conditioner Off

LANDING CHECK LIST

Seat Backs Erect	Mixture Rich
Fasten Belts/Harness	Propeller Set
Fuel on Proper Tank	Flaps Set - (White Arc)
Electric Fuel Pump On	Air Conditioner Off

The "Air Conditioner Off" item in the above Takeoff and Landing Check List is mandatory for air conditioned aircraft only.

On the aft baggage compartment:

MAXIMUM BAGGAGE 200 LBS. NO HEAVY OBJECTS ON HAT SHELF

In full view of the pilot, near the airspeed indicator:

MANEUVERING SPEED 124 KIAS
AT 3000 LBS (SEE A.F.M.)
OR
V_A = 124 KIAS AT 3,000# (SEE P.O.H.)

In full view of the pilot:

FUEL REMAINING WHEN THE QUANTITY INDICATORS READ ZERO CANNOT BE USED SAFELY IN FLIGHT

Adjacent to upper door latch:

ENGAGE LATCH BEFORE FLIGHT

On the instrument panel in full view of the pilot:

DEMONSTRATED CROSSWIND COMPONENT 17 KTS
OR
DEMO. X-WIND 17 KTS

In full view of the pilot:

NO ACROBATIC MANEUVERS,
INCLUDING SPINS, APPROVED

WARNING

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

On the instrument panel in full view of the pilot when the AutoFlite is installed:

OPERATION

TURN AUTOFLITE ON. ADJUST TRIM KNOB FOR MINIMUM HEADING CHANGE: FOR HEADING CHANGE, PRESS DISENGAGE SWITCH ON CONTROL WHEEL, CHANGE HEADING, RELEASE SWITCH. ROTATE TURN KNOB FOR TURN COMMANDS. PUSH TURN KNOB IN TO ENGAGE TRACKER. PUSH TRIM KNOB IN FOR HI SENSITIVITY. LIMITATIONS AUTOFLITE OFF FOR TAKEOFF AND LANDING.

In full view of the pilot, in the area of the air conditioner controls when the air conditioner is installed:

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

Adjacent to fuel filler cap:

FUEL - 100 OR 100LL AVIATION GRADE

OR

FUEL - 100/130 AVIATION GRADE - MIN. USABLE CAPACITY 36 GAL. USABLE CAPACITY TO BOTTOM OF FILLER NECK INDICATOR 25 GAL.

Adjacent to fuel filler cap (serial numbers 28-8311009 and up):

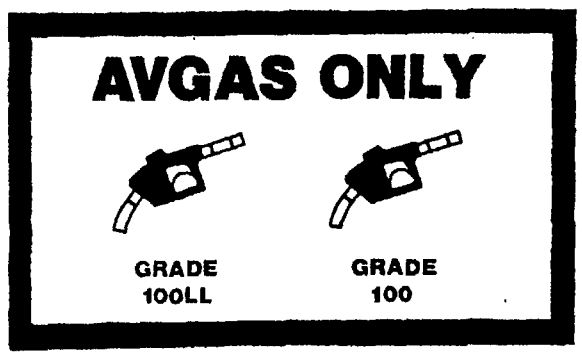


TABLE OF CONTENTS

SECTION 3

EMERGENCY PROCEDURES

TABLE OF CONTENTS (cont)

SECTION 3 (cont)

SECTION 3

EMERGENCY PROCEDURES

3.1 GENERAL

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

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

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

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

These procedures are suggested as a course of action for coping with the particular condition described, but are not a substitute for sound judgment and common sense. Pilots should familiarize themselves with the procedures given in this section and be prepared to take appropriate action should an emergency arise.

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

3.3 EMERGENCY PROCEDURES CHECK LIST

SPEEDS

Stall speeds
3000 lbs. (0° flap) ..... 65 KIAS
3000 lbs. (full flap) ..... 56 KIAS
Maneuvering speeds
3000 lbs. ..... 124 KIAS
1761 lbs. ..... 96 KIAS
Never exceed speed ..... 173 KIAS
Power off glide speed
3000 lbs. (0° flap) ..... 85 KIAS

ENGINE INOPERATIVE PROCEDURES

ENGINE POWER LOSS DURING TAKEOFF (NOT AIRBORNE)

Sufficient runway remaining:
Throttle ..... close immediately
Brakes ..... apply as required
Stop straight ahead.

Insufficient runway remaining:
Throttle ..... close immediately
Brakes ..... apply as required
Mixture ..... IDLE CUT-OFF
Fuel selector ..... OFF
Master switch ..... OFF
Magnetos ..... OFF
Maintain directional control and maneuver to avoid obstacles.

ENGINE POWER LOSS DURING TAKEOFF (IF AIRBORNE)

Sufficient runway remaining:
Airspeed ..... maintain above stall
Directional control ..... maintain
Land straight ahead.

Insufficient runway remaining:
Airspeed ..... maintain above stall
Throttle ..... close
Mixture ..... IDLE CUT-OFF
Fuel selector ..... OFF
Master switch ..... OFF
Magnetos ..... OFF
Flaps ..... as situation requires
Directional control ..... maintain - make only shallow turns to avoid obstacles.

If sufficient altitude has been gained to attempt a restart:
Airspeed ..... maintain safe airspeed
Fuel selector ..... switch to other tank containing fuel
Electric fuel pump ..... ON
Mixture ..... RICH
Carburetor heat ..... ON
If power is not regained proceed with power off landing.

ENGINE POWER LOSS IN FLIGHT

Fuel selector ..... switch to other tank containing fuel
Electric fuel pump ..... ON
Mixture ..... RICH
Carburetor heat ..... ON
Engine gauges ..... check for indication of cause of power loss
Primer ..... locked
If no fuel pressure is indicated, check that fuel selector is on a tank containing fuel.

If power has not been restored:
Ignition switch ..... L then R, then back to BOTH
Throttle and mixture ..... try different settings

When power is restored:
Carburetor heat ..... OFF
Electric fuel pump ..... OFF

If power cannot be restored:
Trim for best glide angle (85 KIAS) and prepare for power off landing.

POWER OFF LANDING

Trim for best glide angle (85 KIAS).
Locate most suitable landing area.
Establish spiral pattern.
1000 feet above field at downwind position for normal landing approach.
When field can be easily reached, slow to 72 KIAS for shortest landing with a full stall touchdown.
Touchdowns should normally be made at lowest possible airspeed with full flaps.

When committed to landing:
Ignition ..... OFF
Master switch ..... OFF
Fuel selector ..... OFF
Mixture ..... IDLE CUT-OFF
Seat belts and harness ..... tight

FIRE

ENGINE FIRE DURING START

Starter ..... crank engine
Mixture ..... IDLE CUT-OFF
Throttle ..... open
Electric fuel pump ..... OFF
Fuel selector ..... OFF
Abandon airplane if fire continues.

FIRE IN FLIGHT

Source of fire ..... check

Engine fire:
Fuel selector ..... OFF
Throttle ..... closed
Mixture ..... IDLE CUT-OFF
Electric fuel pump ..... OFF
Cabin heat ..... OFF
Defroster ..... OFF
Prepare for power off landing.

Electrical fire (smoke in cabin):
Master switch ..... OFF
Cabin heat ..... OFF
Defroster ..... OFF
Vents ..... open to clear cabin
Land as soon as practicable.

LOSS OF OIL PRESSURE

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

LOSS OF FUEL PRESSURE

Electric fuel pump ..... ON
Fuel selector ..... check on full tank

HIGH OIL TEMPERATURE

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

ELECTRICAL FAILURES

ALT annunciator light illuminated
Ammeter ..... check to verify inop. alt.

If ammeter shows zero
ALT switch ..... OFF

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

If power not restored
ALT switch ..... OFF

If alternator output cannot be restored, reduce electrical loads and land as soon as practical. The battery is the only remaining source of electrical power.

ELECTRICAL OVERLOAD (alternator over 20 amps above known electrical load)

FOR AIRPLANES WITH INTERLOCKED BAT AND ALT SWITCH OPERATION

Electrical load ..... reduce

If alternator loads are not reduced
ALT switch ..... OFF

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

FOR AIRPLANES WITH SEPARATE BAT AND ALT SWITCH OPERATION

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

If alternator loads are reduced
Electrical load ..... reduce to minimum

Land as soon as practical.

NOTE

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

If alternator loads are not reduced
ALT switch ..... OFF
BAT switch ..... as required

Land as soon as possible. Anticipate complete electrical failure.

SPIN RECOVERY

Rudder ..... full opposite to direction of rotation
Control wheel ..... full forward while neutralizing ailerons
Throttle ..... close
Rudder ..... neutral (when rotation stops)
Control wheel ..... as required to smoothly regain level flight attitude

OPEN DOOR

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

To close the door in flight:
Slow airplane to 83 KIAS.
Cabin vents ..... close
Storm window ..... open

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

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

CARBURETOR ICING

Carburetor heat ..... ON
Mixture ..... adjust for max. smoothness

ENGINE ROUGHNESS

Carburetor heat ..... ON

If roughness continues after one min:
Carburetor heat ..... OFF
Mixture ..... adjust for max. smoothness
Electric fuel pump ..... ON
Fuel selector ..... switch tanks
Engine gauges ..... check
Magneto switch ..... L then R, then Both

If operation is satisfactory on either one, continue on that magneto at reduced power and full "RICH" mixture to first airport.

Prepare for power off landing.

PROPELLER OVERSPEED

Throttle ..... retard
Oil pressure ..... check
Prop control ..... full DECREASE rpm, then set if any control available
Airspeed ..... reduce
Throttle ..... as required to remain below 2400 rpm

3.5 AMPLIFIED EMERGENCY PROCEDURES (GENERAL)

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

3.7 ENGINE INOPERATIVE PROCEDURES

ENGINE POWER LOSS DURING TAKEOFF (NOT AIRBORNE)

If engine failure occurs before the airplane has lifted off, and if there is sufficient runway left for a safe stop, simply maintain directional control, close the throttle, and brake to a stop.

If there is not sufficient runway remaining for a safe stop, close the throttle, apply maximum braking, pull the mixture control to IDLE CUT-OFF, and turn OFF the fuel selector, the master switch and the magnetos. Maintain directional control, slow the airplane as much as possible, and maneuver to avoid obstacles.

ENGINE POWER LOSS DURING TAKEOFF (IF AIRBORNE)

If engine failure occurs after the airplane has lifted off, and if sufficient landing area remains for a touchdown and stop, lower the nose and maintain airspeed to avoid a stall. Maintain directional control and land and stop straight ahead.

If liftoff has occurred and there is not sufficient landing area remaining for a safe landing and stop, maintain a safe airspeed to avoid a stall. Close the throttle, pull the mixture control to IDLE CUT-OFF, and turn OFF the fuel selector, the master switch, and the magnetos. Use of flaps depends upon the circumstances; however, normally full flaps allow the slowest and softest touchdown.

At low altitudes with a failed engine, turns should not be attempted, except for slight and gentle deviations to avoid obstacles. A controlled crash landing straight ahead is preferable to risking a stall which could result in an uncontrolled roll and crash out of a turn.

If sufficient altitude has been gained to permit a restart attempt, maintain a safe airspeed and switch the fuel selector to another tank containing fuel. Check the electric fuel pump to ensure that it is ON. Check that the mixture control is set RICH and that carburetor heat is ON. If engine failure was caused by fuel exhaustion, power will not be regained after switching tanks until the empty fuel lines are filled. This may require up to ten seconds.

If the propeller has stopped turning, it will be necessary to engage the starter to execute a restart. If power is not regained, proceed with a Power Off Landing.

ENGINE POWER LOSS IN FLIGHT

A complete loss of power is usually caused by a fuel flow interruption, in which case power will be restored shortly after fuel flow is restored. If power loss occurs at a low altitude, the first step should be to prepare for an emergency Power Off Landing. Maintain an airspeed of at least 85 KIAS.

If altitude permits, attempt a restart. Switch the fuel selector to another tank containing fuel. Turn ON the electric fuel pump, set the mixture RICH, and turn ON carburetor heat.

Check the engine gauges for an indication of the cause of the power loss. Be sure that the primer is locked if one is installed. If no fuel pressure is indicated, check the fuel selector to be sure that it is on a tank containing fuel. If fuel exhaustion is the problem, it may take up to ten seconds after switching tanks for empty fuel lines to fill and for power to be restored. If there is water contamination of the fuel, fuel pressure indications will be normal. Water in the fuel could take some time to be passed through, and allowing the propeller to windmill may restore power. If the propeller has stopped turning, engage the starter.

When power is restored and the engine is operating smoothly, turn OFF the carburetor heat and the electric fuel pump.

If the preceding steps do not restore power, prepare for an emergency Power Off Landing. If time permits, try turning the ignition switch to L, then to R, then back to BOTH. Try moving the throttle and mixture controls to various 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.

If power is not regained, proceed with preparations for a Power Off Landing.

POWER OFF LANDING

If loss of power occurs at altitude, trim the airplane for best gliding angle (85 KIAS), and look for a suitable landing area. If the procedures for restoring power are not effective, and if time permits, check charts for airports in the immediate vicinity; it may be possible to reach one if the airplane's altitude is sufficient. If possible, notify the FAA by radio of the situation and intended course of action. If another pilot or a passenger is aboard, that person may assist.

After locating the most suitable landing area, establish a spiral pattern around the field. Try to be at 1000 feet above the field at the downwind position to make a normal landing approach. When assured of reaching the field, slow to 72 KIAS for the shortest landing. Excess altitude may be lost by widening the pattern, extending flaps, slipping, or a combination of these methods.

Once committed to a landing, shut OFF the ignition, the master switch, and the fuel selector. Pull the mixture to IDLE CUT-OFF. Tighten seat belts and shoulder harness.

Flaps may be used as deemed necessary. Normally a full stall touchdown should be made at the lowest possible airspeed with flaps fully extended.

3.9 FIRE

ENGINE FIRE DURING START

Engine fires during start are usually the result of overpriming. The first step in extinguishing the fire is to cut off the source of fuel and to keep the engine turning to use up excess fuel.

Continue cranking the engine with the starter, while pulling the mixture control to IDLE CUT-OFF and advancing the throttle fully open. Turn OFF the electric fuel pump and the fuel selector. Radio for assistance if possible.

If the engine has started, it should be left running. If the engine is not running, continue cranking with the starter. This is an attempt to draw the fire back into the engine.

If the fire continues, leave the fuel selector OFF and the mixture at IDLE CUT-OFF, and abandon the airplane, applying the best external extinguishing means available.

If the fire is on the ground near the airplane, it may be possible to taxi to safety.

FIRE IN FLIGHT

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

If an engine fire is indicated, immediately turn the fuel selector OFF and close the throttle. Pull the mixture control to IDLE CUT-OFF. Be sure that the electric fuel pump is OFF. Turn OFF the cabin heat and defroster. If radio transmission is not required, turn OFF the master switch. Proceed with a Power Off Landing.

NOTE

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

If smoke or fumes in the cabin indicate an electrical fire, turn OFF the master switch. Turn OFF the cabin heat and defroster, and open the vents to clear smoke and fumes from the cabin. Land as soon as practicable.

NOTES

When the master switch is turned off, the stall warning system will not function.

During night flight a flashlight should be in hand before turning off the master switch.

3.11 LOSS OF OIL PRESSURE

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 allow investigation of the cause and to 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.

3.13 LOSS OF FUEL PRESSURE

If loss of fuel pressure occurs, turn ON the electric fuel pump and check that the fuel selector is on a tank containing fuel.

If the problem is not an empty tank, land as soon as practical and have the engine-driven fuel pump and fuel system checked.

3.15 HIGH OIL TEMPERATURE

An abnormally high oil temperature indication may be caused by a low oil level, an obstruction in the oil cooling installation, damaged or improper baffle seals, a defective gauge, or other causes. Land as soon as possible 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.

3.17 ELECTRICAL FAILURES

Loss of alternator output is detected through zero reading on th ammeter. Before executing the following procedure, insure that the readin is zero and not merely low by actuating an electrically powered device, such as the landing light. If no increase in the ammeter reading is noted, alternator failure can be assumed.

The electrical load should be reduced as much as possible. Check the alternator circuit breakers for a popped circuit.

The next step is to attempt to reset the overvoltage relay. This is accomplished by moving the ALT switch to OFF for one second and then to ON. If the trouble was caused by a momentary overvoltage condition (16.5 volts and up) this procedure should return the ammeter to a normal reading.

If the ammeter continues to indicate "0" output, or if the alternator will not remain reset, turn off the ALT switch, maintain minimum electrical load and land as soon as practical. All electrical load is being supplied by the battery.

3.18 ELECTRICAL OVERLOAD (Alternator over 20 amps above know electrical load)

If abnormally high alternator output is observed (more than 20 amps above known electrical load for the operating conditions) it may be caused by a low battery, a battery fault or other abnormal electrical load. If the cause is a low battery, the indication should begin to decrease toward normal within 5 minutes. If the overload condition persists attempt to reduce the load by turning off nonessential equipment. For airplanes with interlocked BAT and ALT switch operation, when the electrical load cannot be reduced turn the ALT switch OFF and land as soon as practical. The battery is the only remaining source of electrical power. Also anticipate complete electrical failure.

For airplanes with separate BAT and ALT switch operations, turn the BAT switch OFF and the ammeter should decrease. Turn the BAT switch ON and continue to monitor the ammeter. If the alternator output does not decrease within 5 minutes, turn the BAT switch OFF and land as soon as practical. All electrical loads are being supplied by the alternator.

—NOTE—

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

3.19 SPIN RECOVERY

Intentional spins are prohibited in this airplane. Should a spin be entered inadvertently, the following procedure should be initiated:

(a) Apply and maintain full rudder opposite the direction of rotation.
(b) As the rudder hits the stop, push the control wheel fully forward and neutralize ailerons. As the stall is broken, relax forward pressure as necessary to prevent an excessive nose down attitude.
(c) Close the throttle.
(d) As rotation stops, neutralize the rudder and ease back on the control wheel to recover smoothly from the dive.

3.21 OPEN DOOR

The cabin doors on the Dakota are double latched; so the chances of one springing open in flight at both the top and side are remote. However, if improperly latched, a door may spring partially open. This will usually happen at takeoff or soon afterward. A partially open door will not affect normal flight characteristics, and a normal landing can be made with the door open.

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

To close the door in flight, slow the airplane to 83 KIAS, close the cabin vents and open the storm window. If the top latch is open, latch it. If the side latch is open, pull on the arm rest while moving the latch handle to the latched position. If both latches are open, close the side latch then the top latch.

3.22 CARBURETOR ICING

Under certain moist atmospheric conditions at temperatures of -5° C t +20° C, it is possible for ice to form in the induction system, even in summer weather. This is due to the high air velocity through the carburetor venturi and the absorption of heat from this air by vaporization of the fuel.

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

3.23 ENGINE ROUGHNESS

Engine roughness is usually due to carburetor icing which is indicated by a drop in manifold pressure, and may be accompanied by a slight loss of airspeed or altitude. If too much ice is allowed to accumulate, restoration of full power may not be possible; therefore, prompt action is required.

Turn carburetor heat ON (See Note). Manifold pressure will decrease slightly and roughness will increase. Wait for a decrease in engine roughness or an increase in manifold pressure, indicating ice removal. If no change i approximately one minute, return the carburetor heat to OFF.

If the engine is still rough, adjust the mixture for maximum smoothness. The engine will run rough if too rich or too lean. The electric fuel pump should be switched to ON and the fuel selector switched to the other tank to see if fuel contamination is the problem. Check the engine gauges for abnormal readings. If any gauge readings are abnormal, proceed accordingly. Move the magneto switch to L then R, then back to BOTH. If operation is satisfactory on either magneto, proceed on that magneto at reduced power, with mixture full RICH, to a landing at the first available airport.

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

NOTE

Partial carburetor heat may be worse than no heat at all, since it may melt part of the ice, which will refreeze in the intake system. When using carburetor heat, therefore, always use full heat, and when ice is removed return the control to the full cold position.

3.25 PROPELLER OVERSPEED

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 set if any control is available. Airspeed should be reduced and throttle used to maintain 2400 RPM.

TABLE OF CONTENTS

SECTION 4

NORMAL PROCEDURES

TABLE OF CONTENTS (cont)

SECTION 4 (cont)

SECTION 4

NORMAL PROCEDURES

4.1 GENERAL

This section describes the recommended procedures for the conduct of normal operations. All of the required (FAA regulations) procedures and those necessary for operation of the airplane as determined by the operating and design features of the airplane are presented.

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

These procedures are provided to present a source of reference and review and to supply information on procedures which are not the same for all aircraft. Pilots should familiarize themselves with the procedures given in this section in order to become proficient in the normal operations of the airplane.

The first portion of this section consists of a short form check list which supplies an action sequence for normal operations with little emphasis on the operation of the systems.

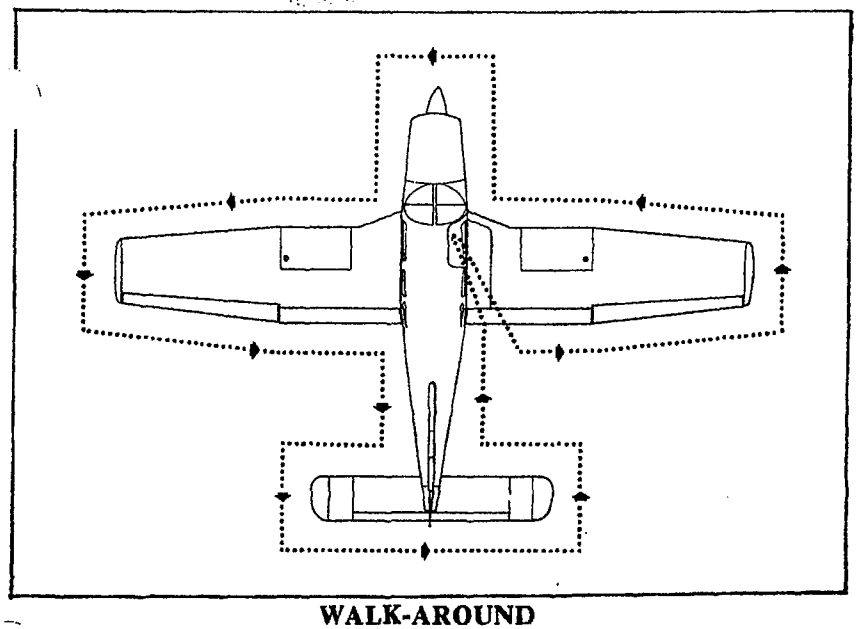
The remainder of the section is devoted to amplified normal procedures which provide detailed information and explanations of the procedures and how to perform them. This portion of the section is not intended for use as an in-flight reference due to the lengthy explanations. The short form check list should be used for this purpose.

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	85 KIAS
(b) Best Angle of Climb Speed	73 KIAS
(c) Turbulent Air Operating Speed (See Subsection 2.3)	124 KIAS
(d) Maximum Flap Speed	102 KIAS
(e) Landing Final Approach Speed (Flaps 40°)	72 KIAS
(f) Maximum Demonstrated Crosswind Velocity	17 KTS



WALK-AROUND
Figure 4-1

4.5 NORMAL PROCEDURES CHECK LIST

PREFLIGHT CHECK

COCKPIT

Control wheel ..... release restraints
Parking brake ..... set
All switches ..... OFF
All avionics ..... OFF
Mixture ..... idle cut-off
Master switch ..... ON
Fuel gauges ..... check quantity
Annunciator panel ..... check
Master switch ..... OFF
Primary flight controls ..... proper operation
Flaps ..... proper operation
Trim ..... neutral
Pitot and static systems ..... drain
Windows ..... check clean

Required papers ..... check on board
Tow bar and baggage ..... stow properly - secur
Baggage door ..... close and secur

RIGHT WING

Surface condition ..... clear of ice, frost, snow
Flap and hinges ..... check
Aileron and hinges ..... check
Wing tip and lights ..... check
Fuel tank ..... check supply visually - secure cap
Fuel tank vent ..... clear
Fuel tank sump ..... drain and check for water, sediment and proper fuel
Tie down and chock ..... remove
Main gear strut ..... proper inflation (4.5 in.)
Tire ..... check
Brake block and disc ..... check
Fresh air inlet ..... clea

NOSE SECTION

General condition ..... check
Cowling ..... secure
Windshield ..... clean
Propeller and spinner ..... check
Air inlets ..... clear
Alternator belt ..... check tension
Chock ..... remove
Nose gear strut ..... proper inflation (3.25 in.)
Nose wheel tire ..... check
Oil ..... check quantity
Dipstick ..... properly seated
Fuel strainer ..... drain

LEFT WING

Surface condition ..... clear of ice, frost, snow
Fresh air inlet ..... clear

Chock ..... remove
Main gear strut ..... proper inflation (4.5 in.)
Tire ..... check
Brake block and disc ..... check
Fuel tank ..... check supply visually - secure cap
Fuel tank vent ..... clear
Fuel tank sump ..... drain and check for water, sediment and proper fuel
Tie down ..... remove
Pitot head ..... remove cover - holes clear
Wing tip and lights ..... check
Aileron and hinges ..... check
Flap and hinges ..... check

FUSELAGE

Antennas ..... check
Left static pad ..... clear
Empennage ..... clear of ice, frost, snow
Fresh air inlet ..... clear
Stabilator and trim tab ..... check
Tie down ..... remove
Right static pad ..... clear
Master switch ..... ON
Cockpit lighting ..... check
Nav and strobe lights ..... check
Stall warning ..... check
Pitot heat ..... check
All switches ..... OFF
Passengers ..... board
Cabin door ..... close and secure
Seat belts and harness ..... fasten/adjust - check inertia reel

BEFORE STARTING ENGINE

Parking brake ..... set
Propeller ..... full INCREASE rpm
Fuel selector ..... desired tank
Carburetor heat ..... OFF
Radios ..... OFF

STARTING ENGINE WHEN COLD

Master switch ..... ON
Electric fuel pump ..... ON
Mixture ..... full RICH
Throttle ..... 1/4 open
Starter ..... engage
Throttle ..... adjust
Oil pressure ..... check
If engine does not start, add 1 to 3 strokes of priming pump and repeat above. After engine starts, lock primer.

STARTING ENGINE WHEN HOT

Throttle ..... 1/2" open
Master switch ..... ON
Electric fuel pump ..... ON
Mixture ..... full RICH
Starter ..... engage
Throttle ..... adjust
Oil pressure ..... check

STARTING ENGINE WHEN FLOODED

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

STARTING WITH EXTERNAL POWER SOURCE

Master switch ..... OFF
All electrical equipment ..... OFF
Terminals ..... connect
External power plug ..... insert in fuselage

Proceed with normal start
Throttle ..... lowest possible RPM
External power plug..... disconnect from fuselage
Master switch ..... ON - check ammeter
Oil pressure .....check

WARM-UP

Throttle ..... 1000 to 1200 RPM

TAXIING

Chocks ..... removed
Taxi area ..... clear
Parking brake .....release
Throttle .....apply slowly
Prop ..... high RPM
Brakes.....check
Steering .....check

GROUND CHECK

Parking brake ..... set
Propeller..... full INCREASE
Throttle .....2000 RPM
Magnetos .....max. drop 175 RPM - max. diff. 50 RPM
Vacuum ..... 5.0" Hg. + .1
Oil temp .....check
Oil pressure .....check
Annunciator panel ..... press-to-test
Air conditioner .....check
Carburetor heat.....check
Propeller..... exercise - then full INCREASE
Electric fuel pump ..... OFF
Fuel pressure .....check
Throttle ..... retard

BEFORE TAKEOFF

Master switch ..... ON
Flight instruments..... check
Fuel selector ..... proper tank
Electric fuel pump ..... ON
Engine gauges ..... check
Carburetor heat..... OFF
Seat backs ..... erect
Primer..... locked
Mixture ..... set
Prop ..... set
Belts/harness ..... fastened/adjusted
Empty seats ..... seat belts snugly fastened
Flaps..... set
Trim tabs ..... set
Controls ..... free
Doors ..... latched
Air conditioner ..... OFF
Parking brake ..... release

TAKEOFF

NORMAL

Flaps..... set
Tab ..... set
Accelerate to 60 to 65 KIAS.
Control wheel ..... back pressure to rotate to climb attitude

SHORT FIELD, OBSTACLE CLEARANCE

Flaps..... 25° (second notch)
Accelerate to 50 to 60 KIAS depending on aircraft weight.
Control wheel ..... back pressure to rotate to climb attitude
After breaking ground, accelerate to 73 KIAS and climb past obstacle.
Accelerate to best rate of climb speed - 85 KIAS and slowly retract the flaps.

SHORT FIELD, NO OBSTACLE

Flaps..... 25° (second notch)
Accelerate to 50 to 60 KIAS depending upon aircraft weight.
Control wheel ..... back pressure to rotate to climb attitude

Accelerate to best rate of climb speed - 85 KIAS and slowly retract the flaps while climbing out.

SOFT FIELD, OBSTACLE CLEARANCE

Flaps ..... 25° (second notch)
Accelerate; pull nose wheel off as soon as possible.
Control wheel ..... lift off at lowest possible airspeed
Just above the ground, accelerate to best angle of climb speed - 73 KIAS and climb past obstacle.
Continue climb while accelerating to best rate of climb speed - 85 KIAS.
Flaps ..... retract slowly

SOFT FIELD, NO OBSTACLE

Flaps ..... 25° (second notch)
Accelerate; pull nose wheel off as soon as possible.
Control wheel ..... lift off at lowest possible airspeed
Just above the ground, accelerate to best rate of climb speed - 85 KIAS and climb out.
Flaps ..... retract slowly

CLIMB

Best rate (3000 lb) (flaps up) ..... 85 KIAS
Best angle (3000 lb) (flaps up) ..... 73 KIAS
En route ..... 100 KIAS
Electric fuel pump ..... OFF at desired altitude

CRUISING

Reference performance charts, Avco-Lycoming Operator's Manual and power setting table.
Normal max power 75%
Power ..... set per power table
Mixture ..... adjust

DESCENT

NORMAL

Throttle ..... as required for 1000 FPM descent
Propeller ..... 2400 RPM
Airspeed ..... 137 KIAS
Mixture ..... rich
Carburetor heat ..... on if required

POWER OFF

Carburetor heat ..... on if required
Throttle ..... closed
Airspeed ..... as required
Mixture ..... as required
Power ..... verify with throttle every 30 seconds

APPROACH AND LANDING

Fuel selector ..... proper tank
Seat backs ..... erect
Belts/harness ..... fasten/adjust
Electric fuel pump ..... ON
Air conditioner ..... OFF
Mixture ..... set
Propeller ..... set
Flaps ..... down - 102 KIAS max.
Trim to 72 KIAS.

STOPPING ENGINE

Flaps ..... retract
Electric fuel pump ..... OFF
Air conditioner ..... OFF
Radios ..... OFF
Propeller ..... full INCREASE
Throttle ..... full aft
Mixture ..... idle cut-off
Magnetos ..... OFF
Master switch ..... OFF

PARKING

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 explanations of the normal procedures necessary for operation of the airplane.

4.9 PREFLIGHT CHECK

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 and landing distances, 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.

CAUTION

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

COCKPIT

Upon entering the cockpit, release the seat belts securing the control wheel and set the parking brake. Turn off all avionics equipment. Insure that all electrical switches and the magneto switch are OFF and the mixture is in idle cut-off. Turn ON the master switch, check the fuel quantity gauges for adequate supply and check that the annunciator panel illuminates. Turn OFF the master switch. Check the primary flight controls and flaps for proper operation and set the trim to neutral. Open the pitot and static drains to remove any moisture that has accumulated in the lines. Check the windows for cleanliness and that the required papers are on board. Properly stow and secure the tow bar and baggage. Close and secure the baggage door.

RIGHT WING

Begin the walk-around at the trailing edge of the right wing by checking 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 and 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.

Drain the fuel tank through the quick drain located at the lower inboard rear corner of the tank, making sure that enough fuel has been drained to insure 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 insure that no fire hazard exists before starting engine.

Remove the tie down and chock.

Next, a complete check of the landing gear. Check the gear strut for proper inflation, there should be 4.5 inches of strut exposure under a normal static load. Check the tire for cuts, wear, and proper inflation. Make a visual check of the brake block and disc.

Check that the fresh air inlet is clear of foreign matter.

NOSE SECTION

Check the general condition of the nose section, look for oil or fluid leakage and that the cowling is secure. 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 and check the alternator belt for proper tension. The landing light should be clean and intact.

Remove the chock and check the nose gear strut for proper inflation, there should be 3.25 inches of strut exposure under a normal static load. Check the tire for cuts, wear, and proper inflation. Check the oil level, make sure that the dipstick has been properly seated.

Open the fuel strainer located on the left side of the firewall long enough to remove any accumulation of water and sediment.

LEFT WING

The wing surface should be clear of ice, frost, snow, or other extraneous substances. Check that the fresh air inlet is clear of foreign matter and remove the chock. Check the main gear strut for proper inflation, there should be 4.5 inches of strut exposure under a normal static load. Check the tire and the brake block and disc.

Open the fuel cap and visually check the fuel color and 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. Drain enough fuel to insure that all water and sediment has been removed.

Remove tie down and remove the cover from the pitot head on the underside of the wing. Make sure the holes are open and 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.

FUSELAGE

Check the condition and security on the antennas and that the holes in the left static pad are clean and unobstructed. The empennage should be clear of ice, frost, snow, or other extraneous substances and the fresh air inlet at the top of the fin should be clear of foreign matter. Check the stabilator and trim tab for damage and operational interference, the trim tab should move in the same direction as stabilator. Remove the tie down. Check that the holes in the right static pad are clean and unobstructed.

Upon returning to the cockpit, an operational check of the interior lights, exterior lights, stall warning system, and pitot heat should now be made. Turn the master switch and the appropriate switches ON. Check the panel lighting and the overhead flood light. Visually confirm that exterior lights are operational. Lift the stall detector on the leading edge of the left wing and determine that the warning horn is activated. With the pitot heat switch ON the pitot head will be hot to the touch. After these checks are complete the master switch and all electrical switches should be turned OFF.

Board the passengers and close and secure the cabin door. Fasten the seat belts and shoulder harness and check the function of the inertia reel by pulling sharply on the strap. Fasten seat belts on empty seats.

— NOTE —

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

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

4.11 BEFORE STARTING ENGINE

Before starting the engine the parking brake should be set and the propeller lever moved to the full INCREASE rpm position. The fuel selector should then be moved to the desired tank. Be sure carburetor heat is OFF. Check all radios to be sure they are OFF.

4.13 STARTING ENGINE

(a) Starting Engine When Cold

Turn ON the master switch and the electric fuel pump. Move the mixture control to the full RICH position. Open the throttle approximately 1/4 of its travel.

Engage the starter by rotating the magneto switch clockwise. When the engine starts, release the starter and adjust the throttle to the desired setting.

If the engine does not start within 5 to 10 seconds, disengage the starter and prime with 1 to 3 strokes of the priming pump. Repeat the starting procedure without pumping the throttle.

(b) Starting Engine When Hot

Open the throttle approximately 1/2 inch. Turn ON the master switch and the electric fuel pump. Move the mixture control lever full RICH and engage the starter by rotating the magneto switch clockwise. When the engine fires, release the magneto switch and move the throttle to the desired setting.

(c) Starting Engine When Flooded

The throttle lever should be full OPEN. Turn ON the master switch and turn OFF the electric fuel pump. Move the mixture control lever to idle cut-off and engage the starter by rotating the magneto switch clockwise. When the engine fires, release the magneto switch, advance the mixture and retard the throttle.

(d) Starting Engine With External Power Source

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

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

After the engine has started, reduce power to the lowest possible RPM, to reduce sparking, and disconnect the jumper cable from the aircraft. Turn the master switch ON and check the alternator ammeter for an indication of output. DO NOT ATTEMPT FLIGHT IF THERE IS NO INDICATION OF ALTERNATOR OUTPUT.

NOTE

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

CAUTION

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

When the engine is firing evenly, advance the throttle to 800 RPM. If oil pressure is not indicated within thirty seconds, stop the engine and determine the trouble. In cold weather it will take a few seconds longer to get an oil pressure indication. If the engine has failed to start, refer to the Lycoming Operating Handbook, Engine Troubles and Their Remedies.

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

4.15 WARM-UP

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

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

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.

4.17 TAXIING

Before attempting to taxi the airplane, ground personnel should be instructed and approved by a qualified person authorized by the owner. Ascertain that the propeller back blast and taxi areas are clear. Release the parking brake.

Power should be applied slowly to start the taxi roll. Taxi a few feet forward and apply the brakes to determine their effectiveness. Taxi with the

propeller set in low pitch, high RPM setting. While taxiing, make slight turns to ascertain the effectiveness of the steering.

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 running up or taxiing over ground containing loose stones, gravel or any loose material that may cause damage to the propeller blades.

4.19 GROUND CHECK

Set the parking brake. The magnetos should be checked at 2000 RPM with the propeller set at high RPM. 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.

Check the vacuum gauge; the indicator should read 5.0" + .1" Hg at 2000 RPM. Check both 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.

Check the annunciator panel lights with the press-to-test button. Also check the air conditioner.

Carburetor heat should be checked prior to takeoff to be sure that the control is operating properly and to clear any ice that might have formed during taxiing. When the carburetor heat is ON the air to the engine is unfiltered; therefore, avoid prolonged ground operation with the carburetor heat ON.

The propeller control should be moved through its complete range to check for proper operation, and then placed in full INCREASE rpm for takeoff. To obtain maximum rpm, push the pedestal mounted control fully forward on the instrument panel. 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.

The electric fuel pump should be turned OFF after starting or during warm-up to make sure that the engine driven pump is operating. Prior to takeoff the electric pump should be turned ON again to prev loss of power during takeoff should the engine driven pump fail. Che the fuel pressure and retard the throttle.

4.21 BEFORE TAKEOFF

All aspects of each particular takeoff should be considered prior to executing the takeoff procedure.

After all aspects of the takeoff are considered, a pretakeoff check procedure must be performed.

The master switch should be ON and all of the flight instruments set and checked as required. Check the fuel selector to make sure it is on the proper tank (fullest). Turn ON the electric fuel pump and check the engine gauges. The carburetor heat should be in the OFF position. Check to ensure that the primer is locked.

All seat backs should be erect.

The mixture and propeller control levers should be set and the se belts and shoulder harness fastened. Fasten the seat belts snugly around the empty seats.

NOTE

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

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

Exercise and set the flaps and trim tabs. Insure proper flight control movement and response.

All doors should be properly secured and latched and the parking brake released.

On air conditioned models, the air conditioner must be OFF to insure normal takeoff performance.

4.23 TAKEOFF

The normal takeoff technique is conventional. The tab should be set slightly aft of neutral, with the exact setting determined by the loading of the airplane. Allow the airplane to accelerate to 50 to 65 KIAS depending on the weight of the aircraft and ease back on the control wheel to rotate to climb attitude.

Takeoffs are normally made with flaps up. However, for short field takeoffs, and for takeoffs under difficult conditions, such as in deep grass or on a soft surface, distance can be reduced appreciably by lowering flaps to 25° (second notch).

SHORT FIELD, OBSTACLE CLEARANCE

Lower flaps to 25° (second notch), accelerate aircraft to 50 to 60 KIAS and ease back on the wheel to rotate. After breaking ground, accelerate to best angle of climb speed, 73 KIAS, and climb past obstacle. Continue climb and accelerate to best rate of climb speed, 85 KIAS, and slowly retract the flaps.

SHORT FIELD, NO OBSTACLE

Lower flaps to 25° (second notch), accelerate aircraft to 50 to 60 KIAS and ease back on the wheel to rotate. After breaking ground, accelerate to best rate of climb speed, 85 KIAS, and slowly retract the flaps while climbing out.

SOFT FIELD, OBSTACLE CLEARANCE

Lower flaps to 25° (second notch), accelerate aircraft, pull nose gear off as soon as possible and lift off at lowest possible airspeed. Accelerate just above the ground the best angle of climb speed, 73 KIAS, to climb past obstacle clearance height. Continue climb while accelerating to best rate of climb speed, 85 KIAS, and slowly retract the flaps.

SOFT FIELD, NO OBSTACLE

Lower flaps to 25° (second notch), accelerate aircraft, pull nose gear off as soon as possible and lift off at lowest possible airspeed. Accelerate just above the ground to best rate of climb speed, 85 KIAS, and climb out while slowly retracting the flaps.

4.25 CLIMB

The best rate of climb at gross weight will be obtained at 85 KIAS. The best angle of climb may be obtained at 73 KIAS. At lighter than gross weight these speeds are reduced somewhat*. For climbing en route, a speed of 100 KIAS is recommended. This will produce better forward speed and increased visibility over the nose during the climb.

When reaching the desired altitude, the electric fuel pump may be turned off.

4.27 CRUISING

The cruising speed is determined by many factors, including power setting, altitude, temperature, loading and equipment installed in the airplane.

The normal maximum cruising power is 75% of the rated horsepower of the engine. When selecting cruising RPM below 2300, limiting manifold pressure for continuous operation, as specified by the appropriate "Avco-Lycoming Operator's Manual," should be observed.

To obtain the desired power, set the manifold pressure and RPM according to the power setting table in this manual.

*To obtain the performance presented in the Performance Section of this handbook, full power (full throttle and 2400 RPM) must be used. Above 8000 feet I.S.A., reduce airspeed one knot per 1000 feet altitude and lean mixture to 125°F rich of peak EGT.

Use of the mixture control in cruising flight reduces fuel consumption significantly, especially at higher altitudes. The mixture should be leaned during cruising operation above 5000 ft. altitude and at pilot's discretion at lower altitudes when 75% power or less is being used. If any doubt exists as to the amount of power being used, the mixture should be in the full RICH position for all operations under 5000 feet.

To lean the mixture, disengage the lock and pull the mixture control until the engine becomes rough, indicating that the lean mixture limit has been reached in the leaner cylinders. Then enrich the mixture by pushing the control towards the instrument panel until engine operation becomes smooth.

If the airplane is equipped with the optional exhaust gas temperature (EGT) gauge, a more accurate means of leaning is available to the pilot. For this procedure, refer to the "Avco-Lycoming Operator's Manual."

The continuous use of carburetor heat during cruising flight decreases engine efficiency. Unless icing conditions in the carburetor are severe, do not cruise with the heat on. Apply full carburetor heat slowly and only for a few seconds at intervals determined by icing severity. Use of partial carburetor heat is not recommended.

In order to keep the airplane in best lateral trim during cruise flight, the fuel should be used alternately from each main tank. It is recommended that one main tank be used for one hour after takeoff, the other main tank used until nearly exhausted, then return to the first main tank.

Always remember that the electric fuel pump should 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. The electric fuel pump should be normally OFF so that any malfunction of the engine driven fuel pump is immediately apparent. 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 a full tank and the electric fuel pump switched to the ON position. Fuel tank selection at low altitude is not recommended, since little recovery time is available in the event of an error in tank selection. When switching tanks, make sure that the selector drops into a detent and is lined up with the desired tank.

4.28 DESCENT

NORMAL

To achieve the performance on Figure 5-31 the power on descent must be used. The throttle should be set for 1000 FPM descent, propeller 2400 RPM, mixture full rich and maintain an airspeed of 137 KIAS. In case carburetor ice is encountered apply full carburetor heat.

POWER OFF

If a prolonged power off descent is to be made, apply full carburetor heat prior to power reduction if icing conditions are suspected. Throttle should be retarded and mixture control leaned as required. Power response should be verified approximately every 30 seconds by partially opening and then closing the throttle (clearing the engine). When leveling off enrichen mixture, set power as required and select carburetor heat off unless carburetor icing conditions are suspected.

4.29 APPROACH AND LANDING

Check to insure the fuel selector is on the proper (fullest) tank and that the seat backs are erect. The seat belts and shoulder harness should be fastened and the inertia reel checked.

NOTE

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

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

Turn ON the electric fuel pump, and turn OFF the air conditioner. The mixture should be set in the full RICH position and the propeller at full INCREASE rpm to facilitate ample power for an emergency go-around. Carburetor heat should not be applied unless there is an indication of carburetor icing, since the use of carburetor heat causes a reduction in power which may be critical in case of a go-around. Full throttle operation with carburetor heat ON can cause detonation.

The airplane should be trimmed to a final approach speed of 72 KIAS with flaps extended. The flaps can be lowered at speeds up to 102 KIAS, if desired.

The amount of flap used during landings and the speed of the aircraft at contact with the runway should be varied according to the landing surface and conditions of wind and airplane loading. It is generally good practice to contact the ground at the minimum possible safe speed consistent with existing conditions.

Normally, the best technique for short and slow landings is to use full flap and enough power to maintain the desired airspeed and approach flight path. Mixture should be full RICH, fuel on the fullest tank, carburetor heat OFF, and electric fuel pump ON. Reduce the speed during the flareout and contact the ground close to the stalling speed (50 to 65 KIAS). After ground contact hold the nose wheel off as long as possible. As the airplane slows down, gently lower the nose and apply the brakes. Braking is most effective when flaps are raised and back pressure is applied to the control wheel, putting most of the aircraft weight on the main wheels. In high wind conditions, particularly in strong crosswinds, it may be desirable to approach the ground at higher then normal speeds with partial or no flaps.

4.31 STOPPING ENGINE

At the pilot's discretion, the flaps should be raised and the electric fuel pump turned OFF.

NOTE

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

The air conditioner and radios should be turned OFF, the propeller set in the full INCREASE position, and the engine stopped by disengaging the mixture control lock and pulling the mixture control back to idle cut-off. The throttle should be left full aft to avoid engine vibration while stopping. Then the magneto and master switches must be turned OFF.

4.33 PARKING

If necessary, the airplane should be moved on the ground with the aid of the nose wheel tow bar provided with each airplane and secured behind the rear seats. The parking brake should be set. The aileron and stabilator controls should be secured by looping the safety belt through the control wheel and pulling it snug. The flaps are locked when in the UP position and should be left retracted.

Wheel chocks should be in place and tie downs secured to the rings provided under each wing and tail skid. The rudder is held in position by its connections to the nose wheel steering and normally does not have to be secured.

4.35 STALLS

The stall characteristics 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 gentle pitching may also precede the stall.

The gross weight stalling speed with power off and full flaps is 56 KIAS. With the flaps up this speed is 65 KIAS. Loss of altitude during stalls can be as great as 350 feet, depending on configuration and power.

NOTE

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

During preflight, the stall warning system should be checked by turning the master switch ON, lifting the detector and checking to determine if the horn is actuated. The master switch should be returned to the OFF position after the check is complete.

4.37 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.

4.39 WEIGHT AND BALANCE

It is the responsibility of the owner and pilot to determine that the airplane remains within the allowable weight vs. center of gravity envelope while in flight.

For weight and balance data, refer to Section 6 (Weight and Balance).

SECTION 5

PERFORMANCE

5.1 GENERAL

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

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

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 quantity checks are recommended.

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

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

WARNING

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

5.5 FLIGHT PLANNING EXAMPLE

(a) Aircraft Loading

The first step in planning 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 effecting 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	1734 lbs.
(2)	Occupants (4 x 170 lbs.)	680 lbs.
(3)	Baggage and Cargo	20 lbs.
(4)	Fuel (6 lb./gal. x 72)	432 lbs.
(5)	Takeoff Weight	2866 lbs.
(6)	Landing Weight (a)(5) minus (g)(1), (2866 lbs. minus 337 lbs.)	2529 lbs.

The takeoff weight is below the maximum of 3000 lbs. and the weight and balance calculations have determined the C.G. position within the approved limits.

(b) Takeoff and Landing

After determining the aircraft loading, all aspects of taker 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 Performance graph (Figure 5-5, 5-7, 5-9, or 5-11) to determine the length of runway necessary for the takeoff and/or the barrier distance.

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

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

	Departure Airport	Destinati Airport
(1) Pressure Altitude	2000 ft.	1800 ft.
(2) Temperature	27°C	31°C
(3) Wind Component (Headwind)	15 KTS	15 KTS
(4) Runway Length Available	7000 ft.	4500 ft.
(5) Runway Required	1460 ft.*	1380 ft. **

NOTE

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

*reference Figure 5-7
**reference Figure 5-35

(c) Climb

The next step in the flight plan example 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 5-15). 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 the graph (Figure 5-15). 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	8000 ft.
(2) Cruise OAT	12°C
(3) Time to Climb (10.5 min. minus 2 min.)	8.5 min.*
(4) Distance to Climb (16 naut. miles minus 3 naut. miles)	13 naut. miles*
(5) Fuel to Climb (3.5 gal. minus 1 gal.)	2.5 gal.*

(d) Descent

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

Utilizing the cruise pressure altitude and OAT, determine the basic fuel, time and distance for descent (Figure 5-31). 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

*reference Figure 5-15

values from the graph (Figure 5-31). 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 flight plan.

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

(1) Time to Descend (8 min. minus 2 min.)	6 min.*
(2) Distance to Descend (20 naut. miles minus 4.5 naut. miles)	15.5 naut. miles*
(3) Fuel to Descend (2 gal. minus .5 gal.)	1.5 gal.*

(e) Cruise

Using the total distance to be traveled during the flight, subtract the previously calculated distance to climb and distance to descend to establish the total cruise distance. Refer to the appropriate Avco Lycoming Operator's Manual 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 appropriate Speed Power graph (Figure 5-19 or 5-21).

Calculate the cruise fuel flow for the cruise power setting from the information provided by the Avco Lycoming Operator's Manual.

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

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

(1) Total Distance	620 naut. miles
(2) Cruise Distance (e)(1) minus (c)(4) minus (d)(2), (620 naut. miles minus 13 naut. miles minus 15.5 naut. miles)	592 naut. miles

*reference Figure 5-31

(3) Cruise Power (Mixture leaned to 50° F rich of peak EGT)	65% rated power
(4) Cruise Speed	134 KTS TAS*
(5) Cruise Fuel Consumption	11.8 GPH*
(6) Cruise Time (e)(2) divided by (e)(4), (592 naut. miles divided by 134 KTS)	4.4 hrs.
(7) Cruise Fuel (e)(5) multiplied by (e)(6), (11.8 GPH multiplied by 4.5 hrs.)	52.1 gal.

(f) Total Flight Time

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

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

(1) Total Flight Time (c)(3) plus (d)(1) plus (e)(6), (.14 hrs. plus .1 hrs. plus 4.4 hrs.)	4.64 hrs.

(g) Total Fuel Required

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

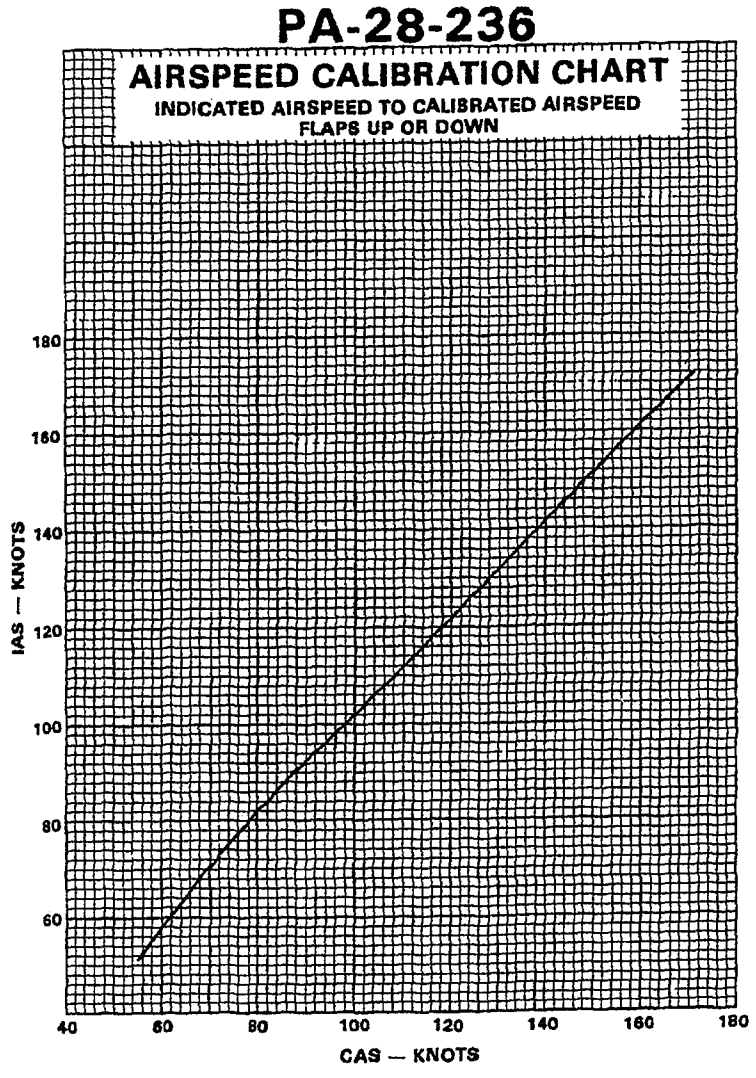
The total fuel calculations for the example flight plan are shown below.

(1) Total Fuel Required (c)(5) plus (d)(3) plus (e)(7), (2.5 gal. plus 1.5 gal. plus 52.1 gal.)	56.1 gal.
(56.1 gal. multiplied by 6 lb./gal.)	337 lbs.

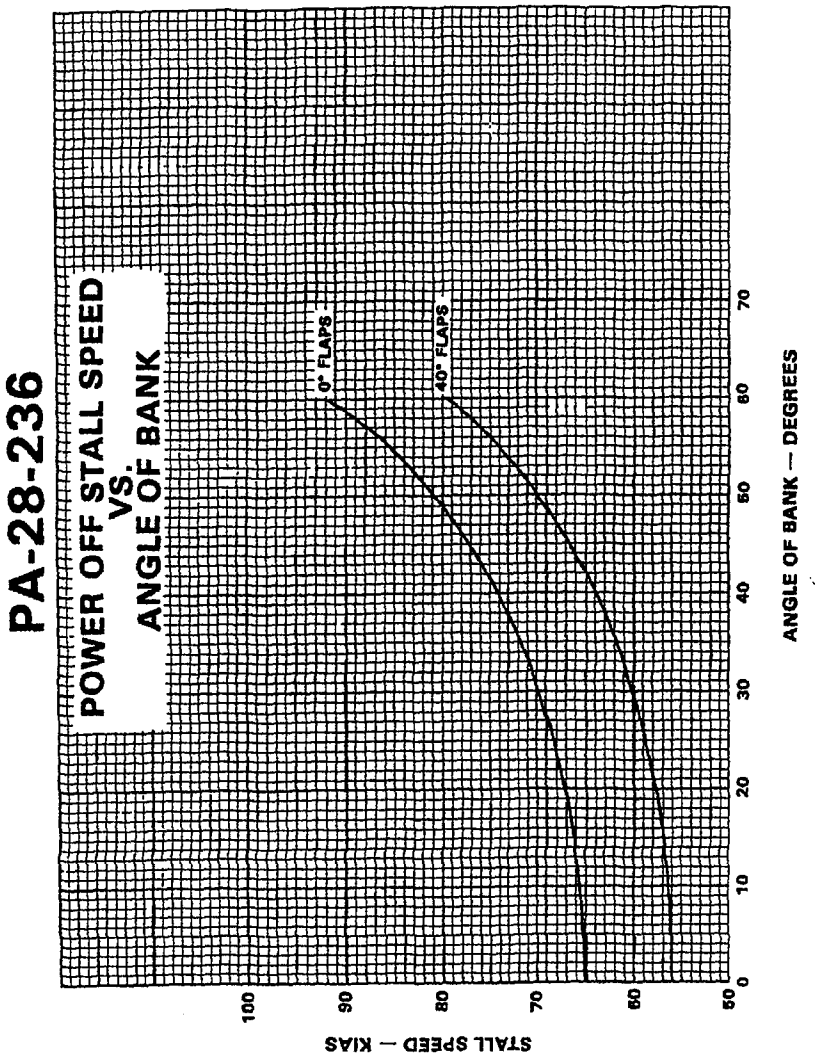
*reference Figure 5-21

5.7 PERFORMANCE GRAPHS

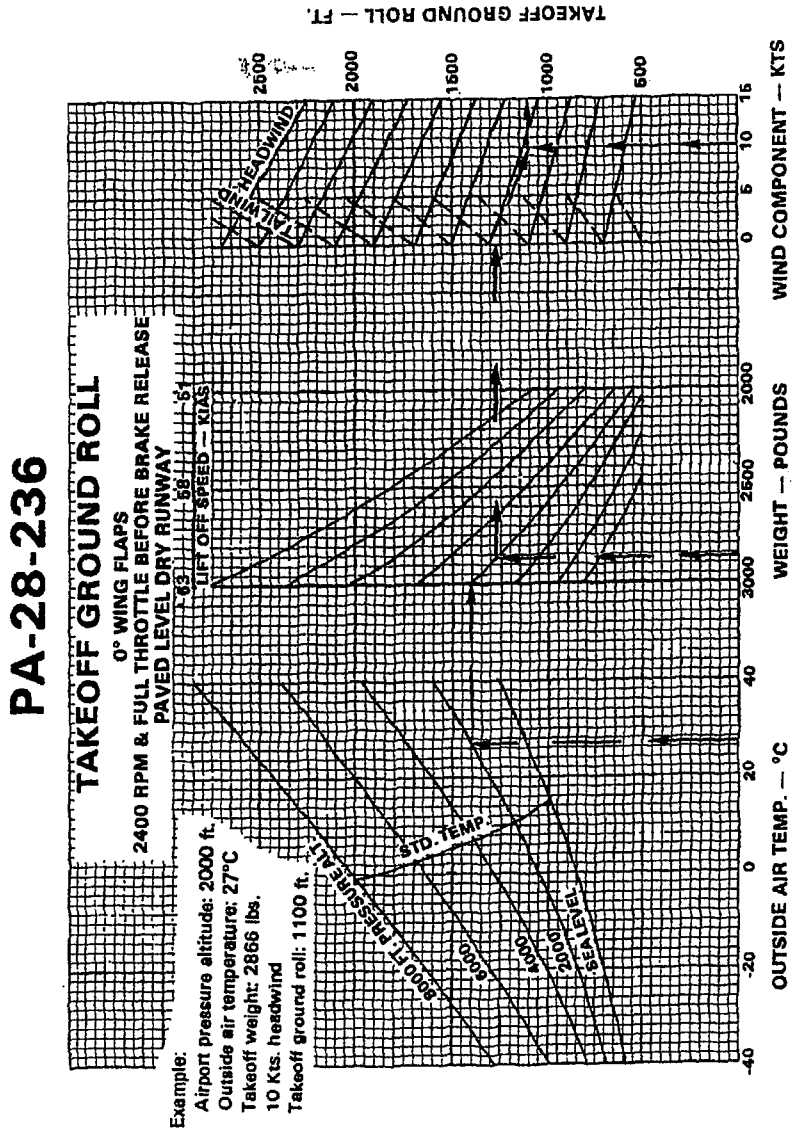
LIST OF FIGURES



AIRSPEED CALIBRATION
Figure 5-1

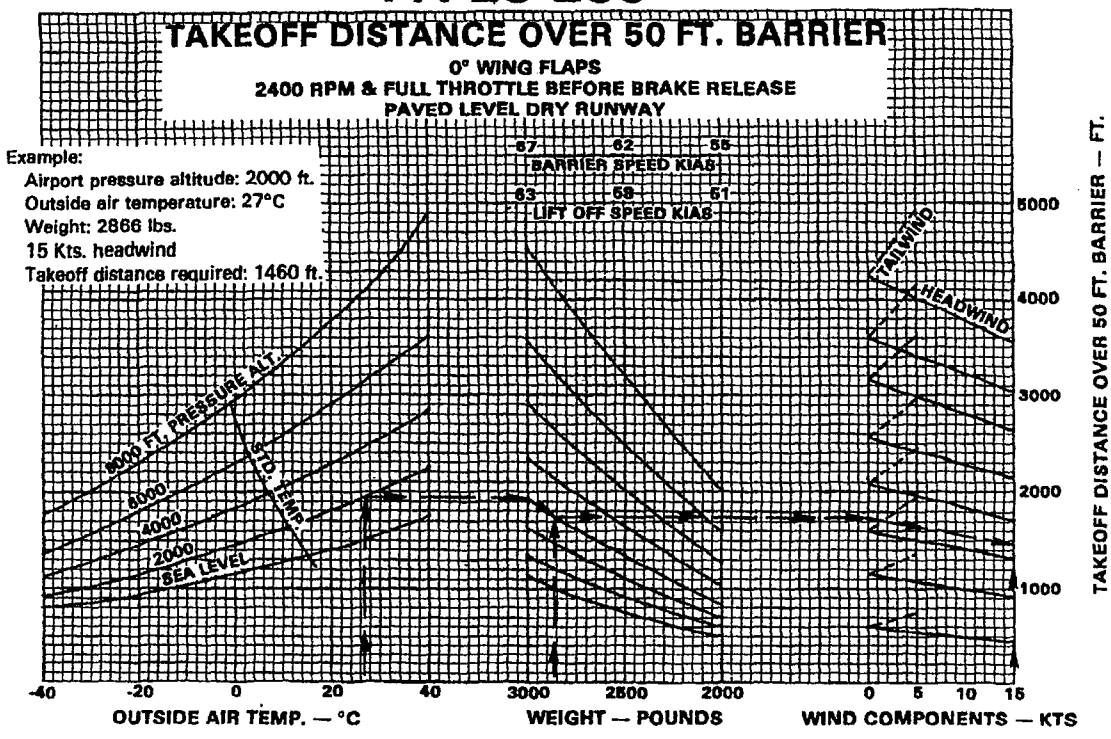


STALL SPEED VS. ANGLE OF BANK
Figure 5-3



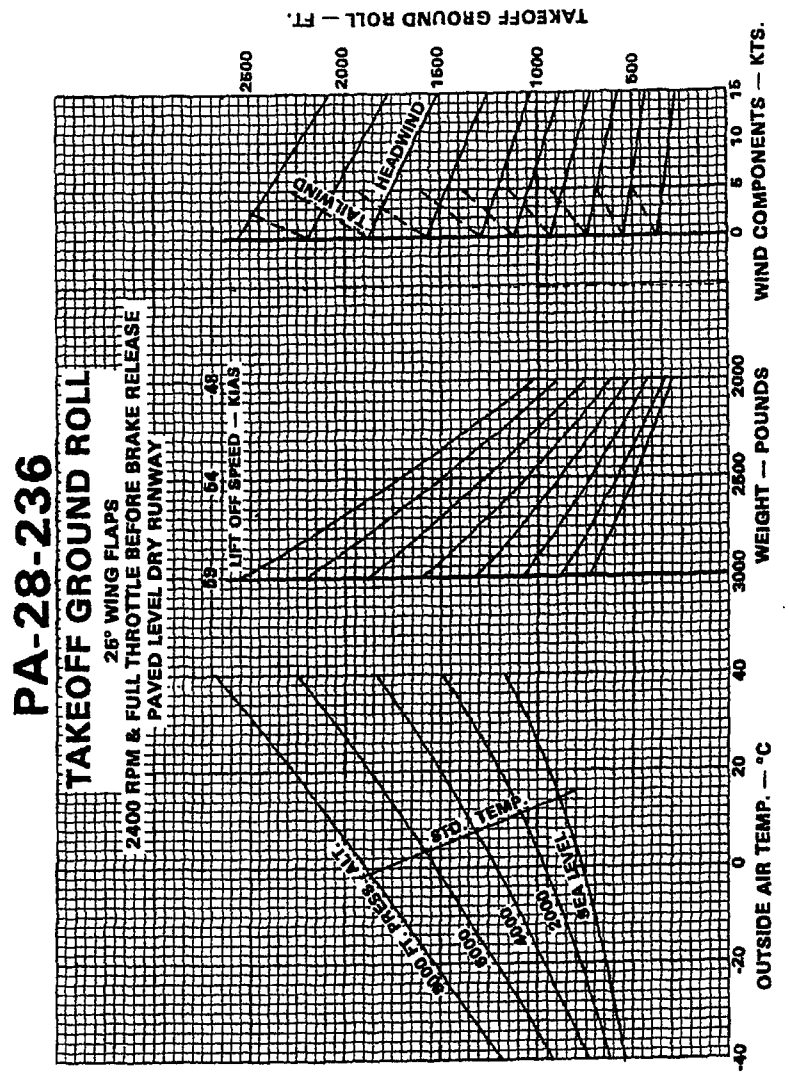
TAKEOFF GROUND ROLL (0° FLAPS)
Figure 5-5

PA-28-236

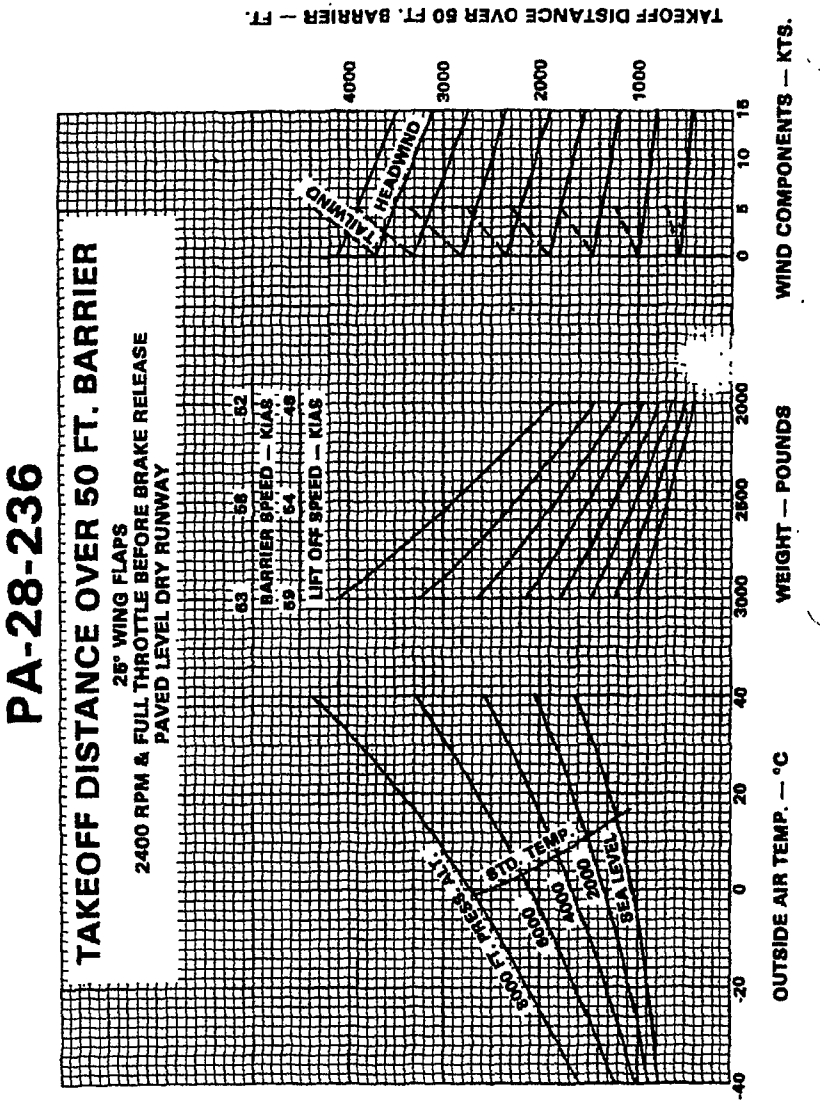


TAKEOFF DISTANCE OVER 50 FT. BARRIER — FT.

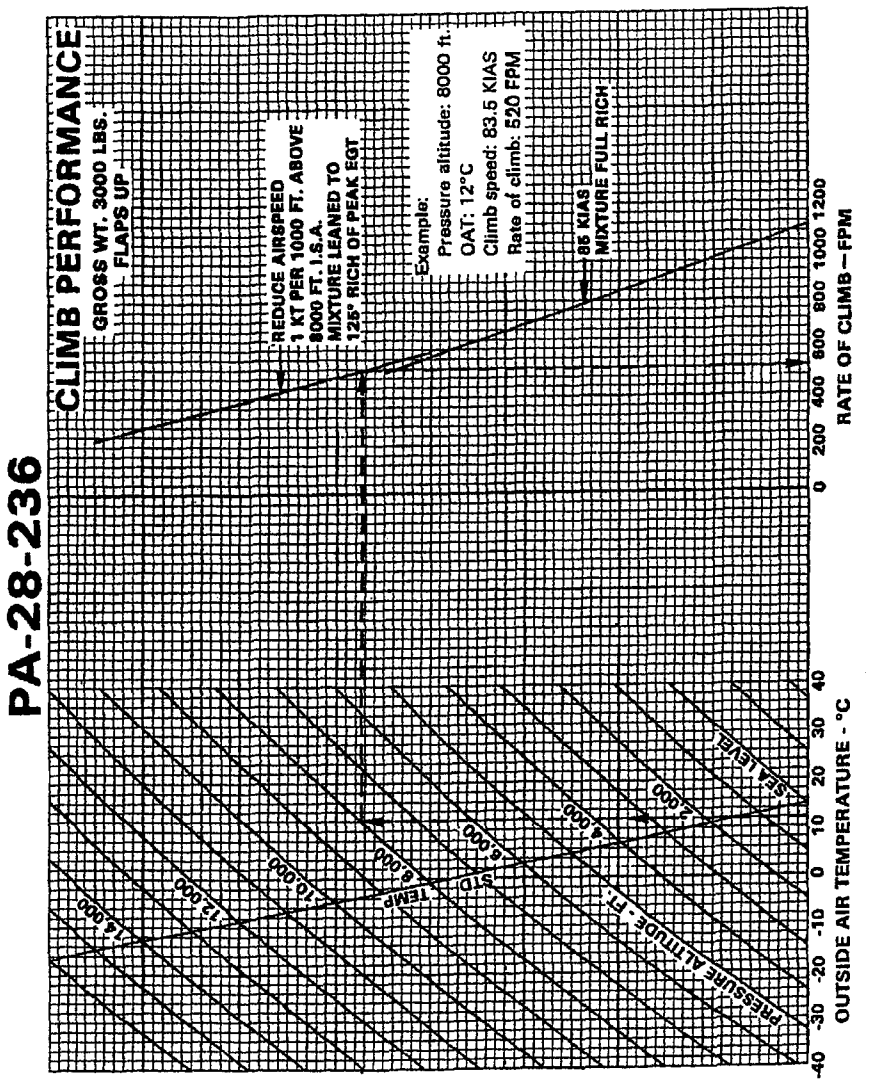
TAKEOFF DISTANCE OVER 50 FT. BARRIER (0° FLAPS)
Figure 5-7



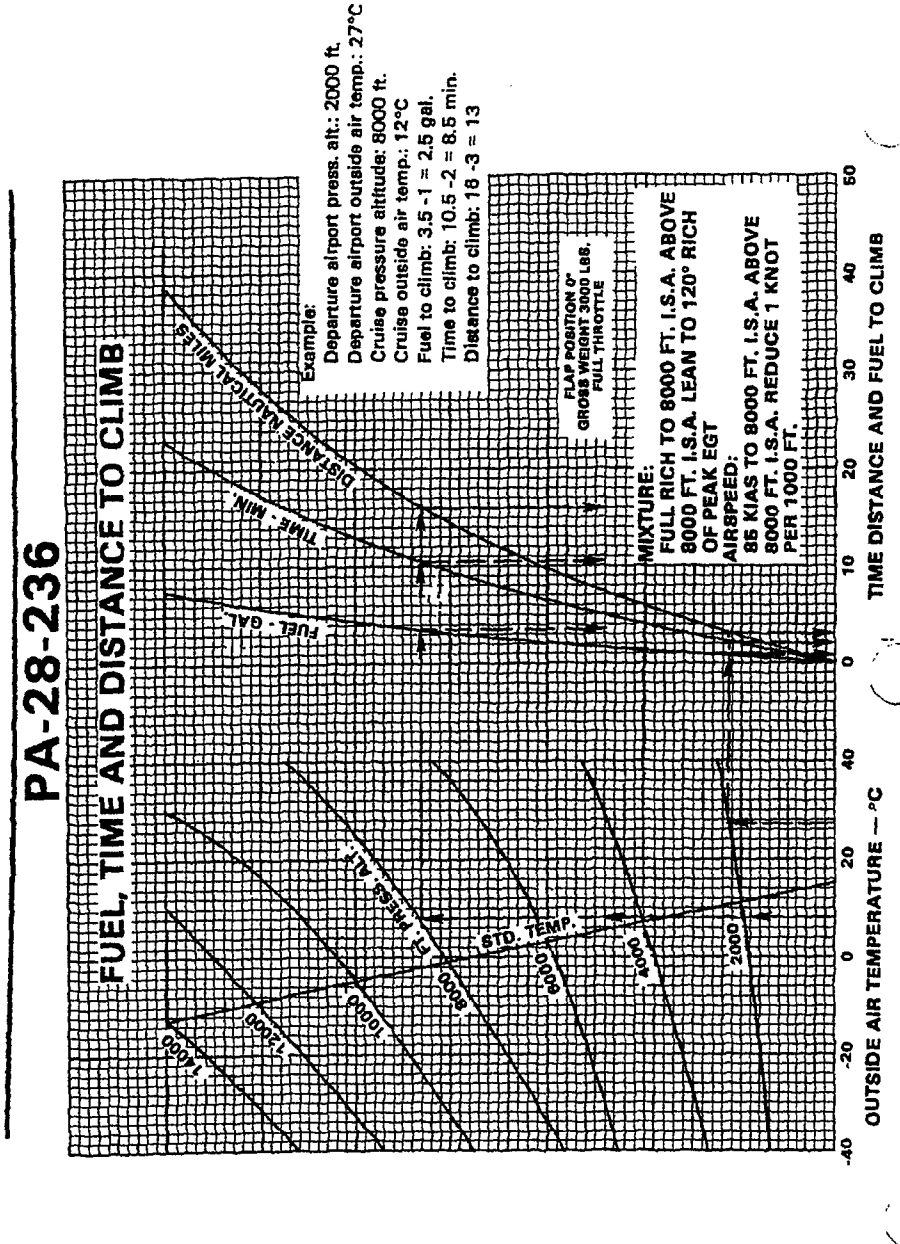
TAKEOFF GROUND ROLL (25° FLAPS)
Figure 5-9



TAKEOFF DISTANCE OVER 50 FT. BARRIER (25° FLAPS)
Figure 5-11



CLIMB PERFORMANCE
Figure 5-13



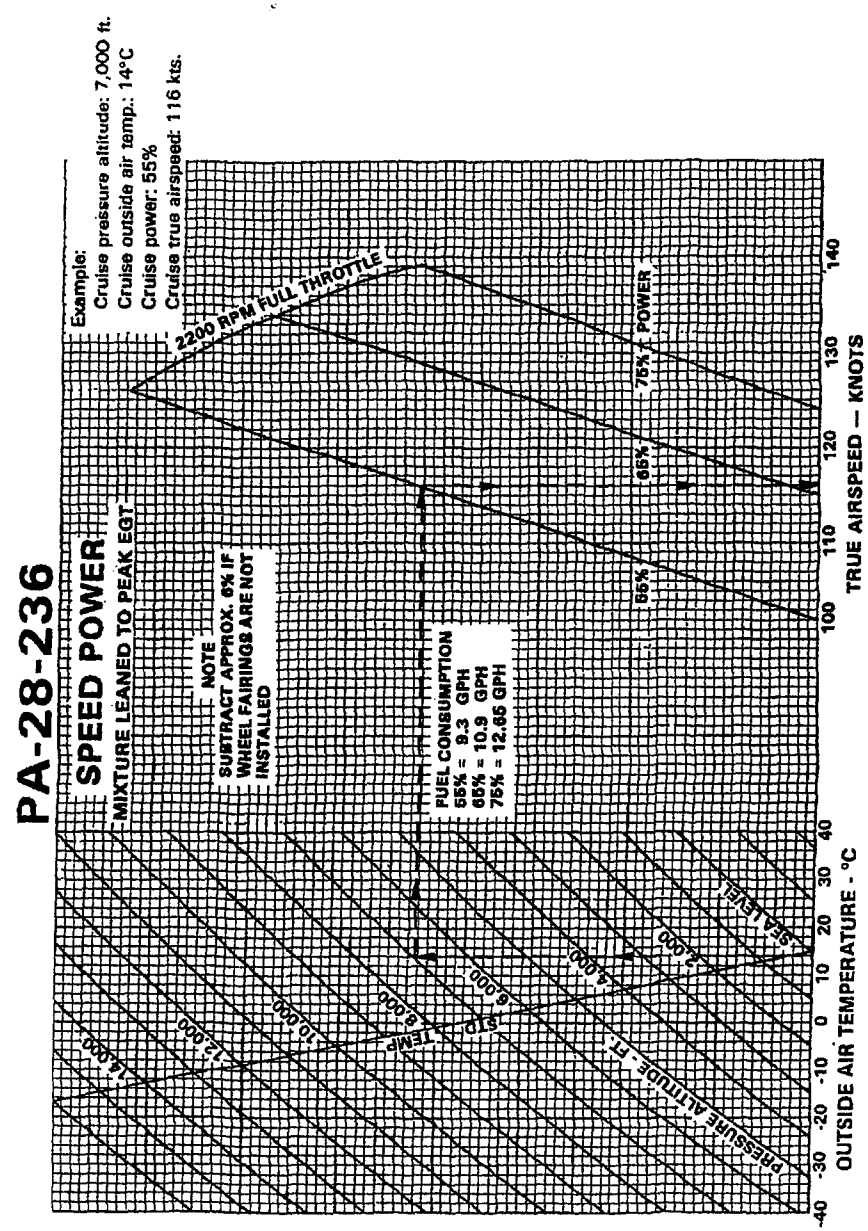
FUEL, TIME AND DISTANCE TO CLIMB
Figure 5-15

POWER SETTING TABLE — AVCO LYCOMING O-540-J3A5D, 235 HP @ 2400 RPM

Press. Alt. Feet	Std. Alt. Temp. °C	129 HP - 55% Rated RPM & MAN. PRESS. 2100	2200	2300	2400	153 HP - 65% Rated RPM & MAN. PRESS. 2100	2200	2300	2400	175 HP - 75% Rated RPM & MAN. PRESS. 2200	2300	2400	200 HP - 85% Rated RPM & MAN. PRESS. 2200	2300	2400
SL	15	20.8	20.0	19.4	18.7	23.2	22.4	21.7	21.0	24.6	23.9	23.1	27.2	26.4	25.5
1000	13	20.5	19.8	19.2	18.5	22.9	22.2	21.5	20.8	24.3	23.6	22.9	26.9	26.1	25.3
2000	11	20.3	19.5	19.0	18.3	22.7	21.9	21.2	20.6	24.1	23.4	22.6	F.T.	25.8	25.0
3000	9	20.0	19.3	18.8	18.1	22.4	21.7	21.0	20.4	23.8	23.1	22.4	—	F.T.	24.7
4000	7	19.8	19.1	18.5	17.9	22.1	21.4	20.8	20.2	23.5	22.8	22.1	—	—	F.T.
5000	5	19.5	18.9	18.3	17.7	21.9	21.2	20.5	20.0	23.2	22.6	21.9			
6000	3	19.3	18.6	18.1	17.5	21.6	21.0	20.3	19.7	F.T.	22.3	21.7			
7000	1	19.1	18.4	17.9	17.3	21.3	20.7	20.1	19.5	—	F.T.	21.5			
8000	-1	18.8	18.2	17.7	17.2	21.1	20.5	19.9	19.3	—	—	F.T.			
9000	-3	18.6	18.0	17.5	17.0	F.T.	20.2	19.7	19.1						
10,000	-5	18.3	17.7	17.2	16.8	—	F.T.	19.4	18.9						
11,000	-7	18.1	17.5	17.0	16.6	—	—	F.T.	F.T.						
12,000	-9	17.8	17.3	16.8	16.4										
13,000	-11	F.T.	17.0	16.6	16.2										
14,000	-13	—	F.T.	16.4	16.0										
15,000	-15	—	—	F.T.	15.8										
16,000	-17	—	—	—	F.T.										

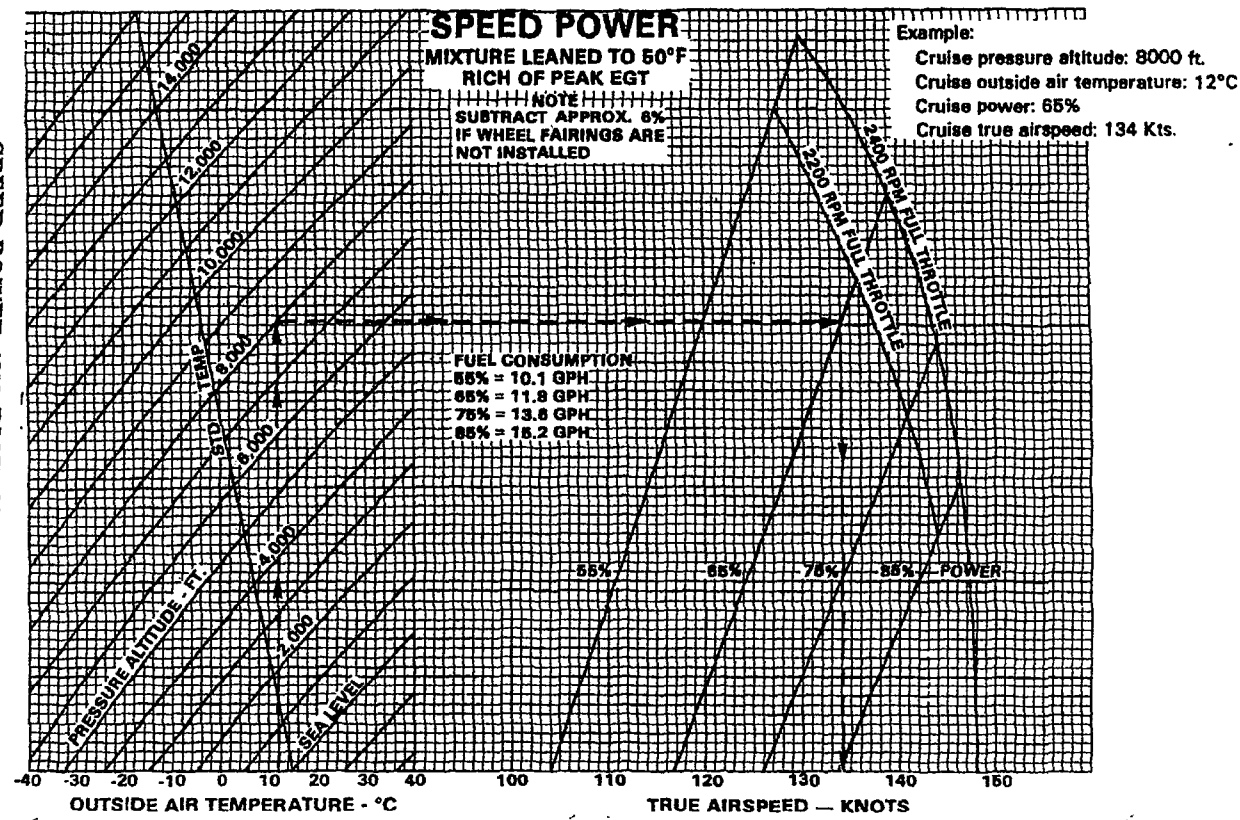
NOTE: To maintain constant power, add approximately 1% for each 6° C above standard, subtract approximately 1% for each 6° C below standard.

POWER SETTING TABLE
Figure 5-17



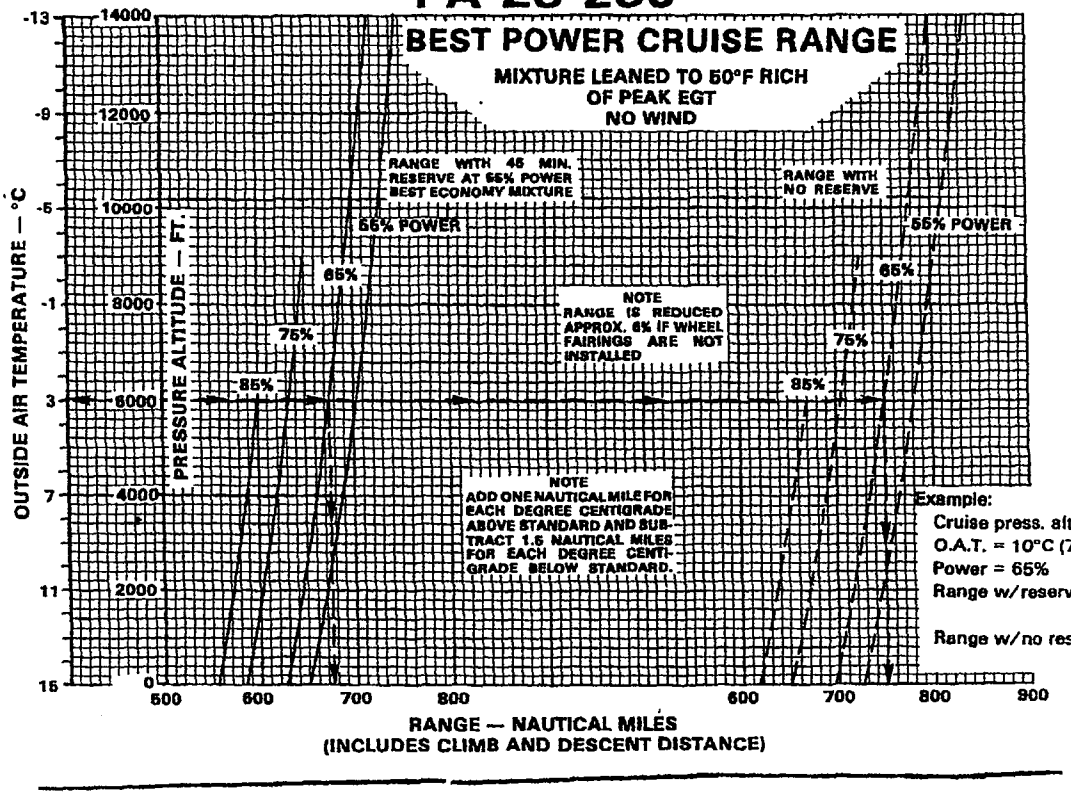
SPEED POWER (PEAK EGT)
Figure 5-19

PA-28-236



SPEED POWER (50° RICH OF PEAK EGT)
Figure 5-21

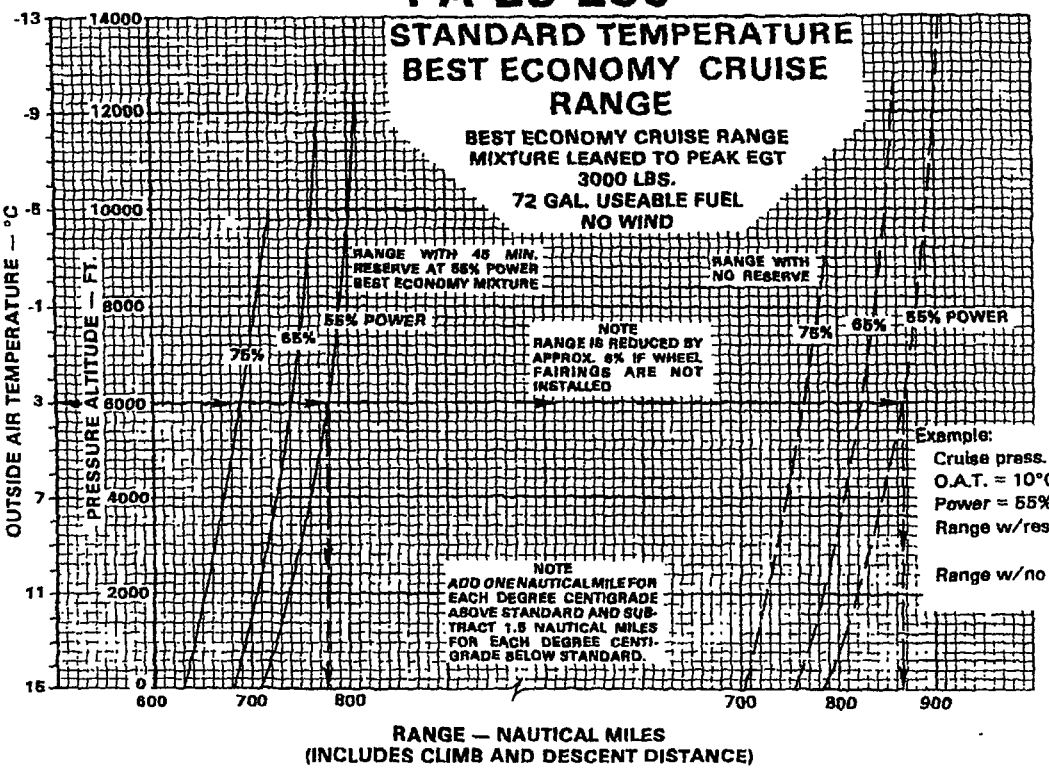
PA-28-236



Example:
Cruise press. alt. = 6000 ft.
O.A.T. = 10°C (7° above std.)
Power = 65%
Range w/reserve = 677 + (1 × 7)
= 684 N. M.
Range w/no res. = 750 + (1 × 7)
= 757 N.M.

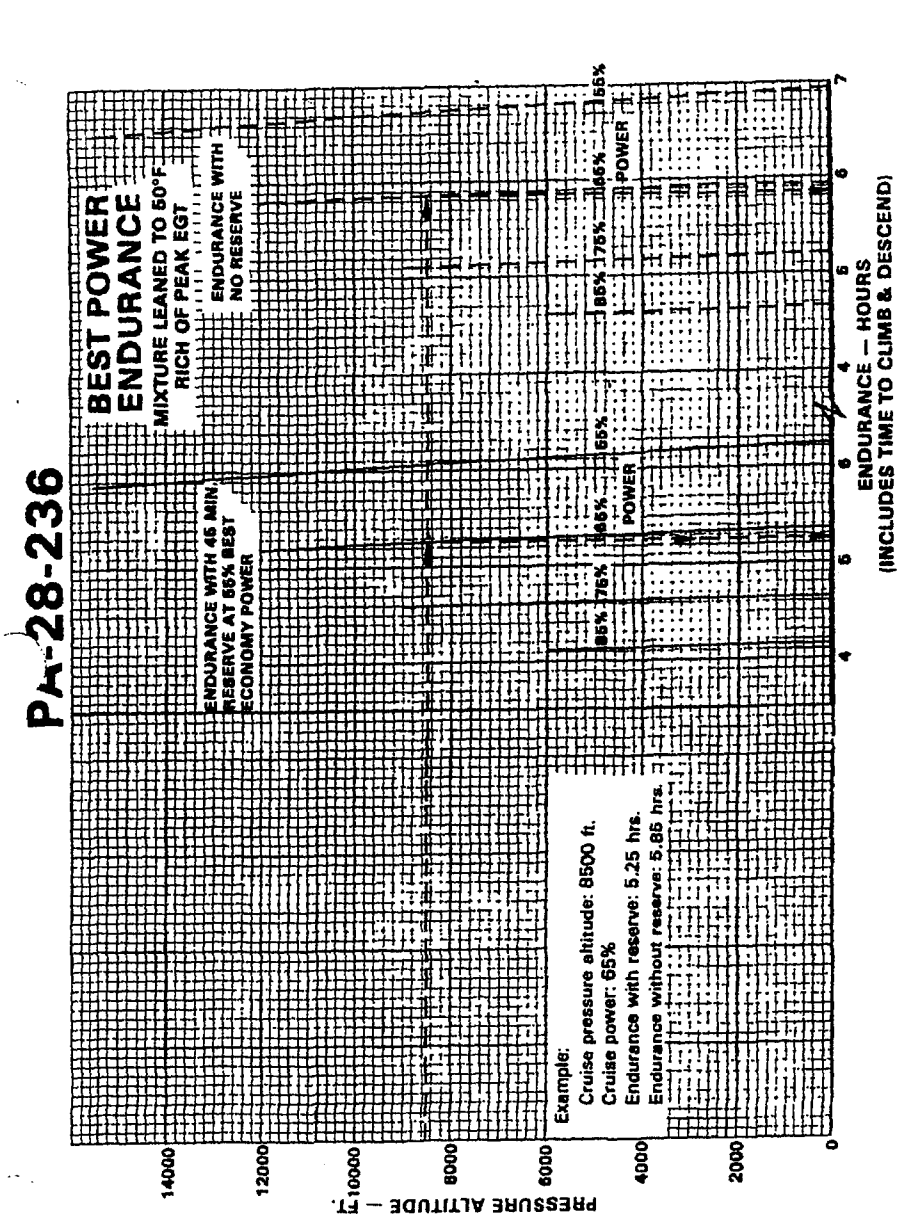
BEST POWER CRUISE RANGE
Figure 5-23

PA-28-236

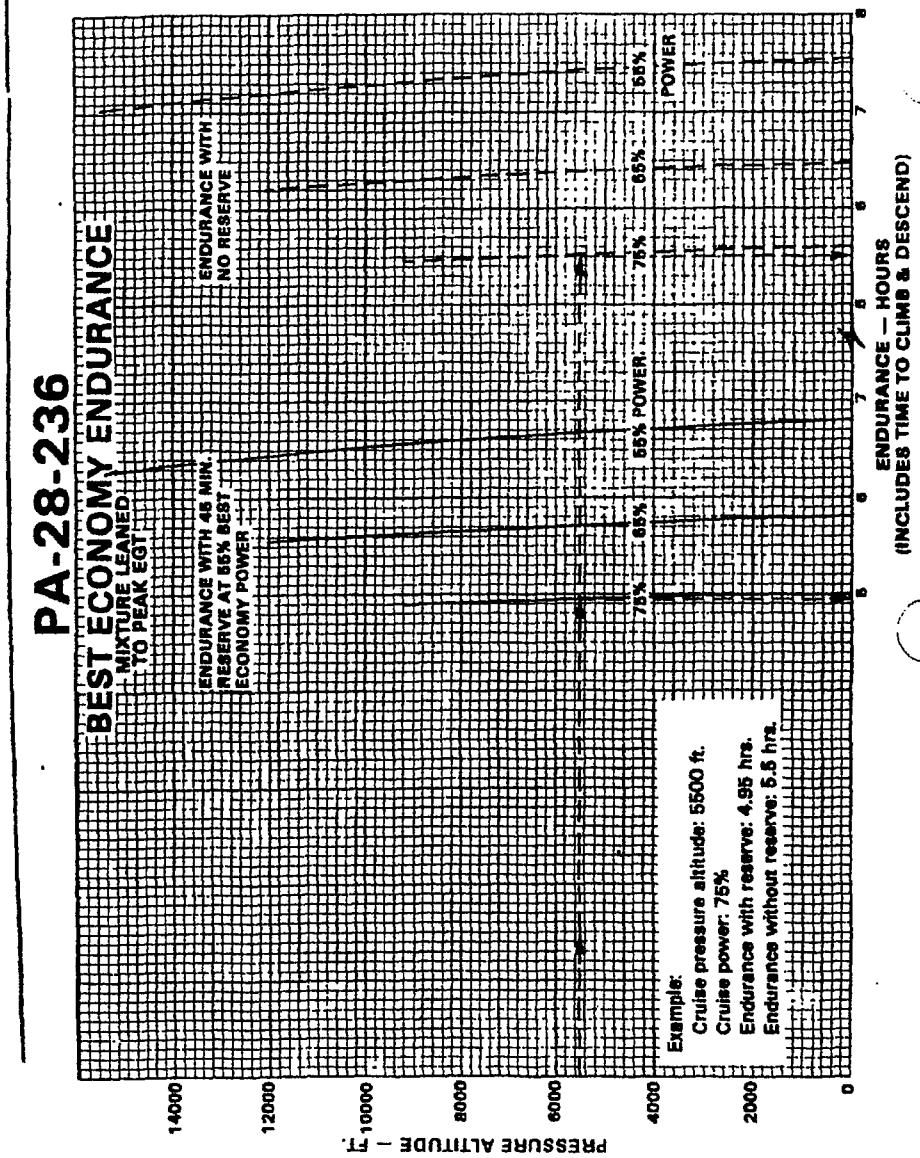


Example:
Cruise press. alt. = 6000 ft.
O.A.T. = 10°C (7° above std.)
Power = 55%
Range w/reserve = 778 + (1 × 7)
= 785 N. M.
Range w/no res. = 865 + (1 × 7)
= 872 N.M.

BEST ECONOMY CRUISE RANGE
Figure 5-25

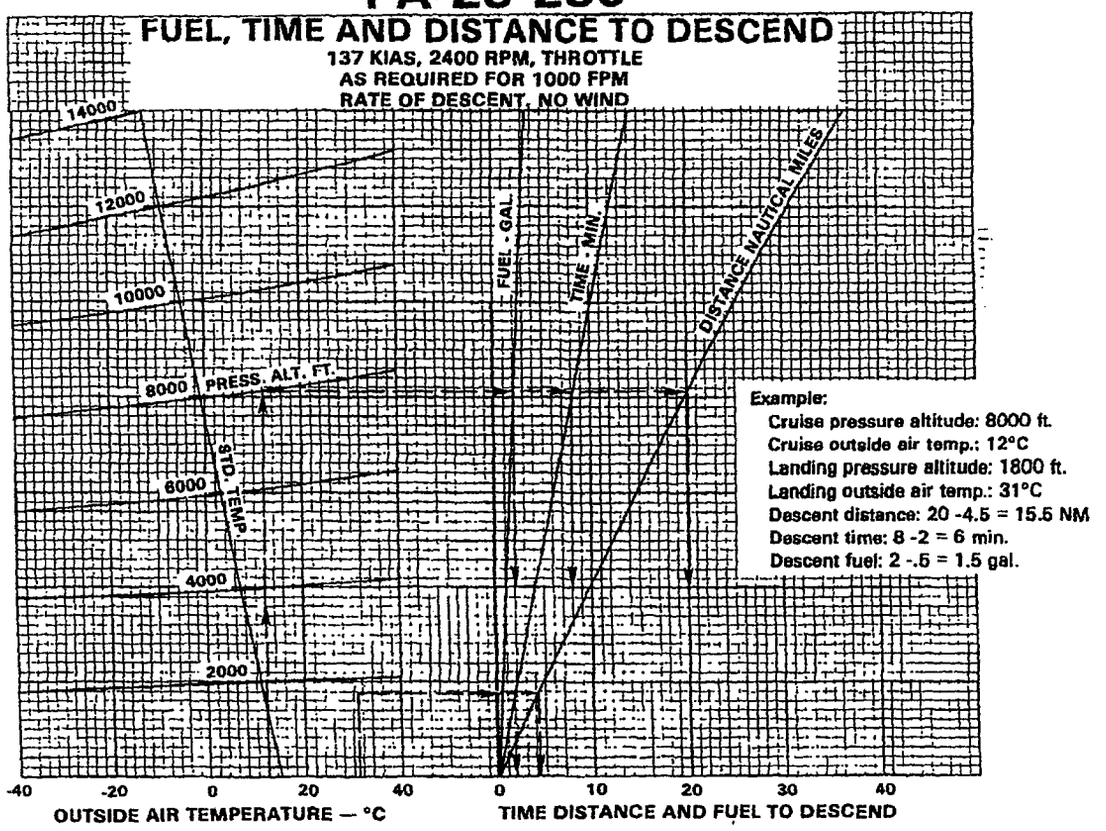


BEST POWER CRUISE ENDURANCE
Figure 5-27

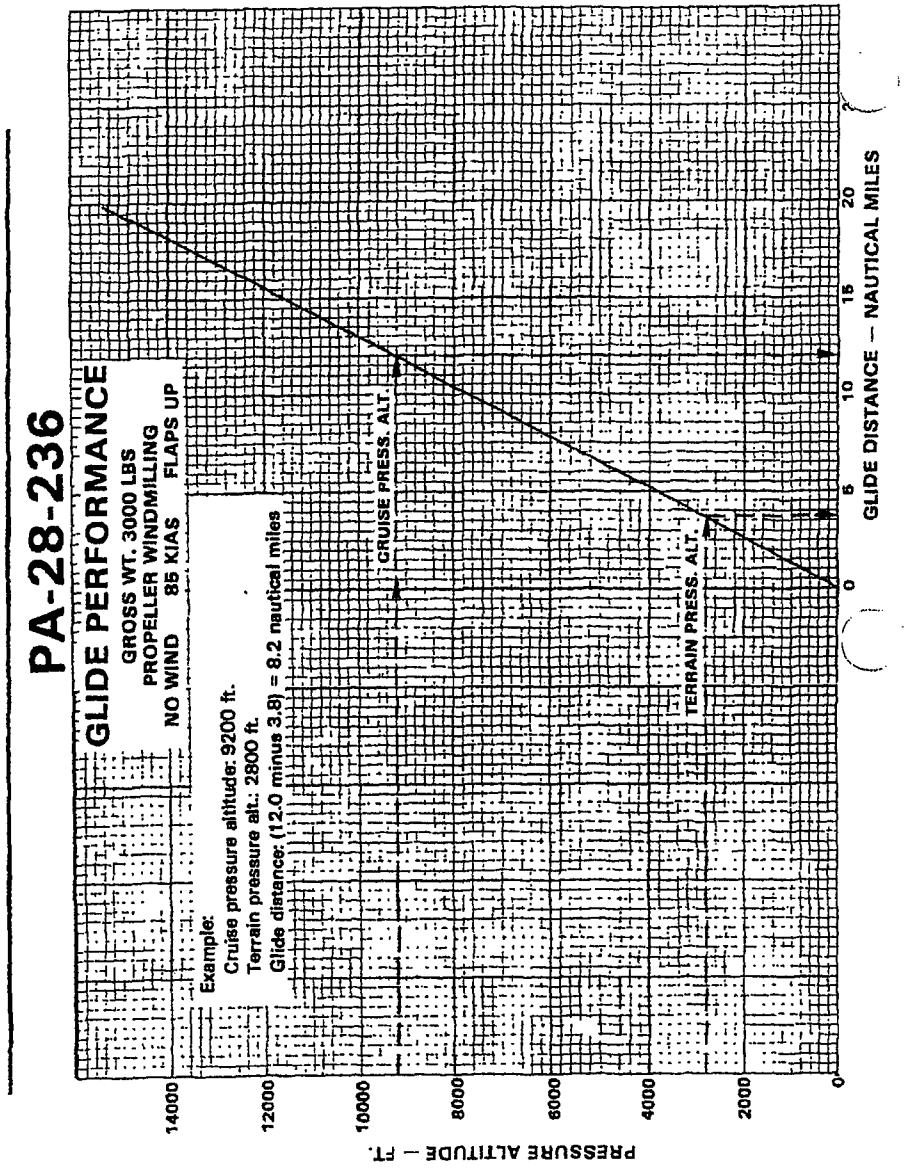


BEST ECONOMY CRUISE ENDURANCE
Figure 5-29

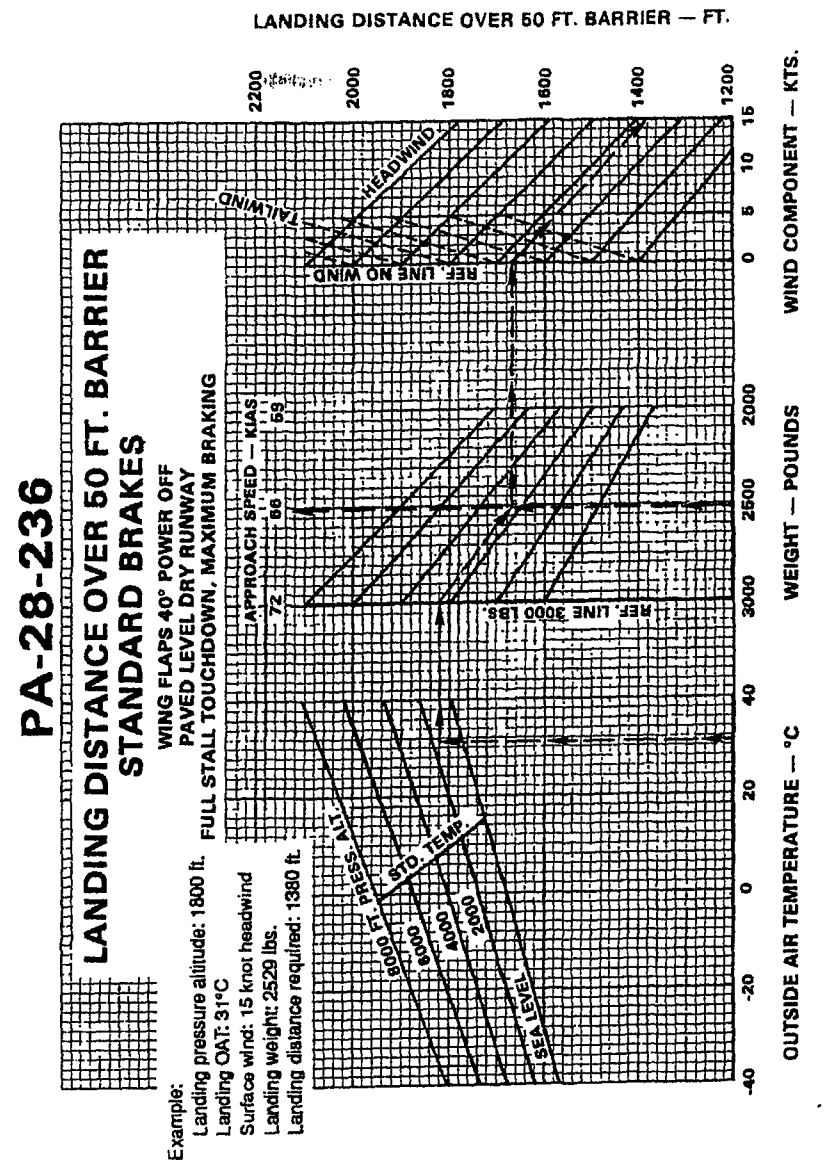
PA-28-236



FUEL, TIME AND DISTANCE TO DESCEND
Figure 5-31

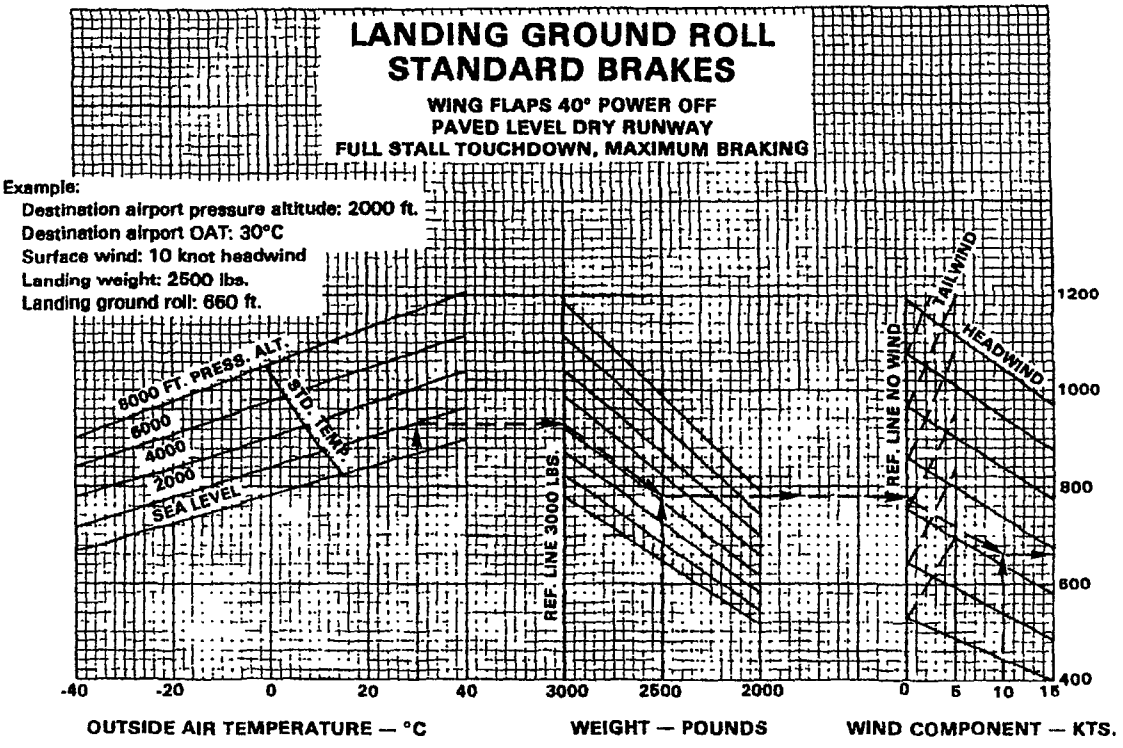


GLIDE PERFORMANCE
Figure 5-33

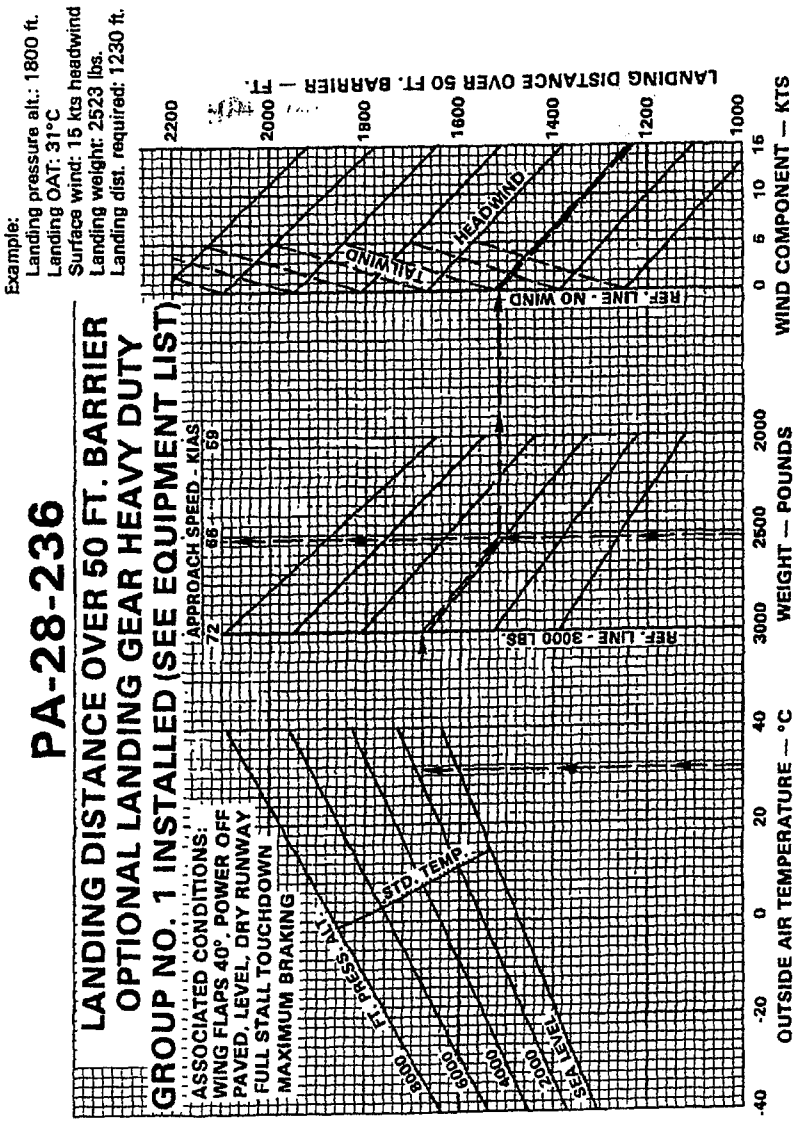


LANDING DISTANCE OVER 50 FT. BARRIER
STANDARD BRAKES
Figure 5-35

PA-28-236

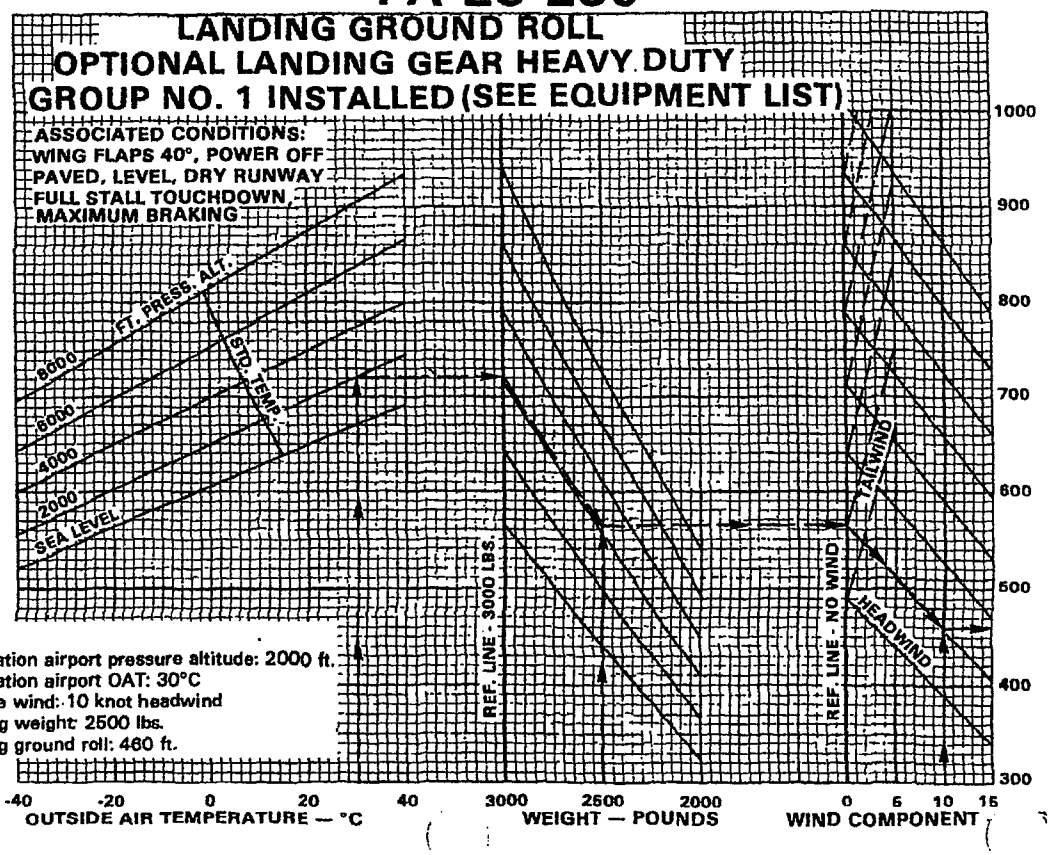


LANDING GROUND ROLL - STANDARD BRAKES
Figure 5-37



LANDING DISTANCE OVER 50 FT. BARRIER
HEAVY DUTY BRAKES
Figure 5-39

PA-28-236



Example:
Destination airport pressure altitude: 2000 ft.
Destination airport OAT: 30°C
Surface wind: 10 knot headwind
Landing weight: 2500 lbs.
Landing ground roll: 460 ft.

LANDING GROUND ROLL - HEAVY DUTY BRAKES
Figure 5-41

TABLE OF CONTENTS

SECTION 6

WEIGHT AND BALANCE

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

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

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

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

The following pages are forms used in weighing an airplane in production and in computing basic empty weight, C.G. position, and useful load. Note that the useful load includes usable fuel, baggage, cargo and passengers. Following this is the method 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, 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 (5.0 gallons total, 2.5 gallons each wing).

CAUTION

Whenever the fuel system is completely drained and fuel is replenished it will be necessary to run the engine for a minimum of 3 minutes at 1000 RPM on each tank to insure no air exists in the fuel supply lines.

(4) Fill with oil to full capacity.

(5) Place pilot and copilot seats in fourth (4th) notch, aft of forward position. Put flaps in the fully retracted position and all control surfaces in the neutral position. Tow bar should be in the proper location and 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 airplane on scales, block main gear oleo pistons in the fully extended position.

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

(c) Weighing - Airplane Basic Empty Weight

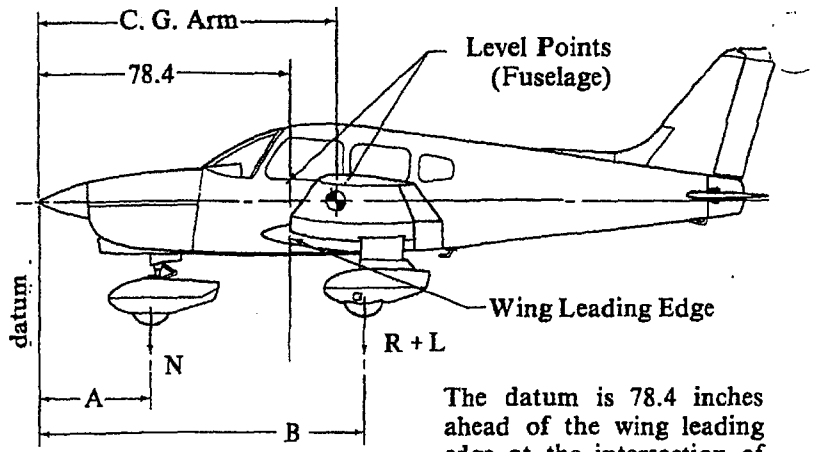
(1) With the airplane level and brakes released, record the weight shown on each scale. Deduct the tare, if any, from each reading.

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

WEIGHING FORM
Figure 6-1

(d) Basic Empty Weight Center of Gravity

(1) The following geometry applies to the PA-28-236 airplane when it is level. Refer to Leveling paragraph 6.3 (b).



A = 32.4
B = 109.7

The datum is 78.4 inches ahead of the wing leading edge at the intersection of the straight and tapered section.

LEVELING DIAGRAM
Figure 6-3

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

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

Where: $T = N + R + L$

6.5 WEIGHT AND BALANCE DATA AND RECORD

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

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

MODEL PA-28-236, DAKOTA

Airplane Serial Number _____

Registration Number _____

Date _____

AIRPLANE BASIC EMPTY WEIGHT

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

*The standard empty weight includes full oil capacity and 5.0 gallons of unusable fuel.

AIRPLANE USEFUL LOAD - NORMAL CATEGORY OPERATION

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

Normal Category: (3011 lbs.) - (lbs.) = lbs.

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

WEIGHT AND BALANCE DATA FORM
Figure 6-5

PA-28-236	Serial Number	Registration Number	Page Number

Date	Item No.	Description of Article or Modification	Weight Change			Running Basic Empty Weigh:	
			Added (+)	Removed (-)	Wt. (l.b.)	Arm (In.)	Moment 100	Wt. (l.b.)	Moment 100
		As licensed							

WEIGHT AND BALANCE RECORD
Figure 6-7

PA-28-236	Serial Number	Registration Number	Page Number

Date	Item No.	Description of Article or Modification	Added (+)	Removed (-)	Weight Change			Running Basic Empty Weight	
					Wt. (Lb.)	Arm (In.)	Moment /100	Wt. (Lb.)	Moment /100

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

6.7 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT

(a) Add the weight of all items to be loaded to the basic empty weight.
(b) Use the Loading Graph (Figure 6-13) to determine the moment of all items to be carried in the airplane.
(c) Add the moment of all items to be loaded to the basic empty weight moment.
(d) Divide the total moment by the total weight to determine the C.G. location.
(e) By using the figures 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.

	Weight (Lbs)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Basic Empty Weight	1780	83.7	148986
Pilot and Front Passenger	340	80.5	27370
Passengers (Rear Seats)	340	118.1	40154
Fuel (72 Gallons Maximum)	432	95.0	41040
Baggage (200 Lbs. Maximum)	119	142.8	16993
Ramp Weight (3011 Lbs. Maximum)	3011	91.2	274543
Fuel allowance for engine start, taxi and run-up	-11	95.0	-1045
Takeoff Weight (3000 Lbs. Maximum)	3000	91.2	273498

The center of gravity (C.G.) of this sample loading problem is at 91.2 inches aft of the datum line. Locate this point (91.2) on the C.G. range and weight graph. Since this point falls within the weight - C.G. envelope, this loading meets the weight and balance requirements.

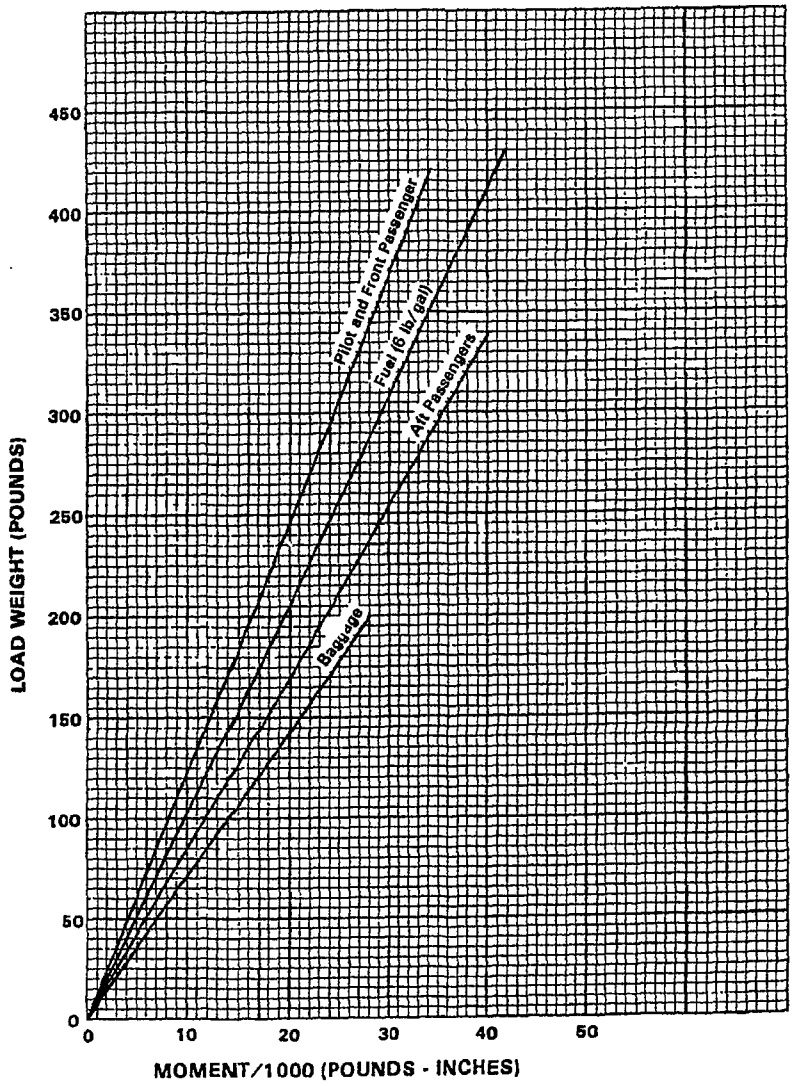
IT IS THE RESPONSIBILITY OF THE PILOT AND AIRCRAFT OWNER TO INSURE THAT THE AIRPLANE IS LOADED PROPERLY.

SAMPLE LOADING PROBLEM (NORMAL CATEGORY)
Figure 6-9

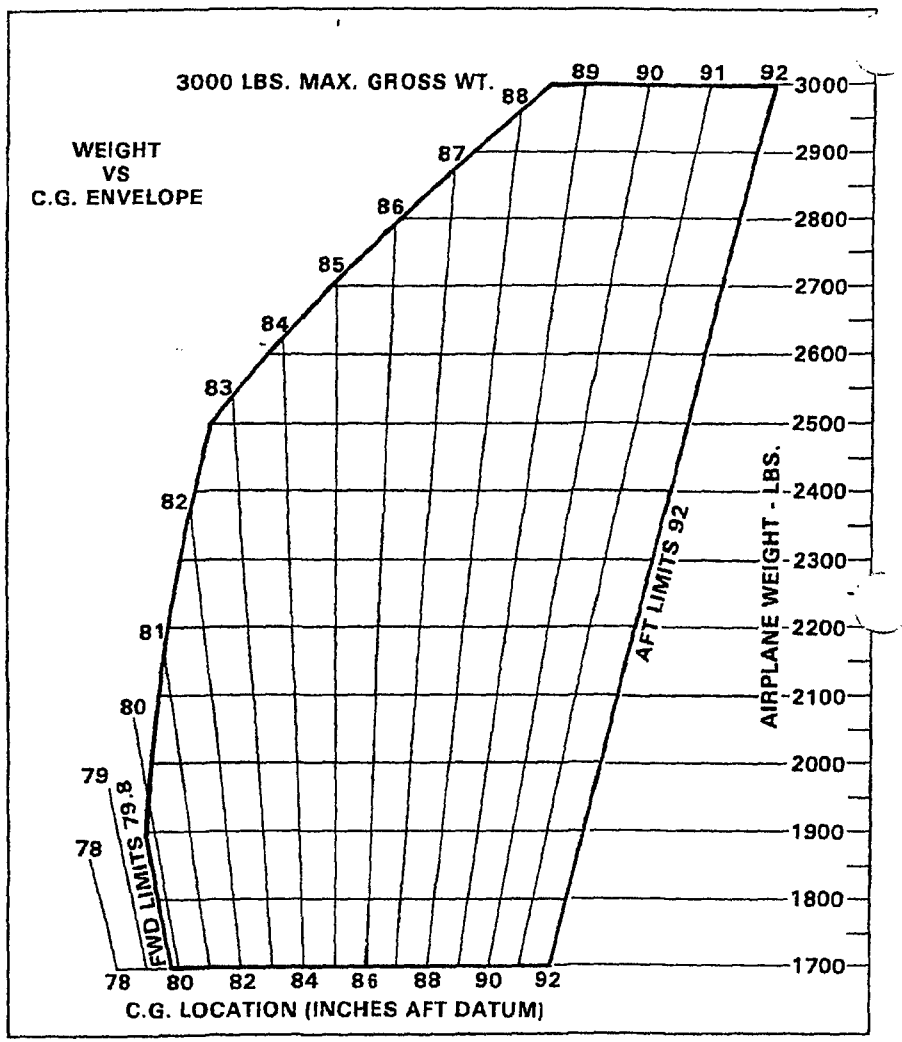
	Weight (Lbs)	Arm Aft Datum (Inches)	Momer (In-Lbs)
Basic Empty Weight			
Pilot and Front Passenger		80.5	
Passenger (Rear Seats)		118.1	
Fuel (72 Gallons Maximum)		95.0	
Baggage (200 Lbs. Maximum)		142.8	
Ramp Weight (3011 Lbs. Maximum)			
Fuel allowance for engine start, taxi and run-up	-11	95.0	-1045
Takeoff Weight (3000 Lbs. Maximum)			

Totals must be within approved weight and C.G. limits. It is the responsibility of the airplane owner and the pilot to insure that the airplane is loaded properly. The Basic Empty Weight C.G. is noted on the Weight and Balance Data Form (Figure 6-5). If the airplane has been altered, refer to the Weight and Balance Record for this information.

WEIGHT AND BALANCE LOADING FORM
Figure 6-11



LOADING GRAPH
Figure 6-13



C. G. RANGE AND WEIGHT
Figure 6-15

6.9 INSTRUCTIONS FOR USING THE WEIGHT AND BALANCE PLOTTER

This plotter is provided to enable the pilot quickly and conveniently to:
(a) Determine the total weight and C.G. position.
(b) Decide how to change his load if his first loading is not within the allowable envelope.

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

The "Basic Empty Weight and Center of Gravity" location is taken from the Weight and Balance Form (Figure 6-5), the Weight and Balance Record (Figure 6-7) or the latest FAA major repair or alteration form.

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

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

Fuel burn-off does not significantly affect the center of gravity.

SAMPLE PROBLEM

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

Assume a basic weight and C.G. location of 1800 pounds at 81.00 inches respectively. We wish to carry a pilot and 3 passengers. Two men weighing 180 and 200 pounds will occupy the front seats, and two children weighing 80 and 100 pounds will ride in the rear. Two suitcases weighing 25 pounds and 20 pounds respectively, will be carried in the rear compartment. We wish to carry 60 gallons of fuel. Will we be within the safe envelope?

(a) Place a dot on the plotter grid at 1800 pounds and 81.00 inches to represent the basic airplane. (See illustration.)
(b) Slide the slotted plastic into position so that the dot is under the slot for the forward seats, at zero weight.
(c) Draw a line up the slot to the 380 pounds position (180 + 200) and put a dot.
(d) Continue moving the plastic and plotting points to account for weight in the rear seats (80 + 100), baggage compartment (45), and fuel tanks (360).
(e) As can be seen from the illustration, the final dot shows the total weight to be 2765 pounds with the C.G. at 86.18. This is well within the envelope.
(f) There will be room for some more fuel.

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

SAMPLE PROBLEM

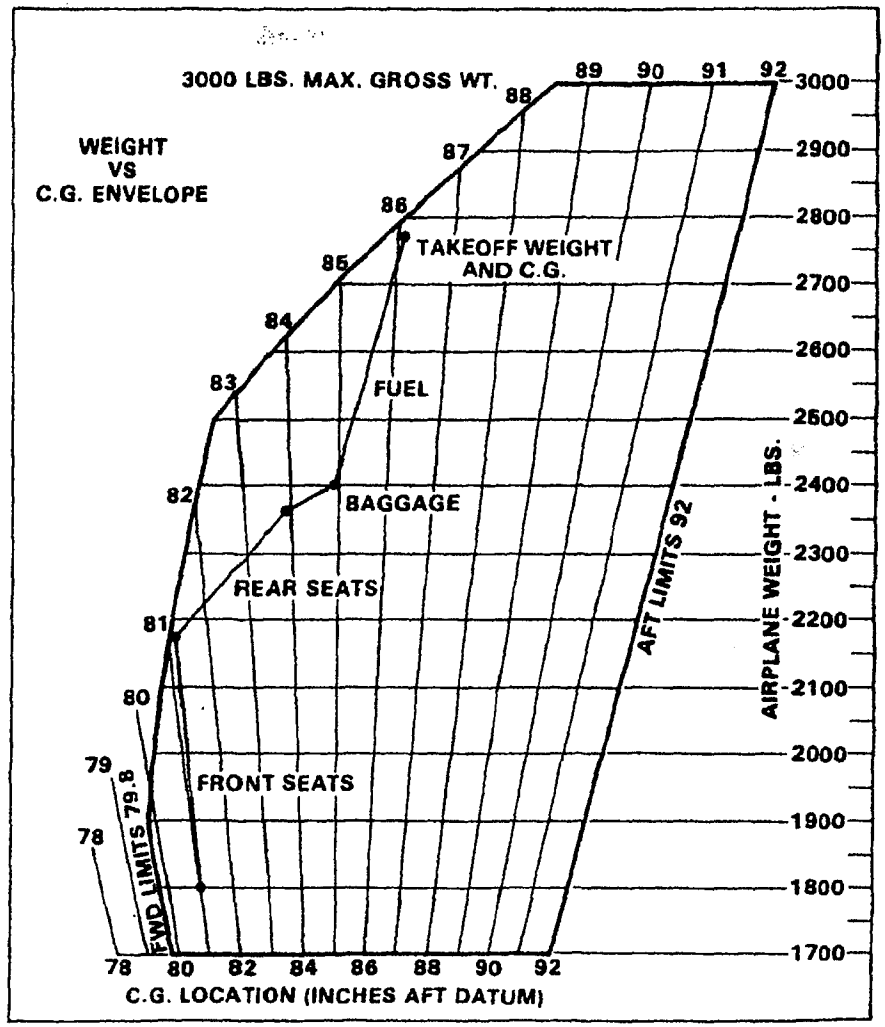


TABLE OF CONTENTS

SECTION 7

DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

SECTION 7

DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

7.1 THE AIRPLANE

The PA-28-236 Dakota is a single-engine, low-wing monoplane of all metal construction. It has seating for up to four occupants and has a two hundred pound luggage compartment.

7.3 AIRFRAME

With the exception of the steel engine mount, the landing gear, miscellaneous steel parts, the cowling, and the lightweight plastic extremities (tips of wings, tail fin, rudder and stabilator), the basic airframe is of aluminum alloy. Aerobatics are prohibited in this airplane since the structure is not designed for aerobatic loads.

The fuselage is a semi-monocoque structure with a passenger door on the forward right hand side and a cargo door on the aft right hand side.

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

A vertical stabilizer, an all-movable horizontal stabilator, and a rudder make up the empennage. The stabilator incorporates an anti-servo tab whic' improves longitudinal stability and provides longitudinal trim. This ta moves in the same direction as the stabilator, but with increased travel.

7.5 ENGINE AND PROPELLER

The Lycoming O-540-J3A5D engine is rated at 235 horsepower at 2400 rpm. The engine is equipped with a geared starter, a 60 ampere alternator, dual magnetos, shielded ignition system, vacuum pump drive, a diaphragm-type fuel pump and a float carburetor.

The exhaust system consists of individual exhaust pipes routed in pairs to three heavy gauge stainless steel mufflers. Exhaust gases are directed overboard at the underside of the engine cowling. The mufflers are surrounded by a shroud which provides heat for the cabin and for windshield defrosting.

The propeller is a Hartzell HC-F2YR-1( )F/F8468A-4R constant speed propeller. The Hartzell propeller is 80 inches in diameter, and is controlled by a Hartzell F-4-21 governor mounted on a pad on the forward end of the crankcase. This governor supplies oil to the propeller through the engi shaft. The governor is controlled by a cable from the cockpit.

The two-piece cowling cools the engine in normal flight conditions, including protracted climb, without the use of cowl flaps or cooling flanges.

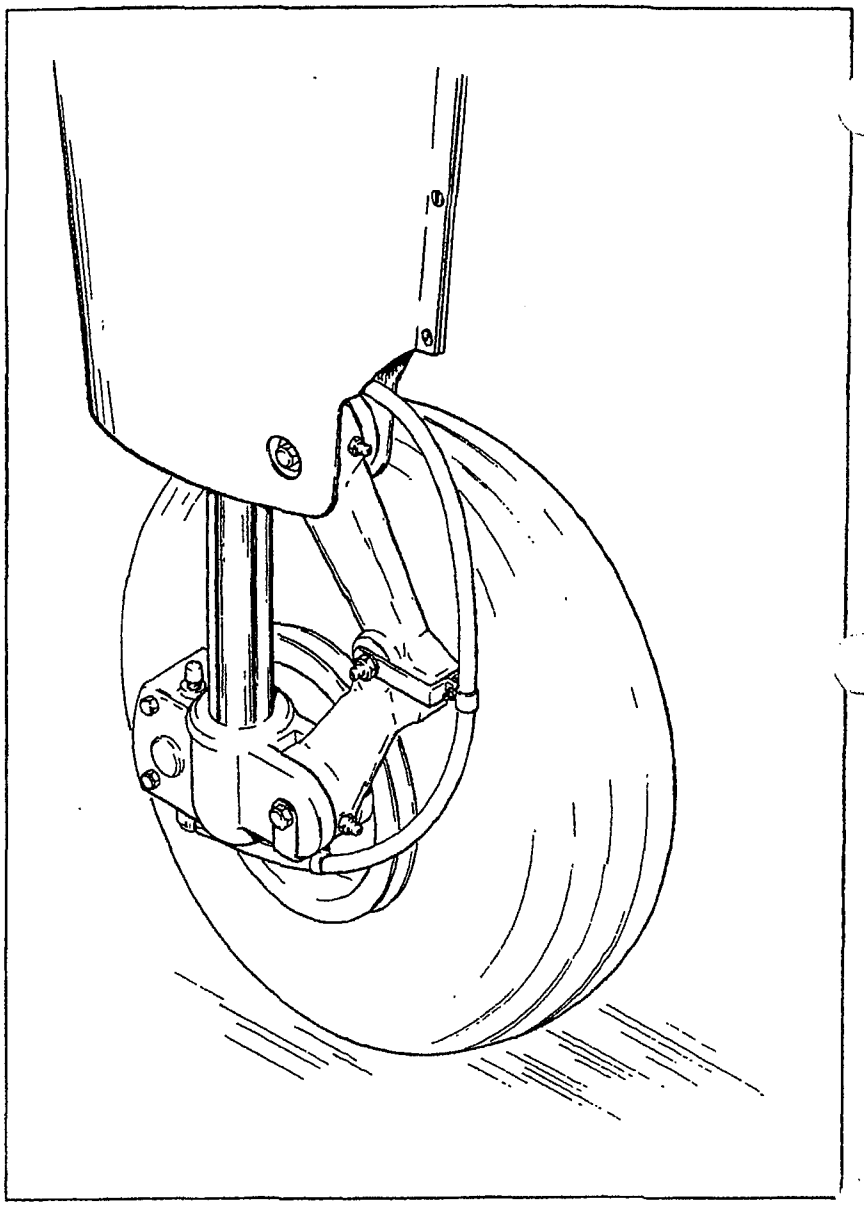
The throttle quadrant, located in the lower center instrument panel, contains the throttle, the mixture control, and the propeller governor control. A friction lock on the right side of the quadrant prevents creeping of the controls. In addition, the mixture control has a lock to prevent activation of the mixture control instead of the pitch control. To the right of the quadrant is the carburetor heat control. Maximum carburetor heat is provided with the control in the ON position. Air passes through a dry-type filter when the carburetor heat is in the OFF position.

A fuel pressure gauge is installed on the engine gauge cluster and a manifold pressure gauge is installed in the left side of the instrument panel.

7.7 INDUCTION SYSTEM

An induction scoop is located at the lower front of the cowling. This scoop is removable for access to the air filter which is attached to the air filter housing immediately behind the scoop. This air filter housing is ducted to the carburetor air box. The air box is mounted onto the bottom of the carburetor and either ram air from the front scoop and through the filter or unfilter heated air from a shroud mounted on the muffler may be manually selected through a two way valve.

Carburetor heat selection insures induction air flow should the filter become blocked. Since the air is heated, the carburetor heat system offers protection against induction system blockage caused by snow or freezing rain or by the freezing of moisture accumulated in the carburetor air intake throat. Carburetor heat air is unfiltered; therefore, it should not be used during ground operation when dust or other contaminants might enter the system. Filtered air should always be used for takeoff.



MAIN WHEEL ASSEMBLY
Figure 7-1

7.9 LANDING GEAR

The landing gears have 6.00 x 6 wheels. The main wheels (Figure 7-1) are equipped with hydraulically operated disc brakes. The nose wheel carries a four ply rating tube type tire and the main gear carry six ply rating tube type tires.

A spring device is incorporated in the rudder pedal torque tube assembly to provide rudder trim. A bungee in the nose gear steering mechanism reduces steering effort and dampens bumps and shocks during taxiing. By use of the rudder pedals and brakes, the nose gear is steerable through a 30-degree arc each side of center. Later aircraft have the bungee removed from the nose gear steering mechanism and are steerable through a 20-degree arc each side of center. A shimmy dampener is also included in the nose gear.

The struts are of the air-oil type, with a normal extension of 3.25 inches for the nose gear and 4.5 inches for the main gear under normal static load (empty weight of airplane plus full fuel and oil).

The brakes are actuated by a hand lever and master cylinder, which is located below and near the center of the instrument panel or by toe brakes mounted on each rudder pedal. The toe brakes and the hand lever each have their own brake cylinders, but they share a common reservoir. The parking brake is incorporated in the lever brake and is operated by pulling back on the lever and depressing the knob attached to the top of the handle. To release the parking brake, pull back on the brake lever to disengage the catch mechanism; then allow the handle to swing forward.

7.11 ENGINE CONTROLS

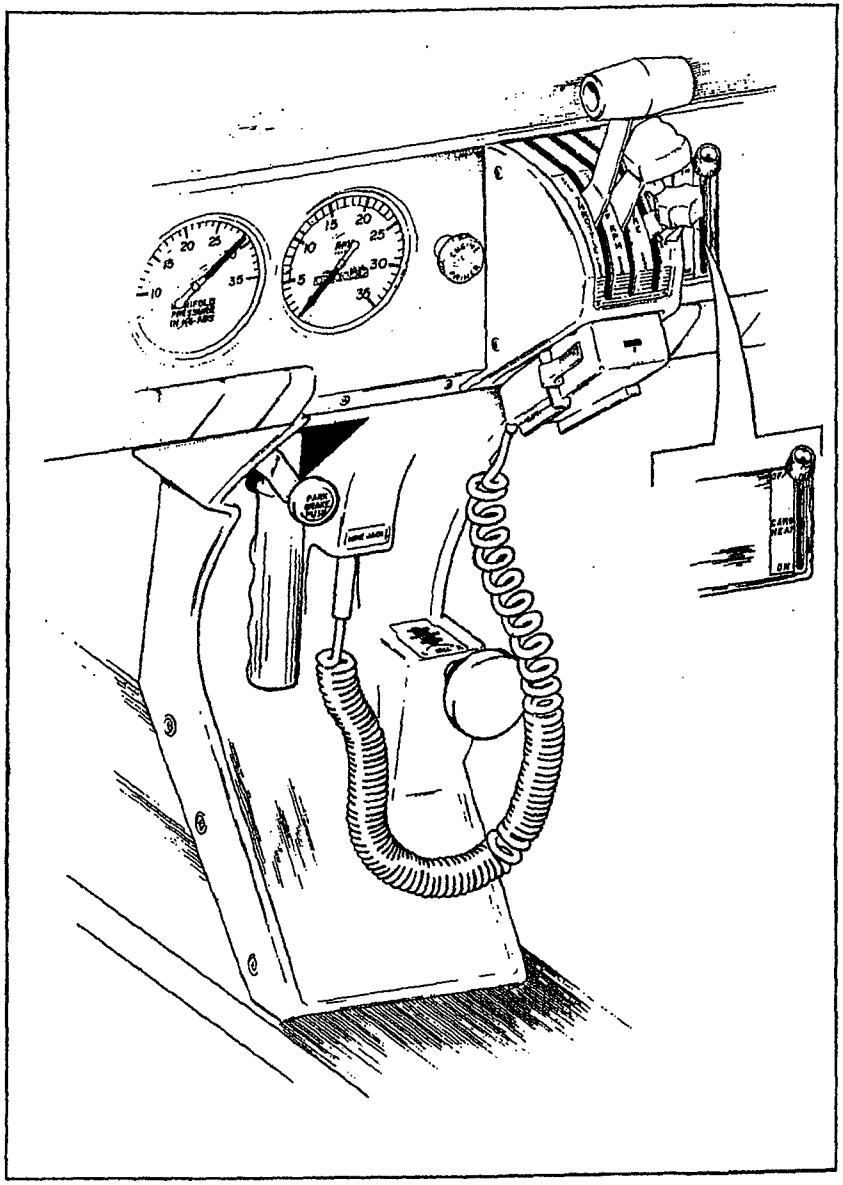
Engine controls consist of a throttle control, a propeller control and a mixture control lever. These controls are located on the control quadrant on the lower center of the instrument panel (Figure 7-3) where they are accessible to both the pilot and the copilot. The controls utilize teflon-lined control cables to reduce friction and binding.

The throttle lever is used to adjust the manifold pressure. The propeller control lever is used to adjust the propeller speed from high RPM to low RPM.

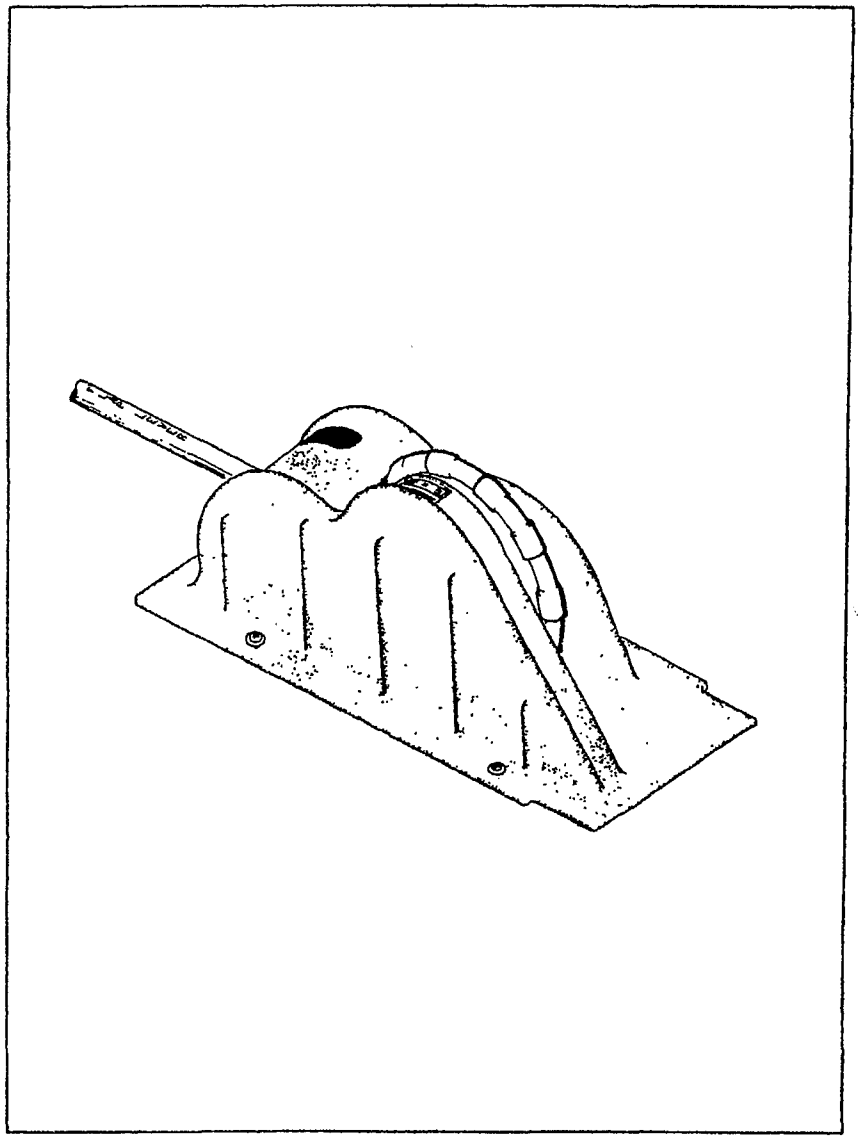
The mixture control lever is used to adjust the air to fuel ratio. The engine is shut down by the placing of the mixture control lever in the full lean position. The mixture control has a lock to prevent activation of the mixture control instead of the pitch control. For information on the leaning procedure, see the Avco-Lycoming Operator's Manual.

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

The carburetor heat control is located to the right of the control quadrant. When the carburetor heat lever is in the OFF position the engine is operating on filtered air; when the lever is in the ON position the engine is operating on unfiltered, heated air. Prolonged ground operation with the carburetor heat control in the ON position should be avoided.



CONTROL QUADRANT AND CONSOLE
Figure 7-3



FLIGHT CONTROL CONSOLE
Figure 7-5

7.13 FLIGHT CONTROLS

Dual controls are provided as standard equipment, with a cable system used between the controls and the surfaces. The horizontal tail is of the all-movable slab type, with an anti-servo tab which also acts as a longitudinal trim tab, actuated by a control mounted on the control tunnel between the two front seats (Figure 7-5).

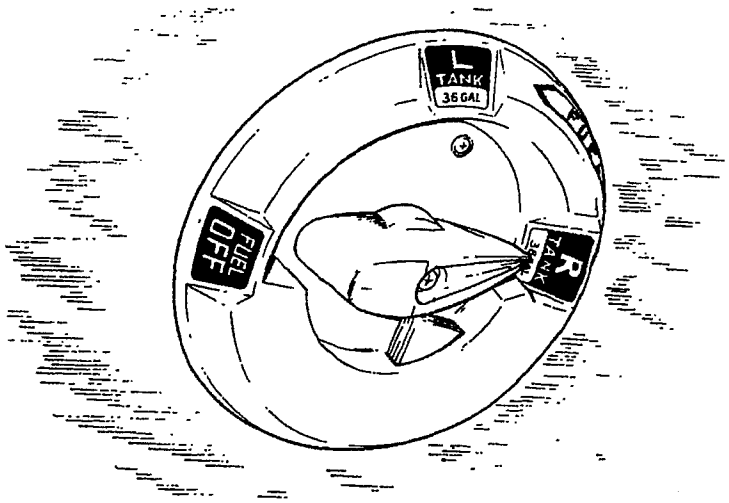
The flaps are manually operated and spring-loaded to return to the up position. A past-center lock incorporated in the actuating linkage holds the flap when it is in the up position so that it may be used as a step on the right side. The flap will not support a step load except when in the full up position, so it must be completely retracted when used as a step. The flaps have three extended positions, 10, 25 and 40 degrees.

7.15 FUEL SYSTEM

The fuel system incorporates two fuel tanks, one in each wing. Each has a capacity of 38.5 U.S. gallons, giving a total of 77 gallons, of which 72 gallons is usable. Each tank is equipped with a filler neck indicator tab to aid in determining fuel remaining when the tanks are not full. Usable capacity to bottom of the indicator tab is 25 gallons. The tanks are attached to the leading edges of the wings and are an integral part of the wing structure. The fuel tanks are vented individually through vent tubes which protrude below the bottom of the wings at the rear outboard corner of each tank. The vents should be checked periodically for obstructions which might block the free passage of air.

Normally, fuel is supplied to the engine through an engine-driven fuel pump. An auxiliary electric fuel pump serves as a back-up feature. The electric fuel pump is controlled by a rocker switch on the switch panel above the throttle quadrant. The electric fuel pump should be ON when switching fuel tanks and during takeoffs and landings (Figure 7-9).

The fuel tank selector (Figure 7-7), which allows the pilot to select the tank supplying fuel to the engine, is located on the left sidewall of the cockpit, below the instrument panel. It has three positions: OFF, LEFT TANK and RIGHT TANK. The arrow on the handle of the selector points to the tank which is supplying fuel to the engine. The valve also incorporates a safety latch which prevents inadvertently selecting the OFF position.



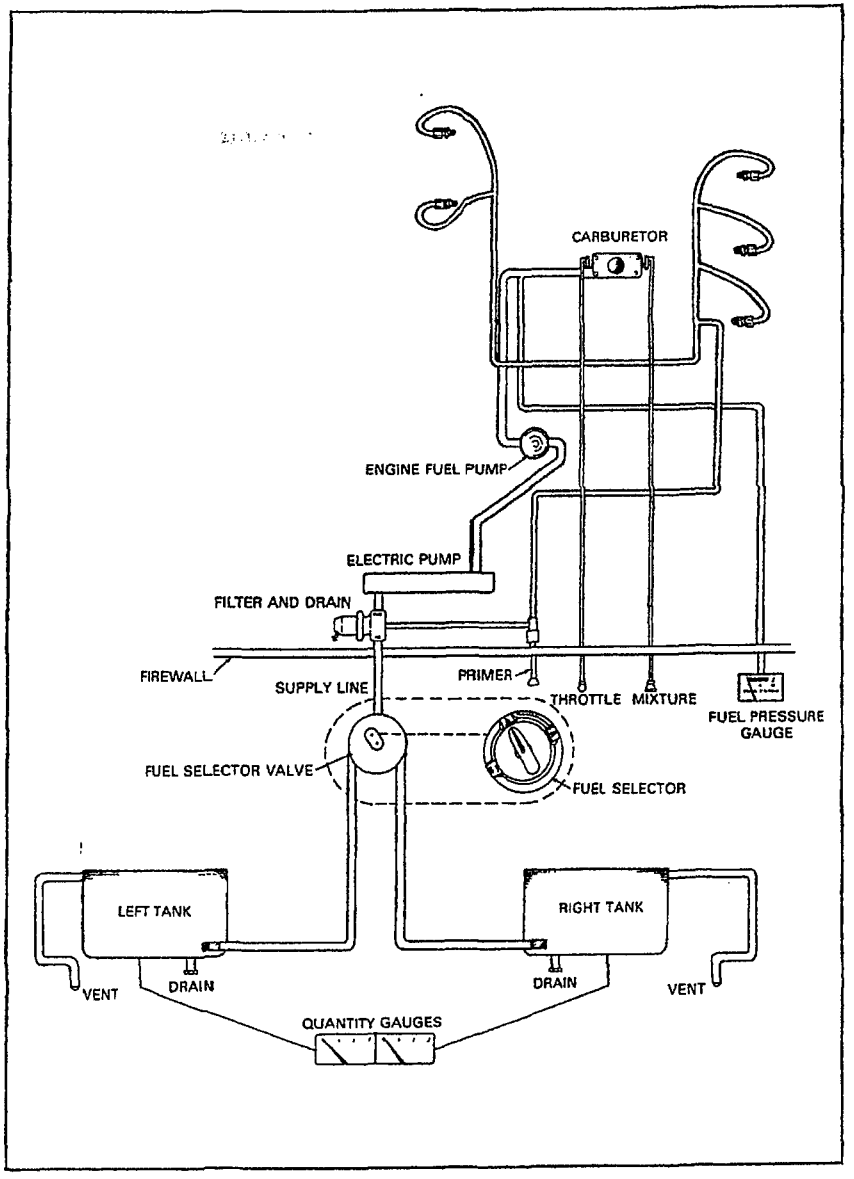
FUEL SELECTOR
Figure 7-7

Fuel quantity and pressure are indicated on gauges on the instrument panel. There is a separate fuel quantity gauge for each tank.

Each fuel tank has an individual quick drain located at the bottom inboard rear corner (see Figure 8-3). These drains are opened by insertion of the probe in the fuel sampler container into the drain. The fuel strainer incorporates a drain which protrudes from the cowling at the lower left front corner of the firewall. All three drains should be drained before flights and the drained fuel checked for contaminants.

CAUTION

When draining fuel, care should be exercised to insure that no fire hazard exists before start-ing the engine.



FUEL SYSTEM SCHEMATIC
Figure 7-9

7.17 ELECTRICAL SYSTEM

The electrical system includes a 14-volt, 60 amp alternator, a voltage regulator, an overvoltage relay, and a master switch relay (Figure 7-11). The 12-volt battery is mounted in a thermoplastic box immediately aft of the baggage compartment. The regulator and overvoltage relay are located on the forward left side of the fuselage behind the instrument panel.

Electrical switches are located on the right center instrument panel (Figure 7-15), and the circuit breakers are located on the lower right instrument panel (Figure 7-13). A rheostat switch on the left side of the switch panel controls the navigational lights and the radio lights. The similar switch on the right side controls and dims the panel lights.

Standard electrical accessories include starter, electric fuel pump, stall warning indicator, ammeter and annunciator panel.

The annunciator panel includes alternator and low oil pressure indicator lights. When the optional gyro system is installed, the annunciator panel also includes a low vacuum indicator light. The annunciator panel lights are provided only as a warning to the pilot that a system may not be operating properly, and that the applicable system gauge should be checked and monitored to determine when or if any necessary action is required.

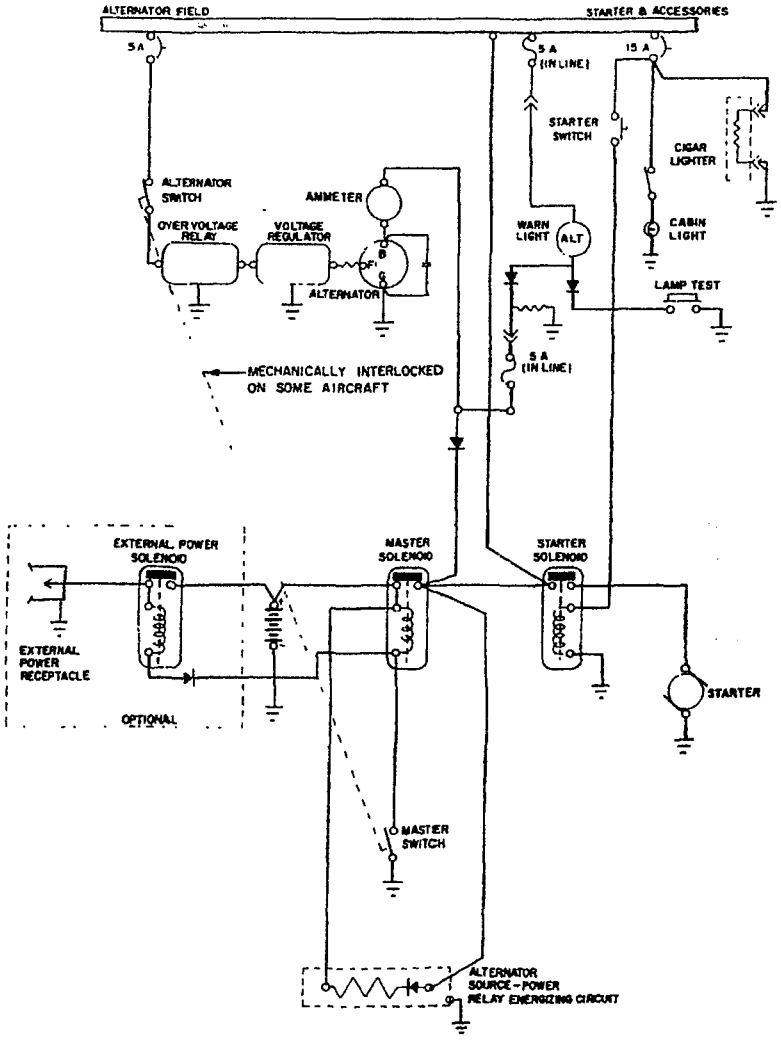
Optional electrical accessories includes navigation, ground recognition, anti-collision, landing, instrument and cabin dome lighting.

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

An optional wing tip/recognition light system consists of 2 lights (one in each wing tip) and is operated by a split landing light/recognition light rocker type switch mounted on the switch panel.

WARNING

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



ALTERNATOR AND STARTER SCHEMATIC
Figure 7-11

NOTE

On airplanes with interlocked BAT and ALT switches, the ALT switch is mechanically interlocked with the BAT switch. When ALT switch is turned ON, the BAT switch will also be turned ON. On airplanes with separate BAT and ALT switch operation, the switches may be positioned independently as desired.

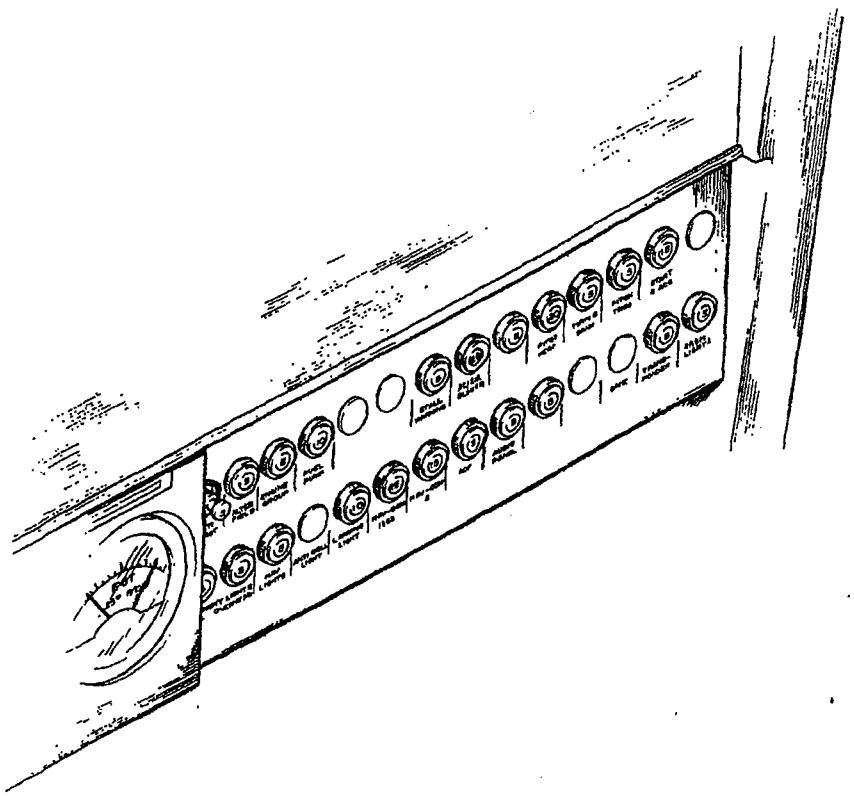
Circuit provisions are made to handle the addition of communications and navigational equipment.

Unlike previous generator systems, the ammeter does not indicate battery discharge; rather it displays in amperes the load placed on the alternator. With all electrical equipment off (except the master switch), the ammeter will be indicating the amount of charging current demanded by the battery. As each item of electrical equipment is turned on, the current will increase to a total appearing on the ammeter. This total includes the battery. The maximum continuous load for night flight, with radios on, is about 30 amperes. This 30 ampere value, plus approximately two amperes for a fully charged battery, will appear continuously under these flight conditions. The amount of current shown on the ammeter will tell immediately whether the alternator system is operating normally, as the amount of current shown should equal the total amount of amperes being drawn by the equipment which is operating.

If no output is indicated on the ammeter, during flight, reduce the electrical load by turning off all unnecessary electrical equipment. Check the 5 ampere field breaker, reset if open. If the breaker is not open, turn off the "ALT" switch for one second to reset the overvoltage relay. If ammeter continues to indicate no output, maintain minimum electrical load and terminate flight as soon as practical.

CAUTION

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



CIRCUIT BREAKER PANEL
Figure 7-13

7.19 VACUUM SYSTEM*

The vacuum system operates the air driven gyro instruments. This system consists of an engine-driven vacuum pump, a vacuum regulator, a filter, a vacuum gauge, the necessary plumbing, and, when installed, the directional and attitude gyro instruments.

The vacuum pump is a dry type pump. A shear drive protects the engine from damage. If the drive shears, the gyros will become inoperative.

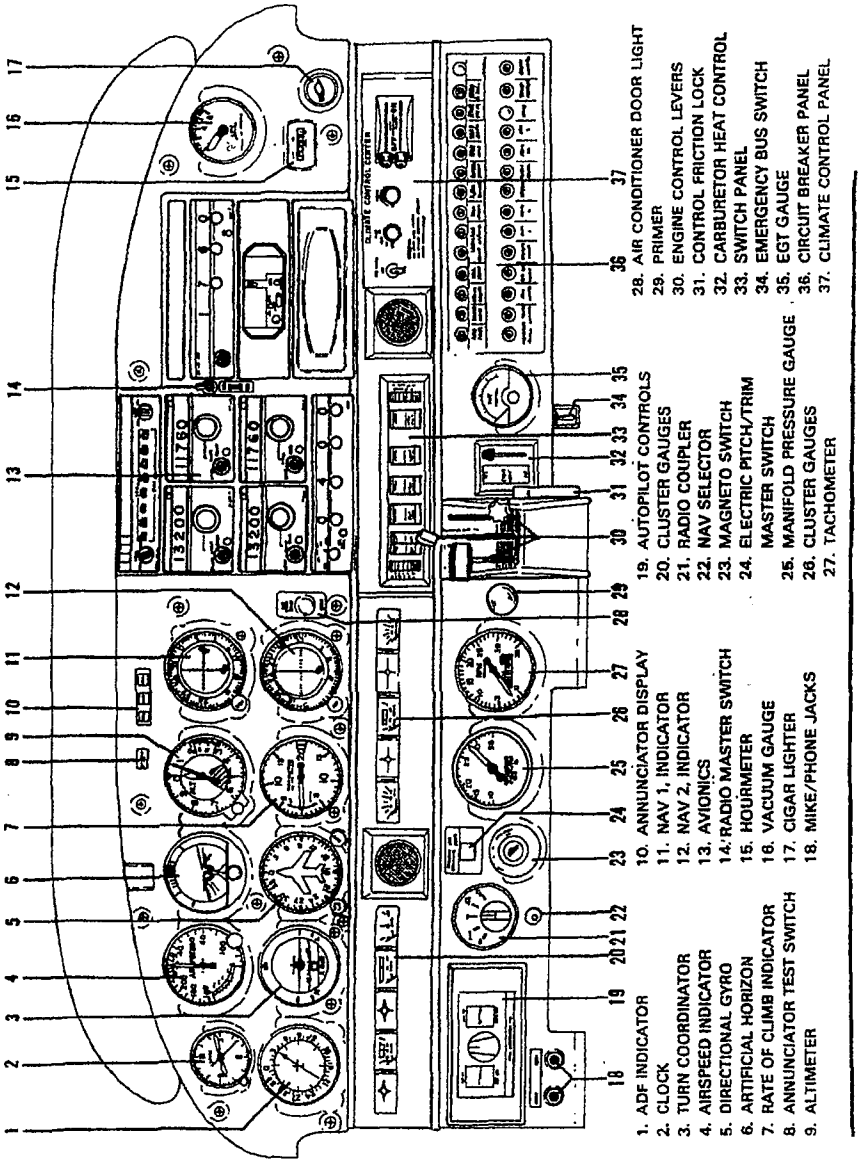
The vacuum gauge, mounted on the right instrument panel to the right of the radios, provides valuable information to the pilot about the operation of the vacuum system. A decrease in pressure in a system that has remained constant over an extended period may indicate a dirty filter, dirty screens, possibly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

A vacuum regulator is provided in the system to protect the gyros. The valve is set so the normal vacuum reads 5.0 ± .1 inches of mercury, a setting which provides sufficient vacuum to operate all the gyros at their rated RPM. Higher settings will damage the gyros, and with a low setting the gyros will be unreliable. The regulator is located behind the instrument panel.

7.21 INSTRUMENT PANEL

The instrument panel accommodates the customary advanced flight instruments and the normally required power plant instruments (Figure 7-15). The artificial horizon and directional gyro are vacuum operated through use of a vacuum pump installed on the engine, while the turn and bank instrument is electrically operated. A vacuum gauge is mounted on the far right side of the instrument panel. The radios and circuit breakers are on the right-hand instrument panel, and extra circuits are provided for the addition of optional radio equipment. An optional radio master switch is located near the top of the instrument panel between the radio stacks. It controls the power to all radios through the aircraft master switch. An emergency bus

*Optional equipment



INSTRUMENT PANEL
Figure 7-15

switch is also provided to give auxiliary power to the avionics bus in the event of a radio master switch circuit failure. The emergency bus switch is located behind the lower right shin guard left of the circuit breaker panel. An annunciator panel is mounted in the upper instrument panel to warn the pilot of a possible malfunction in the alternator, oil pressure or vacuum systems.

7.23 PITOT-STATIC SYSTEM

The system (Figure 7-17) supplies both pitot and static pressure for the airspeed indicator and static pressure for the altimeter and vertical speed indicator (when installed).

Pitot pressure is picked up by the pitot head on the underside of the left wing. An optional heated pitot head, which alleviates problems with icing or heavy rain, is available. The switch for pitot heat is located on the switch panel.

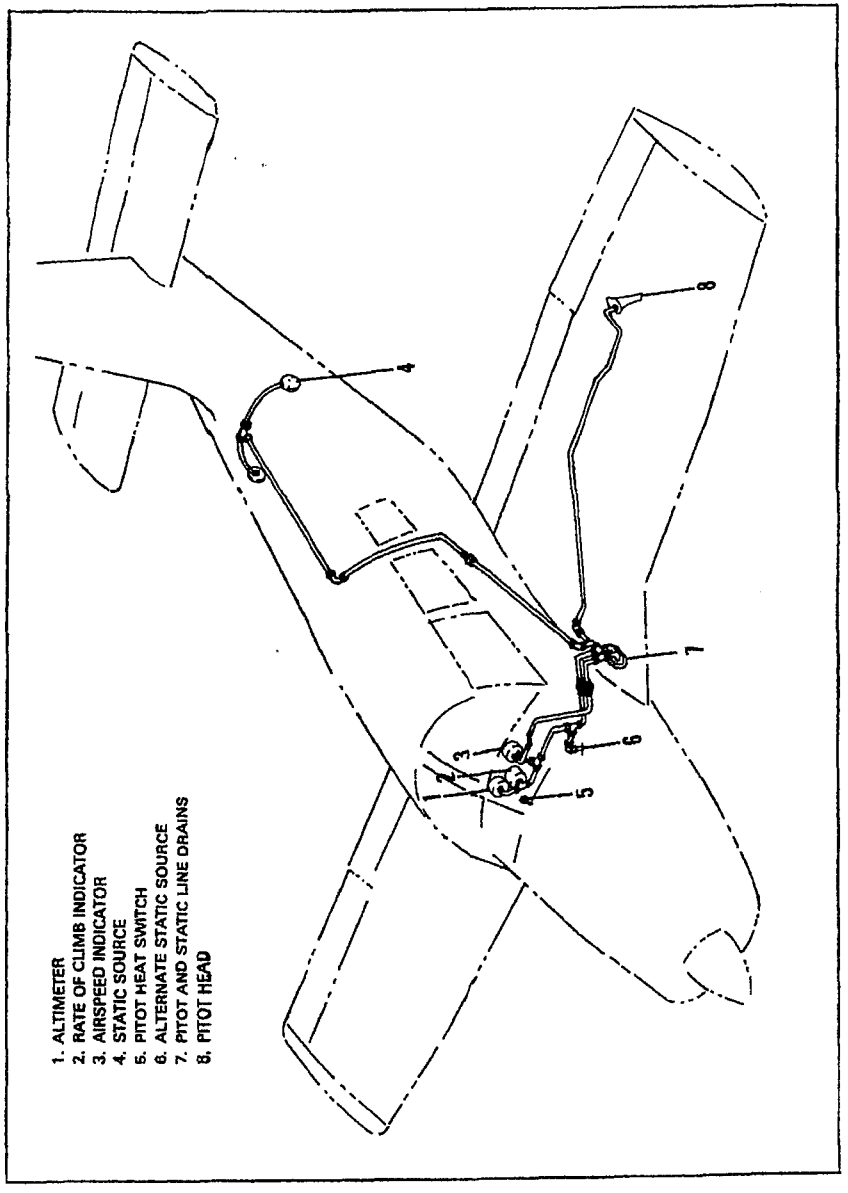
Static pressure is sensed by static pads on each side of the aft fuselage. Push-button type pitot and static drains are located on the lower left sidewall of the cockpit.

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

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

NOTE

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



PITOT-STATIC SYSTEM
Figure 7-17

7.25 HEATING AND VENTILATING SYSTEM

The heating system is designed to supply warm air to the cabin during winter and cool weather flights. The system includes a heat shroud, heat ducts, defroster outlets, heat and defroster controls.

CAUTION

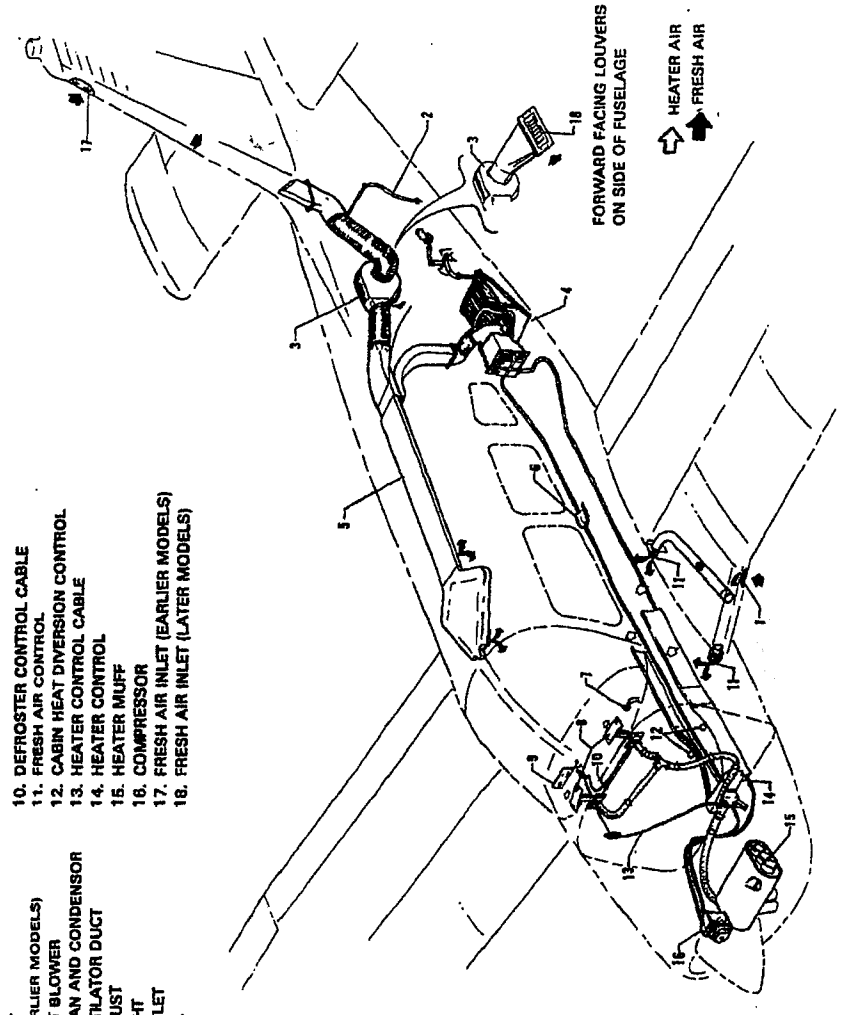
When cabin heat is operated, heat duct surface becomes hot. This could result in burns if arms or legs are placed too close to heat duct outlets or surface.

Fresh air is ducted from the left engine baffle to the heater muff which is attached to the muffler. The heated air is then ducted to the valve box mounted on the firewall. When the valve is open, heated air enters the heat ducts located along each side of the center console. Outlets in the heat ducts are located at each seat location. Airflow to the rear seats can be regulated by controls in the heat ducts located between the front seats. The temperature of the cabin is regulated by the heater control located on the right side of the instrument panel.

Defrosting is accomplished by heat outlets located on the right and left side of the cowl cover. Heated air is ducted directly from the heater valve box to the defroster shut-off valves at the firewall and then to the defroster outlets. The airflow is regulated by a defroster control located below the heat control.

To aid air distribution, the cabin air is exhausted overboard by an outlet located on the bottom of the fuselage. Cabin exhaust outlets are located below and outboard of the rear seats.

An optional overhead ventilating system with outlets over each seat is also available. An additional option to aid in fresh air circulation on models without air conditioning is a cabin air blower to force air through the overhead vent system. This blower is operated by a fan switch with three positions - "OFF," "LOW," and "HIGH." The switch is located on the right side of the instrument panel with the heater and defroster controls.



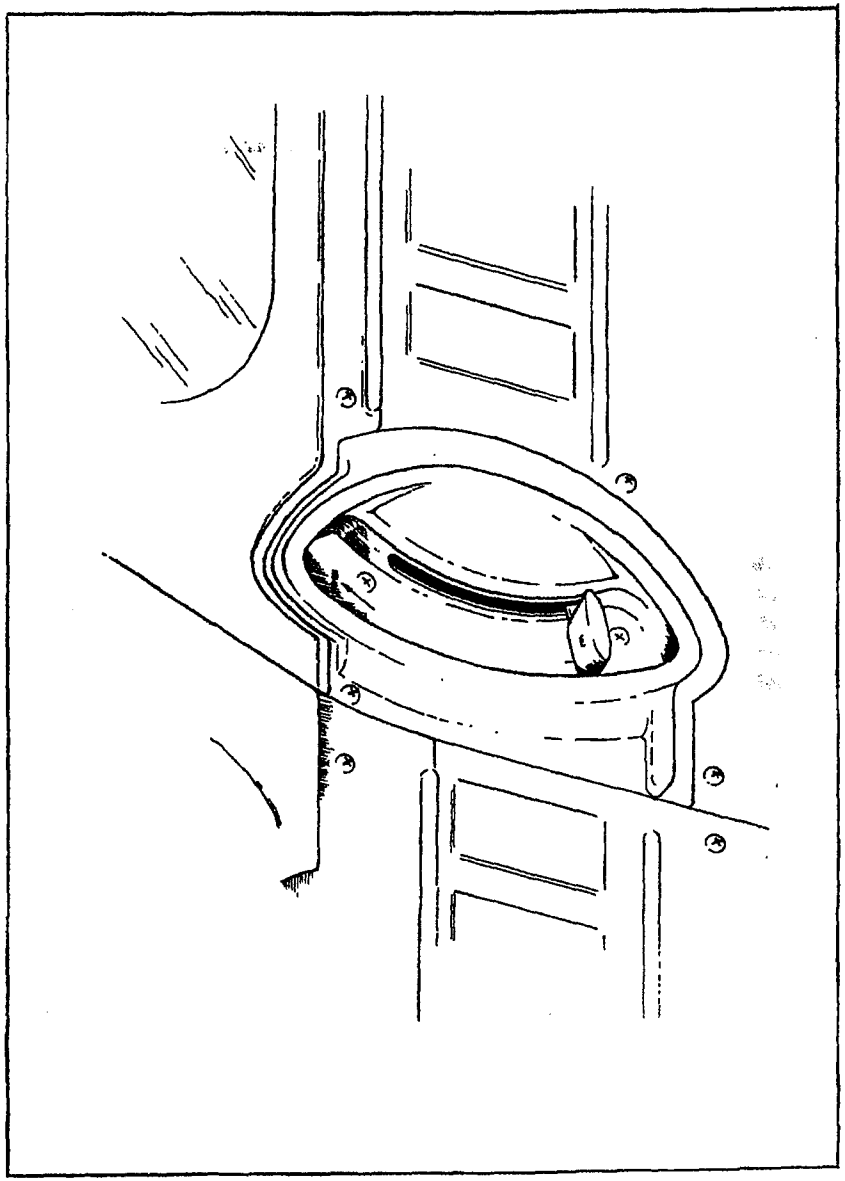
HEATING AND VENTILATING SYSTEM
Figure 7-19

7.27 CABIN FEATURES

All seat backs have three positions: normal, intermediate and recline. The adjustment lever is located at the base of the seat back on the outboard side of the seat. The front seats adjust fore and aft for ease of entry and occupant comfort. An armrest is located on the side panels adjacent to the front seat. The rear seats are removable to provide room for bulky items. Rear seat installations incorporate leg retainers with latching mechanisms which must be released before the rear seats can be removed. Releasing the retainers is accomplished by depressing the plunger behind each rear leg. Optional headrests are available.

Shoulder harnesses with inertia reels are provided for each front seat occupant. On aircraft serial numbers 28-7911001 through 28-8411031, shoulder harnesses with inertia reels were provided as optional equipment for the occupants of the rear seats. On aircraft serial numbers 28-8511001 and up, shoulder harnesses with inertia reels are provided as standard equipment for the occupants of the rear seats. A check of the inertia reel mechanism can be made by pulling sharply on the strap and checking that the reel will lock in place under sudden stress. This locking feature prevents the strap from extending and holds the occupant in place. Under normal movement, the strap will extend and retract as required. On earlier aircraft provided with a single strap adjustable shoulder harness located above the side window for each front seat, the shoulder strap is routed over the shoulder adjacent to the window and attached to the lap belt in the general area of the occupant's hip. Adjust this fixed strap so that all controls are accessible while maintaining adequate restraint for the occupant. Shoulder harnesses should be routinely worn during takeoff, landing, and whenever an inflight emergency situation occurs.

Additional features include pilot storm window, two sun visors, ash-trays for each occupant, map pockets located on the side panels below the instrument panel, miscellaneous pockets on the rear of the front seat backs, armrests for the front occupants, cabin or baggage door locks and ignition lock.



CABIN DOOR LATCH
Figure 7-21

7.29 BAGGAGE AREA

A 24 cubic foot baggage area, located behind the rear seats, is accessible either from the cabin or through an outside baggage door on the right side of the aircraft. Maximum capacity is 200 pounds. Tie-down straps are provided and should be used at all times.

NOTE

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

7.31 STALL WARNING

An approaching stall is indicated by a stall warning indicator which is activated between five and ten knots above stall speed. Mild airframe buffeting and gentle pitching may also precede the stall. Stall speeds are shown on graphs in the Performance Section. The stall warning indicator is a continuous sounding horn located behind the instrument panel. The stall warning indicator is activated by a lift detector installed on the leading edge of the left wing. During preflight, the stall warning system should be checked by turning the master switch ON, lifting the detector and checking to determine if the indicator is actuated.

7.33 FINISH

All exterior surfaces are primed with etching primer and finished with acrylic lacquer. An optional polyurethane enamel finish is available.

7.35 PIPER EXTERNAL POWER*

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

7.37 EMERGENCY LOCATOR TRANSMITTER*

The Emergency Locator Transmitter (ELT) when installed, is located in the aft portion of the fuselage just below the stabilator leading edge and is accessible through a plate on the right side of the fuselage. This plate is attached with slotted-head nylon screws for ease of removal; these screws may be readily removed with a variety of common items such as a dime, a key, a knife blade, etc. If there are no tools available in an emergency the screw heads may be broken off by any means. The ELT is an emergency locator transmitter which meets the requirements of FAR 91.52.

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 or 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 tests must be made at any other time, the tests should be coordinated with the nearest FAA tower or flight service station.

NARCO ELT 10 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.

*Optional equipment

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.

A pilot's remote switch located on the left side panel is provided to allow the transmitter to be turned on from inside the cabin. The pilot's remote switch is placarded "ON" and "ARMED." The switch is normally in the ARMED position. Moving the switch to ON will activate the transmitter. Moving the switch back to the ARMED position will turn off the transmitter only if the impact switch has not been activated.

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.

CCC CIR 11-2 OPERATION

On the unit itself is a three position selector switch placarded "OFF," "ARM" and "ON." The ARM position is provided to set the unit to the automatic position so that it will transmit only after impact and will continue to transmit until the battery is drained to depletion or until the switch is manually moved to the OFF position. The ARM position is selected when the transmitter is installed at the factory and the switch should remain in that position whenever the unit is installed in the airplane. The ON position is provided so the unit can be used as a portable transmitter or in the event the automatic feature was not triggered by impact or to periodically test the function of the transmitter.

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

NOTE

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

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

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

The locator should be checked during the ground check to make certain the unit has not been accidently activated. Check by tuning a radio receiver to 121.50 MHz. If there is an oscillating sound, the locator may have been activated and should be turned off immediately. Reset to the ARM position and check again to ensure against outside interference.

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 left side 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.

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.

7.39 AIR CONDITIONING*

The air conditioning system is a recirculating air system. The major items include: evaporator, condenser, compressor, blower, switches and temperature controls.

The evaporator is located behind the left rear side of the baggage compartment. This cools the air that is used for air conditioning.

The condenser is mounted on a retractable scoop located on the bottom of the fuselage and to the rear of the baggage compartment area. The scoop extends when the air conditioner is on and retracts to a flush position when the system is off.

The compressor is mounted on the forward right underside of the engine. It has an electric clutch which automatically engages or disengages the compressor to the belt drive system of the compressor.

An electrical blower is mounted on the aft side of the rear cabin panel. Air from the baggage area is drawn through the evaporator by the blower and distributed through an overhead duct to individual outlets located adjacent to each occupant.

The switches and temperature control are located on the lower right side of the instrument panel in the climate control center panel. The temperature control regulates the desired temperature of the cabin. Turn the control clockwise for increased cooling, counterclockwise for decreased cooling.

Located inboard of the temperature control is the fan speed switch and the air conditioning ON-OFF switch. The fan can be operated independently of the air conditioning. However, it must be on for air conditioner operation. Turning either switch off will disengage the compressor clutch and retract the condenser door. Cooling air should be felt within one minute after the air conditioner is turned on.

NOTE

If the system is not operating in 5 minutes, turn the system OFF until the fault is corrected.

*Optional equipment

The FAN switch allows operation of the fan with the air conditioner turned OFF to aid cabin air circulation if desired. A "LOW," "MED" or "HIGH" flow of air can be selected to the air conditioner outlets located in the overhead duct. The outlets can be adjusted or turned off by each occupant to regulate individual cooling effect.

The "DOOR OPEN" indicator light is located to the left of the radio stack in front of the pilot. The light illuminates whenever the condenser door is open and remains on until the door is closed.

A circuit breaker located on the circuit breaker panel protects the air conditioning electrical system.

Whenever the throttle is in the full throttle position, it actuates a micro switch which disengages the compressor and retracts the scoop. This is done to obtain maximum power and maximum rate of climb. The fan continues to operate and the air will remain cool for approximately one minute. When the throttle is retarded approximately 1/4 inch, the clutch will engage and the scoop will extend, again supplying cool, dry air.

7.41 CARBURETOR ICE DETECTION SYSTEM

A carburetor ice detection system is available as optional equipment. The system consists of a control box mounted on the instrument panel, a probe sensor mounted in the carburetor and a red warning light to indicate the presence of ice in the carburetor.

If ice is present apply full carburetor heat. Refer to 3.22, Carburetor Icing, in the emergency procedures.

To adjust the system for critical ice detection first turn on the airplane's master switch and then turn on the ice detection unit. Turn the sensitivity knob fully counter clockwise causing the carb ice light to come on. Now rotate the sensitivity knob back (clockwise) until the ice light just goes out. This establishes the critical setting.

WARNING

This instrument is approved as optional equipment only and flight operations should not be predicated on its use.

TABLE OF CONTENTS

SECTION 8

AIRPLANE HANDLING, SERVICING AND MAINTENANCE

SECTION 8

AIRPLANE HANDLING, SERVICING, AND MAINTENANCE

8.1 GENERAL

This section provides general guidelines relating to the handling, servicing, and maintenance of the Dakota. For complete maintenance instructions, refer to the PA-28-236 Maintenance Manual.

Every owner should stay in close contact with an authorized Piper Service Center or Piper's Customer Service 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 incluidng 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.

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 (i.e.: 50, 100, 500, and 1000 hours) for the PA-28-236 Dakota. Appropriate forms are contained in the PA-28-236 Maintenance Manual, and 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 Aircarft 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.

A spectographic 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 FAR Part 61 may perform certain preventive maintenance described in FAR Part 43. This maintenance may be performed only on an aircraft which the pilot owns or operates and which is not used to carry persons or property for hire, except as provided in applicable FAR's. Although such maintenance is allowed by law, each individual should make a self-analysis as to whether he has the ability to perform the work.

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

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

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

8.7 AIRPLANE ALTERATIONS

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

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

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

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

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

8.9 GROUND HANDLING

(a) Towing

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

CAUTION

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

CAUTION

Do not tow the airplane when the controls are secured.

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

(b) Taxiing

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

(1) Taxi a few feet forward and apply the brakes to determine their effectiveness.
(2) Taxi with the propeller set in low pitch, high RPM setting.
(3) While taxiing, make slight turns to ascertain the effectiveness of the steering.
(4) Observe wing clearance when taxiing near buildings or other stationary objects. If possible, station an observer outside the airplane.
(5) When taxiing over uneven ground, avoid holes and ruts.
(6) Do not operate the engine at high RPM when running up or taxiing over ground containing loose stones, gravel, or any loose material that might cause damage to the propeller blades.

(c) Parking

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

(1) To park the airplane, head it into the wind if possible.

(2) Set the parking brake by pulling back on the brake lever and depressing the knob on the handle. To release the parking brake, pull back on the handle until the catch disengages; then allow the handle to swing forward.

CAUTION

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

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

(d) Mooring

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

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

CAUTION

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

NOTE

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

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

8.11 ENGINE AIR FILTER

(a) Removing Engine Air Filter

(1) Remove the front cowl scoop.
(2) Unfasten the quarter-turn fasteners securing the filter.

(b) Cleaning Engine Air Filter

The induction air filter should be checked during each preflight inspection and cleaned or replaced if found to be dirty. Replace the filter after one year, after ten cleanings or 500 flight hours, whichever comes first.

To clean the filter:
(1) Blow compressed air through the filter in the opposite direction of normal airflow to remove light dust contaminants. Air pressure is to be less than 100 psi and keep the nozzle at least one inch from the filter to prevent damage.
(2) If the filter is excessively dirty, flush filter with running water (less than 40 psi) and soak it in a solution of Donaldson D-1400 compound and water. Do not use solvents or gasoline. Rinse until clear water comes through the filter.
(3) Dry the filter thoroughly before inspection. Mechanical dryers may be used provided the heated air is circulated and maintained below 180°F. Do not use a light bulb.
(4) Inspect filter medium for holes or tears and insure the frame provides a good air seal. Replace filter if defects are found.

(c) Installation of Engine Air Filter

After cleaning or replacing the filter, install the filter in the reverse order of removal.

8.13 BRAKE SERVICE

The brake system is filled with MIL-H-5606 (petroleum base) hydraulic brake fluid. The fluid level should be checked periodically or at every 50 hour inspection and replenished when necessary. The brake reservoir is located on the left side of the fire wall in the engine 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 LANDING GEAR SERVICE

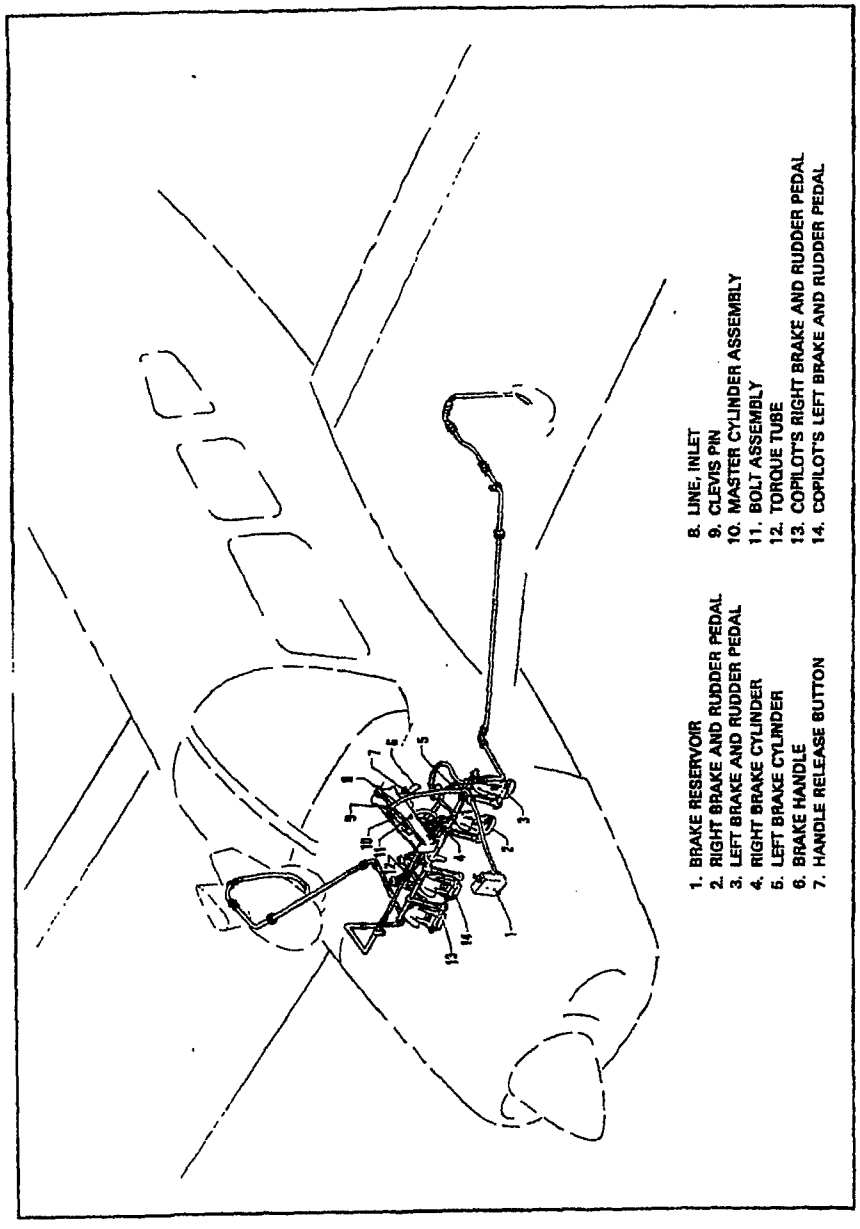
The landing gears use 6.00 x 6 wheels. All three tires are 6.00 x 6 tube type. The main gear tires are 6 ply rating and the nose gear tire is 4 ply rating. (See Section 8.23.)

Main wheels are removed by taking off the hub cap, axle nut, and the two bolts holding the brake segment in place, after which the wheel slips easily from the axle.

The nose wheel is removed by taking off the axle nut and washer from one side, sliding out the axle rod and plugs, lightly tapping out the axle tube, and then removing the wheel and spacer tubes from between the fork. Wheels are replaced by reversing the procedure.

Tires are removed from the wheels by deflating the tire, removing the through bolts, and separating the wheel halves.

Landing gear oleo struts should be checked for proper strut exposure and visible leaks. The required extensions for the struts under normal static load (empty weight of airplane plus full fuel and oil) are 3.25 inches for the nose gear and 4.5 inches for the main gear. If the strut exposure is below that required, it should be determined whether air or oil is needed by first raising the airplane on jacks. Depress the valve core to allow air to escape from the strut housing chamber. Remove the filler plug and slowly raise the strut to full compression. If the fluid is then visible up to the bottom of the filler plug hole, only proper inflation with air is required.



BRAKE SYSTEM
Figure 8-1

If fluid is below the bottom of the filler plug hole, oil should be added. Replace the plug with the valve core removed. Then attach a clear plastic hose to the valve stem of the filler plug and submerge the free end in a container of hydraulic fluid (MIL-H-5606). Fully compress and extend the strut several times, thus drawing fluid into the strut chamber and expelling air. To allow fluid to enter the bottom chamber of the main gear strut housing, it is necessary to disconnect the torque link assembly and allow the strut to extend a full 10 inches. (The nose gear torque links need not be disconnected.) DO NOT allow the strut to extend beyond 12 inches. When air bubbles cease to flow through the hose, fully compress the strut, remove the filler plug, and again check the fluid level. When the fluid level is correct, disconnect the hose, reinstall the valve core, the filler plug, and the main gear torque links.

With the fluid in the strut housing at the proper level, attach a strut pump to the air valve. With the airplane on the ground under normal static load, inflate the oleo strut to the proper strut exposure.

In jacking the airplane for landing gear or other service, two hydraulic jacks and a tail stand should be used. At least 425 pounds of ballast should be placed on the base of the tail stand before jacking up the airplane. The hydraulic jacks are placed under the jack points on the underside of the wings, and the airplane is jacked up until the tail stand can be attached to the tail skid. After attaching the tail stand and adding ballast, the jacking can be continued until the airplane is at the desired height.

8.17 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. If found, they should be repaired as soon as possible by a rated mechanic, since a nick or scratch causes an area of increased stress which can lead to serious cracks or the loss of a propeller tip. The back face of the blades should be painted when necessary with flat black paint to retard glare. To prevent corrosion, the surface should be cleaned and waxed periodically.

8.19 OIL REQUIREMENTS

The oil capacity of the Lycoming O-540 series engine is 12 quarts, and the minimum safe quantity is 2-3/4 quarts. It is recommended that engine oil be drained and replenished every 50 hours. The oil filter element should be changed every 50 hours of operation. The interval between oil and oil filter changes should not exceed a total of four (4) months. Under unfavorable dusty conditions, the oil and oil filter should be changed more frequently.

The following seasonal aviation oil grades and seasonal ambient temperature ranges are recommended:

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

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

NOTE

Refer to the latest issue of Textron Lycoming Service Instruction 1014 (Lubricating Oil Recommendations) for further information.

8.21 FUEL SYSTEM

(a) Servicing Fuel System

At every 50 hour inspection, the fuel screens in the strainer and in the carburetor must be cleaned. The screen in the carburetor is located in the housing where the fuel line connects to the carburetor. The fuel strainer is located on the lower left side of the firewall and is accessible for cleaning with the lower cowl removed. After cleaning, a small amount of grease applied to the gasket will facilitate reassembly.

(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 for additional information.

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

FUEL GRADE COMPARISON CHART

Previous Commercial Fuel Grades (ASTM-D910)			Current Commercial Fuel Grades (ASTM-D910-75)			Current Military Fuel Grades (MIL-G-5572F)		
Grade	Color	Max. TEL ml/U.S. gal	Grade	Color	Max. TEL ml/U.S. gal	Grade	Color	Max. TEL ml/U.S. gal
80/87	red	0.5	80	red	0.5	80/87	red	0.5
91/96	blue	2.0	*100LL	blue	2.0	100/130	blue	2.0
100/130	green	3.0	100	green	**3.0	none	none	none
115/145	purple	4.6	none	none	none	115/145	purple	4.6

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

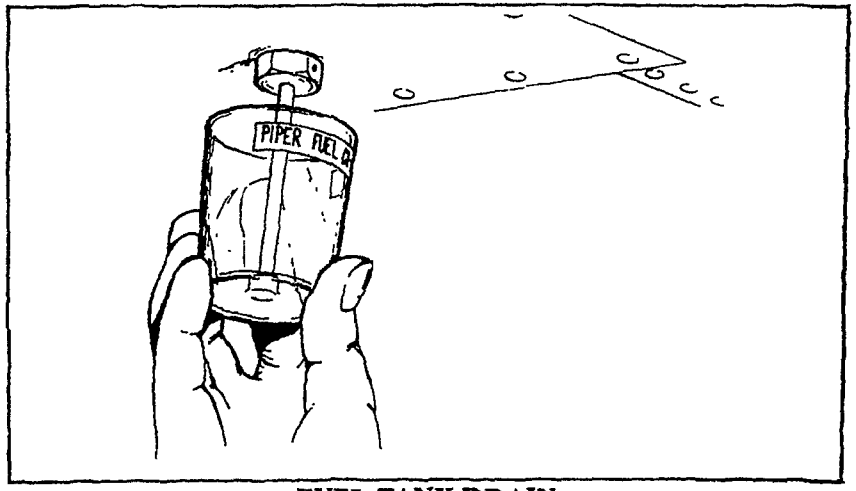
The operation of the aircraft is approved with an anti-icing additive in the fuel. When an anti-icing additive is used, it must meet the specification MIL-I-27686, must be uniformly blended with the fuel while refueling, must not exceed .15% by volume of the refueled quantity, and to ensure its effectiveness should be blended at not less than .10% by volume. One and one half liquid ozs. per ten 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 cannot be used as a substitute for preflight draining of the fuel system drains.



FUEL TANK DRAIN
Figure 8-3

(c) Filling Fuel Tanks

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 38.5 U.S. gallons. When using less than the standard 77 gallon capacity, fuel should be distributed equally between each side. There is approximately 25 gallons in the fuel tank when the fuel level is even with the bottom of the filler neck indicator.

(d) Draining Fuel Valves and Lines

The fuel strainer, located on the lower left side of the firewall, is provided with a quick drain which should be drained before the first flight of the day or after refueling, to check for fuel contamination. If contamination is found, fuel should be drained until the contamination stops. If contamination persists after draining fuel for a minute, contact a mechanic to check the fuel system.

Each fuel tank is provided with a fuel quick drain to check for contamination. Each tank should be checked for contamination in accordance with the above procedure.

(e) Draining Fuel System

The bulk of the fuel may be drained from the fuel cells by the use of a siphon hose placed in the cell or tank through the filler neck. The remainder of the fuel may be drained by opening all the drain valves.

— *CAUTION* —

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

After using the fuel system drains, check to be sure that they are closed completely and are not leaking.

8.23 TIRE INFLATION

For maximum service from the tires, keep them inflated to the proper pressures — 29 psi for the nose gear and 35-40 psi for the main gear. 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.

8.25 BATTERY SERVICE

Access to the 12-volt battery is through the right rear baggage compartment. The battery box has a plastic tube which is normally closed off with a cap and which should be opened occasionally to drain off any accumulation of liquid. 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.

If the battery is not up to charge, recharge starting at a 4 amp rate and finishing with a 2 amp rate. Quick charges are not recommended.

8.27 CLEANING

(a) Cleaning Engine Compartment

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

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

CAUTION

Do not spray solvent into the alternator, vacuum pump, 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) Remove the protective tape from the magnetos.
(5) Lubricate the controls, bearing surfaces, etc., in accordance with the Lubrication Chart in the PA-28 Service Manual.

(b) Cleaning Landing Gear

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

(1) Place a pan under the gear to catch waste.
(2) Spray or brush the gear area with solvent or a mixture of solvent and degreaser, as desired. Where heavy grease and dirt deposits have collected, it may be necessary to brush areas that were sprayed, in order to clean them.

(3) Allow the solvent to remain on the gear from five to ten minutes. Then rinse the gear with additional solvent and allow to dry.
(4) Remove the cover from the wheel and remove the catch pan.
(5) Lubricate the gear in accordance with the Lubrication Chart in the PA-28 Service Manual.

(c) Cleaning Exterior Surfaces

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

(1) Flush away loose dirt with water.
(2) Apply cleaning solution with a soft cloth, a sponge or a soft bristle brush.
(3) To remove exhaust stains, allow the solution to remain on the surface longer.
(4) To remove stubborn oil and grease, use a cloth dampened with naptha.
(5) Rinse all surfaces thoroughly.
(6) Any good automotive wax may be used to preserve painted surfaces. Soft cleaning cloths or a chamois should be used to prevent scratches when cleaning or polishing. A heavier coating of wax on the leading surfaces will reduce the abrasion problems in these areas.

(d) Cleaning Windshield and Windows

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

(3) Remove oil and grease with a cloth moistened with kerosene.

CAUTION

Do not use gasoline, alcohol, benzene, carbon 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 severe scratch or mar in plastic can be removed by rubbing out the scratch with jeweler's rouge. Smooth both sides and apply wax.

(e) Cleaning Headliner, Side Panels and Seats

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

CAUTION

Solvent cleaners require adequate ventilation.

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

TABLE OF CONTENTS

SECTION 9

SUPPLEMENTS

SECTION 9

SUPPLEMENTS

9.1 GENERAL

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

All of the Supplements provided by 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.

SUPPLEMENT 1

AUTOFLITE II AUTOPILOT INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional AutoFlite II Autopilot is installed in accordance with STC SA3066SW-D. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional AutoFlite II Autopilot is installed.

SECTION 2 - LIMITATIONS

(a) Autopilot operation prohibited above 155 KIAS.
(b) Autopilot must be OFF for takeoff and landing.

SECTION 3 - EMERGENCY PROCEDURES

(a) In case of malfunction, depress interrupt switch on pilot's control wheel, or overpower autopilot at either control wheel.
(b) AutoFlite II master switch - OFF.
(c) In climb, cruise or descent configuration a malfunction with a 3 second delay in recovery initiation may result in a 60° bank and a 320 foot altitude loss. Maximum altitude loss measured at 155 KIAS in a descent.
(d) In approach configuration, coupled or uncoupled; a malfunction with a 1 second delay in recovery initiation may result in a 15° bank and a 20 foot altitude loss.

SECTION 4 - NORMAL PROCEDURES

PREFLIGHT INSPECTION

(a) AutoFlite II master switch - ON.
(b) Rotate turn command knob to left and right. Aircraft control wheels should rotate in corresponding directions.
(c) With AutoFlite II on, rotate aircraft control wheel to left and right. Only light forces should be required to override roll servo clutch.
(d) AutoFlite II master switch - OFF - rotate control wheel left and right to assure disengagement.

IN-FLIGHT PROCEDURE

(a) Engagement
  (1) Check turn command knob in center detent position.
  (2) AutoFlite II master switch - ON.

(b) Disengagement
  (1) AutoFlite II master switch - OFF.

(c) Heading Changes
  (1) Move trim knob on instrument for drift correction from a constant heading.
  (2) Move turn command knob for left or right banked turns. Rotation of knob to stop will yield an appropriate bank angle to obtain an approximate standard rate turn. Intermediate settings may be used for lesser turn rates.

(d) OMNI Tracker
  (1) Turn command knob - move to center detent position and push IN to engage tracker. Aircraft will track desired radial established on NAV I (or as selected, if equipped with a NAV selector switch).

NOTE

Tracker must be engaged within 10° of being "on course," i.e. VOR course needle centered and aircraft heading within a 10° of VOR course.

(2) Trim knob - push IN for high sensitivity. Use high sensitivity position for localizer tracking and as desired for OMNI tracking.

(e) Maintain directional trim during all autopilot operations.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

SUPPLEMENT 2

AUTOCONTROL IIIB AUTOPILOT INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Piper AutoControl IIIB is installed in accordance with STC SA3065SW-D. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional Piper AutoControl IIIB Autopilot is installed.

SECTION 2 - LIMITATIONS

(a) Autopilot operation prohibited above 155 KIAS.
(b) Autopilot OFF for takeoff and landing.

SECTION 3 - EMERGENCY PROCEDURES

(a) In an emergency the autopilot can be disconnected by pushing the roll ON-OFF rocker switch to OFF.
(b) The autopilot can be overpowered at either control wheel.
(c) An autopilot runaway, with a 3 second delay in the initiation of recovery, while operating in climb, cruise or descending flight, could result in a 60° bank and a 320 foot altitude loss. Maximum altitude loss measured at 155 KIAS in a descent.
(d) An autopilot runaway, with a 1 second delay in the initiation of recovery, during an approach operation, coupled or uncoupled, could result in a 15° bank and a 20 foot altitude loss.

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

NSD 360A

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

(2) To disable heading card - pull circuit breaker and use magnetic compass for directional data. (Factory installations may utilize NSD and electric trim circuit breaker.)

— NOTE —

If heading card is not operational, autopilot should not be used.

(3) With card disabled, VOR/Localizer and Glide Slope displays are still functional; use card set to rotate card to aircraft heading for correct picture.

(4) Slaving Failure - (i.e. failure to self-correct for gyro drift):
   a. Check that gyro slaving switch is set to No. 1 position (if equipped with Slave No. 1 - No. 2 switch) or "Slaved" position when equipped with Slaved and Free Gyro Mode Switch.
   b. Check for HDG flag.
   c. Check compass circuit breaker.
   d. Reset heading card while observing slaving meter.

— NOTE —

Dead slaving meter needle or a needle displaced fully one direction indicates a slaving system failure.

   e. Select slaving amplifier No. 2, if equipped. If not equipped, proceed with item g below.
   f. Reset heading card while checking slaving meter. If proper slaving indication is not obtained,
   g. Switch to free gyro mode and periodically set card as unslaved gyro.

NOTE

In the localizer mode, the TO-FROM arrows may remain out of view, depending upon the design of the NAV converter used in the installation.

SECTION 4 - NORMAL PROCEDURES

PREFLIGHT INSPECTION

(a) AUTOPILOT
  (1) Place Radio Coupler (if installed) in HDG mode and place the AP ON-OFF switch to the ON position to engage roll section. Rotate roll command knob left and right and observe that control wheel describes a corresponding left and right turn, then center knob.
  (2) Set proper D.G. heading on D.G. and turn HDG bug to aircraft heading. Engage HDG mode rocker switch and rotate HDG bug right and left. Aircraft control wheel should turn same direction as bug. Grasp control wheel and manually override servo, both directions.

(b) RADIO COUPLER - (OPTIONAL)
  (1) Tune and identify VOR or VOT station. Position Radio Coupler to OMNI mode. Engage autopilot ON and HDG switches. Set HDG bug to aircraft heading and rotate O.B.S. to cause OMNI indicator needle to swing left and right slowly. Observe that control wheel rotates in direction of needle movement.
  (2) Disengage AP ON-OFF switch. Reset Radio Coupler control to HDG.

IN-FLIGHT

(a) Trim airplane (ball centered).

(b) Check air pressure/vacuum to ascertain that the directional gyro and attitude gyro are receiving sufficient air.

(c) Roll Section
(1) To engage, center ROLL knob, push AP ON-OFF switch to ON position. To turn, rotate console ROLL knob in desired direction. (Maximum angle of bank should not exceed 30°.)
(2) For heading mode, set directional gyro with magnetic compass. Push directional gyro HDG knob in, rotate bug to aircraft heading. Push console heading rocker (HDG) switch to ON position. To select a new aircraft heading, push D.G. heading knob IN and rotate, in desired direction of turn, to the desired heading.

(d) Radio Coupling VOR-ILS with HSI Type Instrument Display - (Optional)
(1) VOR Navigation
a. Tune and identify VOR station. Select desired course with O.B.S. (HSI Course Knob).
b. Select OMNI mode on radio coupler.
c. Select HDG mode on autopilot console to engage coupler. Aircraft will turn to a 45° intercept angle to intercept the selected VOR course. Intercept angle magnitude depends on radio needle off course magnitude, 100% needle deflection will result in 45° intercept with the intercept angle diminishing as the needle off set diminishes.
d. NAV mode - NAV mode provides reduced VOR sensitivity for tracking weak, or noisy VOR signals. NAV mode should be selected after the aircraft is established on course.

(2) ILS-LOC Front Course
a. Set inbound, front, localizer course on O.B.S. (HSI Course Knob).
b. Select LOC-Normal on radio coupler to intercept and track inbound on the localizer. Select LOC-REV to intercept and track outbound to the procedure turn area.
c. Select HDG mode on autopilot console to engage coupler.

(3) ILS - Back Course
   a. Set inbound, front localizer course on O.B.S. (HSI Course Knob).
   b. Select LOC-REV on radio coupler to intercept and track inbound on the back localizer course. Select LOC-NORM to intercept outbound on the back course to the procedure turn area.
   c. Select HDG mode on autopilot console to engage coupler.

(e) Radio Coupling - VOR/ILS with standard directional gyro - (Optional)
Radio Coupler operation in conjunction with a standard directional gyro and VOR/LOC display differs from operation with an integrated display (HSI) only in one respect. The HDG bug is used as the radio course datum and therefore must be set to match the desired VOR course as selected on the O.B.S.
   (1) For VOR Intercepts and Tracking:
   Select the desired VOR course and set the HDG bug to the same heading. Select OMNI mode on the coupler and HDG mode on the autopilot console.
   (2) For ILS Front Course Intercepts and Tracking:
   Tune the localizer frequency and place the HDG bug on the inbound, front course heading. Select LOC-NORM mode on the coupler and HDG mode on the autopilot console.
   (3) For LOC Back Course Intercepts and Tracking:
   Tune the localizer frequency and place the HDG bug on the inbound course heading to the airport. Select LOC-REV mode with coupler and HDG mode on the autopilot console.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

SUPPLEMENT 3

PIPER ELECTRIC PITCH TRIM

SECTION 1 - GENERAL

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

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional Piper Electric Pitch Trim is installed.

SECTION 2 - LIMITATIONS

No changes of the basic limitations provided by Section 2 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 3 - EMERGENCY PROCEDURES

In case of malfunction, disengage electric pitch trim by activating pitch trim switch on instrument panel to OFF position.

In emergency, electric pitch trim may be overpowered using manual pitch trim.

In cruise configuration, malfunction results in 10° pitch change and 200 ft. altitude variation.

In approach configuration, malfunction results in 5° pitch change and 50 ft. altitude loss.

SECTION 4 - NORMAL PROCEDURES

The electric trim system may be turned ON or OFF by a switch located above the ignition switch. The pitch trim may be changed when the electric trim system is turned on either by moving the manual pitch trim control wheel or by operating the trim control switch on the pilot's control yoke.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

SUPPLEMENT 4

AIR CONDITIONING INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the efficient operation of the airplane when the optional air conditioning system is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional air conditioning system is installed.

SECTION 2 - LIMITATIONS

(a) To insure maximum climb performance the air conditioner must be turned "OFF" manually prior to takeoff to disengage the compressor and retract the condenser door. Also the air conditioner must be turned "OFF" manually before the landing approach in preparation for a possible go-around.

(b) Placards
In full view of the pilot, in the area of the air conditioner controls when the air conditioner is installed:

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

In full view of the pilot, to the right of the engine gauges (condenser door light):

"AIR COND DOOR
OPEN"

SECTION 3 - EMERGENCY PROCEDURES

No changes to the basic Emergency Procedures provided by Section 3 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 4 - NORMAL PROCEDURES

Prior to takeoff, the air conditioner should be checked for proper operation as follows:

(a) Check aircraft master switch "ON."
(b) Turn the air conditioner control switch to "ON" and the fan switch to one of the operating positions - the "AIR COND DOOR OPEN" warning light will turn on, thereby indicating proper air conditioner condenser door actuation.
(c) Turn the air conditioner control switch to "OFF" - the "AIR COND DOOR OPEN" warning light will go out, thereby indicating the air conditioner condenser door is in the up position.
(d) If the "AIR COND DOOR OPEN" light does not respond as specified above, an air conditioner system or indicator bulb malfunction is indicated and further investigation should be conducted prior to flight.

The above operational check may be performed during flight if an in flight failure is suspected.

The condenser door light is located to the right of the engine instrument cluster in front of the pilot. The door light illuminates when the door is open and is off when the door is closed.

SECTION 5 - PERFORMANCE

Operation of the air conditioner will cause slight decreases in cruise speed and range. Power from the engine is required to run the compressor, and the condenser door, when extended, causes a slight increase in drag. When the air conditioner is turned off there is normally no measurable difference in climb, cruise or range performance of the airplane.

NOTE

To insure maximum climb performance the air conditioner must be turned off manually before takeoff to disengage the compressor and retract the condenser door. Also the air conditioner must be turned off manually before the landing approach in preparation for a possible go-around.

Although the cruise speed and range are only slightly affected by the air conditioner operation, these changes should be considered in preflight planning. To be conservative, the following figures assume that the compressor is operating continuously while the airplane is airborne. This will be the case only in extremely hot weather.

(a) The decrease in true airspeed is approximately 4 KTS at all power settings.

(b) The decrease in range may be as much as 48 nautical miles for the 72 gallon capacity.

The climb performance is not compromised measurably with the air conditioner operating since the compressor is declutched and the condenser door is retracted, both automatically, when a full throttle position is selected. When the full throttle position is not used or in the event of a malfunction which would cause the compressor to operate and the condenser door to be extended, a decrease in rate of climb of as much as 100 fpm can be expected. Should a malfunction occur which prevents condenser door retraction when the compressor is turned off, a decrease in rate of climb of as much as 50 fpm can be expected.

SUPPLEMENT 5

CENTURY 21 AUTOPILOT INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Century 21 Autopilot is installed in accordance with STC SA3352SW. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional Century 21 Autopilot is installed.

SECTION 2 - LIMITATIONS

(a) Autopilot operation prohibited above 155 KIAS.
(b) Autopilot OFF during takeoff and landing.

SECTION 3 - EMERGENCY PROCEDURES

(a) AUTOPILOT
In the event of an autopilot malfunction, or anytime the autopilot is not performing as commanded, do not attempt to identify the problem. Regain control of the aircraft by overpowering and immediately disconnecting the autopilot by depressing the AP ON-OFF switch on the programmer OFF.

Do not operate until the system failure has been identified and corrected.

(1) Altitude Loss During Malfunction:
   a. An autopilot malfunction during climb, cruise or descent with a 3 second delay in recovery initiation could result in as much as 60° of bank and 320' altitude loss. Maximum altitude loss was recorded at 155 KIAS during descent.
   b. An autopilot malfunction during an approach with a 1 second delay in recovery initiation could result in as much as 15° bank and 20' altitude loss. Maximum altitude loss measured in approach configuration, and operating either coupled or uncoupled.

(b) COMPASS SYSTEM
(1) Emergency Operation With Optional NSD 360A (HSI) Slaved and/or Non-Slaved:

NSD 360A
a. Appearance of HDG Flag:
   1. Check air supply gauge (vac or pressure) for adequate air supply (4 in. Hg. min.).
   2. Check compass circuit breaker.
   3. Observe display for proper operation.
b. To disable heading card - pull circuit breaker and use magnetic compass for directional data.

— NOTE —

If heading card is not operational, autopilot should not be used.

c. With card disabled VOR/Localizer and Glide Slope displays are still functional; use card set to rotate card to aircraft heading for correct picture.
d. Slaving Failure - (i.e. failure to self correct for gyro drift):
   1. Check gyro slaving switch is set to No. 1 position (if equipped with Slave No. 1 - No. 2 switch) or "Slaved" position when equipped with Slaved and Free Gyro Mode Switch.
   2. Check for HDG Flag.
   3. Check compass circuit breaker.
   4. Reset heading card while observing slaving meter.

— NOTE —

Dead slaving meter needle or a needle displaced fully one direction indicates a slaving system failure.

5. Select slaving amplifier No. 2, if equipped.
6. Reset heading card while checking slaving meter. If proper slaving indication is not obtained, switch to free gyro mode and periodically set card as an unslaved gyro.

— NOTE —

In the localizer mode, the "TO-FROM" arrows may remain out of view, depending upon the design of the NAV converter used in the installation.

SECTION 4 - NORMAL PROCEDURES

Refer to Edo-Aire Mitchell Century 21 Autopilot Operator's Manual, P/N 68S805, dated 1-79 for Autopilot Description and Normal Operating Procedures.

(a) PREFLIGHT PROCEDURES

— NOTE —

During system functional check the system must be provided adequate D.C. voltage (12.0 VDC min.) and instrument air (4.2 in. Hg. min.). It is recommended that the engine be operated to provide the necessary power and that the aircraft be positioned in a level attitude, during the functional check.

(b) AUTOPILOT WITH STANDARD D.G.
(1) Engage autopilot.
(2) Control wheel movement should correspond to HDG command input.
(3) Grasp control wheel and override roll servo actuator to assure override capability.
(4) With HDG bug centered select NAV or APPR mode and note control wheel movement toward VOR needle offset.
(5) Select REV mode and note control wheel movement opposite VOR needle offset.
(6) Disengage autopilot.
(7) Check aileron controls through full travel to assure complete autopilot disengagement.

(c) AUTOPILOT WITH COMPASS SYSTEM (NSD 360A)
(For other compass systems, refer to appropriate manufacturer's instructions)
(1) Check slaving switch in slave or slave 1 or 2 position, as appropriate. (Slaving systems with R.M.I. output provide only slave and free gyro positions.)
(2) Rotate card to center slaving meter - check HDG displayed with magnetic compass HDG.
(3) Perform standard VOR receiver check.
(4) Perform Steps (1) - (7) in Section 4 item (b) except in Steps (4) and (5) substitute course arrow for HDG bug when checking control wheel movement in relation to L/R needle. HDG bug is inoperative with NAV, APPR, or REV mode selected.

(d) IN-FLIGHT PROCEDURE
(1) Trim aircraft for existing flight condition (all axes).
(2) Rotate heading bug to desired heading. Engage autopilot.
(3) During maneuvering flight - control aircraft through use of the HDG bug. (HDG mode)
(4) For navigation operations select modes as required by the operation being conducted and in accordance with the mode description provided in the Century 21 Operator's Manual.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

SUPPLEMENT 6

PIPER CONTROL WHEEL CLOCK INSTALLATION

SECTION 1 - GENERAL

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

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional Piper Control Wheel Clock is installed.

SECTION 2 - LIMITATIONS

No changes of the basic limitations provided by Section 2 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 3 - EMERGENCY PROCEDURES

No changes of the basic Emergency Procedures provided by Section 3 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 4 - NORMAL PROCEDURES

(a) SETTING
While in the CLOCK mode, the time and the date can be set by the operation of the RST button.

(b) DATE SETTING
Pressing the RST button once will cause the date to appear with the month flashing. Pressing the ST-SP button will advance the month at one per second, or at one per push, until the right month appears.

Pressing the RST button once again will cause the date to flash, and it can be set in a similar manner.

(c) TIME SETTING
The RST button must now be pressed two times to cause the hours digits to flash. The correct hour can be set in as described above.

Pressing the RST button once again will now cause the minutes digits to flash. The minutes should be set to the next minute to come up at the zero seconds time mark. The RST button is pressed once more to hold the time displayed. At the time mark, the ST-SP button is pressed momentarily to begin the time counting at the exact second.

If the minutes are not advanced when they are flashing in the set mode, pressing the RST button will return the clock to the normal timekeeping mode without altering the minutes timing. This feature is useful when changing time zones, when only the hours are to be changed.

(d) AUTOMATIC DATE ADVANCE
The calendar function will automatically advance the date correctly according to the four year perpetual calendar. One day must be added manually on Feb. 29 on leap year. The date advances correctly at midnight each day.

(e) DISPLAY TEST
Pressing both the RST and ST-SP buttons at the same time will result in a display test function.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

SUPPLEMENT 7

KNS 80 NAVIGATION SYSTEM

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional KNS 80 Navigation System is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional KNS 80 Navigation System is installed.

SECTION 2 - LIMITATIONS

No changes to the basic limitations provided by Section 2 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 3 - EMERGENCY PROCEDURES

No changes to basic Emergency Procedures provided by Section 3 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 4 - NORMAL PROCEDURES

(a) KNS 80 OPERATION

The KNS 80 can be operated in any of 3 basic modes: (a) VOR, (b) RNAV, or (c) ILS. To change from one mode to another, the appropriate pushbutton switch is pressed, except that the ILS mode is entered automatically whenever an ILS frequency is channeled in the USE waypoint. The display will annunciate the mode by lighting a message above the pushbutton. In addition to the standard VOR and RNAV en route (RNV ENR) modes, the KNS 80 has a constant course width or parallel VOR mode (VOR PAR) and an RNAV approach mode (RNV APR). To place the unit in either of these secondary modes the VOR pushbutton or the RNAV pushbutton, as the case may be, is pushed a second time. Repetitive pushing of the VOR button will cause the system to alternate between the VOR and VOR PAR modes, while repetitive pushing of the RNAV button causes the system to alternate between RNV ENR and RNV APR modes.

(b) CONTROLS

(1) VOR BUTTON

Momentary pushbutton.
When pushed while system is in either RNV modes causes system to go to VOR mode. Otherwise the button causes system to toggle between VOR and VOR PAR modes.

(2) RNAV BUTTON

Momentary pushbutton.
When pushed while system is in either VOR mode causes system to go to RNV ENR mode. Otherwise the button causes system to toggle between RNV ENR and RNV APR modes.

(3) HOLD BUTTON

Two position pushbutton.
When in depressed position, inhibits DME from channeling to a new station when the VOR frequency is changed. Pushing the button again releases the button and channels the DME to the station paired with the VOR station.

(4) USE BUTTON

Momentary pushbutton.
Causes active waypoiont to take on same value as displayed waypoint and data display to go to FRQ mode.

(5) DSP BUTTON
Momentary pushbutton.
Causes displayed waypoint to increment by 1 and data display to go to frequency mode.

(6) DATA BUTTON
Momentary pushbutton.
Causes waypoint data display to change from FRQ to RAD to DST and back to FRQ.

(7) OFF/PULL ID CONTROL
a. Rotate counterclockwise to switch off power to the KNS 80.
b. Rotate clockwise to increase audio level.
c. Pull switch out to hear VOR Ident.

(8) DATA INPUT CONTROL
Dual concentric knobs. Center knob has "in" and "out" positions.
a. Frequency Data
Outer knob varies 1 MHz digit.
A carryover occurs from the tens to hundreds place.
Rollover occurs from 117 to 108.
Center knob varies frequency in .05 MHz steps regardless of whether the switch is in its in or out position.

b. Radial Data
Outer knob varies 10 degree digit.
A carryover occurs from units to tens to hundreds position.
A rollover to zero occurs at 360 degrees.
Center knob "in" position varies 1 degree digit.
Center knob "out" position varies 0.1 degree digit.

c. Distance Data
Outer knob varies 10 NM digit.
A carryover occurs from the tens to hundreds place.
A rollover to zero occurs at 200 NM.
Center knob "in" position varies 1 NM digit.
Center knob "out" position varies 0.1 NM digit.

(9) COURSE SELECT KNOB
Located in CDI unit.
Selects desired course through the VOR ground station or waypoint.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 8 FOR KING KAP 100 SERIES FLIGHT CONTROL SYSTEM

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the King KAP 100 Series Flight Control System is installed in accordance with STC SA1565CE-D. 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 Ward Evans

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VERO BEACH, FLORIDA

DATE OF APPROVAL JULY 23, 1982

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional King KAP 100 Series Flight Control System is installed. The Flight Control System must be operated within the limitations herein specified. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been FAA Approved as a permanent part of this handbook and must remain in this handbook at all times when the optional King KAP 100 Series Flight Control System is installed.

SECTION 2 - LIMITATIONS

The autopilot must be OFF during takeoff and landing.

SECTION 3 - EMERGENCY PROCEDURES

(a) SYSTEM WITH AUTOPILOT ONLY

(1) In case of Autopilot malfunction: (accomplish items a. and b. simultaneously)
   a. Airplane Control Wheel - GRASP FIRMLY and regain aircraft control.
   b. AP ENG Button - PRESS to disengage autopilot.

(b) SYSTEMS WITH AUTOPILOT AND OPTIONAL MANUAL ELECTRIC TRIM

(1) In case of Autopilot malfunction: (accomplish items a. and b. simultaneously)
   a. Airplane Control Wheel - GRASP FIRMLY and regain aircraft control.
   b. AP DISC/TRIM INTER Switch - PRESS.

(2) In case of Manual Electric Trim malfunction:
   a. AP DISC/TRIM INTER Switch - PRESS and HOLD.
   b. PITCH TRIM Circuit Breaker - PULL.
   c. Aircraft - RETRIM manually.

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 POWER Switch - ON
(3) PREFLIGHT TEST BUTTON - PRESS momentarily and NOTE:
   a. All annunciator lights on (TRIM annunciator flashing).
   b. After approximately 5 seconds, all annunciator lights off except AP which will flash approximately 12 times and then remain off.

NOTE

If trim warning light stays on then the manual electric trim did not pass preflight test. The pitch trim circuit breaker should be pulled. The autopilot can still be used.

(4) MANUAL ELECTRIC TRIM (if installed) - TEST as follows:
   a. Actuate the left side of the split switch to the fore and aft positions. The trim wheel should not move on its own. Rotate the trim wheel manually against the engaged clutch to check the pilot's overpower capability.
   b. Actuate right side of split switch unit to the fore and aft positions. The trim wheel should not move on its own and normal trim wheel force is required to move it manually.
   c. Press the AP DISC/TRIM INTER switch down and hold. Manual Electric Trim should not operate either nose up or or nose down.
(5) AUTOPILOT - ENGAGE by pressing AP ENG button.
(6) CONTROL WHEEL - MOVE left and right to verify that the autopilot can be overpowered.
(7) AP DISC/TRIM INTER Switch - PRESS. Verify that the autopilot disconnects and all modes are cancelled.
(8) TRIM - SET to take off position.

(b) AUTOPILOT OPERATION

(1) Before takeoff
AP DISC/TRIM INTER Switch - PRESS.

(2) Autopilot Engagement
AP ENG Button - PRESS. Note AP annunciator on. If no other modes are selected the autopilot will operate in the wings level mode.

(3) Heading Changes
a. Manual Heading Changes
1. CWS Button - PRESS and MANEUVER aircraft to the desired heading.
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)
HEADING Selector Knob - MOVE BUG to the desired heading. Autopilot will automatically turn the aircraft to the new selected heading.

(4) 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.

3. NAV Mode Selector Button - PRESS.
   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.

   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 DG
   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.

If the D-Bar is greater than 2 to 3 dots: the autopilot will annunciate HDG mode 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.

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.

(5) 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.
   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 will disengage, the APR annunciator will illuminate steady and the selected course will be automatically captured and tracked.

   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.
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.

If the D-Bar is greater than 2 to 3 dots: the autopilot will annunciate HDG mode 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.

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.

(6) 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.
   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, the APR annunciator will illuminate steady and the selected course will be automatically captured and tracked.

   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.

If the D-Bar is greater than 2 to 3 dots: the autopilot will annunciate HDG and BC modes with 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.

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.

(7) Missed Approach
   a. AP DISC/TRIM INTER - PRESS to disengage AP.
   b. MISSED APPROACH - EXECUTE.
   c. AP ENG Button - PRESS (if AP operation is desired). Note AP annunciator ON.

(8) Before Landing
   AP DISC/TRIM INTER - PRESS to disengage AP.

SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in Section 6 of the Basic Pilot's Operating Handbook.

SECTION 7 - DESCRIPTION AND OPERATION

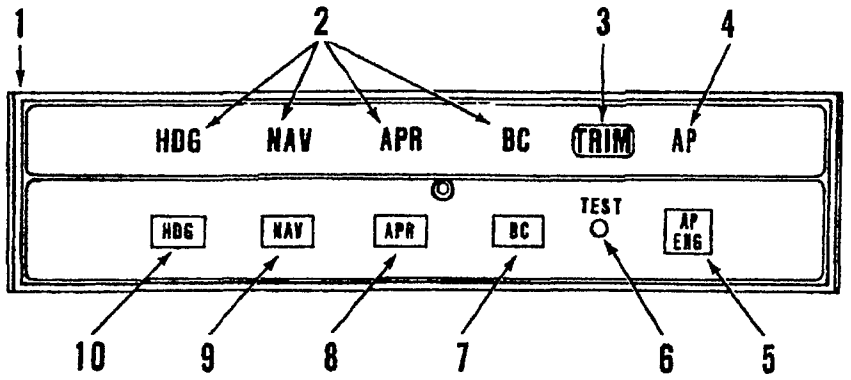
The KAP 100 Autopilot is certified in this airplane with roll axis control. The various instruments and the controls for the operation of the KAP 100 Autopilot are described in Figures 7-1 thru 7-11.

The KAP 100 Autopilot has an optional electric pitch trim system. The trim system is designed to withstand any single inflight malfunction. A trim fault is 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 only the autopilot wings level mode can be selected.
(d) Roll rates in excess of 16° per second will cause the autopilot to disengage except when the CWS switch is held depressed.

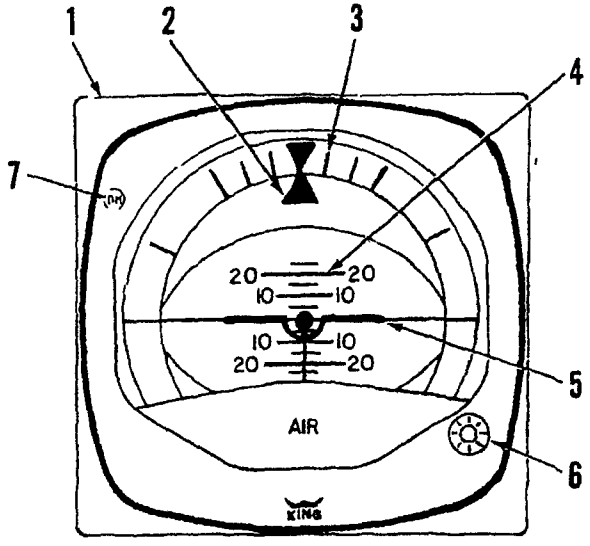


KC 190 AUTOPILOT COMPUTER
Figure 7-1

1. KAP 100 AUTOPILOT COMPUTER - Complete Autopilot computer to include system mode annunciators and system controls.
2. MODE ANNUNCIATORS - Illuminate when a mode is selected by the corresponding mode selector button (PUSH ON - PUSH OFF).
3. TRIM WARNING LIGHT (TRIM) - Illuminates continuously whenever trim power is not on or the system has not been pre-flight tested. The TRIM warning light, located on the right side of the computer, will flash and be accompanied by an audible warning whenever a manual pitch trim malfunction occurs (trim running without being commanded to run).
4. AUTOPILOT ANNUNCIATOR (AP) - 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).
5. AUTOPILOT ENGAGE (AP ENG) BUTTON - When pushed, engages autopilot if all logic conditions are met.

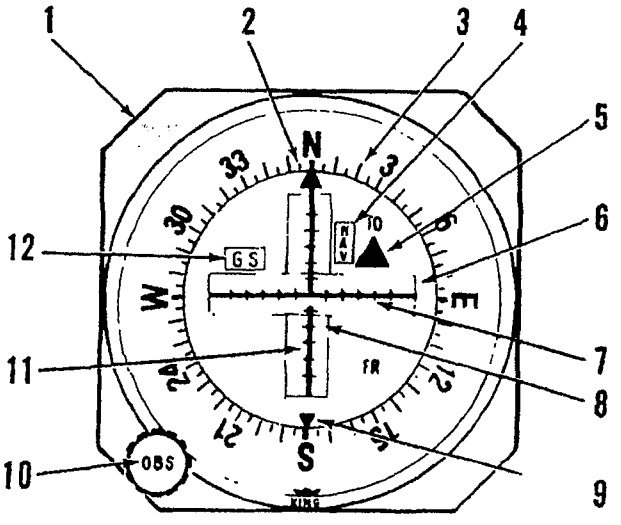
Figure 7-1 (cont)

6. PREFLIGHT TEST (TEST) BUTTON - When momentarily pushed, initiates preflight test sequence which automatically turns on all annunciator lights, tests the roll rate monitor, checks the manual trim drive voltage, checks the manual electric trim monitor 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 cannot be engaged until the preflight test is successfully passed.
7. 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.
8. 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. The tracking gain of the APR mode is greater than the gain in the NAV mode. The APR annunciator will flash until the automatic capture sequence is initiated.
9. 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 will flash until the automatic capture sequence is initiated.
10. 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 20°. Selecting HDG mode will cancel NAV, APR or BC track modes.



KG 258 VERTICAL GYRO
Figure 7-3

1. KG 258 VERTICAL GYRO - Displays airplane attitude as a conventional attitude gyro. The gyro is air driven.
2. ROLL ATTITUDE INDEX - Displays airplane roll attitude with respect to the roll attitude scale.
3. ROLL ATTITUDE SCALE - Scale marked at 0, ±10, ±20, ±30, ±60 and ±90 degrees.
4. 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.
5. 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.
6. SYMBOLIC AIRCRAFT ALIGNMENT KNOB - Provides manual positioning of the symbolic aircraft for level flight under various load conditions.
7. DECISION HEIGHT (DH) ANNUNCIATOR LIGHT - Optional light for use with the aircraft's optional radar altimeter.

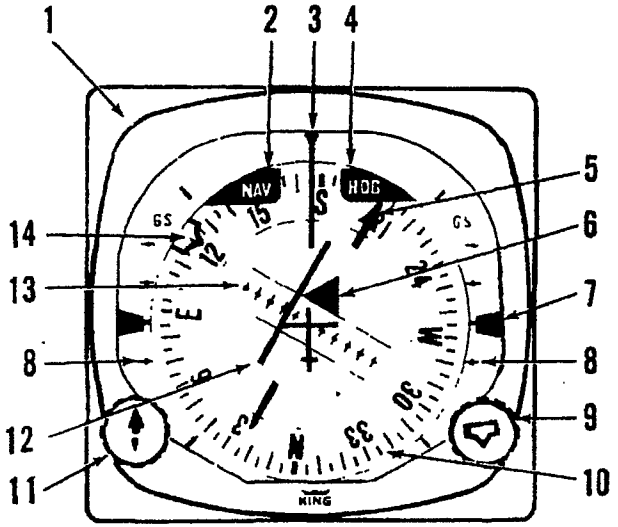


KI 204/206 VOR/LOC/
GLIDE SLOPE INDICATOR (TYPICAL)
Figure 7-5

1. VOR/LOC/GLIDE SLOPE INDICATOR - Provides rectilinear display of VOR/LOC and Glide slope deviation.
2. COURSE INDEX - Indicates selected VOR course.
3. COURSE CARD - Indicates selected VOR course under course index.
4. 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 is tracking valid navigation information.
5. TO/FROM INDICATOR FLAG - Indicates direction of VOR station relative to selected course.
6. GLIDE SLOPE DEVIATION NEEDLE - Indicates deviation from ILS glide slope.
7. COURSE DEVIATION SCALE - A course deviation bar displacement of 5 dots represents full scale (VOR = ±10°, LOC = ±2 1/2°, RNAV = 5NM, RNAV APR - 1 1/4NM) deviation from beam centerline.

Figure 7-5 (cont)

8. GLIDE SLOPE SCALE - Indicates displacement from glide slope beam center. A glide slope deviation needle displacement of 5 dots, represents full scale (0.7°) deviation above or below glide slope beam centerline.
9. RECIPROCAL COURSE INDEX - Indicates reciprocal of selected VOR course.
10. OMNI BEARING SELECTOR (OBS) KNOB - Rotates course card to selected course.
11. COURSE DEVIATION NEEDLE - Indicates course deviation from selected omni course or localizer centerline.
12. GLIDE SLOPE (GS) FLAG - Flag is in view when the GS receiver signal is inadequate.



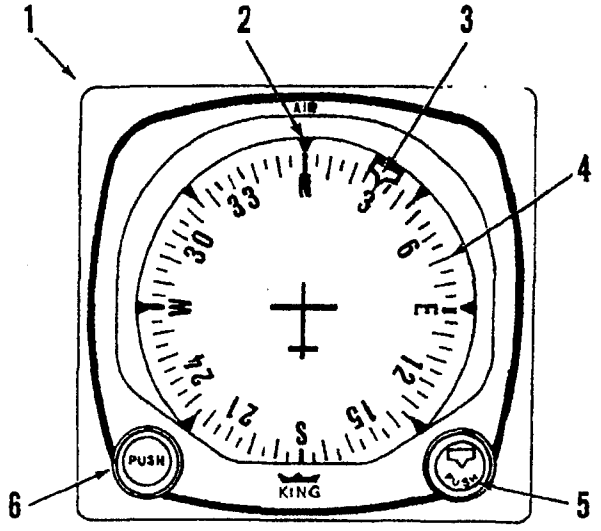
KI 525A HORIZONTAL SITUATION INDICATOR
Figure 7-7

Figure 7-7 (cont)

1. KI 525A HORIZONTAL SITUATION INDICATOR (HSI) - Provides a pictorial presentation of aircraft deviation relative to VOR radials or localizer beams. It also displays glide slope deviations and gives heading reference with respect to magnetic north.
2. 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 is tracking valid navigation information.
3. LUBBER LINE - Indicates aircraft magnetic heading on compass card (10).
4. 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. The CWS switch would be used to maneuver the aircraft laterally.
5. COURSE BEARING POINTER - Indicates selected VOR course or localizer course on compass card (10). The selected VOR radial or localizer heading remains set on the compass card when the compass card (10) rotates.
6. TO/FROM INDICATOR FLAG - Indicates direction of VOR station relative to selected course.
7. DUAL GLIDE SLOPE POINTERS - Indicate on glide slope scale (8) aircraft displacement from glide slope beam center. Glide slope pointers in view indicate a usable glide slope signal is being received.
8. GLIDE SLOPE SCALES - Indicate displacement from glide slope beam center. A glide slope deviation bar displacement of 2 dots, represents full scale (0.7°) deviation above or below glide slope beam centerline.
9. HEADING SELECTOR KNOB (⮌) - Positions heading Bug (14) on compass card (10) by rotating the heading selector knob. The Bug rotates with the compass card.
10. COMPASS CARD - Rotates to display heading of airplane with reference to lubber line (3) on HSI.
11. COURSE SELECTOR KNOB - Positions course bearing pointer (5) on the compass card (10) by rotating the course selector knob.
12. COURSE DEVIATION BAR (D-BAR) - The center portion of omni bearing pointer moves laterally to pictorially indicate the relationship of aircraft to selected course. It indicates in degrees of angular displacement from VOR radials and localizer beams or displacement in nautical miles from RNAV courses.

Figure 7-7 (cont)

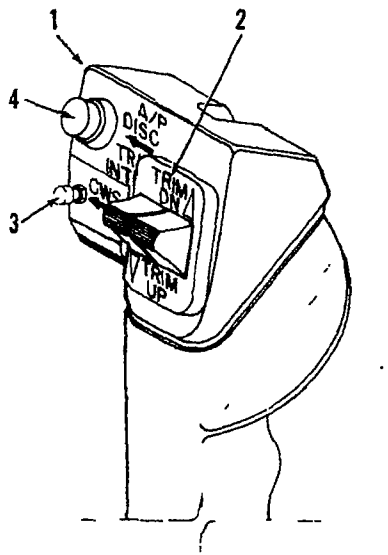
13. COURSE DEVIATION SCALE - A course deviation bar displacement of 5 dots represents full scale (VOR = ±10°, LOC = ±2 1/2°, RNAV = 5NM, RNAV APR - 1 1/4NM) deviation from beam centerline.
14. HEADING BUG - Moved by (⮌) knob (9) to select desired heading.



KG 107 NON-SLAVED DIRECTIONAL GYRO
Figure 7-9

Figure 7-9 (cont)

1. KG 107 NON-SLAVED DIRECTIONAL GYRO (DG) - Provides a stable visual indication of aircraft heading to the pilot. The gyro is air driven.
2. LUBBER LINE - Indicates aircraft magnetic heading on compass card (4).
3. HEADING BUG - Moved by ( ) knob (5) to select desired heading.
4. COMPASS CARD - Rotates to display heading of airplane with reference to lubber line (4) on DG.
5. HEADING SELECTOR KNOB ( ) - Positions heading Bug (3) on compass card (4) by rotating the heading selector knob. The Bug rotates with the compass card.
6. GYRO ADJUSTMENT KNOB (PUSH) - When pushed in, allows the pilot to manually rotate the gyro compass card (4) 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.



AUTOPILOT CONTROL WHEEL SWITCH CAP
Figure 7-11

1. AUTOPILOT CONTROL WHEEL SWITCH CAP - Molded plastic unit mounted on the left horn of the pilot's control wheel which provides mounting for three switch units associated with the autopilot and manual electric trim systems (only used with optional manual electric trim).
2. 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.
3. CONTROL WHEEL STEERING (CWS) BUTTON - When depressed, allows pilot to manually control the aircraft (disengages the servo) without cancellation of any of the selected modes.
4. AUTOPILOT DISCONNECT/TRIM INTERRUPT (AP DISC/TRIM INTER) Switch - When depressed and released, will disengage the autopilot and cancel all operating autopilot modes. When depressed and held, will interrupt all electric trim power (stop trim motion), disengage the autopilot, and cancel all operating autopilot modes.

The airplane MASTER SWITCH 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 POWER 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 KAP 100 Autopilot:

AUTOPILOT - Supplies power to the KC 190, the autopilot roll servo, and the Pitch Trim Circuit Breaker.

PITCH TRIM - Supplies power to the optional manual electric pitch trim system.

COMP-SYSTEM - Supplies power to the optional KCS 55A Compass System.

PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 9 FOR KING KAP 150 SERIES FLIGHT CONTROL SYSTEM

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the King KAP 150 Series Flight Control System is installed in accordance with STC SA1565CE-D. 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 Ward Evans

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VERO BEACH, FLORIDA

DATE OF APPROVAL JULY 23, 1982

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional King KAP 150 Series Flight Control System is installed. The Flight Control System must be operated within the limitations herein specified. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been FAA Approved as a permanent part of this handbook and must remain in this handbook at all times when the optional King KAP 150 Series Flight Control System is installed.

SECTION 2 - LIMITATIONS

(a) During autopilot operation, a pilot with seat belt fastened must be seated at the left pilot position.
(b) The autopilot must be OFF during takeoff and landing.
(c) The system is approved for Category I operation only (Approach mode selected).
(d) Autopilot flap limitation: Maximum flap extension 10° (first notch).
(e) Autopilot airspeed limitation: Maximum 155 KIAS.

NOTE

In accordance with FAA recommendation, use of "altitude hold" mode is not recommended during operation in severe turbulence.

SECTION 3 - EMERGENCY PROCEDURES

(a) In case of Autopilot malfunction: (accomplish items 1. and 2. simultaneously)

(1) Airplane Control Wheel - GRASP FIRMLY and regain aircraft control.
(2) AP DISC/TRIM INTER Switch - PRESS and HOLD.
(3) AP DISC/TRIM INTER Switch - RELEASE while observing pitch trim wheel. If pitch trim wheel is in motion, follow the Electric Trim Malfunction Procedure.

(b) In case of Electric Trim Malfunction (either manual electric or autotrim):

(1) AP DISC/TRIM INTER Switch - PRESS and HOLD throughout recovery.
(2) PITCH TRIM Circuit Breaker - PULL.
(3) Aircraft - RETRIM manually.

CAUTION

When disconnecting the autopilot after a trim malfunction, hold the control wheel firmly; up to 45 pounds of force on the control wheel may be necessary to hold the aircraft level.

Maximum Altitude losses due to autopilot malfunction:

Configuration	Alt Loss
Cruise, Climb, Descent	200 ′
Maneuvering	100 ′
APPR	60 ′

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 POWER Switch - ON.
(3) PREFLIGHT TEST BUTTON - PRESS momentarily and NOTE:
   a. All annunciator lights on (TRIM annunciator flashing).
   b. After approximately 5 seconds, all annunciator lights off except AP which will flash approximately 12 times and then remain off.

NOTE

If trim warning light stays on then the autotrim did not pass preflight test. The autopilot circuit breakers should be pulled. Manual electric trim cannot be used.

(4) MANUAL ELECTRIC TRIM - TEST as follows:
   a. Actuate the left side of the split switch to the fore and aft positions. The trim wheel should not move on its own. Rotate the trim wheel manually against the engaged clutch, to check the pilot's overpower capability.
   b. Actuate right side of split switch unit to the fore and aft positions. The trim wheel should not move on its own and normal trim wheel force is required to move it manually.
   c. Press the AP 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 button.

(6) AUTOPILOT - ENGAGE by pressing AP ENG button.

(7) CONTROL WHEEL - MOVE fore, aft, left and right to verify that the autopilot can be overpowered.

(8) AP DISC/TRIM INTER Switch - PRESS. Verify that the autopilot disconnects and all flight director modes are cancelled.

(9) TRIM - SET to take off position.

(b) AUTOPILOT OPERATION

(1) Before takeoff
AP DISC/TRIM INTER Switch - PRESS.

(2) Autopilot Engagement
   a. FD Mode Selector Button (KFC 150 Only) - PRESS.
   b. AP ENG Button - PRESS. Note AP annunciator on. If no other modes are selected the autopilot will operate in wings level and pitch attitude hold.

(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.

(4) Altitude Hold
   a. ALT Mode Selector Button - PRESS. Note ALT mode annunciator ON. Autopilot will maintain the selected pressure altitude.

   b. Change selected altitudes
      1. Using CWS (recommended for altitude changes greater than 100 ft.)
         CWS Button - PRESS and fly aircraft to desired pressure altitude.

         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.)
         VERTICAL TRIM Control - PRESS either up or down. Vertical Trim will seek an altitude rate of change of 600 ± 100 fpm.

         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.
      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)
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.
   3. NAV Mode Selector Button - PRESS.
   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.

   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 DG
   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.

If the D-Bar is greater than 2 to 3 dots: the autopilot will annunciate HDG mode 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.

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.
         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 will disengage, the APR annunciator will illuminate steady and the selected course will be automatically captured and tracked.

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.
   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.

If the D-Bar is greater than 2 to 3 dots: the autopilot will annunciate HDG mode 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.

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.
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 APR annunciator will illuminate steady and the selected course will be automatically captured and tracked.

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.

If the D-Bar is greater than 2 to 3 dots: the autopilot will annunciate HDG and BC modes with 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.

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.

(9) Glide Slope Coupling

NOTE

Glide slope coupling is inhibited when operating in NAV or APR BC modes. Glide slope coupling occurs automatically in the APR mode.

a. APR Mode - ENGAGED.
b. At glide slope centering - NOTE GS annunciator ON.

NOTE

Autopilot can capture glide slope from above or below the beam while operating in either pitch attitude hold or ALT hold modes.

(10) Missed Approach

a. AP DISC/TRIM INTER Switch - PRESS to disengage AP.
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 operation is desired). Note AP annunciator ON.

NOTE

If it is desired to track the ILS course outbound as part of the missed approach procedure, use the NAV mode to prevent inadvertent GS coupling.

(11) Before Landing
AP DISC/TRIM INTER Switch - PRESS to disengage AP.

(c) FLIGHT DIRECTOR OPERATION (KFC 150 SYSTEMS ONLY)

NOTE

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.

SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in Section 6 of the basic Pilot's Operating Handbook.

SECTION 7 - DESCRIPTION AND OPERATION

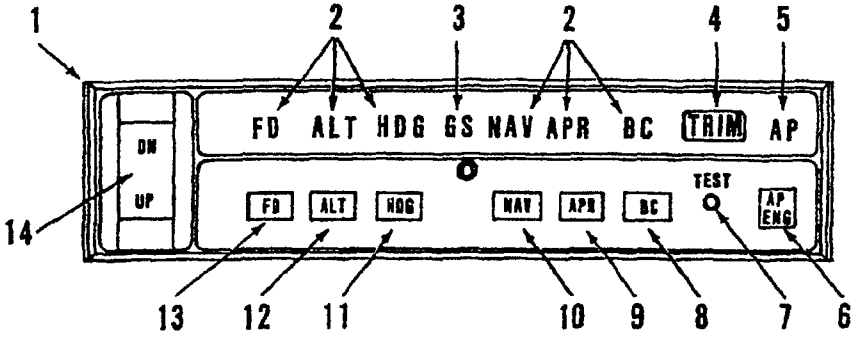
The 150 Series AFCS is certified in this airplane with 2 axis control, pitch and roll. The various instruments and the controls for the operation of the 150 System are described in Figures 7-1 thru 7-15.

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.
(d) Roll rates in excess of 16° per second will cause the autopilot to disengage except when the CWS switch is held depressed.
(e) Pitch rates in excess of 6° per second will cause the autopilot to disengage except when the CWS switch is held depressed.



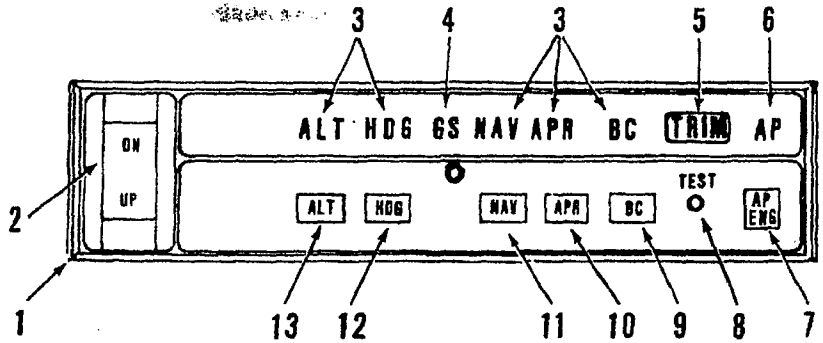
KC 192 AUTOPILOT & FLIGHT DIRECTOR COMPUTER
Figure 7-1

Figure 7-1 (cont)

1. KFC 150 SYSTEM KC 192 AUTOPILOT COMPUTER - Complete Flight Director and Autopilot computer to include system mode annunciators and system controls.
2. MODE ANNUNCIATORS - Illuminates when a mode is selected by the corresponding mode selector button (PUSH ON - PUSH OFF) or when the glide slope (GS) mode is automatically engaged.
3. GLIDE SLOPE (GS) ANNUNCIATOR - Illuminates continuously whenever the autopilot is coupled to the glide slope signal. The GS annunciator will flash if the glide slope signal is lost (GS flag in CDI or absence of glide slope pointers in KI 525A). The autopilot reverts to pitch attitude hold operation. If a valid glide slope 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 glide slope returns and the aircraft passes thru the glide slope. At that point GS couple will re-occur.
4. TRIM WARNING LIGHT (TRIM) - Illuminates continuously whenever trim power is not on or the system has not been preflight tested. Flashes and is accompanied by an audible warning whenever a manual trim fault is detected. The TRIM warning light will illuminate steady 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 power switch may be cycled off to silence the continuous tone but the trim fail light will remain on. The manual electric trim may be used but the autopilot should not be engaged.
5. AUTOPILOT ANNUNCIATOR (AP) - 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).
6. AUTOPILOT ENGAGE (AP ENG) BUTTON - When pushed, engages autopilot if all logic conditions are met.
7. 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 cannot be engaged until the preflight test is successfully passed.

Figure 7-1 (cont)

8. 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. Glide slope coupling is inhibited in the Back Course Approach mode.
9. 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 glide slope 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 will flash until the automatic capture sequence is initiated.
10. 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 will flash until the automatic capture sequence is initiated.
11. 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 20°. Selecting HDG mode will cancel NAV, APR or BC track modes.
12. 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 glide slope is captured.
13. FLIGHT DIRECTOR (FD) MODE SELECTOR BUTTON - When pushed, will select the Flight Director mode (with KC 292 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.
14. 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 glide slope again to allow GS recouple.



KC 191 AUTOPILOT COMPUTER
Figure 7-3

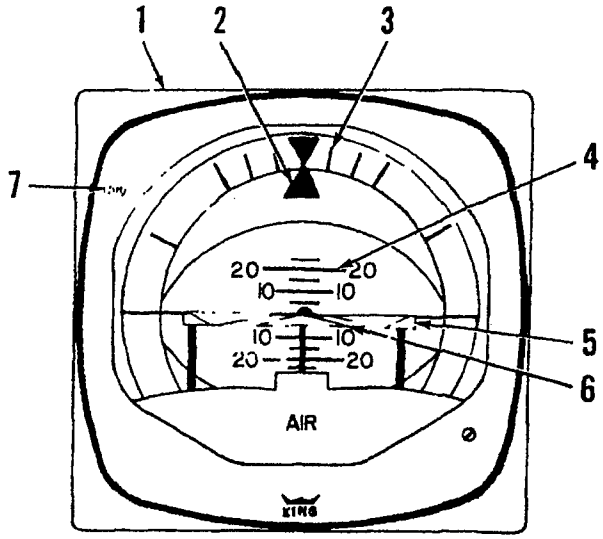
1. KFC 150 SYSTEM KC 191 AUTOPILOT COMPUTER - Complete Flight Director and Autopilot computer to include system mode annunciators and system controls.
2. VERTICAL TRIM CONTROL - A spring loaded to center rocker switch which will provide up or down pitch command changes: while in ALT will adjust altitude 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 glide slope again to allow GS recouple.
3. MODE ANNUNCIATORS - Illuminate when a mode is selected by the corresponding mode selector button (PUSH ON - PUSH OFF) or when the glide slope (GS) mode is automatically engaged.
4. GLIDE SLOPE (GS) ANNUNCIATOR - Illuminates continuously whenever the autopilot is coupled to the glide slope signal. The GS annunciator will flash if the glide slope signal is lost (GS flag in CDI or absence of glide slope pointers in KI 525A). The autopilot reverts to pitch attitude hold operation. If a valid glide slope 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 glide slope returns and the aircraft passes thru the glide slope. At that point GS couple will re-occur.

Figure 7-3 (cont)

5. TRIM WARNING LIGHT (TRIM) - Illuminates continuously whenever trim power is not on or the system has not been preflight tested. Flashes and is accompanied by an audible warning whenever a manual trim fault is detected. The TRIM warning light will illuminate steady 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 power switch may be cycled off to silence the continuous tone but the trim fail light will remain on. The manual electric trim may be used but the autopilot should not be engaged.
6. AUTOPILOT ANNUNCIATOR (AP) - 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.
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 cannot be engaged until the preflight test is 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. Glide slope coupling is inhibited in the Back Course Approach mode.
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 glide slope 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 will flash until the automatic capture sequence is initiated.

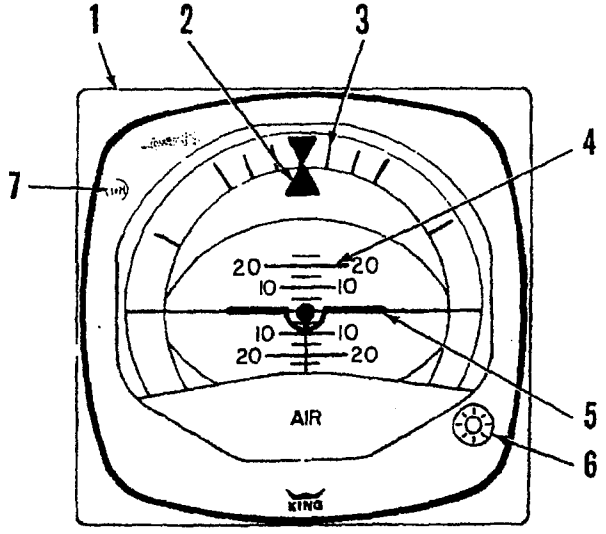
Figure 7-3 (cont)

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 will flash until the automatic capture sequence is initiated.
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 20°. 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 glide slope is captured.



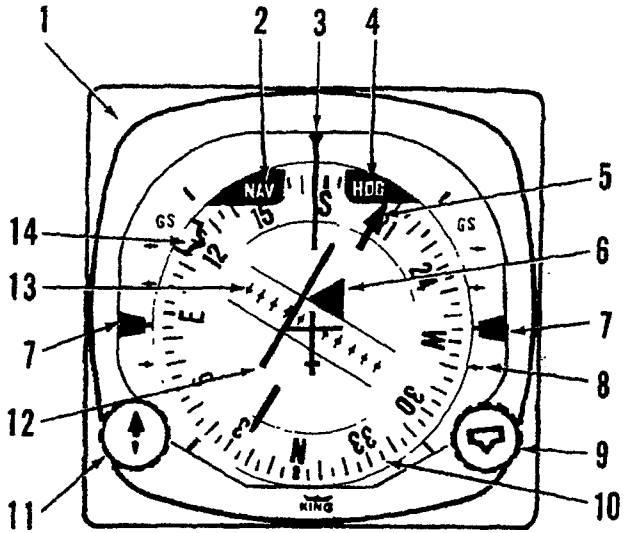
KI 256 FLIGHT COMMAND INDICATOR
Figure 7-5

1. 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.
2. ROLL ATTITUDE INDEX - Displays airplane roll attitude with respect to the roll attitude scale.
3. ROLL ATTITUDE SCALE - Scale marked at 0, ±10, ±20, ±30, ±60 and ±90 degrees.
4. 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.
5. 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.
6. 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.
7. DECISION HEIGHT (DH) ANNUNCIATOR LIGHT - Optional light for use with the aircraft's optional radar altimeter.



KG 258 VERTICAL GYRO
Figure 7-7

1. KG 258 VERTICAL GYRO - Displays airplane attitude as a conventional attitude gyro. The gyro is air driven.
2. ROLL ATTITUDE INDEX - Displays airplane roll attitude with respect to the roll attitude scale.
3. ROLL ATTITUDE SCALE - Scale marked at 0, ±10, ±20, ±30, ±60 and ±90 degrees.
4. 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.
5. 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.
6. SYMBOLIC AIRCRAFT ALIGNMENT KNOB - Provides manual positioning of the symbolic aircraft for level flight under various load conditions.
7. DECISION HEIGHT (DH) ANNUNCIATOR LIGHT - Optional light for use with the aircraft's optional radar altimeter.

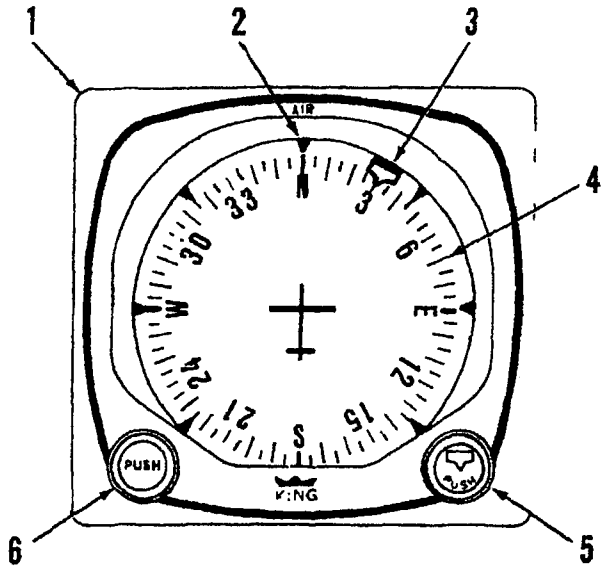


KI 525A HORIZONTAL SITUATION INDICATOR
Figure 7-9

1. KI 525A HORIZONTAL SITUATION INDICATOR (HSI) - Provides a pictorial presentation of aircraft deviation relative to VOR radials or localizer beams. It also displays glide slope deviations and gives heading reference with respect to magnetic north.
2. 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.
3. LUBBER LINE - Indicates aircraft magnetic heading on compass card (10).
4. 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 maneuver the aircraft laterally.

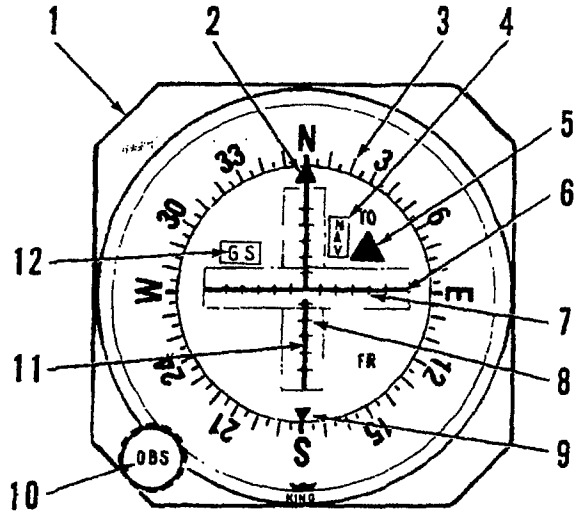
Figure 7-9 (cont)

5. COURSE BEARING POINTER - Indicates selected VOR course or localizer course on compass card (10). The selected VOR radial or localizer heading remains set on the compass card when the compass card (10) rotates.
6. TO/FROM INDICATOR FLAG - Indicates direction of VOR station relative to selected course.
7. DUAL GLIDE SLOPE POINTERS - Indicate on glide slope scale (8) aircraft displacement from glide slope beam center. Glide slope pointers in view indicate a usable glide slope signal is being received. The glide slope pointers will bias out of view if the glide slope signal is lost.
8. GLIDE SLOPE SCALES - Indicate displacement from glide slope beam center. A glide slope deviation bar displacement of 2 dots, represents full scale (0.7°) deviation above or below glide slope beam centerline.
9. HEADING SELECTOR KNOB ( ) - Positions heading bug (14) on compass card (10) by rotating the heading selector knob. The Bug rotates with the compass card.
10. COMPASS CARD - Rotates to display heading of airplane with reference to lubber line (3) on HSI.
11. COURSE SELECTOR KNOB - Positions course bearing pointer (5) on the compass card (10) by rotating the course selector knob.
12. 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.
13. COURSE DEVIATION SCALE - A course deviation bar displacement of 5 dots represents full scale (VOR = ±10°, LOC = ±2 1/2°, RNAV = 5NM, RNAV APR = 1 1/4NM) deviation from beam centerline.
14. HEADING BUG - Moved by ( ) knob (9) to select desired heading.



KG 107 NON-SLAVED DIRECTIONAL GYRO
Figure 7-11

1. KG 107 NON-SLAVED DIRECTIONAL GYRO (DG) - Provides a stable visual indication of aircraft heading to the pilot. The gyro is air driven.
2. LUBBER LINE - Indicates aircraft magnetic heading on compass card (4).
3. HEADING BUG - Moved by ( ) knob (5) to select desired heading.
4. COMPASS CARD - Rotates to display heading of airplane with reference to lubber line (2) on DG.
5. HEADING SELECTOR KNOB ( ) - Positions heading bug (3) on compass card (4) by rotating the heading selector knob. The Bug rotates with the compass card.
6. GYRO ADJUSTMENT KNOB (PUSH) - When pushed in, allows the pilot to manually rotate the gyro compass card (4) 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.

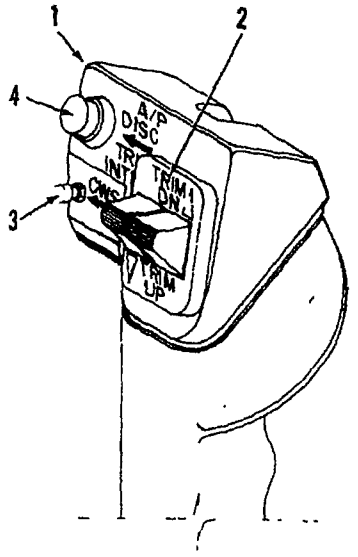


KI 204/206 VOR/LOC/
GLIDE SLOPE INDICATOR (TYPICAL)
Figure 7-13

1. VOR/LOC/GLIDE SLOPE INDICATOR - Provides rectilinear display of VOR/LOC and glide slope deviation.
2. COURSE INDEX - Indicates selected VOR course.
3. COURSE CARD - Indicates selected VOR course under course index.
4. 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.
5. TO/FROM INDICATOR FLAG - Indicates direction of VOR station relative to selected course.
6. GLIDE SLOPE DEVIATION NEEDLE - Indicates deviation from ILS glide slope.
7. COURSE DEVIATION SCALE - A course deviation bar displacement of 5 dots represents full scale (VOR = ±10°, LOC = ±2 1/2°, RNAV = 5NM, RNAV APR = 1 1/4NM) deviation from beam centerline.

Figure 7-13 (cont)

8. GLIDE SLOPE SCALE - Indicates displacement from glide slope beam center. A glide slope deviation needle displacement of 5 dots, represents full scale (0.7°) deviation above or below glide slope beam centerline.
9. RECIPROCAL COURSE INDEX - Indicates reciprocal of selected VOR course.
10. OMNI BEARING SELECTOR (OBS) KNOB - Rotates course card to selected course.
11. COURSE DEVIATION NEEDLE - Indicates course deviation from selected omni course or localizer centerline.
12. GLIDE SLOPE (GS) FLAG - Flag is in view when the GS receiver signal is inadequate.



AUTOPILOT CONTROL WHEEL SWITCH CAP
Figure 7-15

Figure 7-15 (cont)

1. AUTOPILOT CONTROL WHEEL SWITCH CAP - Molded plastic unit mounted on the left horn of the pilot's control wheel which provides mounting for three switch units associated with the autopilot and manual electric trim systems.
2. 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.
3. CONTROL WHEEL STEERING (CWS) BUTTON - When depressed, allows pilot to manually control the aircraft (disengages the 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 glide slope to allow GS recouple.
4. AUTOPILOT DISCONNECT/TRIM INTERRUPT (AP DISC/TRIM INTER) Switch - When depressed and released will disengage the autopilot and cancel all operating Flight Director modes. When depressed and held will interrupt all electric trim power (stop trim motion), disengage the autopilot, and cancel all operating Flight Director modes.

The airplane MASTER SWITCH 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 POWER switch supplies power to the avionics buss 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:

AUTOPILOT - Supplies power to the KC 192 or the KC 191 Computer, the autopilot pitch and roll servos, and the Pitch Trim Circuit Breaker.

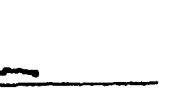
PITCH TRIM - Supplies power to the autotrim and manual electric pitch trim systems.

COMP-SYSTEM - Supplies power to the optional KCS 55A Compass System.

PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT No. 10 FOR AUXILIARY VACUUM SYSTEM

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Piper Auxiliary Vacuum System is installed in accordance with Piper Drawing No. 87775-2. The information contained herein supplements or supersedes the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed. For limitations, procedures, and performance information not contained in this supplement, consult the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED 

D.H. TROMPLER
D.O.A. NO. SO-1
PIPER AIRCRAFT CORPORATION
VERO BEACH, FLORIDA

DATE OF APPROVAL Dec 11, 1986

ISSUED: OCTOBER 14, 1986

REPORT: VB-910
9-75

SECTION 1 - GENERAL

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

SECTION 2 - LIMITATIONS

1. The auxiliary vacuum system is limited to standby function only. Flight with the engine driven air pump inoperative is not approved.
2. Discontinue flight in instrument meteorological conditions (IMC) if vacuum pressure falls below 4.8 In. Hg.
3. The auxiliary pump/motor assembly and elapsed time indicator must be removed from service after 500 hours accumulated operating time or 10 years, whichever occurs first.

SECTION 3 - EMERGENCY PROCEDURES

LOSS OF VACUUM SUCTION - Low vacuum (VAC) annunciator and VAC OFF lamp lit.

1. Check suction gauge to verify inoperative pump.
2. If vacuum suction gauge is below 4.5 inches HG press auxiliary vacuum switch to AUX ON.
3. Verify the following:
   a. Suction gauge reads 4.8 to 5.2 inches of mercury.
   b. VAC annunciator and VAC OFF lamp go out.
   c. AUX ON lamp lit.

CAUTION

Compass error may exceed 10° when auxiliary vacuum system is in operation.

4. Monitor electrical load.
   a. Verify alternator capacity is not being exceeded.
   b. If required, turn off non-essential equipment.
5. Land at earliest opportunity to have primary system repaired.

SECTION 4 - NORMAL PROCEDURES

1. Preflight Check.
   a. Turn battery switch on and verify that VAC OFF light is illuminated.

NOTE

Due to electrical power requirements of the auxiliary vacuum pump it is suggested that the engine be operating while making the following checks.

   b. Press auxiliary vacuum pump switch on and verify AUX ON light is illuminated. Electrical load should be approximately 15 amps on ammeter.
   c. Press auxiliary vacuum pump switch off and verify AUX ON light goes out.
2. Inflight Check - Prior to entering instrument flight conditions.
   a. Turn off non-essential electrical equipment.
   b. Press auxiliary vacuum pump switch on and verify AUX ON light illuminated. Electrical load should be approximately 15 amps on ammeter.
   c. Press auxiliary vacuum pump switch off and verify AUX ON light goes out.

NOTE

For maximum service life, avoid continuous non-emergency operation of the auxiliary vacuum pump.

SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT & 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

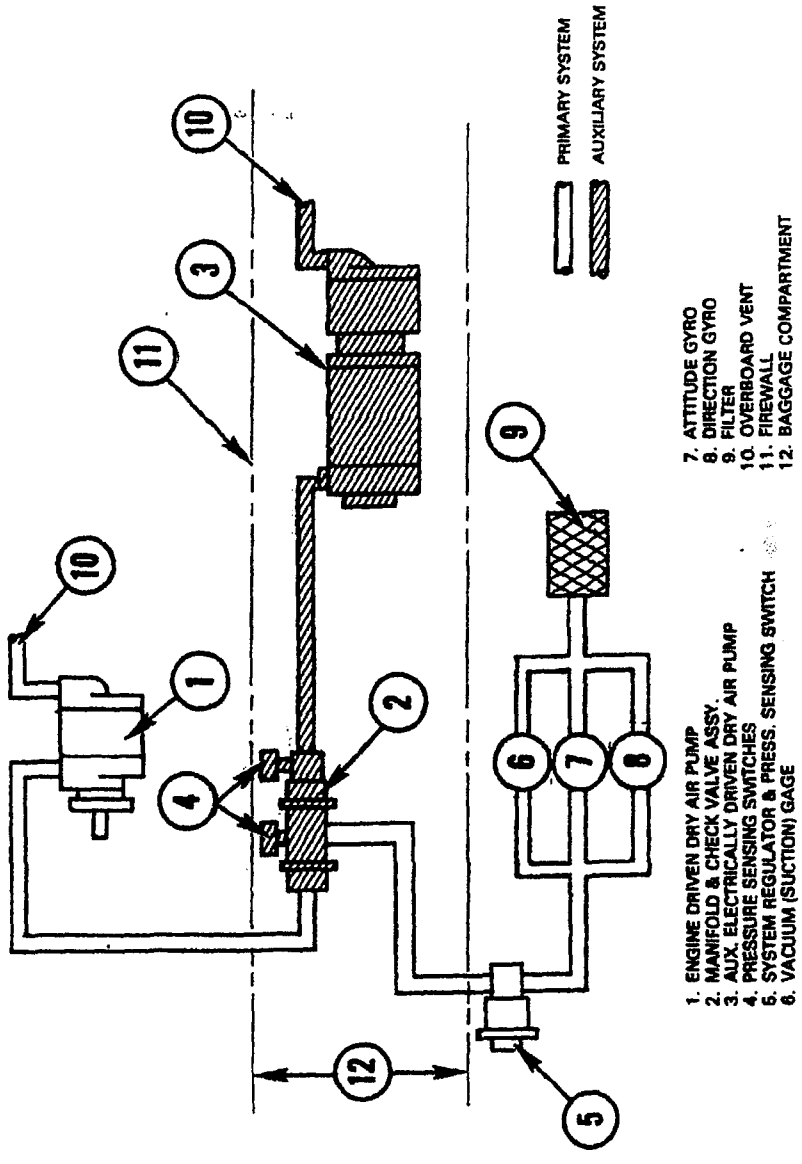
The auxiliary dry air pump system provides an independent back-up source of pneumatic power to operate the gyro flight instruments in the event the engine driven air pump fails.

The auxiliary pump is mounted on the forward side of the firewall and connects to the primary system at a manifold downstream of the vacuum regulator. Isolation of the primary and auxiliary systems from each other is accomplished by check valves on each side of the manifold. The primary system vacuum switch is located on the regulator and senses vacuum supplied to the gyros.

A control switch (labeled AUX VAC) is located on the right side of the instrument panel near the vacuum suction gage.

The switch button incorporates two annunciator light sections labeled VAC OFF and AUX ON. The VAC OFF section is controlled by a vacuum switch in the primary pneumatic system and illuminates an amber light when the engine driven pump is inoperative or when the system vacuum falls below the switch activation level. The AUX ON section is controlled by a vacuum switch on the manifold and illuminates a blue light when the auxiliary pump is operating. When the auxiliary pump is activated at high altitude, or if the system has developed air leaks, the AUX ON light may fail to illuminate. This indicates that the system vacuum is still below the AUX ON switch activation level even though the auxiliary pump is operating. The annunciator lights do not incorporate a press-to-test feature. If the lights do not illuminate, check for burned out lamps. Replace with MS25237-330 bulbs and retest the system.

System electrical protection is provided by a 20 amp circuit breaker in the pump motor circuit and a 5 amp circuit breaker in the annunciator light circuit. The breakers are mounted on the circuit breaker panel.


PRIMARY SYSTEM
AUXILIARY SYSTEM
1. ENGINE DRIVEN DRY AIR PUMP
2. MANIFOLD & CHECK VALVE ASSY.
3. AUX. ELECTRICALLY DRIVEN DRY AIR PUMP
4. PRESSURE SENSING SWITCHES
5. SYSTEM REGULATOR & PRESS. SENSING SWITCH
6. VACUUM (SUCTION) GAGE
7. ATTITUDE GYRO
8. DIRECTION GYRO
9. FILTER
10. OVERBOARD VENT
11. FIREWALL
12. BAGGAGE COMPARTMENT

PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT No. 11 FOR CENTURY 31 AUTOPILOT MODEL AK924

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Century 31 Autopilot System Model AK924 is installed in accordance with STC SA5680SW. The information contained herein supplements or supersedes the information in the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures, and performance information not contained in this supplement, consult the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED D.H. Trompler

D.H. TROMPLER
D.O.A. NO. SO-1
PIPER AIRCRAFT CORPORATION
VERO BEACH, FLORIDA

DATE OF APPROVAL Dec 11, 1986

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Century 31 Autopilot Model AK924 is installed in accordance with FAA Approved Piper data.

SECTION 2 - LIMITATIONS

1. Autopilot OFF during takeoff and landing.
2. Maximum airspeed for autopilot operation is 160 KIAS.
3. Autopilot operation prohibited with more than 2 notches (25°) flaps extended.
4. Placard (P/N 13A990-1) - in full view of the pilot:

CONDUCT TRIM CHECK
PRIOR TO FIRST FLIGHT
OF DAY (SEE AFM).

SECTION 3 - EMERGENCY PROCEDURES

1. AUTOPILOT
   In the event of an autopilot malfunction, or anytime the autopilot is not performing as commanded, do not attempt to identify the problem system. Regain control of the aircraft by overpowering and immediately disconnecting the autopilot. Be prepared for any residual trim force and retrim, as necessary, using the aircraft's primary trim control.

CAUTION

Do not overpower autopilot in pitch for more than approximately 3 seconds as the autotrim system will cause an increase in pitch overpower forces.

a. Autopilot is disconnected by:
(1.) Pressing AP OFF bar on pilot's trim switch.
(2.) Pressing the AP ON-OFF switch on the programmer OFF.
(3.) Depressing master disconnect switch.

b. Autotrim is disconnected by:
(1.) Any action in step a. above, or
(2.) Pushing the trim master OFF.
After failed system has been identified, leave system circuit breaker open and do not operate until the system failure has been identified and corrected.

c. Altitude Loss During Malfunction:
(1.) An autopilot malfunction during climb, cruise or descent with a 3 second delay in recovery initiation could result in as much as 60° of bank and 250 foot altitude loss. Maximum altitude loss was recorded at 180 KIAS during descent.
(2.) An autopilot malfunction during an approach with a 1 second delay in recovery initiation could result in as much as 22° bank and 100 foot altitude loss. Maximum altitude loss measured with 2 notches flaps extended, gear down and operating either coupled or uncoupled.

2. COMPASS SYSTEM

a. Emergency Operation with Optional NSD 360A (HSI) Slaved and/or Non-Slaved:
1. Appearance of HDG flag:
(a.) Check air supply gauge (vacuum or pressure) for adequate air supply (4.8 in. Hg. min.).
(b.) Check compass circuit breaker.
(c.) Observe display for proper operation.
2. To disable heading card - pull circuit breaker and use magnetic compass for directional data.

NOTE

If heading card is not operational, autopilot should not be used.

(3.) With card disabled VOR/Localizer and glide slope displays are still functional; use card set to rotate card to aircraft heading for correct picture.
(4.) Slaving Failure - (i.e. failure to self correct for gyro drift):
(a.) Check gyro slaving switch is set to No. 1 position (if equipped with Slave No. 1 - No. 2 switch) or SLAVED position when equipped with Slaved and Free Gyro Mode Switch.
(b.) Check for HDG Flag.
(c.) Check compass circuit breaker.
(d.) Reset heading card while observing slaving meter.

NOTE

Dead slaving meter needle or a needle displaced fully one direction indicates a slaving system failure.

(e.) Select slaving amplifier No. 2, if equipped.
(f.) Reset heading card while checking slaving meter. If proper slaving indication is not obtained, switch to free gyro mode and periodically set card as an unslaved gyro.

NOTE

In the localizer mode, the to-from arrows may remain out of view, depending upon the design of the NAV converter used in the installation.

SECTION 4 - NORMAL PROCEDURES

I. PREFLIGHT PROCEDURES

NOTE

During system functional check the system must be provided adequate dc voltage (12.0 Vdc min.) and instrument air (4.8 in. Hg. min.). It is recommended that the engine be operated to provide the necessary power and that the aircraft be positioned in a level attitude, during the functional check.

a. AUTOPILOT/AUTOTRIM - To be performed before the first flight of each day.
   (1.) Trim system switch - on.
   (2.) Engage autopilot.
   (3.) Move the heading bug left and right of the lubber line. Observe that the control wheel moves in the direction of the heading bug displacement.
   (4.) Press the DN switch - verify that the control wheel moves in the down direction. Verify that after approximately a 3 second delay, the trim moves in the down direction.
   (5.) Press the UP switch - verify that the control wheel moves in the up direction. Verify that after approximately a 3 second delay, the trim moves in the up direction.
   (6.) Grasp control wheel and override roll and pitch servo actuators to assure override capability.
   (7.) Hold control yoke and disengage autopilot by activating the AP OFF switch on the control wheel.
   (8.) Check controls through full travel in roll and pitch to assure complete autopilot disengagement.
   (9.) Press and hold the TEST switch - all mode annunciators light with AP flashing.
   (10.) Release the TEST switch after all annunciator lights except HDG, ATT, and TEST turn off.
   (11.) Press the DN switch - HDG, ATT and TEST remain on.
   (12.) Press the UP switch - HDG, ATT and TEST remain on.
   (13.) Momentarily press the TEST switch - HDG and ATT remain on, TEST flashes.

(14.) Press the DN switch - the TEST light remains off as long as the DN switch is held.
(15.) Press the UP switch - the TEST light remains off as long as the UP switch is held.
(16.) Momentarily press the TEST switch - HDG and ATT lights remain on and the TEST light goes out.

b. COMMAND TRIM SYSTEM - To be performed before the first flight of each day.
(1.) Using the control wheel trim switch, verify normal trim up and down operation.
(2.) Press and hold the center bar on the control wheel trim switch. Observe that the trim system does not operate.
(3.) Release the center bar on the control wheel trim switch. Move the control wheel trim switch fore and aft. Observe that the trim system does not operate.
This completes the test sequences.

CAUTIONS

Any failure of the above procedures indicates that a failure exists in the system and the system shall not be operated until the failure has been located and corrected.

Check the elevator trim position before takeoff.

c. COMPASS SYSTEM (NSD 360A)
(For other compass systems, refer to appropriate manufacturer's instructions)
(1.) Check slaving switch in SLAVE or SLAVE No. 1 or No. 2 position, as appropriate. (Slaving systems with RMI output provide only slave and free gyro positions.)
(2.) Rotate card to center slaving meter - check HDG displayed with magnetic compass HDG.
(3.) Perform standard VOR receiver check.

2. IN-FLIGHT PROCEDURE - AUTOPILOT
a. Rotate heading bug to desired heading.
b. Trim aircraft for existing flight condition (all axes). Engage autopilot.
c. During maneuvering flight - control aircraft through use of the heading bug and the pitch modifier. (HDG-ATT modes)

d. For navigation operations select modes as required by the operation being conducted and in accordance with the mode description provided in Section 7.1. For specific instructions relating to coupled instrument approach operations, refer to Special Operations and Information.

3. IN-FLIGHT PROCEDURE - COMMAND/AUTOTRIM SYSTEM
   a. Trim master switch - ON.
   b. When the autopilot is engaged, pitch trim is accomplished and maintained automatically.
   c. With the autopilot OFF, command trim is obtained by pressing and rocking the combination TRIM-AP disconnect bar on the pilot's control wheel trim switch.

4. SPECIAL OPERATIONS AND INFORMATION
   a. Altitude Hold Operation
      For best results, reduce rate of climb or descent to 1000 FPM before engaging altitude hold mode.
   b. Flap Extension
      For smooth control, changes in flap extension should be made one notch at a time allowing time between changes for the airspeed to stabilize.
   c. Instrument Approach Operations
      Initial and intermediate approach segments should be conducted between 90-100 KIAS with flaps positioned 0° to full down position. Upon intercepting the glide path or when passing the final approach fix lower the landing gear and reduce power for approximately 80-95 KIAS on the final approach segment. Adjust power as necessary during remainder of approach to maintain correct airspeed. Monitor course guidance information (raw data) throughout the approach. All power changes should be of small magnitude and smoothly applied for best tracking performance. Do not change aircraft configuration during final approach while autopilot is engaged. For approaches without glide path coupling, adjust pitch attitude in conjunction with power to maintain desired airspeed and descent rate.

NOTE

The autopilot will not decouple from the GS or localizer in the event of radio failure, however, warnings will flash in the mode appropriate to the failure. Monitor course guidance raw data during the approach to assure signal quality.

d. Instrument Approach Go-Around Maneuver
(1.) Disconnect the autopilot and manually control the aircraft.
(2.) Add takeoff power, or power as desired.
(3.) Check that correct attitude and that a positive rate of climb is indicated, then raise gear and flaps.
(4.) Set the heading bug to the desired missed approach heading.
(5.) Re-engage the autopilot.

SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in Section 6 of the basic Pilot's Operating Handbook.

SECTION 7 - DESCRIPTION AND OPERATION

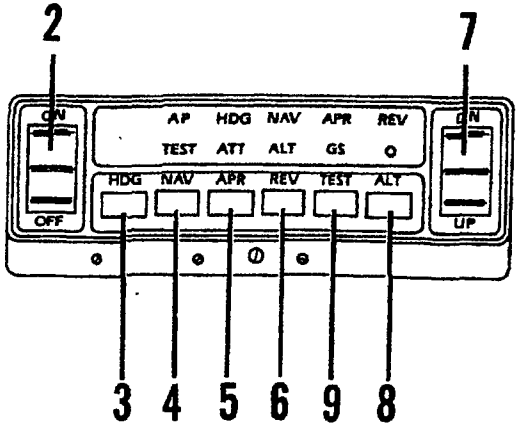
The Century 31 Autopilot is a light weight electronic autopilot system utilizing vertical and directional gyro signals and dc electric servos to provide three axis sensing and two surface control. The system includes lateral and vertical radio coupling, command and automatic elevator trim; and navigation and autopilot failure monitor and warning systems.

The Century 31 is activated with the aircraft master switch and operates in a low power state until the autopilot is engaged. Mode selection is made by pushing the desired mode switch on the mode programmer. The selected mode will illuminate on the annunciator panel.

The annunciator panel contains an ambient light level sensor which will automatically dim the annunciator light level during night operations. The programmer contains mode recognition lights and dimming is provided by the panel light dimmer switch.

The electric elevator trim system is a fully redundant type in both the manual and autotrim modes. The trim system is powered through a separate system master switch that must be ON during autopilot operations, and for the control wheel trim command switch to function when the autopilot is OFF.

7.1 COCKPIT CONTROLS AND FUNCTIONS



ID 762-C CONTROLLER/FLIGHT COMPUTER
Figure 7-1

1. Trim System Master switch (Figure 7-3) - provides power for all autotrim and control wheel electric trim operations.
2. Autopilot ON - OFF switch - Momentary rocker type switch which engages or disengages the autopilot roll, pitch and trim servos and lights or extinguishes autopilot (AP) annunciator, as appropriate.

NOTE

The autopilot will switch to HDG and ATT modes upon engagement or disengagement with automatic pitch attitude synchronization.

3. HDG Mode Selector switch - provides turn control and heading hold through use of the heading index (bug) on the DG or HSI heading instrument.

Figure 7-1 (cont)

4. NAV (Navigation) Mode Selector switch - provides automatic 45° VOR-LOC intercept angle; tracking and crosswind correction. The autopilot utilizes the HDG bug as the VOR course reference and a separate VOR indicator instrument for left-right information when using a DG or the course indicator and left-right needle for reference inputs when using an HSI type compass/VOR display. The NAV mode provides automatic gain and rate reductions and bank limiting to improve tracking performance. NAV mode should normally be used as an enroute function. Select APR mode for LOC and VOR approaches.

NOTES

The heading bug is disabled when using an HSI and NAV, APR or REV is selected, except when using selected angle intercept feature (refer to Special Modes and Operations).

With a D.G., the heading bug must be set to the desired radio course when using NAV, APR or REV modes.

Select desired course on HSI course selector (or OBS and D.G.) and select NAV mode for VOR tracking.

5. APR (Approach) Mode Selector switch - provides automatic 45° VOR-LOC intercept angle, tracking and crosswind correction during instrument approach operations. D.G./H.S.I. operation and function are identical to NAV mode. Select the desired course on H.S.I. (or O.B.S. and D.G.) course selector and select APR mode.
6. REV (Back Course) Mode Selector Switch - for use in tracking the LOC front course outbound, or the LOC back course inbound, or the published VOR approach course outbound. When using an HSI display always set the course selector on the inbound front localizer course or VOR inbound published approach course when using REV mode. When using a D.G. the heading bug must be set to the final approach course.
7. Pitch Modifier/Attitude Selector switch
   The pitch data modifier is a momentary type switch that is used to select the ATT mode or modify the aircraft attitude. When the autopilot is engaged, automatic pitch synchronization is provided to the attitude existing at engagement. In ATT mode, actuation of

Figure 7-1 (cont)

the modifier UP or DN will cause a pitch attitude change at a rate of 0.7° per second. In ALT mode, actuation of the pitch modifier will cause the autopilot to enter the ATT mode with subsequent operation as described above.

8. ALT (Altitude) Mode Selector Switch
   Selection of ALT mode will cause the autopilot to maintain the pressure level (altitude) at the point of engagement. Because of the pitch rate control provided by the autopilot, altitude mode may be engaged from any rate of climb or descent, however, for maximum passenger comfort, rate of climb or descent should be reduced to 1000 FPM or less prior to ALT mode engagement.
9. Test - See Section 4 for test procedure.

a. SPECIAL MODES AND OPERATIONS

(1.) Glide Slope (GS) Mode - The GS mode is fully autotic, therefore, no GS engage switch is used. The GS mode may be entered from either ATT mode or ALT mode, from above the GS centerline or below the centerline.

Activation of the GS mode depends upon satisfying two sets of conditions; completion of the ARMING sequence and the satisfying of an equation relating to the aircraft's position relative to the GS centerline and the rate at which the aircraft is approaching or departing from the GS centerline.

For GS mode arming, the following conditions must exist simultaneously:

(a.) No. 1 NAV radio must be channeled to a localizer frequency.
(b.) Localizer deviation must be less than 80%.
(c.) Localizer flag not extended - valid LOC signal.
(d.) GS Flag not extended - valid GS signal.
(e.) System in APR mode.
(f.) System in either ATT or ALT mode.

When the GS mode arming conditions are met, the GS mode annunciator will illuminate in conjunction with the active pitch mode. Loss of any arming condition prior to GS capture will cause the GS annunciator to extinguish.

GS mode activation (GS capture) is indicated by the active pitch mode annunciator extinguishing, leaving only the GS annunciator lighted. Since GS mode activation results from a combination of position and rate information, GS capture will probably occur before the GS needle centers in such a manner that the transition on to the GS centerline will be anticipated and therefore, very smooth.

After GS capture, loss of valid GS signal will cause the GS annunciator to flash. Also selection of HDG, NAV or REV mode will cause GS to flash, indicating an inconsistent GS tracking condition. APR mode must be selected while tracking glide slope.

The GS mode may be deactivated by selection of any other pitch mode (ATT, ALT), however, automatic reactivation is possible from any pitch mode if APR mode is selected.

NOTE

If valid glide slope data is lost after coupling, the autopilot will NOT automatically decouple, however the GS light will flash. The pilot must monitor raw course guidance data during the approach to assure signal quality.

Since GS arm and capture are automatic when the arming and capture sequence is met, the GS must be locked out for holding operations on the localizer at the L.O.M. When localizer holding is desired, localizer tracking must be performed in NAV mode which will offer the same tracking dynamics as APR mode but will inhibit GS arm and capture. When APR clearance is received, select APR mode for completion of the approach.

(2) Selected Angle Intercepts - If an H.S.I. type heading system is installed, selected angle intercepts may be made during VOR or localizer intercept situations by selecting HDG and NAV, HDG and APR, or HDG and REV, simultaneously, as appropriate. During a selected angle intercept operation, the autopilot will follow the heading bug until reaching the computed On Course Turn Point at which time capture is indicated by extinguishing of the

HDG mode annunciator. Selected angle intercepts of over 60° are not recommended.

NOTE

If radio information becomes invalid (Flag) after initiation of a selected angle intercept the applicable navigation mode annunciator will flash and the autopilot will remain in HDG mode. The automatic mode shift to the invalid radio mode will not occur.

(3) CWS Mode - The system is equipped with a control wheel steering switch on the pilot's control wheel. When depressed and held, this switch will disengage the autopilot roll and pitch servos to allow manual aircraft maneuvering. When released, the servos will re-engage with the lateral (roll) mode previously in use activated. The pitch mode previously engaged will remain programmed in the following condition:

(a.) ALT Mode - If ALT mode had been in use, the ALT mode will synchronize at the new pressure altitude existing at release of the CWS switch.

(b.) ATT Mode - If the ATT mode had been in use, the system will synchronize with the aircraft attitude existing at release of the switch.

(4) System Test (Ground operations only) - The system is equipped with a comprehensive test circuit which, when activated, will test the failure monitor circuits and all the annunciator lamps. Activation of the TEST switch will initiate the system test only when the autopilot is not engaged. When autopilot is engaged, activation of the TEST switch will test the annunciator lamps. If the autopilot is engaged during the test sequence, the sequence will terminate immediately. Refer to Section 4 for tests required before the first flight of each day.

(5) Warning System and Interlocks - The Century 31 system includes a number of automatic interlocks that will prevent system operation or individual mode operation if the input information is not valid or if other prerequisite conditions do not exist. In addition to the interlocks, the system will annunciate various failure conditions as advisory information for the pilot. Following is a brief description of the interlocks and warnings provided.

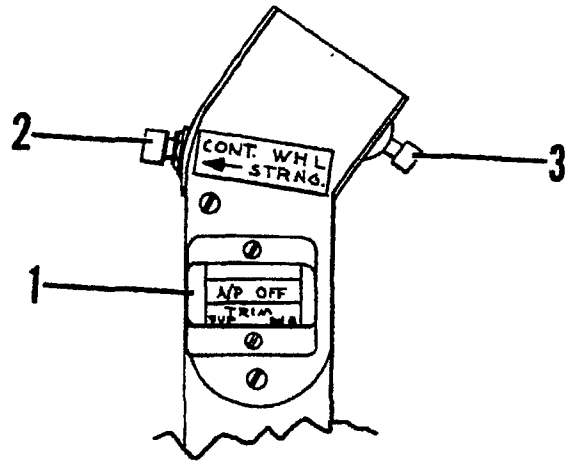
(a.) Interlocks

1. Autopilot engagement is inhibited unless an excitation signal is being provided to the attitude gyro.
2. Selection of ALT mode is inhibited if the system altitude information is unreliable or if the entire system has not been powered for approximately 3 minutes to allow stabilization of the altitude source.
3. During Dual Mode (selected angle) intercepts, if the navigation information becomes invalid the appropriate NAV/APR/REV annunciator will flash and automatic mode switching from HDG to the coupled navigation mode will be inhibited.

(b.) Warnings

1. Low Voltage - When the aircraft bus voltage falls below the minimum required for reliable system function, any mode annunciator not already ON will flash.
2. Attitude Gyro Excitation - Absence of valid gyro excitation will cause the autopilot to disengage and the AP annunciator to flash. The autopilot cannot be reengaged until this condition is corrected.
3. AP Disengagement - Anytime the autopilot is disengaged the AP annunciator will flash for approximately 5 seconds, then remain OFF.
4. Navigation Information Invalid - The appropriate navigation mode annunciator will flash when selected and invalid navigation signals are present NAV flag in view). Additionally, the appropriate navigation mode annunciator (NAV /APR/REV will flash during a dual mode intercept if invalid navigation information is present.
5. GS Information Invalid - The GS annunciator will flash when GS information (GS Flag in view) is invalid after the GS mode is active or when HDG, NAV or REV mode is selected after GS capture. If valid GS information is not available during the arming sequence, the system will not arm and GS capture will not occur.

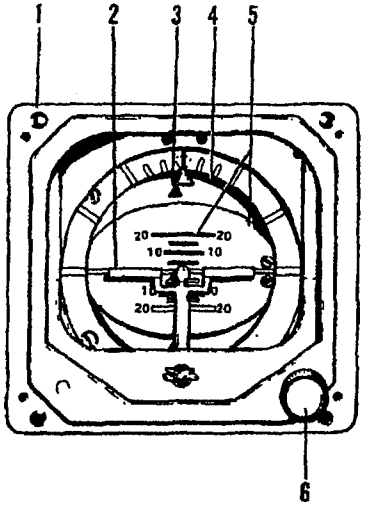
b. REMOTE CONTROL SWITCHES



AUTOPILOT CONTROL WHEEL SWITCH CAP
Figure 7-3

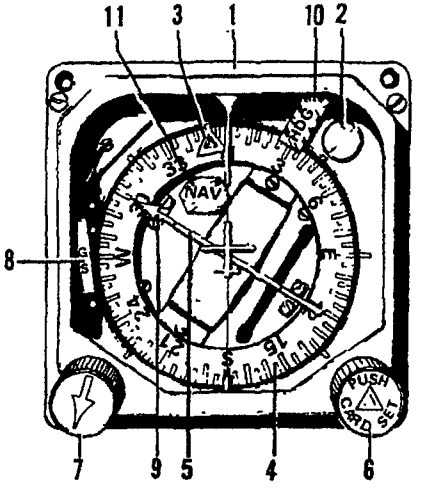
(1) Command trim switch - Split action type switch requiring the top bar to be depressed and the rocker to be moved fore or aft to cause the electric trim to function from the control wheel switch. Depressing the center bar will disconnect the autopilot.
(2) Control wheel steering (CWS) switch - See explanation in Special Modes and Operations Section.
(3) Master disconnect switch - Pressing this switch will disconnect autopilot and interrupt command/autotrim while depressed. Trim operation will resume when the switch is released.

7.3 INSTRUMENTS



ATTITUDE GYRO
Figure 7-5

(1.) Standard 3 inch air driven attitude indicator gyro.
(2.) 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.
(3.) Roll attitude index - Displays airplane roll attitude with respect to the roll attitude scale.
(4.) Roll attitude scale - Scale marked at 0, +10, +20, +30, +60 and +90 degrees.
(5.) Pitch attitude scale - Moves with respect to the symbolic airplane to present pitch attitude. Scale graduated at 0, +5, +10, +15, +20 degrees.
(6.) Symbolic aircraft alignment nob - Provides manual positioning of the symbolic aircraft for level flight under various load conditions.



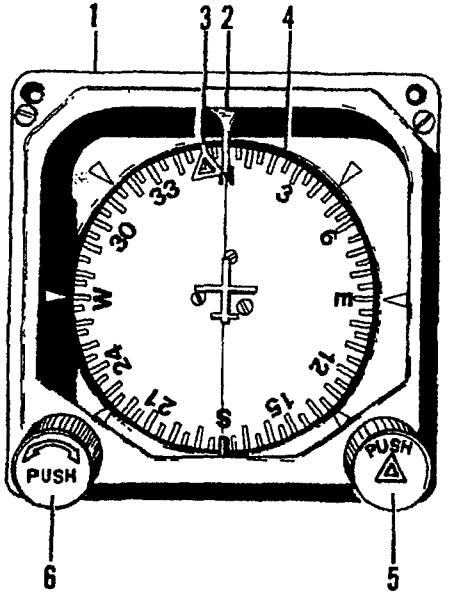
NSD-360A NAVIGATION SITUATION DISPLAY
Figure 7-7

(1.) NSD-360A Compass System - (For details of any other compass system, refer to manufacturer's information.)
(2.) Slaving Meter - Oscillation of needle indicates that compass is slaved to magnetic flux detector. Needle maintained in either extreme position for more than 2 - 3 minutes indicates system failure.

NOTE

NSD-360A System includes a slaving selector switch allowing the selection of free gyro mode. Refer to emergency procedures for failure instructions.

(3.) HDG index (bug) for autopilot heading control.
(4.) Compass card.
(5.) Left-right portion of VOR-LOC course needle.
(6.) HDG control knob - push in for initial compass setting.
(7.) VOR course needle set knob (O.B.S.).
(8.) GS Indicator with flag alarm.
(9.) VOR-LOC bearing selector course needle and omni bearing indicator.
(10.) Heading warning flag.
(11.) Navigation warning flag.



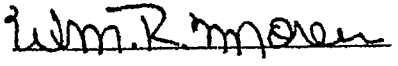
DIRECTIONAL GYRO
Figure 7-9

1. Non-slaved directional gyro - Provides a stable visual indication of aircraft heading to the pilot. The gyro is air driven.
2. Lubber line - Indicates aircraft magnetic heading on compass card (4).
3. Heading bug - moved by (⚠) knob (5) to select desired heading.
4. Compass card - Rotates to display heading of airplane with reference to lubber line (2) on DG.
5. Heading selector knob (⚠) - Positions heading bug (3) on compass card (4) by rotating the heading selector knob. The bug rotates with the compass card.
6. Gyro adjustment knob (PUSH) - When pushed in, allows the pilot to manually rotate the gyro compass card (4) 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.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 12
FOR
BENDIX/KING KLN 90A GPS
NAVIGATION SYSTEM WITH
KAP 100/150 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 90A 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 

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VERO BEACH, FLORIDA

DATE OF APPROVAL DECEMBER 07, 1993

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Bendix/King KLN 90A GPS Navigation System is installed. The Navigation System must be operated within the limitations herein specified. The information contained within this supplement is to be used in conjunction with the complete handbook.

Provided the KLN 90A GPS Navigation System is receiving adequate usable signals, it has been demonstrated capable of and has shown to meet the accuracy specifications of:

VFR/IFR Enroute Oceanic, Enroute Domestic and Terminal operation within the U.S. National Airspace System, North Atlantic Minimum Navigation Performance Specification (MNPS) airspace and latitudes bounded by 74° north and 60° south using WGS-84 (NAD 83) chart references in accordance with the criteria of Notice 8110.47, AC 91-49 and AC 120-33.

NOTE:

Prior to initial operational capability (IOC) of GPS by the Department of Defense (DOD), aircraft using GPS for oceanic IFR operations must also be equipped with other approved means, such as dual INS or dual Omega, that are approved and appropriate for the intended route of flight. These systems must be installed and operating and be actively monitored by the flight crew. Upon IOC, a KLN 90A GPS may be used to replace one of the other approved means of long-range navigation. A single KLN 90A GPS installation may also be used on short oceanic routes which require only one means of long-range navigation.

This supplement has been FAA Approved as a permanent part of this handbook and must remain in this handbook at all times when the optional Bendix/King KLN 90A GPS Navigation System is installed.

SECTION 2 - LIMITATIONS

A. The KLN 90A GPS Pilot's Guide, Bendix/King p/n 006-08743-0000, dated September 1993 (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 10 or later.
2. The system is not approved for approach operation.
3. IFR 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.

C. When using the KLN 90A GPS, additional equipment required for the specific type of operation must be installed and operating.

SECTION 3 - EMERGENCY PROCEDURES

If the KLN 90A GPS information is flagged, utilize remaining operational navigation equipment as required.

SECTION 4 - NORMAL PROCEDURES

(a) OPERATION

Normal operating procedures are outlined in the Bendix/King KLN 90A GPS Navigation System, Pilots Guide p/n 006-08743-0000 dated September, 1993, (or later applicable revision).

(b) AURAL ALERT TONES

1. Altitude Alerting Aural Tones:

   1000 feet prior to reaching the selected altitude - three short tones.

   Upon reaching the selected altitude - two short tones.

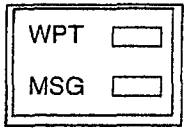
   Deviating above or below the selected altitude by more than the warn altitude - four short tones.

2. Height Above Airport Aural Tone:

   A short tone, followed by a long tone, followed by a short tone.

SECTION 4 - NORMAL PROCEDURES (CONT'D)

(c) EXTERNAL ANNUNCIATORS: (OPTIONAL)



1. Waypoint (WPT)

   Approximately 36 seconds prior to reaching a direct to waypoint or 20 seconds prior to the beginning of turn anticipation (turn anticipation function enabled) the waypoint alert annunciator will begin flashing. This is called "waypoint alerting".

   WARNING:

   Turn anticipation is automatically disabled for waypoints used exclusively in SID/STARS where overflight is required. For waypoints shared between SID/STARS and published enroute 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.

2. Message (MSG)

   MSG will flash to alert the pilot of a situation that requires attention. Press the MSG button on the KLN 90A GPS to view the message. (Appendix B of the Pilots Guide contains a list of all of the message page messages and their meanings).

(d) SYSTEM SWITCHES:

NAV/GPS - 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 90A GPS.

SECTION 5 - PERFORMANCE

Installation of the Bendix/King KLN 90A GPS does not affect the basic performance information in Section 5 of this Pilot's Operating Handbook.

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.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT 13
FOR
3M (SERIES II) STORMSCOPE, WX-1000/WX-1000+

This supplement must be attached to the Pilot's Operating Handbook and the FAA Approved Airplane Flight Manual when the optional WX-1000/WX-1000+ Stormscope System is installed per Piper Drawing CA34-2-024-4. 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 Wm. R. Moreu
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PIPER AIRCRAFT CORPORATION
VERO BEACH, FLORIDA

DATE OF APPROVAL December 07, 1993

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional WX-1000 or WX-1000+ Stormscope system is installed in accordance with FAA Approved Piper data.

SECTION 2 - LIMITATIONS

(a) The WX-1000/WX-1000+ Stormscope system signal displays are not intended for the purpose of penetrating thunderstorm areas or areas of severe turbulence; such intentional use is not approved.

NOTE

Range selector determines receiver sensitivity and therefore relative range. Displayed range is based on signal strength and is not to be used for accurate determination of thunderstorm location.

(b) The WX-1000 checklist functions are for reference only.

(c) Placards

Located on the instrument panel:

STORMSCOPE NOT TO BE USED FOR
THUNDERSTORM AREA PENETRATION

SECTION 3 - EMERGENCY PROCEDURES

No change.

SECTION 4 - NORMAL PROCEDURES

Normal operating procedures are outlined in the 3M Model, Series II, Stormscope Pilot's Handbook, P/N 75-0299-5332-2(781)11, latest revision.

SECTION 5 - PERFORMANCE

No change.

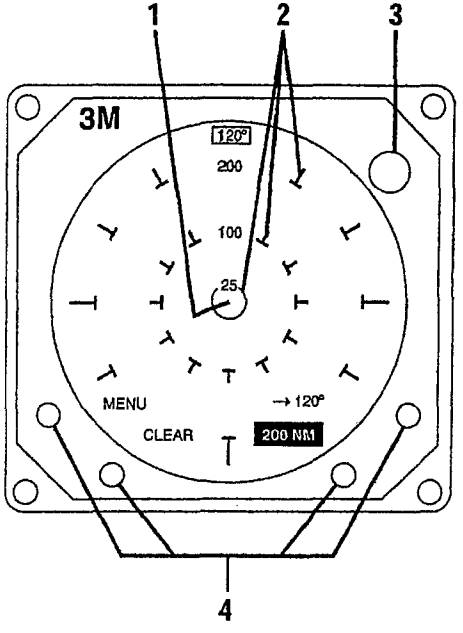
SECTION 6 - WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in the Equipment List attached to the Pilot's Operating Handbook.

SECTION 7 - DESCRIPTION AND OPERATION

The 3M (Series II) Stormscope, WX-1000, weather mapping system provides a visual screen readout of the electrical discharges associated with thunderstorms. This information with proper interpretation, will allow the pilot to detect severe thunderstorm activity. A series of green dots will be displayed on the screen to indicate the electrical discharge areas. The display scope provides full scale selectable ranges of 200, 100, 50, and 25 nautical miles along with 30° azimuth sectors.

The WX-1000 has a heading stabilized display which automatically repositions thunderstorm information relative to the aircraft heading, eliminating the need to clear the display after each heading change. The "CLEAR" function remains useful for verifying thunderstorm information and for determining whether storm cells are building or dissipating. Heading information is displayed when operating in the weather modes and a "FLAG" advisory will appear in the event of heading source malfunction.



1. MAPPING DIRECTION INDICATOR
2. RANGE REFERENCE
3. POWER/BRIGHTNESS
4. MOMENTARY CONTACT FUNCTION BUTTONS

WX-1000 STORMSCOPE
Figure 7-1

SECTION 10

OPERATING TIPS

10.1 GENERAL

This section provides operating tips of particular value in the operation of the Dakota.

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 about 77 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) Flaps may be lowered at airspeeds up to 102 KIAS. To reduce flap operating loads, it is desirable to have the airplane at a slower speed before extending the flaps. The flap step will not support weight if the flaps are in any extended position. The flaps must be placed in the "UP" position before they will lock and support weight on the step.

(d) Before attempting to reset any circuit breaker, allow a two to five minute cooling off period.

(e) 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 the reflected light can produce spatial disorientation. Strobe lights should not be used in close proximity to the ground such as during taxiing, takeoff or landing.

(g) The rudder pedals are suspended from a torque tube which extends across the fuselage. The pilot should become familiar with the proper positioning of his feet on the rudder pedals so as to avoid interference with the torque tube when moving the rudder pedals or operating the toe brakes.

(h) 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 nd safety aids.

(i) The airplane should not be flown in severe turbulence as damage to the airframe structure could result.

(j) Prolonged slips or skids which result in excess of 2000 ft. 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 tank being used is not full.

TABLE OF CONTENTS

SECTION 10

OPERATING TIPS