PILOT'S OPERATING HANDBOOK

DUPLICATE

PIPER CHEYENNE

FAA APPROVED IN NORMAL CATEGORY BASED ON CAR 3 AND FAR PART 21, SUBPART J. THIS DOCUMENT INCLUDES THE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY CAR 3 AND FAR PART 21, SUBPART J AND CONSTITUTES THE APPROVED AIRPLANE FLIGHT MANUAL AND MUST BE CARRIED IN THE AIRPLANE AT ALL TIMES.

AIRPLANE SERIAL NO. 31T7820056

AIRPLANE REGISTRATION NO. 781CK

PA-31T
REPORT: 2048

FAA APPROVED BY: Paul E Everly

PAUL E. EVERLY
D.O.A. NO. EA-1
PIPER AIRCRAFT CORPORATION
LOCK HAVEN, PENNSYLVANIA

HANDBOOK ISSUED DATE: OCTOBER 21, 1976
AIRPLANE APPROVAL DATE: MAY 3, 1972

PIPER

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
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APPLICABILITY

The aircraft serial number eligibility bracket for application of this handbook is 31T-7720001 through 31T-7920094. The specific application of this handbook is limited to the Piper PA-31T model airplane designated by serial number and registration number on the face of the title page of this handbook.

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

WARNING

INSPECTION, MAINTENANCE AND PARTS REQUIREMENTS FOR ALL NON-PIPER APPROVED STC INSTALLATIONS ARE NOT INCLUDED IN THIS HANDBOOK. WHEN A NON-PIPER APPROVED STC INSTALLATION IS INCORPORATED ON THE AIRPLANE, THOSE PORTIONS OF THE AIRPLANE AFFECTED BY THE INSTALLATION MUST BE INSPECTED IN ACCORDANCE WITH THE INSPECTION PROGRAM PUBLISHED BY THE OWNER OF THE STC. SINCE NON-PIPER APPROVED STC INSTALLATIONS MAY CHANGE SYSTEMS INTERFACE, OPERATING CHARACTERISTICS AND COMPONENT LOADS OR STRESSES ON ADJACENT STRUCTURES, PIPER PROVIDED INSPECTION CRITERIA MAY NOT BE VALID FOR AIRPLANES WITH NON-PIPER APPROVED STC INSTALLATIONS.

REVISIONS

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

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

I. Revisions

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

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

II. Identification of Revised Material

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

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

ORIGINAL PAGES ISSUED

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

Title, ii through v, 1-1 through 1-14, 2-1 through 2-18, 3-1 through 3-26, 4-1 through 4-30, 5-1 through 5-80, 6-1 through 6-56, 7-1 through 7-48, 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-31T Cheyenne Pilot's Operating Handbook, REPORT: 2048 issued October 21, 1976.

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 1 - 761 625 (PR770214)	1-6	Added Vsse; relocated (c) to page 1-7.	
	1-7	Added (c) from previous page; relocated material to page 1-8.	
	1-8	Added material from previous page; relocated material to page 1-9.	
	1-9	Added material from previous page.	
	2-2	Added KCAS and KIAS labels.	
	2-9	Changed "manual" to "handbook."	
	2-11	Added item (21) and (22) to (a); deleted (b) (4) and (c) (8).	
	2-12	Revised item (g) (3); deleted item (h) (4).	
	2-16	Removed "On fuel system console."	
	3-i	Revised paragraph 3.23.	
	3-ii	Relocated 3.27 to last item; renumbered paragraphs and page nos. accordingly.	
	3-3	Replaced "Recommended single-engine maneuvering speed" with "Safe single-engine speed"; revised Engine Failure During Flight (Above 91 KIAS) procedures.	
	3-5	Removed "cowl flap" reference.	
	3-6	Revised "Main Generator Circuit Breaker" to read "Generator Bus Tie Circuit Breaker."	
	3-7	Relocated Flight With Primary Longitudinal Control Failed to page 3-9; added material relocated from page 3-8.	
	3-8	Relocated material to previous page; revised Emergency Descent Procedure and added info; changed "Asymmetric Flap Extension" to "Condition" and revised info.	
	3-9	Added material from page 3-7.	
	3-11	Revised airspeed in NOTES	
	3-12	Removed "cowl flap" references; added info to Engine Failure During Takeoff; revised Engine Failure During Flight (Above 91 KIAS) procedures.	
	3-14	Revised airspeeds; revised Single-Engine Go-Around procedures.	
	3-16	Change "power levers" to "power lever."	
	3-17	Revised paragraph 3.9.	
	3-18	Revised Single Generator Failure info.	
	3-19	Revised "Main Generator C/B" to read "Generator Bus Tie C/B."	
	3-21	Revised airspeeds; relocated 3.27 to page 3-26.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 1 - 761 625 (PR770214) (cont)	3-22	Revised paragraph no. from 3.29 to 3.27; revised para. no. in NOTES.	
	3-23	Revised paragraph no. from 3.31 to 3.29; added 3.33 from page 3-24 and renumbered as 3.31.	
	3-24	Revised paragraph nos. 3.33 to 3.31, 3.35 to 3.33, 3.37 to 3.35, and 3.39 to 3.37; relocated 3.31 to previous page; revised 3.33; added info to 3.35.	
	3-25	Revised paragraph nos. from 3.41 to 3.39, 3.43 to 3.41, and 3.45 to 3.43; revised 3.41 title and info.	
	3-26	Added material relocated from page 3-21.	
	4-2	Added Safe Single-Engine Speed; renumbered items accordingly.	
	4-6	Added "52%" to Normal Start procedures.	
	4-8	Revised airspeed in Takeoff and Climb.	
	4-9	Revised airspeed and procedures in Before Landing; revised Shut Down procedures.	
	4-13	Changed "valves" to "sumps."	
	4-16	Revised Normal Start procedures.	
	4-19	Revised procedures in 4.19.	
	4-20	Revised airspeed in 4.23.	
	4-22	In 4.31 revised airspeeds and brake info.	
	4-23	Revised 4.37.	
	5-9	Changed "cowl flap" to "Oil Cooler Door."	
	5-11	Revised Figure 5-1.	
	5-12	Revised Figure 5-3.	
	5-23	Revised NOTE.	
	5-29, 5-30	Changed "cowl flap" to "Oil Cooler Door."	
	5-31, 5-32	Changed "cowl flap" to "Oil Cooler Door "; revised airspeed.	
	5-37 thru 5-64	Revised all IOAT figures.	
	5-69, 5-74, 5-75	Changed "Cowl Flap" to "Oil Cooler Door."	
	6-56	Revised item 517.	
	7-7	Revised paragraph 7.9.	
	7-14	Revised info in 7.19.	
	7-26	Revised 41 in illust. and 45 in list.	
	7-27	Removed "(cowl flap)."	
	8-5	Added item (b) (8) to 8.9.	
	8-6	Added info to item (c) (2).	
	9-i	Added Supplement No. 3 to Table of Contents.	
	9-11 thru 9-26	Added Supplement 3 (Sperry SPZ-200/Stars IVC Automatic Flight Control System With Torque Switching (WTS).	Paul E. Everly PE Everly
	10-2	Added items (n), (o) and (p).	Feb. 14, 1977

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 2 - 761 625 (PR770506)	2-7	Revised NOTE.	
	2-8	Added info to 2.13.	
	2-15	Revised Emergency Gear Extension placard.	
	3-7	Revised airspeeds in Stability Augmentation System Failure procedures.	
	3-26	Revised airspeed in para. 3.45.	
	4-19	Added info to para. 4.19.	
	5-29	Revised Figure 5-37.	
	5-41	Revised Figure 5-55.	
	5-51	Revised Figure 5-75.	
	5-53	Revised Figure 5-79.	
	5-58	Revised Figure 5-89.	
	6-29	Added PAC Dwg. No. to item 79.	
	6-32	Changed (Ng) to (Np) in item 113.	
	7-15	Added items 15 and 16 to list in Figure 7-11.	
	7-22	Revised electrical panel description in para. 7.25.	
	7-32	Deleted extraneous callouts from Figure 7-29.	Paul E. Everly
	8-16	Revised items (c) (6) and (d) (6).	P E Everly
	8-17	Revised item (e) (5), a.	
	8-18	Added info to item (h).	May 6, 1977
Rev. 3 - 761 625 (PR770825)	1-11, 1-12, 1-13, 1-14	Revised 1.21, Conversion Factors.	
	2-5	Revised "Normal Cruise" in table (d) to read "Economy Cruise."	
	2-17	Added ser. no. ident. to SAS warning placard.	
	3-ii	Revised Page Nos. for 3.31, 3.37, 3.41, 3.43 and 3.45; added Paragraph No. 3.47.	
	3-7	Revised heading under Stability Augmentation System Failure.	
	3-8	Revised Gear Up Landing procedure.	
	3-20	Revised introduction in 3.25, Stability Augmentation System Failure.	
	3-23	Revised 48 cu. ft. table; added 22 cu. ft. table; relocated 3.31, Crossfeed Procedure, to page 3-24.	
	3-24	Added 3.31 relocated from page 3-23; revised nose lowering procedure in 3.33, Emergency Descent Procedures; relocated 3.37, Gear Up Landing, to page 3-25.	
	3-25	Added 3.37 relocated from page 3-24; revised info. in 3.37, Gear Up Landing; relocated 3.41, Asymmetric Flap Condition, and 3.43, Alternate Static Source, to page 3-26.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 3 - 761 625 (PR770825) (cont)	3-26	Added 3.41 and 3.43 relocated from page 3-25; relocated 3.45, Flight With Primary Longitudinal Control Failed to page 3-27.	
	3-27	Added page (3.45 relocated from page 3-26; added 3.47, Annunciator Failure).	
	3-28	Added page (3.47 continued).	
	3-29	Added page (3.47 continued).	
	4-12	Added ser. no. ident. to Annun. display; added Annun. display; relocated material to page 4-13.	
	4-13	Added material relocated from page 4-12.	
	4-18	Added ser. no. ident. to SAS check in 4.15, Before Taxi.	
	4-19	Revised HTG test in 4.19, Engine Run-Up.	
	4-24	Revised instructions in 4.39, Cabin Pressurization System.	
	4-29	Added CAUTION to In Flight procedures of (b) Pneumatic Wing and Tail Deicing System.	
	5-9	Added Economy Cruise Power tables to List of Figures (Fig. 5-78 thru 5-78c); relocated 5-79 thru 5-85 to page 5-10.	
	5-10	Added Economy Cruise Power tables to List of Figures (Fig. 5-78d thru 5-78o); added material relocated from page 5-9.	
	5-31	Revised Climb Speed in Fig. 5-41.	
	5-32	Revised Climb Speed in Fig. 5-43.	
	5-37 thru 5-52	Revised IOAT figures; revised "Maximum Range" to read "Economy Cruise"; miscellaneous revisions.	
	5-52a thru 5-52p	Added pages (added Economy Cruise Power tables).	
	5-53 thru 5-64	Revised IOAT figures.	
	5-67	Added Economy Cruise to Fig. 5-111; revised TAS figure.	
	5-70	Added Economy Cruise Power to Fig. 5-117.	
	5-71	Added Economy Cruise Power to Fig. 5-119.	
	6-32	Revised arm in item 115; added item 122; relocated item 131 to page 6-33.	
	6-33	Added 131 from page 6-32; added items 138 and 142; relocated items 147,149 and 151 to page 6-34.	
	6-34	Added 147,149 and 151 from page 6-33.	
	6-35	Revised PAC Dwg. No. in item 179.	
	6-41	Revised part no. in item 213.	
	6-43	Revised name of item 227.	
	6-53	Added Radio Equipment item 396.	
	6-55	Added items 504 and 514.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 3 - 761 625 (PR770825) (cont)	6-56	Added items 516, 525, 527, 529 and 531; revised item 519.	
	7-i	Added Paragraph No. 7.28	
	7-ii	Revised Page Nos. for 7.79 and 7.81; added Paragraph No. 7.83.	
	7-14	Revised SAS test and warning info. in 7.21, Stability Augmentation System.	
	7-15	Added item 17 to Fig. 7-11; added ser. no. ident.	
	7-16	Added ser. no. ident. to stall light description.	
	7-18	Added note to Fig. 7-15.	
	7-20	Revised Fig. 7-17.	
	7-24	Revised illustration and callouts in Fig. 7-21.	
	7-25	Revised 7.27, Instrument Panel; relocated material from page 7-27.	
	7-26	Added ser. no. ident. to Fig. 7-23.	
	7-27	Relocated material to page 7-25; deleted material; added Fig. 7-24.	
	7-27a	Added page (added 7.28, Annunciator Display System).	
	7-27b	Added page (7.28 continued).	
	7-34	Revised warning light info.	
	7-37	Revised oxygen cylinder description in 7.43, Oxygen System.	
	7-46	Revised description in 7.71, Refreshment Cabinet and Beverage Dispenser; revised description in 7.73, Folding Tables.	
	7-47	Relocated 7.79 and 7.81 to page 7-48; added Fig. 7-37.	Paul E. Everly
	7-48	Added 7.79 and 7.81 relocated from page 7-47; added 7.83, Emergency Avionics and Attitude Gyro Battery.	P E Everly August 25, 1977
Rev. 4 - 761 625 (PR771209)	4-i	Revised pg. no.	
	4-22	Added Caution to para. 4.31, Before Landing; relocated para. 4.35, After Landing to pg. 4-23.	
	4-23	Added info. from pg. 4-22.	Paul E. Everly
	7-13	Added Caution; relocated Caution to pg. 7-14.	P E Everly
	7-14	Added info. from pg. 7-13.	Dec. 9, 1977

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 5 - 761 625 (PR781006)	1-4	Revised para 1.13; added footnote.	
	1-5	Revised para. 1.19, Vmca.	
	1-6	Revised para. 1.19, Vsse.	
	1-12	Revised para. 1.21, ft. lb. and kg. conversions.	
	1-13	Corrected spelling.	
	2-1	Changed Vmc to Vmca.	
	2-2	Added new material to para. 2.3.	
	2-6	Added fuel additive info. to para. 2.7 (f).	
	2-8	Added max. ramp weight to para. 2.15.	
	2-13	Added para. 2.37 (c).	
	3-i	Revised para. 3.23.	
	3-ii	Revised para. 3.25, 3.27, 3.35, 3.41, 3.42, 3.43, and 3.47.	
	3-3	Revised para. 3.3, Speeds; deleted Vsse.	
	3-6	Added Avionics Bus Failure; relocated material to pg. 3-7.	
	3-7	Added material from pg. 3-6; relocated material to pg. 3-8.	
	3-8	Added material from pg. 3-7 and serial no. effectivity to Asymmetric Flap Condition; relocated material to pg. 3-9.	
	3-9	Added material from pg. 3-8 and Flap System Malfunction.	
	3 11	Changed Vmc to Vmca.	
	3-19	Added Avionics Bus Failure; relocated material to pg. 3-20.	
	3-20	Added material from pg. 3-19; relocated para. 3.25 to pg. 3-21.	
	3-21	Added material from pg. 3-20.	
	3-22	Revised para. 3.27; relocated material to pg. 3-23.	
	3-23	Added material from pg. 3-22; revised para. 3.29; relocated material to pg. 3-24.	
	3-24	Added revised material from pg. 3-23; relocated material to pg. 3-25.	
	3-25	Added revised material from pg. 3-24.	
	3-26	Added serial no. effectivity to para. 3.41; added para. 3.42; relocated para. 3.43 to pg. 3-27.	
	3-27	Added para 3.43 from pg. 3-26; relocated material to pg. 3-28.	
	3-28	Added material from pg. 3-27; relocated material to pg. 3-29.	
	3-29	Added (e), (f), and material from pg. 3-28.	
	4-i	Added para. 4.45 and 4.47.	
	4-2	Revised para. 4.3.	
	4-16	Added Note; relocated material to pg. 4-17.	
	4-17	Added material from pg. 4-16.	
	4-19	Revised para. 4.19.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 5 - 761 625 (PR781006) (cont)	4-20	Revised para. 4.21 and 4.23; relocated material to pg. 4-21.	
	4-21	Added material from pg. 4-20; revised para. 4.25 and 4.29; relocated material to pg. 4-22.	
	4-22	Added material from pg. 4-21; revised para. 4.31; relocated para. 4.33 to pg. 4-23.	
	4-23	Added para. 4.33 from pg. 4-22.	
	4-24	Added serial no. effectivity to para. 4.39.	
	4-25a, 4-25b	Added pgs. (Added info. to para. 4.39.)	
	4-29	Added para. 4.45.	
	4-30	Added para. 4.47.	
	5-7	Revised para. 5.5 (h).	
	5-10	Revised Fig. nos.; added Fig. 5-106 thru 5-110 and 5-121 thru 5-139; relocated figures to pg. 5-10a.	
	5-10a	Added pg. (Added figures from pg. 5-10).	
	5-10b	Added pg.	
	5-15	Revised Fig. 5-9.	
	5-33	Revised Fig. 5-45.	
	5-37	Revised Fig. 5-47.	
	5-43 thru 5-52a	Revised Fig. 5-59 thru Fig. 5-78.	
	5-52d	Revised Fig. 5-78c.	
	5-52e	Revised Fig. 5-78d.	
	5-52h	Revised Fig. 5-78g.	
	5-52i	Revised Fig. 5-78h.	
	5-52j	Revised Fig. 5-78i.	
	5-52o thru 5-60	Revised Fig. 5-78n thru Fig. 5-93.	
	5-61	Revised Fig. 5-97.	
	5-62	Revised Fig. 5-99.	
	5-63	Revised and renumbered Fig. 5-102 and Fig. 5-103.	
	5-64	Revised and renumbered Fig. 5-104 and Fig. 5-105.	
	5-65	Added Fig. 5-106 and Fig. 5-107.	
	5-66	Added Fig. 5-108 and Fig. 5-109.	
	5-66a	Added pg. (Added Fig. 5-110).	
	5-66b	Added pg.	
	5-72	Added new Fig. 5-121; deleted existing chart.	
	5-73	Added new Fig. 5-123; changed existing chart to Fig. 5-145 and relocated to pg. 5-85.	
	5-74	Added new Fig. 5-125; changed existing chart to Fig. 5-147 and relocated to pg. 5-86.	
	5-75	Added new Fig. 5-127; changed existing chart to Fig. 5-149 and relocated to pg. 5-87.	
	5-76	Added new Fig. 5-128; changed existing chart to Fig. 5-151 and relocated to pg. 5-88.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 5 - 761 625 (PR781006) (cont)	5-77	Added new Fig. 5-129; changed existing chart to Fig. 5-153 and relocated to pg. 5-89.	
	5-78	Added new Fig. 5-131; changed existing chart to Fig. 5-155 and relocated to pg. 5-90.	
	5-79	Added new Fig. 5-133; changed existing chart to Fig. 5-157 and relocated to 5-91.	
	5-80	Added new Fig. 5-135.	
	5-81 thru 5-91	Added pgs. (Added new Fig. 5-137 thru Fig. 5-157).	
	6-i	Revised para. 6.15 (n) pg. no.	
	6-1	Revised para. 6.1.	
	6-7	Changed Gross Weight to Max. Ramp Weight.	
	6-11	Revised para. 6.7 (d).	
	6-20	Revised Notes.	
	6-31	Added item 98.	
	6-35	Revised item 165; added item 166.	
	6-41	Added item 214.	
	6-43	Added items 231, 233, and 235.	
	6-47	Added items 299 and 301.	
	6-49	Added items 329 and 331.	
	6-50	Added item 333; relocated items to pgs. 6-51, 6-52, and 6-53.	
	6-51	Added items from pg. 6-50; added new items; revised item nos.; relocated items to pgs. 6-53, 6-54, and 6-55.	
	6-52	Added items from pg. 6-50; added new items; revised item nos.; relocated items to pgs. 6-55 and 6-56.	
	6-53	Added items from pgs. 6-50 and 6-51; added new items; revised item nos.; relocated items to pg. 6-56.	
	6-54	Added items from pg. 6-51; revised item nos.; added new items.	
	6-55	Added items from pgs. 6-51 and 6-52; revised item nos.; added item 435; relocated items to pg. 6-59.	
	6-56	Added items from pgs. 6-52 and 6-53; revised item nos.; added new items; relocated items to pg. 6-60.	
	6-57	Added pg. (Added items 455 through 463.)	
	6-58	Added pg.	
	6-59	Added pg. (Added items from pg. 6-55.)	
	6-60	Added pg. (Added items from pg. 6-56.)	
	7-i, 7-ii	Revised pg. nos.	
	7-12	Added Caution.	
	7-13	Added serial no. effectivity to para. 7.19.	
	7-13a	Added pg. (Added material from pg. 7-14 and new info. to para. 7.19.)	
	7-13b	Added pg. (Added new info. to para. 7.19.)	
	7-14	Relocated material to pg. 7-13a.	
	7-20	Revised Fig. 7-17.	

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

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 5 - 761 625 (PR781006) (cont)	7-23	Revised Fig. 7-19.	
	7-27	Added serial no. effectivity to Fig. 7-24.	
	7-27a	Added Fig. 7-24a; relocated material to pg. 7-27b.	
	7-27b	Added material from pg. 7-27a; relocated material to pg. 7-28.	
	7-28	Added material from pgs. 7-27b and 7-29; relocated Fig. 7-25 to pg. 7-28a.	
	7-28a	Added pg. (Added Fig. 7-25 from pg. 7-28.)	
	7-28b	Added pg. (Added material from pg. 7-29 and new info. to para. 7.31.)	
	7-29	Relocated material to pgs. 7-28 and 7-28b; added material from pg. 7-30.	
	7-30	Relocated material to pg. 7-29; added material from pg. 7-31.	
	7-31	Relocated material to pg. 7-30; added Fig. 7-29 from pg. 7-32.	
	7-32	Relocated material to pg. 7-31; added new Fig. 7-30.	
	7-33	Revised para. 7.41.	
	7-34	Added new info. to para. 7.41.	
	7-35	Added serial no. effectivity to Fig. 7-31.	
	7-36	Relocated Fig. 7-33 to pg. 7-38; added new Fig. 7-32.	
	7-37	Revised para. 7.43.	
	7-38	Added Fig. 7-33 from pg. 7-36; relocated material to pg. 7-39.	
	7-39	Added material from pg. 7-38; relocated material to pg. 7-40.	
	7-40	Added material from pg. 7-39.	
	7-41	Revised para. 7.59.	
	7-42	Revised para. 7.59.	
	7-42a	Added pg. (Added new info. to para. 7.59.)	
	7-42b	Added pg.	
	7-49	Added pg. (Added para. 7.85.)	
	8-12	Added new info. to para. 8.23; relocated material to pg. 8-12a.	
	8-12a	Added pg. (Added material from pgs. 8-12 and 8-13 and Cautions.)	
	8-12b	Added pg.	
	8-13	Relocated material to pg. 8-12a.	Paul E. Everly
	9-i	Added Supplement 4.	PE Everly
	9-27 thru 9-40	Added pgs. (Added KFC 300 AFCS with Flight Director.)	Oct. 6, 1978

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 6 - 761 625 (PR790115)	2-8	Changed "Max. Takeoff to "Max. Flight and Landing."	
	3-19	Revised para.	
	3-23	Relocated info. to pg. 3-24; added warning.	
	3-24	Added info. from pg. 3-23; relocated items 3.31 and 3.33 to pg. 3-24b.	
	3-24a	Added pg. ; (added new charts).	
	3-24b	Added pg. ; (added items 3.31 and 3.33 from pg. 3-24.	
	4-28	Revised item 4.43 (a) (4).	
	6-1	Revised paragraphs.	
	6-25	Revised items 33 (weight) and added note.	
	6-35	Added item 168, relocated item 179 to pg. 6-36.	
	6-36	Added item 179 from pg. 6-35.	
	6-39	Added items 202 and 203; changed item 203 to 204.	
	6-41	Added lines.	
	6-45	Deleted item 265.	
	6-47	Revised items 299 and 301.	
	6-59	Deleted item 504.	
	7-i	Revised index.	
	7-41	Added item 7.58 and relocated item 7.59 to pg. 7-42.	
	7-42	Added new info. from item 7.58, relocated old info. to pg. 7-42a and added old info. from pg. 7-41.	P E Everly Paul E. Everly Jan. 15, 1979
	7-42a	Added new pg. (added relocated info.).	
	7-42b	Added new pg. (added relocated info.).	
Rev. 7 - 761 625 (PR810522)	ii	Revised Warning.	
	iii	Added serial no. applicability.	
	2-1	Revised para. 2.1.	
	2-5	Revised Engine Operating Limits.	
	2-11	Revised item (a) (15).	
	3-ii	Revised Table of Contents.	
	3-1	Revised para. 3.1.	
	3-3	Revised Engine Failure During Takeoff (Below 91 KIAS).	
	3-4	Revised Single-Engine Go-Around.	
	3-5	Revised Engine Fire On Ground and Engine Fire In Flight.	
	3-8	Revised Crossfeed Procedure and Gear Up Landing; relocated info. to pg. 3-9.	
	3-9	Added ending serial no. effectivity; added info. from pg. 3-8.	
	3-12	Revised Engine Failure During Takeoff.	
	3-14	Revised Single-Engine Go-Around; changed Notes to Cautions.	
	3-17	Revised para.'s 3.9 and 3.11.	
	3-22	Added ending serial no. effectivity.	
	3-24	Revised fig. no.	

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 7 - 761 625 (PR810522) (cont)	3-24a	Added ending serial no. effectivity; revised fig. no.	
	3-24b	Revised para. 3.31.	
	3-25	Revised para. 3.37.	
	3-26	Added ending serial no. effectivity to para.'s 3.41 and 3.42.	
	3-27	Added engine serial no. effectivity to para. 3.47.	
	4-1	Revised para. 4.1 and 4.3.	
	4-5	Revised Preflight Check.	
	4-11	Revised para. 4.9.	
	4-12	Added ending serial no. effectivity; revised info.	
	4-14	Revised info.	
	4-15	Revised para. 4.11.	
	4-17	Revised info.	
	4-19, 4-20, 4-21, 4-22	Added ending serial no. effectivity.	
	4-23	Revised para. 4.37.	
	4-25a	Added ending serial no. effectivity.	
	6-1	Revised para. 6.1.	
	6-54	Relocated item 415 to pg. 6-55; added new item 396.	
	6-55	Relocated item 435 to pg. 6-56; added item 415 from pg. 6-54.	
	6-56	Added item 435 from pg. 6-55.	
	7-4	Revised info.	
	7-13a, 7-14	Added ending serial no. effectivity.	
	7-15	Revised serial no. effectivity; added ending serial no. effectivity.	
	7-18	Added ending serial no. effectivity to Figure 7-15.	
	7-21	Corrected spelling.	
	7-24	Revised Figure 7-21.	
	7-25	Revised para. 7.27; added ending serial no. effectivity.	
	7-27	Revised Figure 7-24.	
	7-27a	Revised Figure 7-24a; added ending serial no. effectivity.	
	7-27b	Added ending serial no. effectivity; revised info.	
	7-28	Revised info.	
	7-32, 7-34, 7-36, 7-37	Added ending serial no. effectivity.	PE E.I.T. Paul E. Everly May 22, 1981
	7-42	Corrected spelling.	

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 8 - 761 625 (PR831107)	2-17	Added Placard.	
	4-9	Added Note.	
	4-22	Relocated para. 4.31 info. to pg. 4-23; added Note to para. 4.31.	
	4-23	Relocated para. 4.37 info. to pg. 4-24; added para. 4.31 info. from pg. 4-22.	
	4-24	Relocated para. 4.39 info. to pg. 4-25; added para. 4.37 info. from pg. 4-23.	
	4-25	Added para. 4.39 info. from pg. 4-24.	
	7-13	Added para. 7.19 info. from pg. 7-13a.	
	7-13a	Relocated para. 7.19 info. to pg. 7-13 and pg. 7-13b; revised para. 7.19 info. and added Caution.	
	7-13b	Added para. 7.19 info. from pg. 7-13a.	
	8-2	Revised para. 8.3 info.	
	8-3	Revised para. 8.5 info.	
	8-18	Revised item (h).	
	9-3	Revised item (g) and (i).	
	9-9	Revised item (g).	
	9-11	Revised item (g); added item (h).	
	9-17	Revised item (q).	
	9-19	Revised item (g); added item (h)	Paul E Everly Paul E. Everly November 7, 1983
	9-26	Revised item (q).	
	9-28	Revised item ((f); added item (h); revised item callouts.	
Rev. 9 - 761 625 (PR840203)	1-3	Revised para. 1.7.	
	2-12	Revised para. 2.25.	
	2-15	Added serial number.	
	2-16	Revised placard.	
	2-17	Added placard.	
	5-3	Revised para. 5.5 (a) (4).	
	5-4	Revised para. 5.5 (b) (3), (4).	
	5-5	Revised para. 5.5 (e).	
	5-7	Revised para. 5.5 (i).	
	5-10	Revised para. 5.7; relocated info. from pg. 5-10a.	
	5-10a	Moved info. to pg. 5-10; deleted page.	
	5-10b	Deleted page.	
	5-70	Revised fig. 5-117.	
	5-71	Revised fig. 5-1 19.	
	5-72	Deleted fig. 121; relocated, renumbered fig. 141.	
	5-73	Deleted fig. 123; relocated, renumbered fig. 143.	
	5-74	Deleted fig. 125; relocated, renumbered fig. 145.	
	5-75	Deleted fig. 127; relocated, renumbered fig. 147.	
	5-76	Deleted fig. 128; relocated, renumbered fig. 149.	
	5-77	Deleted fig. 129; relocated, renumbered fig. 151.	

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Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 9 - 761 625 (PR840203) (cont)	5-78	Deleted fig. 131; relocated, renumbered fig. 153.	
	5-79	Deleted fig. 133; relocated, renumbered fig. 155.	
	5-80	Deleted fig. 135; relocated, renumbered fig. 157.	
	5-81	Deleted fig. 137; and page.	
	5-82	Deleted fig. 139; and page.	
	5-83 thru 5-91	Pages deleted.	
	6-5	Revised fig. 6-5.	
	6-13	Revised fig. 6-11.	
	6-15	Revised fig. 6-15.	Paul E Everly
	6-21	Revised fig. 6-19.	Paul E. Everly
	7-17	Revised fig. 7-13; revised para. 7.23.	Feb. 3, 1984
	7-18	Revised fig. 7-15.	
Rev 10 - 761 625 (PR900420)	2-15	Revised placard serial number effectivity.	
	2-17	Revised placard. Added placard and serial number effectivity. Moved info. to page 2-18.	
	2-18	Relocated info. from page 2-17.	
	4-5	Added Warning to Cockpit checklist. Revised Left Wing checklist. Moved info. to page 4-6.	
	4-6	Relocated info. from page 4-5. Added Warning to Before Starting Engines checklist.	
	4-9	Added Warning to Shutdown checklist.	
	4-11, 4-13, 4-14	Revised para. 4.9. Added Warning.	
	4-15	Revised para. 4.11. Added Warning.	
	4-17	Revised APU Start para.	
	4-19	Added Warning to para. 4.19.	
	4-23	Added Warning to para. 4.37.	
	4-29	Added info. to para. 4.43 (d).	
	5-7	Revised fig. number in para. 5.5 (i).	
	6-20	Revised para. 6.13.	
	7-10	Revised para. 7.15. Added Warning.	
	7-21	Added Note to para. 7-25.	
	8-1	Revised para 8.1.	D. H. Trompler
	8-2	Revised para. 8.3.	D. H. Trompler
	8-16	Added Caution to para 8.37 (d).	May 11, 1990

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

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 11 - 761 625 (PR970523)	iv-m	Added page. Added Rev. 11 to Log of Revisions.	
	iv-n	Added page.	
	2-4	Added Warning.	
	2-5	Added Warning.	
	4-9	Revised paragraph 4.5.	
	4-16	Revised paragraph 4.13.	
	4-23	Revised paragraph 4.37.	
	7-25	Revised paragraph 7.27.	
	7-27b	Revised paragraph 7.28.	
	7-28	Revised paragraph 7.28.	Peter E. Peck
	8-14	Revised paragraph 8.27.	May 23, 1997
Rev. 12 (PR030131)	iii	Added Warning.	
	iv-m	Added Rev. 12 to Log of Revisions.	
	3-5	Revised paragraph 3.3.	
	3-18	Revised paragraph 3.15.	
	8-1	Revised paragraph 8.1.	
	8-1a	Added page and moved info. from page 8-1.	
	8-1b	Added page.	
	8-2	Revised paragraph 8.3.	Albert J. Mill
			Jan. 31, 2003

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

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date

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SECTION 1

GENERAL

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SECTION 1

SECTION 1

GENERAL

1.1 INTRODUCTION

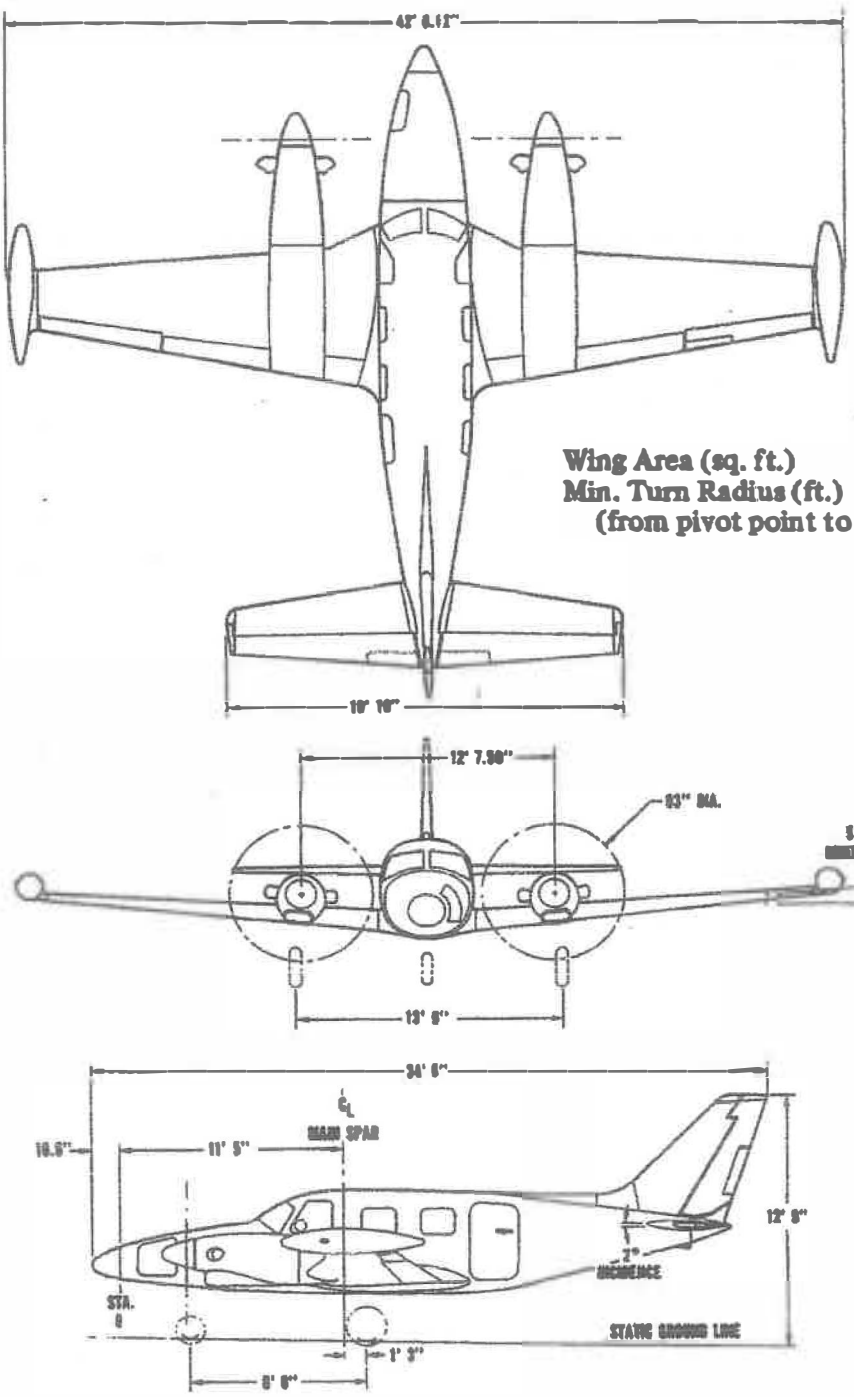
This Pilot's Operating Handbook is designed for maximum utilization as an operating guide for the pilot. It includes the material required to be furnished to the pilot by C.A.R. 3 and FAR Part 21, Subpart J. It also contains supplemental data supplied by the airplane manufacturer.

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 familiarize himself with the limitations, performance, procedures and operational handling characteristics of the airplane before flight.

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



Wing Area (sq. ft.)	**229**
Min. Turn Radius (ft.) (from pivot point to wing tip)	**31.67**

THREE VIEW

Figure 1-1

1.3 ENGINES

(a)	Number of Engines	2
(b)	Engine Manufacturer	Pratt and Whitney (UACL)
(c)	Engine Model Number	PT6A-28
(d)	Rated Horsepower	620
(e)	Propeller Speed (rpm)	2200
(f)	Dry Weight (lbs)	317
(g)	Engine Type	Free Turbine, Reverse Flow 2-Shaft
	Compressor stages and type	3 axial stages 1 centrifugal stage
	Turbine stages and type	1 stage compression 1 stage power
	Combustion chamber type	annular

1.5 PROPELLERS

(a)	Number of Propellers	2
(b)	Propeller Manufacturer	Hartzell
(c)	Blade Model	T-10173-HB-8 or T-10173-B-8
(d)	Number of Blades	3
(e)	Hub Model	HC-B3TN-3B
(f)	Propeller Diameter (inches)	93
(g)	Propeller Type	Hydraulically Operated, Constant Speed, Full Feathering, Reversible

1.7 FUEL

(a)	Fuel Capacity (U.S. gal) (total)	374
(b)	Usable Fuel (U.S. gal) (total)	366
(c)	Fuel Grade, Aviation	Fuels conforming to PWA 522, CPW 46 (including Jet A, Jet A-1, Jet B, JP4 and JP5)

1.9 OIL

(a)	Oil Capacity (each engine) (U.S. gal.)	2.3
(b)	Oil Specification	Refer to latest revision of UACL Service Bulletin No. 1.

1.11 MAXIMUM WEIGHTS

(a)	Ramp Weight (lbs)	9050
(b)	Maximum Takeoff Weight (lbs)	9000
(c)	Maximum Landing Weight (lbs)	9000
(d)	Maximum Zero Fuel Weight (lbs)	7200
(e)	Maximum Weights in Baggage Compartments (lbs)	
	(1) Forward	300
	(2) Aft	200

1.13 STANDARD AIRPLANE WEIGHTS*

(a)	Standard Empty Weight (lbs)	4976
(b)	Maximum Useful Load (including ramp fuel) (lbs)	4074

1.15 BAGGAGE SPACE

(a)	Compartment Volume (cubic feet)	
	(1) Forward	20
	(2) Aft	22
(b)	Forward Baggage Door Size (in. wide x in. high)	26 x 21

1.17 SPECIFIC LOADINGS

(a)	Wing Loading (lbs per sq ft)	39.3
(b)	Power Loading (lbs per hp)	7.26

*These values are approximate and vary from one aircraft to another. Refer to Figure 6-7 for the Standard Empty Weight value and the Useful Load value to be used for C.G. calculations for the aircraft specified.

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 compressability.
V_A	Maneuvering Speed is the maximum speed at which application of full available aerodynamic control will not overstress the airplane.
V_{FE}	Maximum Flap Extended Speed is the highest speed permissible with wing flaps in a prescribed extended position.
V_{LE}	Maximum Landing Gear Extended Speed is the maximum speed at which an aircraft can be safely flown with the landing gear extended.
V_{LO}	Maximum Landing Gear Operating Speed is the maximum speed at which the landing gear can be safely extended or retracted.
V_{MCA}	Air Minimum Control Speed is the minimum flight speed at which the airplane is directionally controllable as determined in accordance with Federal Aviation Regulations. Airplane certification conditions include one engine becoming inoperative and windmilling; not more than a 5° bank towards the oerative engine; takeoff power on operative engine; landing gear up; flaps in takeoff position; and most rearward C.G.
V_{NE}/M_{NE}	Never Exceed Speed or Mach Number is the speed limit that may not be exceeded at any time.
V_{NO}	Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air and then only with caution.

V_S	Stalling Speed or the minimum steady flight speed at which the airplane is controllable.
V_{SO}	Stalling Speed or the minimum steady flight speed at which the airplane is controllable in the landing configuration.
V_{SSE}	Intentional One Engine Inoperative Speed is a minimum speed selected by the manufacturer for intentionally rendering one engine inoperative in flight for pilot training.
V_X	Best Angle-of-Climb Speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.
V_Y	Best Rate-of-Climb Speed is the airspeed which delivers the greatest gain in altitude in the shortest possible time.

(b) Meterological Terminology

ISA	International Standard Atmosphere in which: The air is a dry perfect gas; The temperature at sea level is 15° Celcius (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 (-0.003564° F) per foot and zero above that altitude.
OAT	Outside Air Temperature is the free air static temperature, obtained either from inflight temperature indications or ground meteorological sources, adjusted for instrument error and compressibility effects.
Indicated Pressure Altitude	The number actually read from an altimeter when the barometric subscale has been set to 29.92 inches of mercury (1013 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 for unrestricted periods of use..
Maximum Climb Power	Maximum power permissible during climb.
Maximum Cruise Power	Maximum power permissible during cruise.

(d) Engine Controls and Instruments

Power Control Lever	The lever which modulates engine power from reverse thrust through takeoff power.
Propelle Control Lever	The lever which requests a propeller governor to maintain propeller rpm at a selected value or feathers a propeller.
Condition Lever	The lever which controls fuel flow to an engine.
Beta Range	The region where the propeller blade angle is between the fine pitch stop and the maximum reverse pitch setting.
ITT Gauge	Inter-turbine temperature gauge - indicates temperature immediately upstream of the free turbine vanes.
Gas Generator RPM (N_g)	Indicates the percent of gas generator rpm based on a figure of 100% at 37,500 rpm.
Propeller RPM (N_p)	Indicates propeller speed in rpm.
Engine Torquemeter	Indicates shaft output torque in lb-ft.

(e) Airplane Performance and Flight Planning Terminology

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

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

(f) Weight and Balance Terminology

Reference Datum	An imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Station	A location along the airplane fuselage usually given in terms of distance 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.

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1.21 CONVERSION FACTORS

MULTIPLY	BY	TO OBTAIN
acres	0.4047	ha
	43560	sq. ft.
	0.0015625	sq. mi.
atmospheres (atm)	76	cm Hg
	29.92	in. Hg
	1.0133	bar
	1.033	kg/cm^2
	14.70	lb./sq. in.
	2116	lb./sq. ft.
bars (bar)	0.98692	atm.
	14.503768	lb./sq. in.
British Thermal Unit (BTU)	0.2519958	kg-cal
centimeters (cm)	0.3937	in.
	0.032808	ft.
centimeters of mercury at 0°C (cm Hg)	0.01316	atm
	0.3937	in. Hg
	0.1934	lb./sq. in.
	27.85	lb./sq. ft.
	135.95	kg/m^2
centimeters per second (cm/sec.)	0.032808	ft./sec.
	1.9685	ft./min.
	0.02237	mph
cubic centimeters (cm^3)	0.03381	fl. oz.
	0.06102	cu. in.
	3.531×10^{-5}	cu. ft.
	0.001	l
	2.642×10^{-4}	U.S. gal.
cubic feet (cu.ft.)	28317	cm^3
	0.028317	m^3
	1728	cu. in.
	0.037037	cu. yd.
	7.481	U.S. gal.
	28.32	l
cubic feet per minute (cu. ft./min.	0.472	l/sec.
	0.028317	m^3/min.

MULTIPLY	BY	TO OBTAIN
cubic inches (cu. in.)	16.39	cm^3
	1.639×10^{-5}	m^3
	5.787×10^{-4}	cu. ft.
	0.5541	fl. oz.
	0.01639	l
	4.329×10^{-3}	U.S. gal.
	0.01732	U.S. qt.
cubic meters (m^3)	61024	cu. in.
	1.308	cu. yd.
	35.3147	cu. ft.
	264.2	U.S. gal.
cubic meters per minute (m^3/min.)	35.3147	cu. ft./min.
cubic yards (cu. yd.)	27	cu. ft.
	0.7646	m^3
	202	U.S. gal.
degrees (arc)	0.01745	radians
degrees per second (deg./sec.)	0.01745	radians/sec.
drams, fluid (dr. fl.)	0.125	fl. oz.
drams, avdp. (dr. avdp.)	0.0625	oz. avdp.
feet (ft.)	30.48	cm
	0.3048	m
	12	in.
	0.33333	yd.
	0.0606061	rod
	1.894×10^{-4}	mi.
	1.645×10^{-4}	NM
feet per minute (ft./min.)	0.01136	mph
	0.01829	km/hr.
	0.508	cm/sec.
	0.00508	m/sec.

MULTIPLY	BY	TO OBTAIN
feet per second (ft./sec.)	0.6818	mph
	1.097	km/hr.
	30.48	cm/sec.
	0.5921	kts.
foot-pounds (ft.-lb.)	0.138255	m-kg
	3.24×10^{-4}	kg-cal
foot-pounds per minute (ft.-lb./min.)	3.030×10^{-5}	hp
foot-pounds per second (ft.-lb./sec.)	1.818×10^{-5}	hp
gallons, Imperial (Imperial gal.)	277.4	cu. in.
	1.201	U.S. gal.
	4.546	l
gallons, U.S. dry (U.S. gal. dry)	268.8	cu. in.
	1.556×10^{-1}	cu. ft.
	1.164	U.S. gal.
	4.405	l
gallons, U.S. liquid (U.S. gal.)	231	cu. in.
	0.1337	cu. ft.
	4.951×10^{-3}	cu. yd.
	3785.4	cm^3
	3.785×10^{-3}	m^3
	3.785	l
	0.83268	Imperial gal.
	128	fl. oz.
gallons per acre (gal./acre)	9.353	l/ha
grams (g)	0.001	kg
	0.3527	oz. avdp.
	2.205×10^{-3}	lb.
grams per centimeter (g/cm)	0.1	kg/m
	6.721×10^{-2}	lb./ft.
	5.601×10^{-3}	lb./in.
grams per cubic centimeter (g/cm^3)	1000	kg/m^3
	0.03613	lb./cu. in.
	62.43	lb./cu. ft.

MULTIPLY	BY	TO OBTAIN
hectares (ha)	2.471	acres
	107639	sq. ft.
	10000	m^2
horsepower (hp)	33000	ft.-lb./min.
	550	ft.-lb./sec.
	76.04	m-kg/sec.
	1.014	metric hp
horsepower, metric	75	m-kg/sec.
	0.9863	hp
inches (in.)	25.40	mm
	2.540	cm
	0.0254	m
	0.08333	ft.
	0.027777	yd.
inches of mercury at 0°C (in. Hg)	0.033421	atm
	0.4912	lb./sq. in.
	70.73	lb./sq. ft.
	345.3	kg/m^2
	2.540	cm Hg
	25.40	mm Hg
inch-pounds (in.-lb.)	0.011521	m-kg
kilograms (kg)	2.204622	lb.
	35.27	oz. avdp.
	1000	g
kilogram-calories (kg-cal)	3.9683	BTU
	3087	ft.-lb.
	426.9	m-kg
kilograms per cubic meter (kg/m^3)	0.06243	lb./cu. ft.
	0.001	g/cm^3
kilograms per hectare (kg/ha)	0.892	lb./acre
kilograms per square centimeter (kg/cm^2)	0.9678	atm
	28.96	in. Hg
	14.22	lb./sq. in.
	2048	lb./sq. ft.

MULTIPLY	BY	TO OBTAIN
kilograms per square meter (kg/m^2)	2.896×10^{-3}	in. Hg
	1.422×10^{-3}	lb./sq. in.
	0.2048	lb./sq. ft.
kilometers (km)	1×10^{5}	cm
	3280.8	ft.
	0.6214	mi.
	0.53996	NM
kilometers per hour (km/hr.)	0.9113	ft./sec.
	58.68	ft./min.
	0.53996	kt
	0.6214	mph
	0.27778	m/sec.
	16.67	m/min.
knots (kt)	1	nautical mph
	1.689	ft./sec.
	1.1516	statute mph
	1.852	km/hr.
	51.48	m/sec.
liters (l)	1000	cm^3
	61.02	cu. in.
	0.03531	cu. ft.
	33.814	fl. oz.
	0.264172	U.S. gal.
	0.2200	Imperial gal.
	1.05669	qt.
liters per hectare (l/ha)	13.69	fl. oz./acre
	0.107	gal./acre
liters per second (l/sec.)	2.12	cu. ft./min.
meters (m)	39.37	in.
	3.280840	ft.
	1.0936	yd.
	0.198838	rod
	6.214×10^{-4}	mi.
	5.3996×10^{-4}	NM
meter-kilogram (m-kg)	7.23301	ft.-lb.
	86.798	in.-lb.

MULTIPLY	BY	TO OBTAIN
meters per minute (m/min.)	0.06	km/hr.
meters per second (m/sec.)	3.280840	ft./sec.
	196.8504	ft./min.
	2.237	mph
	3.6	km/hr.
microns	3.937×10^{-5}	in.
miles, statute (mi.)	5280	ft.
	1.6093	km
	1609.3	m
	0.8684	NM
miles per hour (mph)	44.7041	cm/sec.
	4.470×10^{-1}	m/sec.
	1.467	ft./sec.
	88	ft./min.
	1.6093	km/hr.
	0.8684	kt
miles per hour square (m/hr. sq.)	2.151	ft./sec. sq.
millibars	2.953×10^{-2}	in. Hg
millimeters (mm)	0.03937	in.
millimeters of mercury at 0°C (mm Hg)	0.03937	in. Hg
nautical miles (NM)	6080	ft.
	1.1516	statute mi.
	1852	m
	1.852	km
ounces, avdp. (oz. avdp.)	28.35	g
	16	dr. avdp.
ounces, fluid (fl. oz.)	8	dr. fl.
	29.57	cm^3
	1.805	cu. in.
	0.0296	l
	0.0078	U.S. gal.

MULTIPLY	BY	TO OBTAIN
ounces, fluid per acre (fl. oz./ acre)	0.073	l/ha
pounds (lb.)	0.453592	kg
	453.6	g
	3.108×10^{-2}	slug
pounds per acre (lb./acre)	1.121	kg/ha
pounds per cubic foot (lb./cu. ft.)	16.02	kg/m^3
pounds per cubic inch (lb./cu. in.)	1728	lb./cu. ft.
	27.68	g/cm^3
pounds per square foot (lb./sq. ft.)	0.1414	in. Hg
	4.88243	kg/m^2
	4.725×10^{-4}	atm
pounds per square inch (psi or lb./sq. in.)	5.1715	cm Hg
	2.036	in. Hg
	0.06804	atm
	0.0689476	bar
	703.1	kg/m^2
quart, U.S. (qt.)	0.94635	l
	57.749	cu. in.
radians	57.30	deg. (arc)
	0.1592	rev.
radians per second (radians/sec.)	57.30	deg./sec.
	0.1592	rev./sec.
	9.549	rpm
revolutions (rev.)	6.283	radians
revolutions per minute (rpm or rev./min.)	0.1047	radians/sec.
revolutions per second (rev./sec.)	6.283	radians/sec.

MULTIPLY	BY	TO OBTAIN
rod	16.5	ft.
	5.5	yd.
	5.029	m
slug	32.174	lb.
square centimeters (cm^2)	0.1550	sq. in.
	0.001076	sq. ft.
square feet (sq. ft.)	929	cm^2
	0.092903	m^2
	144	sq. in.
	0.1111	sq. yd.
	2.296×10^{-5}	acres
square inches (sq. in.)	6.4516	cm^2
	6.944×10^{-3}	sq. ft.
square kilometers (km^2)	0.3861	sq. mi.
square meters (m^2)	10.76391	sq. ft.
	1.196	sq. yd.
	0.0001	ha
square miles (sq. mi.)	2.590	km^2
	640	acres
square rods (sq. rods)	30.25	sq. yd.
square yards (sq. yd.)	0.8361	m^2
	9	sq. ft.
	0.0330579	sq. rods
yards (yd.)	0.9144	m
	3	ft.
	36	in.
	0.181818	rod

SECTION 2

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SECTION 2

LIMITATIONS

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SECTION 2

LIMITATIONS

2.1 GENERAL

This section provides the "FAA Approved" operating limitations, instrument markings, color coding and basic placards necessary for the operation of the PA-31T Cheyenne and its systems.

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

2.3 AIRSPEED LIMITATIONS

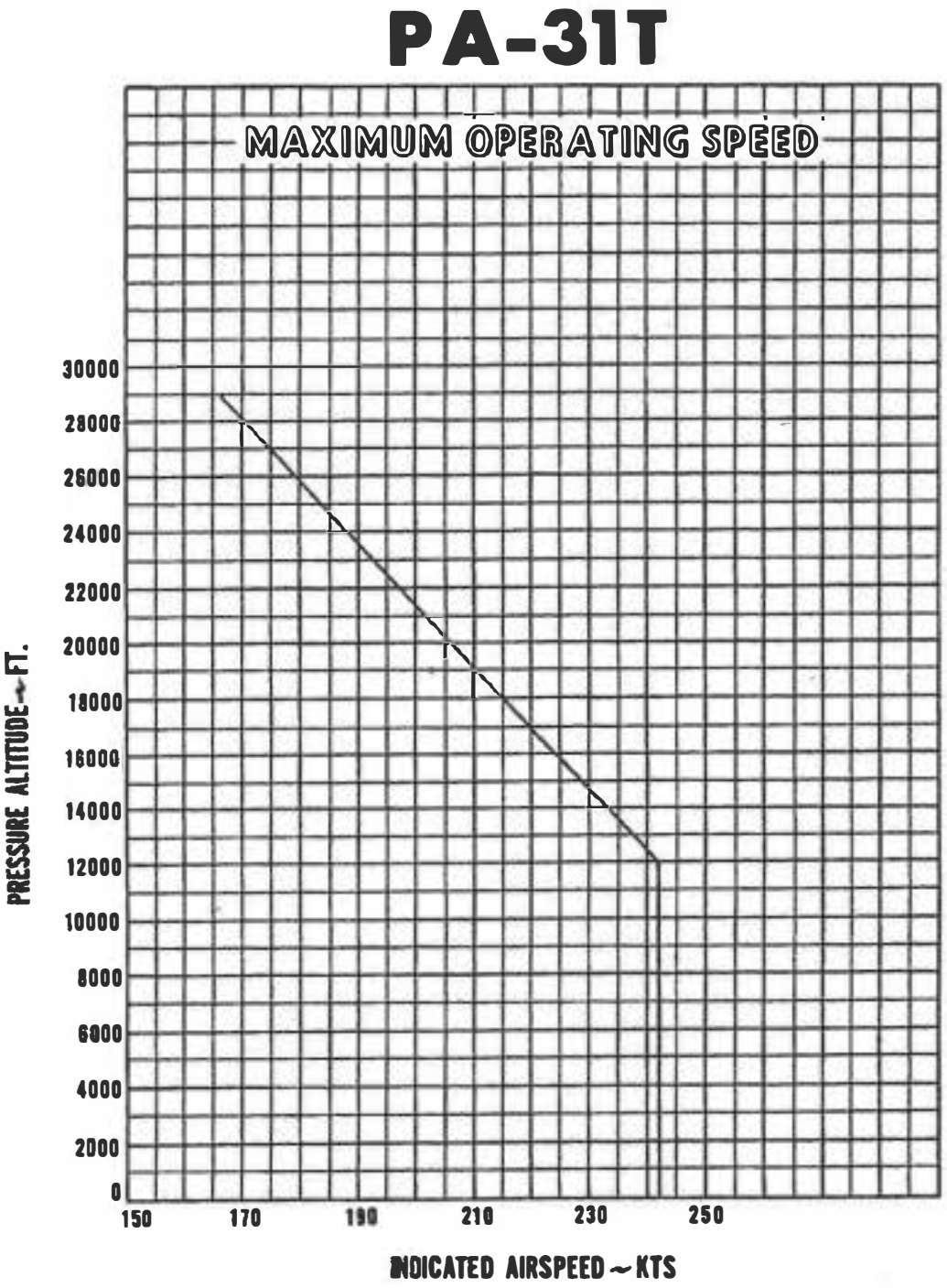
SPEED	KCAS	KIAS
Maximum Operating Speed (V_{MO}) - Do not exceed this speed in any operation (up to 12,000 ft). (See Figure 2-1 for speeds above 12,000 ft.)	246	242
Design Maneuvering Speed (V_A) - Do not make full or abrupt control movements above this speed (at gross weight up to 26,900 ft). (See Figure 2-1 for speeds above 26,900 ft.)	180	177
Maximum Flaps Extended Speed (V_{FE}) - Do not exceed this speed at the given flap setting.		
15° flap	174	181
40° flap	144	148
Maximum Gear Extended Speed (V_{LE}) - Do not exceed this speed with landing gear extended.	156	153
Maximum Landing Gear Operating Speed (V_{LO}) - Do not operate landing gear above this speed.		
Extension	156	153
Retraction	143	139
Air Minimum Control Speed (V_{MCA}) - Lowest airspeed at which airplane is controllable with one engine operating and no flaps.	96	91

	KCAS	KIAS
Stall Speed (full flaps) (power off) (See Section 5, Performance, for stall speeds at reduced weights.)	76	75

NOTE

Maximum altitude loss in a stall is 750 feet.

Best Multi-Engine Rate of Climb Speed (above 20,000 ft. decrease climb speed by 1.7 knots per 1000 ft).	126	122
Minimum Multi-Engine Climb Speed (above 20,000 ft).	122	117
Minimum Speed for Cruise, Holding, or Descent (above 20,000 ft).	124	120



MAXIMUM OPERATING SPEED

Figure 2-1

2.5 AIRSPEED INDICATOR MARKINGS

MARKING	KIAS
Green Arc (Normal Operating Range)	86 to 242
White Arc (Flaps Extended Range)	75 to 148
Radial Red Line (Minimum Control Speed)	91
Radial Blue Line (Best Rate of Climb Speed - Single Engine)	113

NOTE

Maximum Operating Limit Speed (V_{MO}) shown by Red Needle.

2.7 POWER PLANT LIMITATIONS

WARNING

POSITIONING OF POWER LEVERS BELOW THE FLIGHT IDLE STOP IN FLIGHT IS PROHIBITED. SUCH POSITIONING MAY LEAD TO LOSS OF AIRPLANE CONTROL OR MAY RESULT IN AN ENGINE OVERSPEED CONDITION AND CONSEQUENT LOSS OF ENGINE POWER.

(a) Number of Engines	2
(b) Engine Manufacturer	Pratt and Whitney (UACL)
(c) Engine Model Number	PT6A-28

(d) Engine Operating Limits

OPERATING CONDITION		OPERATING LIMITS						
		TORQUE (1)		MAXIMUM				
POWER SETTING	SHP	2200 RPM	2000 RPM	OBSERVED ITT°C	Ng RPM (2) %	Np RPM (1) %	OIL PRESSURE PSIG (3)	OIL TEMPERATURE ° C (4)
TAKE OFF	620	1464		750	38100 - 101.5	2200 - 100	80 to 100	10 to 99
MAX. CONTINUOUS/ EN ROUTE EMER.	620	1484	1628	750	38100 - 101.5	2200 - 100	80 to 100	10 to 99
MAX. CRUISE	620	1484	1628	750	38100 - 101.5	2200 - 100	80 to 100	10 to 99
ECONOMY CRUISE	620	1484	1628	695		2200 - 100	80 to 100	0 to 99
MAX. CLIMB	620	1484	1628	710		2200 - 100	80 to 100	0 to 99
IDLE (7)		—	—	660 (5)			40 (MIN)	-40 to 99
STARTING		—	—	1090 (6)				-40 (MIN)
ACCELERATION		2100 (6)	@2420 RPM	850 (6)	38500 - 102.6	2420 - 110		0 to 99
MAX. REVERSE (7)	200	508	@2068 RPM	750	31530 - 84	2068 - 94	80 to 100	0 to 99

WARNING

POSITIONING OF POWER LEVERS BELOW THE FLIGHT IDLE STOP IN FLIGHT IS PROHIBITED. SUCH POSITIONING MAY LEAD TO LOSS OF AIRPLANE CONTROL OR MAY RESULT IN AN ENGINE OVERSPEED CONDITION AND CONSEQUENT LOSS OF ENGINE POWER.

(1) Maximum permissible sustained torque is 1628 lb-ft (53 psig). Np must be set so as not to exceed power limitations.
(2) For every 10°C (18°F) below -30°C (-22°F) ambient temperature, reduce maximum allowable Ng by 2.2%.
(3) Normal oil pressure is 80 to 100 psig at gas generator speeds above 27,000 rpm (72%) with oil temperature between 60 to 70°C (140° to 158°F). Oil pressures below 80 psig are undesirable, and should be tolerated only for the completion of the flight preferably at reduced power setting. Oil pressures below normal should be reported as an engine discrepancy, and should be corrected before next takeoff. Oil pressures below 40 psig are unsafe, and require that either the engine be shut down or a landing be made as soon as possible, using the minimum power required to sustain flight.
(4) For increased service life of the engine (i.e. time between oil changes) an oil temperature between 74° to 80°C (165° to 176°F) is recommended. A minimum oil temperature of 55°C (130°F) is recommended for fuel heater operation at takeoff power.
(5) At 50% rpm (Ng) minimum, advance power control lever as required to maintain temperature within this limit.
(6) These values are time-limited to two seconds.
(7) Reverse limited to ground operation only.

(e) Generator Limits

Limit the load on each generator as follows, except during starting:

Maximum Flight Load	See Note	200 Amps
GEN. LOAD		MIN. Ng
0 to 100 Amps		49%
100 to 150 Amps		53%
150 to 180 Amps		59%
180 to 200 Amps		63%

NOTE

Above 26,000 feet with power plant ice protection "ON," limit the output of each generator to 125 amps.

(f) Fuel Grade — Fuels conforming to PWA 522 or CPW46

Anti-icing additive per MIL-1-27686 is approved for use in the above fuels in the amount by volume of .15% maximum. (See Section 8 for blending and handling procedures.)

NOTE

If fuel conforming to PWA 522 or CPW 46 is not available, Aviation Gasoline MIL-G-5572, all grades, may be used for a maximum of 150 hours between overhauls.

(g)	Oil Grade	Refer to UACL Engine Service Bulletin No. 1 for approved oils
(h)	Number of Propellers	2
(i)	Propeller Manufacturer	Hartzell
(j)	Propeller Hub Model	HC-B3TN-3B
(k)	Propeller Blade Model	T-10173-HB-8 or T-10173-B-8
(l)	Propeller Diameter	
	Minimum	93 IN.
	Maximum	93 IN.
(m)	Propeller Blade Angles at Propeller Station 30 at Hydraulic Low Pitch Stop	20.2°

2.9 STARTER LIMITATIONS

Use of the starters is limited to 30 seconds "ON," one minute "OFF," 30 seconds "ON," one minute "OFF," 30 seconds "ON," 30 minutes "OFF" before a fourth start may be attempted.

2.11 POWER PLANT INSTRUMENT MARKINGS

(a)	Tachometer (Propeller)	
	Green Arc (Normal Operating Range)	1800 to 2200 RPM
	Radial Red Line (Maximum)	2200 RPM
(b)	Tachometer (Gas Generator)	
	Green Arc (Normal Operating Range)	51 to 101.5%
	Radial Red Line (Maximum)	101.5%
(c)	Fuel Pressure	
	Green Arc (Normal Operating Range)	15 to 50 PSI
	Yellow Arc (Caution)	5 to 15 PSI
	Radial Red Line (Minimum)	5 PSI
(d)	Fuel Flow	
	Green Arc	.5 to 5 PPH x 100
(e)	Oil Pressure	
	Green Arc (Normal Operating Range)	80 to 100 PSI
	Yellow Arc (Caution)	40 to 80 PSI
	Radial Red Line (Maximum)	100 PSI
	Radial Red Line (Minimum)	40 PSI
(f)	Oil Temperature (Dual Gauge)	
	Green Arc (Normal Operating Range)	55°C to 99°C
	Yellow Arc (Caution)	0° C to 55° C
	Radial Red Line (Maximum)	99°C
(g)	Inter Turbine Temperature	
	Green Arc (Normal Operating Range)	500°C to 695°C
	Radial Red Line (Maximum)	750°C
(h)	Engine Torque	
	Green Arc (Normal Operating Range)	0 to 1484 LB-FT
	Radial Red Line	1484 LB-FT
	Red Diamond	(2000 RPM Max.) 1628 LB-FT

2.13 WEIGHT LIMITS

(a)	Maximum Ramp Weight	9050 LBS
(b)	Maximum Takeoff Weight	9000 LBS
(c)	Maximum Landing Weight	9000 LBS
(d)	Maximum Zero Fuel Weight	7200 LBS
(e)	Maximum Weights in Baggage Compartments	
	Forward	300 LBS
	Aft	200 LBS

NOTE

IT IS THE RESPONSIBILITY OF THE AIRPLANE OWNER AND PILOT TO ASSURE THAT THE AIRPLANE IS PROPERLY LOADED. MAXIMUM ALLOWABLE GROSS WEIGHT IS 9000 POUNDS. SEE "WEIGHT AND BALANCE SECTION" FOR LOADING INSTRUCTIONS.

When carrying 7 occupants, fuel or baggage may have to be relocated. Load front baggage compartment first and locate heaviest occupants forward.

When carrying 8 occupants, front baggage compartment must be loaded to bring CG limit within 138 inches rearward limit. Fuel must be reduced to keep total weight within 9000 lb. limit. Locate heaviest occupants forward.

2.15 CENTER OF GRAVITY LIMITS (LANDING GEAR EXTENDED)

Weight Pounds	Forward Limit Inches Aft of Datum	Rearward Limit Inches Aft of Datum
6800 or less	125.0	138.0
8500	129.6	138.0
9000 (Max. Flight and Landing)	131.9	138.0
9050 (Max. Ramp)	132.1	138.0

NOTES

Straight line variation between points indicated.

The Datum Line is located 137.0 inches forward of the wing main spar centerline.

2.17 MANEUVER LIMITS

This is a normal category airplane. No acrobatic maneuvers (including spins) approved.

2.19 FLIGHT MANEUVERING LOAD FACTOR LIMITS

(a)	Positive Load Factor (Flaps Up)	3.36 G
(b)	Negative Load Factor (Flaps Up)	-1.34 G
(c)	Positive Load Factor (Flaps Down)	2.00 G

NOTE

No inverted maneuvers approved.

2.21 CREW LIMITS

Minimum Crew — One Pilot

2.23 TYPES OF OPERATION LIMITS

The Federal Aviation Regulations make the operator of an aircraft responsible for insuring that sufficient and proper instruments and equipment are installed, operating, and calibrated for the type of flight being undertaken. These regulations (for example, see FAR 91.3(a), 91.25, 91.33, 91.97, 91.170 and 91.209) also specify the minimum instruments and equipment which must be available for the various types of flight such as VFR, IFR, night, commercial, air taxi, high altitude, icing and so on. It is recommended that pilots of this aircraft make themselves familiar with these regulations in order to avoid violating them. While the regulations list minimum instruments and equipment, experienced pilots realize that the minimum practical instruments and equipment depends on the pilot's capability, weather, terrain, the flight plan, facilities to be used, whether flight is during daylight or night, at high or low altitude, for hire or not, in icing conditions or not, and so on. Pilots are cautioned to consider all factors in determining whether they have all the required equipment for making a particular flight.

When properly equipped this airplane may be flown day or night, VFR or IFR, and in known icing conditions.

The certificating regulations of the FAA for this airplane require the manufacturer to specify in the Pilot's Operating Handbook the types of operation for which the airplane is equipped.

The equipment installed in this aircraft has been substantiated to 29,000 feet.

When this airplane was delivered it contained the properly installed equipment listed in the Weight and Balance Section of this handbook and, therefore, was satisfactory for the types of operation indicated below by an asterisk.

(a) (1)_____Day VFR

(2)_____Night VFR

(b) (1)_____Day and night IFR after adequate communication and navigation radio has been installed in an FAA approved manner.

(2)_____Day and night IFR

(c) (1)_____Known icing conditions after required deicing and icing equipment listed for operation in icing conditions has been installed in accordance with Piper drawings or in an FAA approved manner.

(2)_____Known icing conditions.

Operators are warned that if any of the equipment listed as having been installed at time of delivery is changed, not operating, or not properly maintained and calibrated, the airplane may not be properly equipped for all the conditions noted above. It is the responsibility of the pilot to determine whether the lack of a piece of equipment limits the conditions under which he may fly the airplane.

AIRCRAFT

REGISTRATION NO. _____ SERIAL NO. _____

Owners desiring to make changes or additions to the equipment must have these modifications done in an FAA-approved manner. All PA-31T aircraft are delivered equipped for day and night VFR flight, and for IFR flight except when there may be insufficient communications or navigation radio.

The performance, handling qualities and structure of the airplane are approved for instrument flight.

If an owner of an airplane which is approved for VFR flight only desires to extend his operations to IFR, he should have radio equipment installed in accordance with Piper-approved drawings or other FAA-approved data (or data approved by the aviation agency of the country of registration). The owner should insure that the radio equipment is adequate for the ground facilities to be used, is of sufficiently high quality and reliability, is properly functioning, adjusted and calibrated, and that it is compatible with previously installed equipment before authorizing it to be flown under instrument conditions.

When the original equipment or FAA-approved equivalent equipment is installed as originally or in an FAA-approved manner, is functioning properly, and is calibrated in accordance with the Federal Aviation Regulations, and when adequate radio communications and navigation equipment is installed as indicated above, this airplane is approved for day and night VFR and IFR flight.

If the airplane is approved for night IFR, but is not approved for flight in icing conditions when delivered, it will be necessary for an owner to add all the equipment listed in this section as required for flight in icing conditions. If this equipment is properly installed in accordance with Piper-approved drawings and all the other equipment required for night IFR flight is installed in an FAA-approved manner, is adequate for the ground facilities to be used, is of sufficient quality, is functioning properly, and is calibrated in accordance with the FAR's, the airplane is approved for IFR flight in known icing conditions. If anti-icing and deicing equipment is not installed in accordance with Piper drawings, FAA approval or approval of the aviation agency of the country of registry must be obtained in order to legally conduct flight in icing conditions.

If any of the anti-icing or deicing equipment is missing or not functioning, flight through known or forecast icing conditions is prohibited.

Pilots are also reminded that oxygen must be available to passengers and crew for flights to high cabin altitudes and that special electronic equipment is required for flight above specified altitudes.

FAR 135 places special requirements on air taxi and commercial operators.

In accordance with the FAR's, this airplane is not properly equipped for the condition of flight indicated if any of the equipment listed below is not properly installed, functioning, properly maintained and calibrated according to the FAR's. The pilot is responsible for assuring compliance with the latest ammendments to FAR 91 concerning required equipment.

(a) Day VFR
- (1) Airspeed indicator
- (2) Altimeter
- (3) Magnetic direction indicator
- (4) Tachometer - Ng and propeller - each engine
- (5) Oil pressure gauge - each engine
- (6) Stall warning indicator
- (7) Oil temperature gauge - each engine
- (8) Torquemeter - each engine
- (9) Fuel gauges
- (10) Engine and propeller deicing - each engine
- (11) Fuel flow indicator - each engine
- (12) Fire detector - each engine
- (13) Free air temperature indicator
- (14) Fuel pressure indicator - each engine
- (15) Inter-turbine temperature gauge (ITT) - each engine
- (16) Landing gear position indicator
- (17) Seat belts - each occupant
- (18) Very pistol and flotation gear over water, if for hire
- (19) SAS system
- (20) Emergency locator transmitter (ELT)
- (21) Above 12,500 feet - transponder with automatic altitude reporting capacity
- (22) Starter generator - each engine

(b) Night VFR
- (1) All equipment required for Day VFR
- (2) Position lights
- (3) Anti-collision lights
- (4) Instrument lights
- (5) Landing light, if for hire

(c) Day IFR
- (1) All equipment required for Day VFR
- (2) Two-way radio for communication
- (3) Suitable and adequate navigation radio equipment
- (4) Gyroscopic rate of turn indicator
- (5) Bank indicator
- (6) Clock with sweep second hand
- (7) Sensitive altimeter adjustable for barometric pressure
- (8) Gyroscopic bank and pitch indicator
- (9) Gyroscopic direction indicator
- (10) Pilot's windshield wiper

(d) Night IFR
  (1) All equipment required for day and night VFR
  (2) All equipment required for Day IFR

(e) Flight in Positive Control Areas
  (1) Transponder

(f) Flight in Known Icing Conditions
  (1) All equipment required for night IFR
  (2) Heated windshield (std. equipment)
  (3) Alternate static source (std. equipment)
  (4) Heated pitot tube (std. equipment)
  (5) Heated SAS vane (std. equipment)
  (6) Wing and tail deicing system
  (7) All weather antennas
  (8) Static wicks
  (9) Engine ice protection system (std. equipment)

(g) Flight When Pressurized
  (1) Cabin differential pressure gauge
  (2) Cabin pressure altitude gauge
  (3) Oxygen system installed and minimum 10 min. supply for each occupant above 25,000 ft. MSL
  (4) Cabin rate of change gauge

NOTE

NO PRESSURIZED FLIGHT IF ANY CRACKS ARE OBSERVED IN A WINDOW, WINDSHIELD OR ANY STRUCTURE WITHIN THE PRESSURIZED AREA OF THE FUSELAGE.

(h) Flight When Third and Fourth Seats are Reversed
  (1) Seat headrests (10 inch minimum height) installed
  (2) Seat backs bolted in upright position
  (3) Seats latched at forward position

2.25 FUEL LIMITATIONS

(a)	Fuel capacity when filled to tip tank fillers (U.S. gal)	374
(b)	Fuel capacity when filled to nacelle tank fillers (U.S. gal)	336
(c)	Unusable Fuel (total) (U.S. gal)	8.0

2.27 MAXIMUM OPERATING ALTITUDE LIMIT

Maximum Approved Altitude	29,000 FT

NOTE

In flight above 25,000 feet, oxygen masks must be connected to supply.

2.29 OUTSIDE AIR TEMPERATURE LIMITS

Aircraft shall not be operated when takeoff ambient temperature exceeds ISA + 37°C.

2.31 CABIN PRESSURIZATION LIMIT

Maximum Cabin Differential Pressure	5.5 +.1-.0 PSI
Maximum Cabin Altitude	10,500 FT

Do not land when airplane cabin is pressurized above .3 psi.

2.33 FUEL BOOST PUMP LIMITATIONS

(a) Both fuel boost pumps must be operative for each engine for takeoff.
(b) One fuel boost pump must be operative for each engine for all other flight conditions.

2.35 NICKEL-CADMIUM BATTERY LIMITATION

No takeoffs authorized with "Battery Over Temp" light on.

2.37 STABILITY AUGMENTATION SYSTEM LIMITATIONS

(a) Flight should not be initiated with malfunction of either the Primary or the Override SAS Systems.
(b) The Primary SAS must be ON except in the case of a malfunction.
(c) The SAS down spring must be replaced after every 2000 hours of aircraft operation.

2.39 STALL MARGIN INDICATOR

Approaches cannot be predicated on the stall margin indicator.

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2.41 PLACARDS

On overhead switch, engine control panel:

THIS AIRCRAFT MUST BE OPERATED AS A NORMAL CATEGORY AIRPLANE IN COMPLIANCE WITH THE OPERATING LIMITATIONS STATED IN THE FORM OF PLACARDS, MARKINGS AND MANUALS. NO ACROBATIC MANEUVERS (INCLUDING SPINS) APPROVED.

FOR TYPES OF OPERATION SEE PILOT'S OPERATING HANDBOOK.

On overhead switch, engine control panel:

SAS INOP-MAX CLIMB POWER 400 SHP
(955 TORQUE @ 2200 RPM)
MINIMUM CONTROL SPEED 91 KIAS
MAX. SP. LG - RET 139 KIAS EXTEND 153 KIAS
DES. MANEUV. SPEED (AT MAX. GROSS WT.) 177 KIAS
(UP TO 26,900 FT)
(SEE VMO CHART FOR MANEUV. SPEEDS ABOVE 26,900 FT)
SEE PILOT'S OPERATING HANDBOOK FOR ADDITIONAL SPEEDS

On instrument panel adjacent to stall warning light:

(Ser. Nos. 31T-7720001 through 7720069)

STALL WARNING

On floor between pilot and copilot seats:

EMERGENCY GEAR EXTENSION
DEPRESSURIZE CABIN
LIFT ACCESS PANEL
Extension instructions on reverse side.

On underside of emergency gear extension door

EMERGENCY GEAR EXTENSION

1. PLACE GEAR SELECTOR HANDLE IN THE DOWN POSITION.
2. PULL EMERGENCY PUMP HANDLE OUT AS FAR AS POSSIBLE.
3. PUMP HANDLE UP AND DOWN UNTIL ALL 3 GREEN LIGHTS COME ON. CONTINUE PUMPING UNTIL PRESSURE BUILDS UP AND SELECTOR HANDLE RETURNS TO NEUTRAL.

On each end of fuel system control console:

FUEL ON
FIREWALL SHUT-OFF
LEFT TANK
183.0 GAL

ON FUEL
FIREWALL SHUT-OFF
RIGHT TANK
183.0 GAL.

On the right side of the cabin:

EMERGENCY EXIT
REMOVE GLASS

On handle beneath glass

PULL

On forward baggage compartment door:

BAGGAGE CAPACITY
300 LBS MAX
SEE LOADING SCHEDULE

On rear bulkhead in rear baggage compartment

MAXIMUM BAGGAGE 200 LBS
SEE LOADING SCHEDULE

On instrument panel:

AIRCRAFT NOT APPROVED FOR LANDING WHEN PRESSURIZED

On instrument panel

CAUTION

DO NOT OPERATE WINDSHIELD WIPER ABOVE 153 KIAS
OR ON DRY WINDSHIELD

On magnetic compass

COMPASS ERRATIC WHEN WINDSHIELD HEAT IS ON

On instrument panel adjacent to cabin air recirculation detent:

DO NOT USE DURING FLIGHT

On left window molding:

Ser. Nos. 31T-7720001 through 7720069

WARNING

TURN OFF ANTI-COLLISION LIGHTS WHEN TAXIING IN VICINITY OF OTHER AIRCRAFT OR DURING FLIGHT THROUGH CLOUD FOG OR HAZE STANDARD POSITION LIGHTS TO BE TURNED ON FOR ALL NIGHT OPERATIONS

Ser. Nos. 31T-7820002 through 31T-7920094

WARNING

TURN OFF ANTI-COLLISION LIGHTS WHEN TAXIING IN VICINITY OF OTHER AIRCRAFT OR DURING FLIGHT THROUGH CLOUD, FOG OR HAZE

STANDARD POSITION LIGHTS TO BE TURNED ON FOR ALL NIGHT OPERATIONS

On left window molding (Serial numbers 31T-7720001 through 31T-7820066 and 31T-7820068 through 31T-7820092):

NO FLAP SELECTION WITH AUTOPILOT ENGAGED

On left instrument panel:

Stability augmentation power and RAM warning placard
(Ser. Nos. 31T-7720001 through 7720069)
PWR WARN RAM

Stability augmentation test switch placard
1.0 Vs Test 1.3Vs Test

On the SAS override cover on the right side of the pedestal:

STABILITY AUGMENTOR
EMERGENCY OVERRIDE
REMOVE COVER-PULL LANYARD
SEE FLIGHT MANUAL FOR
COMPLETE INFORMATION

On instrument panel adjacent to cigar lighter receptacle:

FOR CIGAR
LIGHTER ONLY

Near nacelle and tip tank fuel fillers:

FUEL
USE AVIATION KEROSENE
SEE AIRPLANE FLIGHT MANUAL
FOR ALTERNATE FUELS

WARNING
FILL THRU NACELLE FILLER
COMPLETE FUELING THRU TIP TANK

Limitations Section AFM Addition Required By AD's

AD 97-26-12 – Power Levers Below Flight Idle

"Positioning of power levers below the flight idle stop while the airplane is in flight is prohibited. Such positioning could lead to loss of airplane control or may result in an overspeed condition and consequent loss of engine power."

AD 99-14-01 – Flight Into Icing Warning

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

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

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

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

-Accumulation of ice on the engine nacelles and propeller spinners farther aft than normally observed.

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

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

AD 2000-06-06 – Operation of De-ice Boots

-Except for certain phases of flight where the AFM specifies that deicing boots should not be used (e.g., take-off, final approach, and landing), compliance with the following is required.

-Wing and Tail Leading Edge Pneumatic Deicing Boot System, if installed, must be activated:

> -At the first sign of ice formation anywhere on the aircraft, or upon annunciation from an ice detector system, whichever occurs first; and

-The system must either be continued to be operated in the automatic cycling mode, if available; or the system must be manually cycled as needed to minimize the ice accretions on the airframe.

- The wing and tail leading edge pneumatic deicing boot system may be deactivated only after:

  -leaving known or observed/detected icing that the flight crew has visually observed on the aircraft or was identified by the on-board sensors; and

  -after the airplane is determined to be clear of ice.

SECTION 3

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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 the required (FAA regulations) emergency procedures and those necessary for the operation of the airplane as determined by the operating and design features of the airplane are presented.

Emergency procedures associated with those optional systems and equipment which require handbook supplements are provided in 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 presents 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.

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3.3 EMERGENCY CHECK LIST

SPEEDS

Air Minimum control speed ..... 91 KIAS
Best single-engine rate-of-climb speed ..... 113 KIAS
Best single-engine angle-of-climb speed ..... 104 KIAS

ENGINE INOPERATIVE PROCEDURES

ENGINE SECURING PROCEDURE
(FEATHERING PROCEDURE)

Power lever ..... IDLE
Propeller ..... FEATHERED
Condition lever ..... STOP
Generator switch ..... OFF
Oil cooler door ..... CLOSE
Prop sync. ..... OFF
Electrical load ..... reduce
Crossfeed ..... consider

ENGINE FAILURE DURING TAKEOFF
(Below 91 KIAS)

Power levers ..... IDLE
Brakes ..... as required
Power levers ..... REVERSE as desired
Stop straight ahead.
If insufficient runway remains for a safe stop:
Condition levers ..... STOP
Fire wall shutoff valves ..... CLOSE
Battery master ..... OFF
Generators ..... OFF

ENGINE FAILURE DURING TAKEOFF
(91 KIAS or above)

Airspeed ..... 91 KIAS min.
Directional control ..... maintain
Power (operative engine) ..... maximum (620 SHP)
Gear ..... RETRACT
Prop (inop. engine) ..... FEATHER
Airspeed ..... accelerate to 104 KIAS until clear of obstacles; then 113 KIAS
Trim ..... 5° toward operative engine
Climb ..... straight ahead (Avoid obstacles and attain sufficient altitude to execute single-engine landing procedure.)
Inop. engine ..... complete Engine Securing Procedure
Land as soon as practical at nearest suitable airport.

ENGINE FAILURE DURING FLIGHT
(Above 91 KIAS)

Airspeed ..... attain 113 KIAS min.
Directional control ..... maintain
Inop. eng. ..... identify and verify
Air start ..... attempt
If Air Start unsuccessful:
Engine securing procedure ..... complete
Land at nearest suitable airport.

ENGINE FAILURE DURING FLIGHT
(Below 91 KIAS)

Rudder ..... apply toward operative engine
Power levers (both engines) ..... retard to stop turn
Pitch attitude ..... lower nose to accelerate above 91 KIAS
Operative eng ..... increase power as airspeed increases above 91 KIAS
Air Start ..... attempt
If Air Start unsuccessful:
Engine Securing Procedure ..... complete
Land at nearest suitable airport.

INTENTIONAL SHUTDOWN OF ONE ENGINE

Gen. switch of eng. to be shut down (prior to eng. power removal) ..... OFF
Engine shutdown procedures ..... accomplished

ENGINE FLAME-OUT (2ND ENGINE)

Power lever .....IDLE
Prop control .....DO NOT FEATHER
Condition lever .....STOP
Air Start procedure .....accomplished

SINGLE-ENGINE APPROACH AND LANDING

Engine Securing Procedure .....completed
Fuel source .....NO CROSSFEED
Gear handle .....UP
Gear handle (hyd. pump check) .....returned to NEUTRAL
Seat belts and smoking sign .....ON
Non-essential bus .....ON
Flaps (on downwind leg) .....approach position
Airspeed .....113 KIAS min.
Cabin .....depressurized
Prop control .....full forward
Autopilot/Yaw damper .....OFF
Landing gear .....DOWN
Flaps (when landing assured) .....full DOWN
Reverse .....apply carefully if needed

SINGLE-ENGINE GO-AROUND

Directional control .....maintain
Power .....620 SHP max.
Flaps .....15°
Gear .....retracted
Flaps .....(full UP)
Trim .....as desired
Airspeed .....113 KIAS min.

AIR STARTING

STARTER ASSIST

Non-essential bus .....OFF
Radar .....STANDBY or OFF
Electrical load .....min. required
Power lever .....IDLE
Prop .....operating range
Condition lever .....STOP
Fuel quantity .....checked
Fire wall shutoff valve .....ON
Fuel pump .....ON
Ignition .....ON
Generators .....both OFF
Starter .....ON
Turbine speed (Ng) .....10% min.
Condition lever .....RUN
Ignition light .....on
Generator - op. eng. (if Ng stabilizes below 10%) .....ON
Power and prop controls .....as required
Starter (at stabilized idle) .....OFF
Ignition switch .....OFF
Generators (above 68% Ng) .....both ON
Non-essential bus .....ON

WINDMILLING ENGINE AND PROPELLER (Ng ABOVE 10%) (NO STARTER ASSIST)

Non-essential bus .....OFF
Radar .....STANDBY or OFF
Electrical load .....min. required
Power lever .....IDLE
Prop control .....full FORWARD
Condition lever .....STOP
Fuel quantity .....checked
Fire wall shutoff valve .....ON
Fuel pump .....ON
Generator (inop. eng.) .....OFF
Airspeed .....140 KIAS min.
Altitude .....below 20,000 ft.
Ignition switch .....ON
Turbine speed .....above 10%
Condition lever .....RUN
Ignition light .....on
Power and prop controls (after ITT has peaked) .....as required
Generator (above 68% Ng) .....ON
Ignition switch .....OFF
Non-essential bus .....ON

EMERGENCY AIR START (Ng BELOW 10%)

Prop control.....operating range
Power lever.....IDLE
Condition lever.....STOP
Generator (inop. eng.).....OFF
Fuel pump.....ON
Ignition switch.....ON
Airspeed (dive to increase Ng).....Vmo max.
Condition lever.....RUN
ITT.....monitored
Condition lever (if overtemp. tendencies exist during accel. to idle).....moved to STOP periodically
Ng.....52% or greater
Power lever.....as desired
Generator.....ON
Ignition switch.....OFF
Non-essential bus.....ON

ENGINE FIRE ON GROUND (Engine start, taxi and takeoff with sufficient distance remaining to stop)

Affected engine:
Condition lever.....STOP
Fire wall shutoff valve.....CLOSE
Brakes.....as required
Starter.....ON
Fuel pump.....OFF
Ignition switch.....OFF
Fire extinguisher switch(es) (if installed).....actuate
Radio.....call for assistance
External fire extinguisher.....use

NOTES

If fire continues, shut down both engines and evacuate.

If fire is on the ground, it may be possible to taxi away.

ENGINE FIRE IN FLIGHT

Power.....as required
Affected engine.....identify and verify
Prop (affected eng.).....FEATHERED
Feathered engine.....complete Engine Securing Procedure
Condition lever.....STOP
Fire wall shutoff valve (unless practicing).....OFF
Ignition.....OFF
Fuel pump (unless practicing).....OFF
Fire extinguisher (if fire persists).....actuated
Prop sync.....OFF
Bus tie switch (inop. eng.).....OFF
Electrical load.....monitor
Crossfeed.....if required

ENGINE FIRE EXTINGUISHER OPERATION (OPTIONAL)

Complete engine fire check list.
If fire persists:
Switch cover (selected engine).....lift
Switch.....actuate

CAUTION

This fire extinguisher is a single shot system with one cylinder for each engine. Inadvertent operation of the cylinder may cause engine stoppage.

OVERSPEED PROPELLER

If prop speed exceeds 2300 RPM:
Power lever.....IDLE
Prop control (if prop speed cannot be kept below 2300 RPM).....FEATHER

CAUTION

Prior to moving the condition lever to the STOP position, verify the prop has feathered. This can be accomplished by referring to the prop (Np) gage along with a noticeable reduction of drag. If the prop does not feather, do not shut down the engine.

If prop moves to feather:
Condition lever.....STOP
Engine Securing Procedure.....complete

If prop does not feather:
Power lever.....REDUCE TORQUE
Airspeed.....REDUCE to lowest practical airspeed to maintain RPM at or below 2300

HIGH OIL TEMPERATURE

Oil cooler doors.....OPEN
Power.....reduce if required

LOSS OF OIL PRESSURE

Between 40 and 80 psi:
Power .....reduce
Below 40 psi:
Engine Securing Procedure .....complete

ROUGH AIR OPERATION

Airspeed .....slow to maneuvering speed or slightly less
Fly attitude and avoid abrupt maneuvers.
Seat belts and
shoulder harnesses.....tighten
In heavy rain or with less than 250 lbs. of fuel per tank:
Ignition.....ON

ELECTRICAL MALFUNCTIONS

BATTERY OVERTEMP.

Battery master.....OFF
Battery overtemp. light
(after 10 min.) .....checked
Battery master (if
overtemp. light out) .....ON
Battery master (if
overtemp. light on).....OFF

SINGLE GENERATOR FAILURE

(Zero amps or gen. inop. light ON.)

Generator switch .....OFF
Circuit breakers .....checked
Engine bus tie switches.....ON
Non-essential bus (if load
exceeds 150 amps) .....OFF
Non-essential bus (prior to
landing flap extension) .....ON

GENERATOR BUS TIE CIRCUIT BREAKER OUT

High-reading ammeter.....monitored
Electrical load (to get
ammeter below 200 amps) .....reduce as necessary
Generator bus tie C/B .....reset
Generator .....ON

If circuit breaker pops again:
Generator bus tie C/B .....not reset
Generator.....OFF

BATTERY CIRCUIT BREAKER OUT

Battery master.....OFF
Battery C/B .....reset
If C/B does not reopen:
Battery master .....ON
If C/B will not stay reset:
Battery master.....OFF
Land as soon as practical.

DUAL GENERATOR FAILURE

Inop. generator or generators .....OFF
Non-essential bus.....OFF
Electrical load.....min.
Circuit breakers .....checked
Non-essential bus (prior to
landing flap extension) .....ON
Land as soon as practical.

AVIONICS BUS FAILURE

Single bus failure:
Bus failure .....isolated
Avionics bus C/B.....checked
If C/B does not reset:
Avionics bus tie C/B .....reset
Electrical load (above 50 amps) .....reduce
Alternate avionic power switch
(if unable to maintain load below
50 amps).....ON
Avionics bus C/B.....try to reset

Dual bus failure:
Avionics master switch.....check ON
Avionics bus tie C/B .....pull
Avionics bus C/Bs .....reset
If one C/B does not reset, proceed as single bus failure.
If both C/Bs do not reset:
Avionics master switch .....OFF
Alternate avionic power switch.....ON
Avionics electrical load .....minimum
Avionics bus C/B.....try to reset

ABNORMAL DEICE AMMETER READINGS

Zero amps:
C/B.....checked
C/B (if OFF).....ON
C/B (if ON with zero amps).....OFF

Less than 26 amps:
Icing conditions.....avoided
Use of system.....emergencies only
Time of operation.....minimum

ELECTRICAL FIRE

Flashlight (at night).....located
Battery master.....OFF
Generators.....OFF
Reference for instru. flight
(electric gyros unreliable).....vacuum turn indic.
All elect. switches.....OFF
Avionics master switch.....OFF
All C/Bs.....checked & pulled
Battery master.....ON
Generators.....ON
C/Bs and switches (one at a
time to locate faulty unit).....ON
Faulty unit (C/B).....pulled

STABILITY AUGMENTATION SYSTEM FAILURE

(SAS warning light ON.)

SAS FAILURE ON TAKEOFF

Power per engine (955 lb. ft. torque
@2200 RPM).....reduced to 400 SHP
Airspeed.....accelerate to 125 KIAS
Proceed as below.

SAS FAILURE IN FLIGHT

SAS override cover release pin.....removed
SAS override cover.....removed
Control wheel (anticipate
nose down force).....grasped firmly
SAS override lanyard.....pulled
Trim.....as required

CLIMB WITH SAS OVERRIDE

Airspeed.....126 KIAS min.
Power per engine (955 lb. ft. torque
@2200 RPM).....400 SHP max.

APPROACH AND LANDING WITH
SAS OVERRIDE

Approach speed (until landing
assured).....109 KIAS min.

GO-AROUND WITH SAS OVERRIDE

Power (955 lb. ft. torque
@2200 RPM).....400 SHP
Airspeed (while gear and
flaps down).....109 KIAS
Gear and flaps.....retracted
Airspeed.....126 KIAS min.

SINGLE-ENGINE FLIGHT WITH
SAS OVERRIDE

Power.....620 SHP max.

PRESSURIZATION SYSTEM MALFUNCTION

DIFFERENTIAL PRESSURE ABOVE 5.7 PSI
OR
CONTINUAL CABIN PRESSURE
FLUCTUATION @5.5 PSI

Press. controller.....set to higher alt.
Cabin pressure.....dumped if necessary
Oxygen.....used if necessary

RAPID INCREASE IN DIFFERENTIAL PRESSURE
OR
SMOKE OR FUMES IN CABIN

Cabin pressure.....dumped
Air control.....OUTSIDE AIR
Oxygen.....used if necessary

CABIN ALTITUDE ABOVE 10,500 FEET

Descend or use oxygen.

EMERGENCY OXYGEN SYSTEM

NOTE

Minimum supply above 25,000 ft. is 300 PSI.

Fittings.....insert in receptacles
Oxygen knob.....pull ON
Masks.....don
Flow indicators.....check
Oxygen supply.....monitor

CROSSFEED PROCEDURE

Fuel pump (inop. eng.).....ON
Crossfeed.....ON
Fuel pump (op. eng.).....OFF
Before landing:
Fuel pump (op. eng.).....ON
Crossfeed.....OFF
If Ng is "0" (zero) or when fire hazard exists:
Fuel pump (inop. eng.).....OFF

EMERGENCY DESCENT PROCEDURES

GEAR AND FLAPS RETRACTED

Power levers.....IDLE
Prop controls.....full forward
Aircraft attitude.....30° bank
Airspeed.....red line
Aircraft attitude.....wings level, nose down

GEAR AND FLAPS EXTENDED

Power levers.....IDLE
Prop controls.....full forward
Aircraft attitude.....30° bank
Wing flaps (below 181 KIAS).....15°
Gear (below 153 KIAS).....extended
Wing flaps (below 148 KIAS).....full down
Airspeed.....148 KIAS max.
Aircraft attitude.....wings level, nose down

EMERGENCY GEAR EXTENSION

Cabin.....depressurized
Airspeed.....130 KIAS max.
Emerg. gear ext. cover.....lifted
Gear selector.....down
Emerg. gear ext. handle (till 3 green lights & sel. returns to neutral).....extended & pumped

GEAR UP LANDING

Select suitable landing area.
Ground personnel.....inform
Fuel.....burn off excess if time allows
Passengers.....brief
Autopilot.....OFF
Landing check list (except gear down).....completed
Gear selector.....UP
Generator switches.....OFF
Flaps.....down
Master switch (daylight).....OFF
Make a normal approach.
When runway is made:
Condition levers.....STOP
Prop controls.....FEATHER
Fire wall shutoff valves.....OFF
Master switch (nights after touchdown).....OFF
Evacuate when aircraft comes to a stop

WARNING

Total drag of the airplane will be significantly reduced with props in feather. Pilot should plan for increased landing distances.

EMERGENCY EXIT

Exit (second window from front on right side).....locate
Plexiglas cover.....remove
Handle.....pull
Emergency exit window.....pull in

ASYMMETRIC FLAP CONDITION (SER. NOS. 31T-7720001 THROUGH 31T-7820066 AND 31T-7820068 THROUGH 31T-7820092)

SPLIT FLAPS (0 ° and 15° or 15° and 40°)

Flap switch.....return to original position
Airspeed.....113 KIAS
Aileron .....maintain wings level
Flap switch.....opposite direction (try to obtain symmetric flaps)
Land as soon as possible at nearest suitable airport.

SPLIT FLAPS (0° and 40°)

Flap switch.....return to original position
Airspeed.....113 KIAS
Aileron .....maintain wings level
Rudder.....in direction of flap with largest deflection
Asymmetric power.....into the flap with the largest deflection (add power on side with the smallest flap deflection)
Flap switch.....opposite direction (try to obtain symmetric flaps)
Land as soon as possible at nearest suitable airport.

FLAP SYSTEM MALFUNCTION (SER. NOS. 31T-7820067, 31T-7920001 THROUGH 31T-7920094)

ANNUNCIATOR LIGHT ON

Flap selector switch.....check operation
If flaps respond to command:
Flaps still usable, service before next flight.
If flaps do not respond to command:
Control wheel .....determine flap symmetry
Flap motor C/B (if symmetrical) .....check and reset

NO RESPONSE FROM SELECTOR SWITCH

Flap position indicator .....check
If indicator OFF:
Flap control C/B.....check and reset
If indicator shows flap position:
Annunciator.....test
Control wheel (if annunciator fails to illuminate) .....determine flap symmetry
Flap motor C/B (if symmetrical) .....check and reset

FLIGHT WITH PRIMARY LONGITUDINAL CONTROL FAILED

SAS .....if operative leave ON
When ready for landing approach:
Trim.....in level flight to 126-135 KIAS
Runway .....select longest in area
Gear.....extend
Airspeed .....maintain 126-135 KIAS

CAUTION

Do not lower flaps before landing gear is down and locked.

Flaps .....extend to 15° (approach detent)
Trim .....to 109-114 KIAS (approx. 600 lb. ft. torque, 2000 RPM Np)
When positioned over the runway, flare airplane with trim tabs alone and slowly reduce power.

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3.5 AMPLIFIED EMERGENCY PROCEDURES (GENERAL)

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

During these emergency procedures, it is imperative that the pilot continue good flying technique regardless of the situation.

3.7 ENGINE INOPERATIVE PROCEDURES

IDENTIFYING DEAD ENGINE AND VERIFYING POWER LOSS

If it is suspected that an engine has lost power, the faulty engine must be identified, and its power loss verified. First check engine gauges for a drop in ITT and torque. When the wings are level, the rudder pressure required to maintain directional control will be on the side of the operating engine - in short, a dead foot equals a dead engine.

NOTES

The minimum control speed (Vmca) is 91 KIAS.

When practicing or demonstrating Vmca or with an actual engine failure, it is important to realize that the nose attitude is quite high, approximately 20° to 25° nose up. When an engine is cut or fails at this attitude, the airspeed dissipates quite rapidly; therefore, to maintain Vmca (91 KIAS) the nose attitude must be lowered promptly to 2° to 5° above the horizon. Accelerate to best single-engine rate-of-climb speed (113 KIAS) as soon as practical.

Do not practice stalls or demonstrate Vmca below 7,000 feet.

ENGINE SECURING PROCEDURE (FEATHERING PROCEDURE)

Begin the securing procedure by bringing the power lever to IDLE and the propeller lever to FEATHER. Pull the condition lever to STOP. Turn OFF the generator of the inoperative engine, and CLOSE its oil cooler door. The propeller synchronizer (if installed) should be turned OFF. Complete the procedure by reducing the electrical load and considering the use of crossfeed if the fuel quantity dictates.

ENGINE FAILURE DURING TAKEOFF

If engine failure occurs at an airspeed below 91 KIAS and there is sufficient runway remaining, maintain directional control with rudder and braking. Reduce power to "IDLE" and stop straight ahead, using brakes and reverse thrust as required.

If engine failure occurs at an airspeed below 91 KIAS and there is not sufficient runway remaining for a stop straight ahead, pull condition levers to "STOP," close fire wall shutoff valves, and turn OFF the battery master and both generator switches. Maintain directional control, maneuvering to avoid obstacles if necessary.

If an engine fails when the airspeed is above 91 KIAS, and if conditions preclude an immediate landing or a stop on the runway, maintain directional control and advance all control levers for maximum power while maintaining torque and ITT within limits. Retract the landing gear. with coordinated power lever settings, the airplane will tend to turn toward the dead engine. Verify the loss of power of the suspected engine by retarding its power lever to IDLE. As soon as the dead engine is identified and verified, pull its propeller lever to FEATHER and its condition lever to STOP. Accelerate to 104 KIAS until all obstacles are cleared; then maintain a minimum airspeed of 113 KIAS.

Trim the airplane 5° in the direction of the operating engine and continue to climb straight ahead. Concentrate on gaining altitude and avoiding obstacles. Be extremely attentive to maintaining airspeed at or above 113 KIAS. Complete engine securing procedures for the inoperative engine by turning OFF its ignition and generator and closing its oil cooler door. Do not engage the starter. Turn OFF the propeller synchronizer (if installed).

Once the airplane is under control and at a safe altitude, preparations may be made for a single-engine landing as soon as practical.

ENGINE FAILURE DURING FLIGHT (ABOVE 91 KIAS)

Should an engine fail during flight above 91 KIAS, accelerate to a minimum airspeed of 113 KIAS, and maintain directional control. Check that gear and flaps are retracted.

Identify the faulty engine and verify the power loss. Follow the appropriate Air Start procedure in an attempt to start the engine. If the starting attempt is unsuccessful, complete Engine Securing Procedures for the dead engine. Trim the airplane as necessary to compensate for the failed engine. Maintain single-engine flight. Land as soon as practical at a suitable airport.

ENGINE FAILURE DURING FLIGHT (BELOW 91 KIAS)

If an engine fails during flight at an airspeed below 91 KIAS, apply rudder toward the operative engine to maintain directional control. Retarding the power levers on both engines will alleviate the tendency of the airplane to turn toward the failed engine. Accelerate to an airspeed above 91 KIAS by lowering the nose of the airplane. Trim as necessary. Once the airspeed reaches 91 KIAS, apply power to the operating engine to attain a minimum of 113 KIAS.

Follow the appropriate Air Start procedure in an attempt to restart the failed engine. If the starting attempt is unsuccessful, complete Engine Securing Procedures for the failed engine and maintain single-engine flight. Land as soon as practical at a suitable airport.

INTENTIONAL SHUTDOWN AND RESTART OF ONE ENGINE

To shut down an engine, turn OFF the generator switch of the engine to be shut down. This should be done before reducing power. Then complete engine shutdown procedures as outlined above in Engine Failure in Flight.

To restart an engine that has been shut down in flight, complete the appropriate Air Start procedure. Leave the generator switch of the engine OFF until Ng exceeds 68%; then turn the generator ON.

ENGINE FLAME-OUT (2ND ENGINE)

If one engine is failed or shut down and the second engine experiences a flame out, immediately pull the power lever to "IDLE" and the condition lever to "STOP." Do not feather the propeller unless landing is imminent.

Depending upon Ng, immediately implement the appropriate relight or restart procedures as outlined in Air Start.

NOTE

The propeller will not unfeather without the engine operating.

SINGLE-ENGINE APPROACH AND LANDING

For a single-engine approach and landing, be sure that propeller feathering and the Engine Securing Procedure is completed. Before attempting a single-engine landing, check the function of the hydraulic pump on the operating engine to ensure that the gear can be extended normally. Place the gear selector lever in the "UP" position while the gear is retracted. If the lever automatically returns to neutral, the pump is producing sufficient pressure for gear extension. Should the hydraulic pump prove to be inoperative, the gear will have to be lowered by use of the emergency hand-operated hydraulic pump. If the non-essential bus has been OFF, turn it ON.

Turn seat belt and no smoking sign ON and ensure that all occupants comply. On the downwind leg, at an airspeed below 181 KIAS, extend wing flaps 15°. Maintain airspeed at a minimum of 113 KIAS. Be sure that the cabin is depressurized for landing. The propeller synchronizer should be OFF. The approach should be planned so that large power changes will not be necessary.

Place the propeller control of the operating engine full forward. Turn OFF autopilot/yaw damper. Extend the landing gear, and check for three green lights.

When the landing is assured and, at an airspeed below 148 KIAS, extend wing flaps to 40°. Reduce power slowly during the landing flare, and maintain directional control. Sudden power reductions will result in large yaw angles.

After touching down, slowly pull the power lever of the operating engine to "IDLE." If reverse thrust is necessary, it should be applied slowly and carefully. Maintain directional control with rudder and braking.

NOTE

A Before Landing check list should be completed before each and every landing.

SINGLE-ENGINE GO-AROUND

A single-engine go-around should be avoided if at all possible. A go-around from a full flap position is not possible unless sufficient altitude is available to raise flaps in a descent. If it becomes necessary to execute a single-engine go-around, maintain directional control of the airplane. When one engine is out, application of power to the operating engine will necessitate increased effort to maintain control. A final approach speed above 113 KIAS will place the airplane in the best configuration should a go-around be necessary.

To execute a single-engine go-around, apply maximum power (620 SHP) to the operating engine. Maintain directional control, and trim for 113 KIAS. Retract the flaps to 15°, then retract the landing gear, and then retract the flaps full UP. Maintain airspeed at or above 113 KIAS.

CAUTIONS

A go-around should not be attempted after the airspeed is decreased below 113 KIAS or with 40° flaps.

Remember to complete the Before Landing check list before each landing attempt.

AIR START (STARTER ASSIST)

CAUTION

Above 20,000 feet, starts tend to be hotter. It is recommended that above 20,000 feet, 20% Ng be achieved prior to introduction of fuel and ignition. It may be necessary to drop off all non-essential electrical load and use the generator of the good engine to get this Ng. If insufficient Ng is available from the battery alone, then turn on the operable generator after the Ng RPM has stabilized. If conditions permit, it is recommended that air starts be made below 20,000 feet.

After every generator assist start, the main bus tie circuit breaker must be checked and IN.

For a starter assisted air start, the non-essential bus should be OFF, the radar in either OFF or STANDBY, and the electrical load reduced to the minimum required. Place the power lever in the "IDLE" position, and check that the propeller lever is in its operating range.

The condition lever should be in the "STOP" position. Check the fuel quantity. Open the fire wall shutoff valve, and turn ON the fuel pump of the engine being started. Turn ON the ignition, and turn OFF both generators.

Engage the starter, and after Ng stabilizes above a minimum of 10% for 5 seconds, advance the condition lever to "RUN." If the Ng stabilizes below 10%, turn ON the generator of the operating engine. (See the above CAUTION.) The ignition light should come on.

Adjust power and propeller levers as required, and at 45% Ng, turn the starter OFF, and turn the ignition switch OFF. When Ng stabilizes above 68% turn both generators ON. Turn ON the non-essential bus.

AIR START - WINDMILLING ENGINE AND PROPELLER (Ng ABOVE 10%) (NO STARTER ASSIST)

If the engine and propeller are windmilling and the Ng has not fallen below 10%, the engine can be started without use of the starter. Turn OFF the non-essential bus, and turn the radar either OFF or to STANDBY. Reduce the electrical load to the minimum required.

Place the power lever in the "IDLE" position, the propeller control full forward, and the condition lever on "STOP" for the engine to be started. Check fuel quantity. Open the fire wall shutoff valve, and turn the fuel pump ON. The generator of the inoperative engine should be OFF.

Airspeed should be at a minimum of 140 KIAS, and altitude must be below 20,000 feet. Turn ON the ignition switch. When Ng stabilizes above 10%, advance the condition lever to "RUN." The ignition light should come on.

After ITT has peaked, set power and propeller levers as required. When Ng exceeds 68%, turn the generator switch ON, turn the ignition switch OFF, and turn the non-essential bus ON.

NOTE

In turbulent air, if fuel quantity is below 250 lbs per tank, leave the ignition switch ON.

NOTE

Regardless of airspeed or altitude, there is always the chance that the engine may light up successfully just as the ignition and fuel are turned ON. In an emergency, turn on the ignition just as soon as possible after flame-out provided the Ng has not fallen below 52%. It is not necessary to shut off the fuel when attempting an air start under these circumstances. The power control lever, however, should be retarded to "IDLE."

CAUTION

Do not attempt a relight if the Ng tachometer indicates zero RPM.

AIR START - EMERGENCY (Ng BELOW 10%)

If an air start must be accomplished in an emergency situation, and Ng has fallen below 10%, advance the propeller control to any position in operating range, and retard the power level to "IDLE" and the condition lever to "STOP."

Switch the generator of the engine to be started OFF and the fuel pump and ignition switch ON. Affecting a dive to increase airspeed will increase Ng; however, do not let airspeed exceed Vmo (242 KIAS).

Advance the condition lever to "RUN" and monitor ITT. If over-temperature tendencies are encountered during engine acceleration to idle, intermittently pull the condition lever to "STOP" to maintain temperature within limits.

When Ng exceeds 52%, advance the power lever to the desired setting. When Ng exceeds 68%, turn the generator ON, turn the ignition switch OFF, and turn the non-essential bus ON.

3.9 ENGINE FIRE ON GROUND (Engine start, taxi and takeoff with sufficient distance remaining to stop)

If an engine fire occurs during start or ground operations, immediately place the condition lever of the affected engine in the "STOP" position. Close the fire wall shutoff valve. Turn ON the starter switch. Turn OFF the fuel pump and the ignition switch. Brake to a stop if the airplane is moving.

If the airplane is stopped, propellers should be feathered and passengers should evacuate. If the fire persists, the pilot should shut down both engines and evacuate.

If time permits and help is available, radio for assistance. If the optional engine fire extinguisher is installed and the fire persists, lift the fire extinguisher switch cover on the left side panel, and depress the fire extinguisher switch of the burning engine.

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

3.11 ENGINE FIRE IN FLIGHT

If an engine fire occurs in flight, apply power as required to maintain at least 113 KIAS. Identify and verify the burning engine, and feather its propeller. Proceed to secure the feathered engine by turning OFF its generator, pulling its condition lever to "STOP." Turn OFF its fire wall shutoff valve, ignition, and fuel pump.

If the optional engine fire extinguisher system is installed, and if the fire persists, lift the cover, and depress the switch of the extinguisher for the burning engine.

NOTE

When conducting a practice run through these procedures, do not turn off fire wall shutoff valve and fuel pump, and do not actuate the engine fire extinguisher.

To continue operation on a single engine, turn OFF the propeller synchronizer, and turn OFF the bus tie switch of the inoperative engine. Monitor the electrical load, and reduce it if necessary. Consider the use of crossfeed to extend range if necessary.

3.13 ENGINE FIRE EXTINGUISHER OPERATION (OPTIONAL EQUIPMENT)

If after completing the engine fire procedures (ENGINE FIRE ON GROUND OR ENGINE FIRE IN FLIGHT) the fire persists, the engine fire extinguisher (if installed) should be deployed.

Lift the switch cover for the affected engine and actuate the switch.

CAUTION

This fire extinguisher is a single shot system with one cylinder for each engine. Inadvertent operation of the cylinder may cause engine stoppage.

3.15 OVERSPEEDING PROPELLER

CAUTION

Prior to moving the condition lever to the STOP position, verify the prop has feathered. This can be accomplished by referring to the prop (Np) gage along with a noticeable reduction of drag. If the prop does not feather, do not shut down the engine.

If propeller speed exceeds 2300 RPM, retard the power lever of the engine with the overspeed condition to IDLE and feather the propeller. If the propeller moves to feather, as indicated by a very low RPM and a noticeable reduction of drag, shutdown the engine by moving the condition lever to STOP. Proceed with the engine securing procedure.

If the propeller does not feather, this could indicate an internal failure that has caused the propeller to move to full low pitch. Initiate corrective action by immediately reducing the power lever setting and decreasing the airspeed with a nose up attitude.

Once the propeller speed has been reduced to 2300 RPM or below by airspeed and power reduction, the pilot can test for regained RPM control with the propeller lever.

The engine should not be shut down if the propeller cannot be feathered since high drag would result from a windmilling propeller in low pitch. If engine shutdown is desired, the pilot should first test for feathering ability with the engine running at idle power.

3.17 HIGH OIL TEMPERATURE

If oil temperatures exceed Limits, open oil cooler doors to maintain oil temperatures below red line.

3.19 LOSS OF OIL PRESSURE

If oil pressure falls below 80 psi, the power setting should be reduced. Oil pressure below 40 psi is unsafe. and the affected engine should be shut down.

3.21 ROUGH AIR OPERATION

In conditions of extreme turbulence, slow the airplane to maneuvering speed or slightly less. Maneuvering speed will decrease with the weight of the airplane - e.g., 177 KIAS at 9000 lbs, 165 KIAS at 7200 lbs. A reduction in airspeed will ease the stress to which the airplane is subjected by turbulence. Fly attitude and avoid abrupt maneuvers. Fasten seat belts and shoulder harnesses as a precaution against buffeting and lurching. When flying in heavy rain or with less than 250 lbs of fuel per tank, operating with the ignition ON will reduce the possibility of a flame-out.

3.23 ELECTRICAL MALFUNCTIONS

BATTERY OVERTEMP.

If the "BAT OVERTEMP" annunciator light illuminates in flight, turn the battery master switch OFF. If the light goes out within 10 minutes, turn the battery master switch back ON. If the light does not go out within 10 minutes, leave the battery master switch OFF, and land as soon as practicable.

When the battery overtemp light remains lit, no further flights are permitted until the system has been serviced and the condition corrected.

SINGLE GENERATOR FAILURE

If a "GEN INOP" warning light illuminates or if there is a zero reading on the ammeter, a generator failure is indicated. If this condition occurs, turn OFF the suspected generator and look for open circuit breakers. Check the 5 amp "GEN CONT" circuit breaker located on the side panel and the 200 amp "GEN BUS TIE" circuit breaker located in the floor between the pilot and copilot seats for the affected generator.

Once the generator failure is verified, check that the engine bus tie switches are ON. If the electrical load on the remaining generator exceeds 150 amps, turn OFF the non-essential bus. For flap operation prior to landing, the non-essential bus must be ON. Wait 15 minutes and try to reset circuit breaker.

GENERATOR BUS TIE CIRCUIT BREAKER OUT

If the "GEN BUS TIE" circuit breaker located in the floor between the pilot and copilot seats opens, check the ammeter. Reduce the electrical load as necessary to bring the ammeter reading below 200 amps.

Reset the "GEN BUS TIE" circuit breaker. If it stays reset, turn the generator ON. If the circuit breaker will not reset or if it reopens immediately, leave the generator OFF, and continue flight with a reduced electrical load. Wait 15 minutes and try to reset the circuit breaker.

BATTERY CIRCUIT BREAKER OUT

If the battery circuit breaker opens, turn the battery master switch OFF, and reset the circuit breaker. If the circuit breaker does not reopen, turn the battery master switch back ON. If the circuit breaker will not stay reset, turn the battery master switch OFF and land as soon as practicable.

DUAL GENERATOR FAILURE

If both "GEN INOP" warning lights illuminate or zero (0) ammeter readings indicate that both generators are inoperative, turn OFF the generator switches. Turn OFF the non-essential bus, and reduce electrical load to a minimum. Check for open circuit breakers.

If the failure of both generators is verified, leave the switches of the inoperative generators OFF, maintain the reduced electrical load, and land as soon as practicable. When operating with both generators OFF, do not turn the battery master switch OFF. Prior to extending the wing flaps for landing, the non-essential bus must be turned back ON.

AVIONICS BUS FAILURE

When a loss of power is experienced in either bus, the associated avionics bus circuit breaker should be checked and reset. If the circuit breaker fails to reset, leave it out and reset the avionics bus tie circuit breaker. This will restore power to the failed bus from the functioning bus. Reduce the total avionics load and maintain it below 50 amps. If safe operation of the aircraft requires an electrical load greater than 50 amps, the alternate avionic power switch should be turned ON. After sufficient cooling, try to reset the popped avionics bus circuit breaker.

When a loss of power has occurred in both avionics buses, check that the avionics master switch is ON. Pull the avionics bus tie circuit breaker and check that the avionics bus circuit breakers are in, reset if popped. Resume normal operation if power is restored. If only one of the avionics buses is returned to service, proceed as a single bus failure. If both avionics bus circuit breakers are in and power loss is still evident, pull avionics bus tie circuit breaker and turn on emergency bus power switch. Avionics bus tie breaker may be reset if avionics power is less than 50 amps.

ABNORMAL DEICE AMMETER READINGS

The ammeter for the electrothermal deicers should read 26 to 30 amps when the system is ON.

If the deicer ammeter reads zero when the switch is ON, check the circuit breaker. If the breaker has opened, reset it. If the switch is ON and the circuit breaker is set and the ammeter still reads zero, turn the system OFF and avoid icing conditions.

If the deicer ammeter reading is less than 26 amps, avoid icing conditions, as the continued operation of the system cannot be assured. In an emergency, the system may be activated, but time of operation must be kept to a minimum.

ELECTRICAL FIRE

Electrical fires can be detected by the distinctive odor of smouldering insulation. Since all cabin and panel lighting will be turned OFF during the following procedures, be sure that at night a flashlight is in hand before beginning the Electrical Fire check list.

Turn OFF the battery master switch and both generators.

Since electrical gyros will be rendered unreliable, use the vacuum turn indicator for instrument flight.

Turn OFF the avionics master switch, climate control master switch, and all other electrical switches. Check for open circuit breakers, then pull ALL circuit breakers.

Turn the battery master and both generators ON. Then, one at a time reset circuit breakers and turn ON electrical switches until the faulty unit is located. Leave the circuit breaker of the faulty unit pulled for the remainder of the flight.

CAUTIONS

Any time a generator switch is to be turned OFF, be careful not to inadvertently engage the starter.

When the electrical system is failed or shut down, warning horns and lights are rendered inoperative.

NOTE

When the battery master switch and both generator switches are OFF, the cabin will depressurize due to deflation of the door seal.

3.25 STABILITY AUGMENTATION SYSTEM FAILURE

The following SAS failure procedures should be undertaken if a SAS warning light illuminates.

SAS FAILURE ON TAKEOFF

If SAS failure occurs during takeoff, reduce power to 400 SHP (2200 RPM at 955 lb. ft. torque) on each engine and accelerate to 125 KIAS. Then complete the SAS override procedures outlined below.

SAS FAILURE IN FLIGHT

When the SAS has failed, the SAS override system should be actuated to provide suitable handling characteristics for the rest of the flight. Remove the SAS override cover release pin/ring on the right side of the control pedestal, and remove the access cover. Grasp the control wheel firmly and anticipate a nose down force. PULL the SAS override lanyard.

The system is designed to require about 20 seconds to reach full travel. Retrimming will require about one full turn of trim tab change. If not retrimmed a 20 pound pull force on the control wheel will be required to maintain the same attitude.

CLIMB WITH SAS OVERRIDE

To climb with the SAS override system activated, gear and flaps must be retracted and a minimum climb speed of 126 KIAS maintained. Maximum power to be used during climb is 400 SHP (2200 RPM at 955 lb. ft. torque) per engine. At gross weight on a standard day at sea level, this power setting gives a climb rate of approximately 1300 feet per minute.

CRUISE WITH SAS OVERRIDE

Use normal procedures.

APPROACH AND LANDING WITH SAS OVERRIDE

Maintain a minimum approach speed of 109 KIAS until landing is assured when the SAS override system is activated. All other landing procedures remain the same.

GO AROUND WITH SAS OVERRIDE

To execute a go-around with the SAS override system activated, apply power to 400 SHP (2200 RPM at 955 lb. ft. torque) on each engine. Maintain a minimum airspeed of 109 KIAS while gear and wing flaps are down. When gear and wing flaps are retracted, increase airspeed to a minimum of 126 KIAS.

SINGLE-ENGINE FLIGHT WITH SAS OVERRIDE

Use normal single-engine operating procedures. Maximum allowable power is 620 SHP.

3.27 PRESSURIZATION SYSTEM MALFUNCTION

DIFFERENTIAL PRESSURE ABOVE 5.7 PSI OR CONTINUAL CABIN PRESSURE FLUCTUATION AT 5.5 PSI (Serial numbers 31T-7720001 through 31T-7820066 and 31T-7820068 through 31T-7820092)

Cabin differential pressure is automatically regulated to 5.5 psi. If the pressure exceeds 5.7 psi, a safety valve releases pressure. If a malfunction occurs causing differential pressure to exceed 5.7 psi, there will be an aural and visual warning from the annunciator system, and the differential pressure indicator will exceed the red line on the gauge.

If cabin differential pressure exceeds 5.7 psi, steps should be taken immediately to reduce it to acceptable limits. Setting the outer ring of the cabin altitude controller to a higher altitude should lower the cabin differential pressure. Descending to a lower altitude should accomplish the same effect.

If differential pressure cannot be brought under control, it may become necessary to unload cabin pressure. This may be done by slowly lifting the emergency gear extender cover. If the cabin is depressurized at a high altitude, descend and use oxygen as required.

The above procedures also apply when cabin pressure fluctuates several hundred feet continually.

DIFFERENTIAL PRESSURE ABOVE 5.7 PSI OR CONTINUAL CABIN PRESSURE FLUCTUATION AT 5.5 PSI (Serial numbers 31T-7820067, 31T-7920001 through 31T-7920094)

Cabin differential pressure is automatically regulated to 5.5 psi by the isobaric and safety valve. If a malfunction occurs causing differential pressure to exceed 5.7 psi, there will be an aural and visual warning from the annunciator system, and the differential pressure indicator will exceed the red line on the gauge.

If cabin differential pressure exceeds 5.5 psi, steps should be taken immediately to reduce it to acceptable limits. Setting the cabin altitude controller to a higher altitude should lower the cabin differential pressure. Descending to a lower altitude should accomplish the same effect.

If differential pressure cannot be brought under control, it may become necessary to unload cabin pressure. This may be done by slowly lifting the emergency gear extender cover. Rapid depressurization is possible by selecting the dump position on the dump/test switch. The use of the dump switch is recommended only during an extreme emergency.

The above procedures also apply when cabin pressure fluctuates several hundred feet continually.

RAPID INCREASE IN DIFFERENTIAL PRESSURE OR SMOKE OR FUMES IN CABIN

If cabin differential pressure rises rapidly, or if the pressurized air in the cabin becomes contaminated with smoke or fumes, immediately depressurize the cabin by slowly lifting the emergency gear extender cover. Place the cabin air control lever in the "OUTSIDE AIR" position. At high altitudes, begin descent and use oxygen as required.

If fire is suspected, do not use oxygen in a pressurized cabin or at lower altitudes where oxygen is not required .

CABIN ALTITUDE ABOVE 10,500 FEET

If the annunciator warning and cabin altitude gauge indicate that cabin altitude has exceeded 10,500 feet, descend until cabin altitude falls below 10,500 feet. Use emergency oxygen if necessary.

NOTES

For oxygen system procedures, see Paragraph 3.29.

If the pressurization system malfunctions, do not attempt pressurized flight until the system is serviced and the fault corrected.

3.29 EMERGENCY OXYGEN SYSTEM

Emergency oxygen should be used any time the cabin altitude exceeds 10,000 feet. Should the need arise for oxygen to be employed, oxygen mask fittings should be inserted into the oxygen receptacles. Pulling out the oxygen control knob to the ON position begins the flow of oxygen through the masks. The absence of the red pellet in the flow indicator on each mask hose indicates that oxygen is flowing through the mask.

Occupants should don the masks, checking the flow indicator frequently. The pilot should monitor the oxygen pressure gauge to determine oxygen supply and consumption.

WARNING

Certain petroleum base substances (mustache wax, lipstick, etc.) are combustible in the presence of 100% oxygen. Donning mask set at 100% oxygen could cause burns to areas where petroleum base substances have been applied.

If the oxygen cylinder has a pressure of 1800 psi at 70°F (21°C) when the use of oxygen is begun, oxygen will be available as shown below:

48 CUBIC FOOT OXYGEN CYLINDER

Occupants		Oxygen Supply Range in Hours With Fully Charged Cylinder		Cylinder Pressure Required for 10 Min. Supply (21°C)*	
Crew	Passengers	120 LPH Mask	180 LPH Mask	120 LPH Mask	180 LPH Mask
1		11.00	5.33	230	250
1	1	5.50	2.67	260	300
1	2	3.67	1.77	280	350
1	3	2.75	1.33	310	400
1	4	2.20	1.07	340	450
1	5	1.83	.88	360	500
1	6	1.57	.75	390	550
1	7	1.37	.67	420	600

22 CUBIC FOOT OXYGEN CYLINDER

Occupants		Oxygen Supply Range in Hours With Fully Charged Cylinder		Cylinder Pressure Required for 10 Min. Supply (21°C)*	
Crew	Passengers	120 LPH Mask	180 LPH Mask	120 LPH Mask	180 LPH Mask
1		4.37	2.43	260	310
1	1	2.18	1.22	318	420
1	2	1.46	.80	376	530
1	3	1.09	.60	433	635
1	4	.87	.48	491	745
1	5	.73	.40	549	855
1	6	.62	.33	607	965
1	7	.54	.30	665	1075

*For flight above 25,000 feet a minimum oxygen supply of 10 minutes for each occupant is required.

OXYGEN SUPPLY/CYLINDER PRESSURE
(SERIAL NUMBERS 31T-7420001 THROUGH 31T-7920048)
Figure 5-1

OXYGEN DURATION WITH FULLY CHARGED TANK

No. Of Masks In Operation	Oxygen Duration (Hours) 22 Ft.^{3}	48 Ft.^{3}
1	2.45	5.34
2	1.22	2.67
3	.82	1.78
4	.61	1.33
5	.49	1.07
6	.41	.89
7	.35	.76
8	.31	.67
9	.27	.59
10	.24	.53

CYLINDER PRESSURE REQUIRED FOR 10 MINUTE SUPPLY*

No. Of Masks In Operation	PSI (22) 10 Min. Supply Press.	PSI (48) 10 Min. Supply Press.
1	309	250
2	418	300
3	527	350
4	636	400
5	745	450
6	854	500
7	962	549
8	1071	599
9	1180	649
10	1289	699

NOTE

A Diluter Demand Mask operating at 100% or Therapeutic Mask shall count as 2 masks.

*For flight above 25,000 feet a minimum oxygen supply of 10 minutes for each occupant is required.

OXYGEN SUPPLY/CYLINDER PRESSURE
(SERIAL NUMBERS 31T-7920049 THROUGH 31T-7920094)
Figure 3-3

For additional information, refer to Paragraph 7.43, Oxygen System.

3.31 CROSSFEED PROCEDURE

The fuel crossfeed system may be used if during single-engine flight it becomes necessary to use fuel from the inoperative engine side to extend range.

To use crossfeed, turn ON the fuel pump of the inoperative engine, turn the crossfeed valve ON, and turn OFF the fuel pump of the operating engine.

Fuel crossfeed should be OFF during landings; therefore, be sure that before landing the fuel pump of the operating engine is returned to ON and the crossfeed is turned OFF. Turn OFF the fuel pump of the inoperative engine only if Ng = 0 or when a fire hazard exists.

3.33 EMERGENCY DESCENT PROCEDURES

If it becomes necessary to descend rapidly to a lower altitude, retard the power levels to IDLE and advance the propeller controls fully forward for 2200 RPM. When lowering the nose during initial pushover, roll the airplane 30° until the nose is down to the desired pitch angle, then roll the wings level.

When descending in smooth air, or if a high speed descent is desired, the gear and flaps should be left retracted. Maintain the airspeed at red line, and assume a wings level, nose down attitude. Trim as necessary.

When descending in rough air, or if a low speed of descent is desired, slow to 181 KIAS and extend 15° of flaps. At an airspeed below 153 KIAS, extend the landing gear. When the airspeed falls below 148 KIAS, fully extend the flaps to 40°. Continue descent without exceeding 148 KIAS. Maintain a wings level, nose down attitude, trimming as necessary.

If a pressurization failure has occurred, employ emergency oxygen at altitudes above 10,000 feet (see Paragraph 3.29).

Vertical speed during descent will be approximately 5000 feet per minute. Descend off the airway, and be aware of terrain elevation.

3.35 EMERGENCY GEAR EXTENSION

If the landing gear will not extend by normal means, the emergency gear extender provides hydraulic pressure for gear extension. Remember that if the cabin is pressurized, raising the emergency gear extender cover will dump pressure.

Maintain airspeed below 130 KIAS. Lift the emergency gear extender cover located on the floor between the pilot and the copilot seats. Note that emergency gear extension procedures are printed on the underside of the cover.

Place the gear selector lever in the "DOWN" position; extend the emergency hand pump handle, and pump up and down on the handle until all three green gear down lights illuminate and the gear selector returns to neutral. Visually check gear extension by observing the nose gear in the mirror on the left nacelle. The master switch or a generator switch must be ON for the gear lights to illuminate.

3.37 GEAR UP LANDING

If all normal and emergency gear extension procedures have failed, a gear up landing will be necessary. Select a suitable landing area. If possible, inform ground personnel of the emergency situation. If time allows, burn off excess fuel. Brief passengers on the use of the emergency exit and be sure that all occupants have seat belts and shoulder harnesses secured properly.

When ready to land, complete the landing check list as for a normal landing, except that the gear selector should be in the "UP" position. Turn OFF the autopilot the master switch and both generator switches.

Make a normal approach. and when the runway is "made" and landing is assured, place condition lever in "STOP." propeller levers in "FEATHER." and turn OFF fire wall shutoffs. Land smoothly, touching down in a level attitude. All occupants should evacuate as soon as the airplane has stopped.

WARNING

Total drag of the airplane will be significantly reduced with props in feather. Pilot should plan for increased landing distances.

3.39 EMERGENCY EXIT

An emergency exit is located on the right side of the fuselage, and is the second window aft of the windshield.

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

NOTE

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

3.41 ASYMMETRIC FLAP CONDITION (Serial Numbers 31T-7720001 through 31T-7820066 and 31T-7820068 through 31T-7820092)

In the event of a flap system failure, an asymmetric ("split") flap condition may occur. Large flap asymmetry (40° differential) may be avoided by using the incremental flap extension and retraction procedures detailed in Paragraph 7.19.

An asymmetric condition of 0° and 15°, or 15° and 40° may be handled with (a) approximately 50% of the available aileron deflection opposite the direction of roll tendency, (b) negligible rudder, and (c) symmetric engine power at 117 KIAS or slightly above the single-engine best- rate-of-climb speed of 113 KIAS ("blue line"). Higher speeds require more aileron force, while lower speeds necessitate increased aileron deflection angles. Therefore, with an asymmetric flap configuration, airspeed should be maintained near the "blue line" and landing accomplished at slightly (+10 KIAS) above normal touchdown speed.

A large flap asymmetry (40° differential) will necessitate (a) full aileron opposite roll tendency, (b) the use of rudder in the direction of the larger flap extension, and (c) asymmetric engine power (added power on the side of the lesser flap extension angle) to maintain straight flight.

It may be possible to neutralize an asymmetric flap condition by returning a still-operable flap segment to the position of the inoperable segment. At the onset of an asymmetrical flap condition, return the flap control switch to its original position.

Do not attempt to reset the flap time-delay relay system in flight. A maximum of approximately 9° flap asymmetry results from failure of the left flap to leave a limit switch position, and resetting this system could result in another second of right flap operation with an attendant increase in asymmetry. (See Paragraph 7.19.)

3.42 FLAP SYSTEM MALFUNCTION (Serial Numbers 31T-7820067, 31T-7920001 through 31T-7920094)

In the event the "FLAP" annunciator should illuminate, the flap selector switch should be checked for proper operation. If the flaps respond to command an internal component of the amplifier has failed. The flaps are still usable and the amplifier should be repaired before the next flight. If the flaps do not respond a flap system shutdown has occurred. Check the flap symmetry. The amplifier may have shut down the system because it detected a 5° differential in flap position or one of the rheostats may have failed. Determine through control wheel input that an asymmetric condition does not exist (i.e., the control wheel is not displaced in the direction of the larger flap deflection angle to maintain heading). Check and reset the flap motor circuit breaker. If the flaps still remain inoperative, a rheostat may have failed. The shutdown will remain until the system has been repaired.

When the flap selector becomes inoperative and the annunciator does not illuminate, check the flap position indicator. If the indicator is pointing to OFF, power has been lost to the amplifier. Without power the amplifier cannot activate the annunciator. Check and reset the flap control circuit breaker. If the indicator is showing the flap position, test the annunciator for proper operation. If the annunciator fails to illuminate, proceed as a system shutdown and determine the cause. When it has been determined that shutdown was not caused by an asymmetric flap condition, check and reset the flap motor circuit breaker. If the annunciator functions properly when tested, check and reset the flap motor circuit breaker.

3.43 ALTERNATE STATIC SOURCE

In the event the alternate static source must be used, the control lever located on the instrument panel to the right of the control pedestal should be moved to the right (ALTERNATE SOURCE).

Correct the airspeed and altimeter indications using the correction graphs provided in Section 5.

3.45 FLIGHT WITH PRIMARY LONGITUDINAL CONTROL FAILED

If the primary longitudinal control fails and the stability augmentation system is still operative, leave the unit (SAS) on. When ready for a landing approach, trim the airplane in level flight to 126-135 KIAS. Select the longest runway in the area.

Extend the landing gear and maintain 126-135 KIAS.

CAUTION

Do not lower approach flaps before landing gear is down and locked.

After the landing gear is down and locked (3 green lights) the flaps should be extended to 15° (approach detent). Trim the airplane to 109-114 KIAS (approx. 600 lb. ft. torque, 2000 RPM Np). When positioned over the landing runway, flare the airplane with trim tabs alone and slowly reduce power.

CAUTION

Do not extend full flaps.

3.47 ANNUNCIATOR FAILURE (Serial Numbers 31T-7820001 through 31T-7920094)

In airplanes with serial numbers 31T-7820001 through 31T-7920094, the following procedures are recommended in the event of an annunciator system malfunction.

NOTE

The following procedures are intended as in-flight remedies. If an annunciator system malfunction occurs, maintenance should be performed by a certified mechanic as soon as possible.

ILLUMINATION OF ANNUNCIATOR POWER DISPLAY LIGHT

The illumination of the ANN POWER display light indicates that one or more of the six following malfunctions requires attention:

(a) Essential Power OFF

The annunciator controller receives 28 input volts from the essential bus through three sources: the annunciator power circuit and the left and right engine fire extinguisher inoperative circuits. (If optional engine fire extinguishers are not installed, the three sources are annunciator power, annunciator warning 1 and annunciator warning 2.) The circuit breakers are labeled accordingly. Loss of power from the annunciator power circuit will illuminate the ANN POWER display light. If failure of the annunciator power circuit occurs, the annunciator system will continue to function, powered by the two remaining power sources.

During operation with the annunciator power circuit disabled, the ANN POWER display light will remain lit, and the source of power to the annunciator controller heater will be lost. With the controller heater inoperative, the possibility of an annunciator controller undertemperature condition increases, especially in low (-55°C) ambient temperatures.

(b) Annunciator Controller Overtemperature

If the heater servo on the annunciator controller fails and the annunciator controller internal temperature exceeds 70°C, the annunciator power display light will illuminate. If the ambient temperature is high, there is reason to suspect a controller overtemperature condition.

The annunciator controller heater is powered through the annunciator power circuit. To correct an overtemperature condition, pull the annunciator power circuit breaker until the controller has cooled down. When the annunciator power circuit is restored after the controller is cool, the annunciator power display light will extinguish and remain unlit unless the internal temperature of the controller again exceeds 70°C. The pilot may elect to leave the annunciator power circuit disabled with power being supplied to the annunciator system by the two remaining power sources.

(c) Annunciator Controller Undertemperature

If the annunciator power circuit is disabled or if the heater servo on the annunciator controller fails and the internal temperature of the controller goes below 40°C the annunciator power display light will illuminate. In the event of a controller undertemperature condition, operation at a higher ambient temperature should allow the annunciator system to remain functional.

(d) Internal Flasher Power Supply Failure

If the internal flasher power supply fails, the annunciator power display light will illuminate. If pressing the annunciator test switch does not activate the master caution indicator and cause the display lights to flash, such a malfunction is indicated. With the internal flasher power supply failed, the annunciator functions as a display only. If a monitored system malfunctions under these conditions, the associated display light will illuminate without flashing and without a master caution indication.

(e) External No. 1 Channel

A +28 VDC input is applied to the external No. 1 channel.

(f) External No. 2 Channel

A ground input is applied to the external No. 2 channel.

INTERNAL BIAS SUPPLY FAILURE

The annunciator controller contains an internal bias supply. If this supply fails, the master caution indicator/reset switch is disabled. The annunciator power display light will not flash, however, both of the oil temperature lights will flash. If a display channel is activated while the system is in such a failed condition, the display light will flash, and will remain flashing. Any additional channels which are activated will flash also. Pressing the test switch will cause all red display lights, whether active or inactive, to flash.

In the event of an internal bias supply failure, the system is still functional as a display. A malfunction under these conditions will cause the associated display light to flash without a master caution indication.

CAUTION

In the event of an internal bias supply failure, the oil temperature display will flash regardless of whether or not the oil temperature is high. It is therefore imperative the pilot monitor the oil temperature gauge for the remainder of the flight, regardless of whether or not the oil temperature display is lit.

DIMMER CIRCUIT FAILURE

In the event of a dimmer circuit failure, the display will no longer have the capacity of being dimmed. Such a failure will cause the display to automatically go to and remain in the bright mode without any corrective measures necessary.

SECTION 4

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SECTION 4

NORMAL PROCEDURES

4.1 GENERAL

This section describes the recommended procedures for the conduct of normal operations for PA-31T Cheyenne airplanes. All of the required (FAA regulations) procedures and those necessary for the 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 presented in Section 9 (Supplements).

These procedures are provided as 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 is a short form check list which supplies an action sequence for normal procedures 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 in flight.

4.3 AIRSPEEDS FOR SAFE OPERATION

The following airspeeds are those which are significant to the operation of the airplane. These figures are for standard airplanes flown at maximum gross weight under normal conditions at sea level. For additional airspeed information see Section 2.

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

(a) Maximum Operating Speed (up to 12,000 feet) (See Vmo chart in Section 2 for speeds above 12,000 feet)	242 KIAS
(b) Design Maneuvering Speed (at max. gross weight) (up to 26,900 feet) (See Vmo chart in Section 2 for speeds above 26,900 feet)	177 KIAS
(c) Maximum Flap Extended Speed	
15 ° flaps	181 KIAS
40° flaps	148 KIAS

(d)	Maximum Gear Extended Speed	153 KIAS
(e)	Maximum Gear Operating Speed	
	Retraction	139 KIAS
	Extension	153 KIAS
(f)	Best Rate of Climb Speed	122 KIAS
(g)	Best Angle of Climb Speed	96 KIAS
(h)	Final Approach Speed	98 KIAS
(i)	Intentional One Engine Inoperative Speed	113 KIAS
(j)	Minimum Multi-Engine Climb Speed (above 20,000 ft.)	117 KIAS
(k)	Minimum Speed for Cruise, Holding, or Descent (above 20,000 ft.)	120 KIAS
(l)	Maximum Demonstrated Crosswind Velocity	16 KTS

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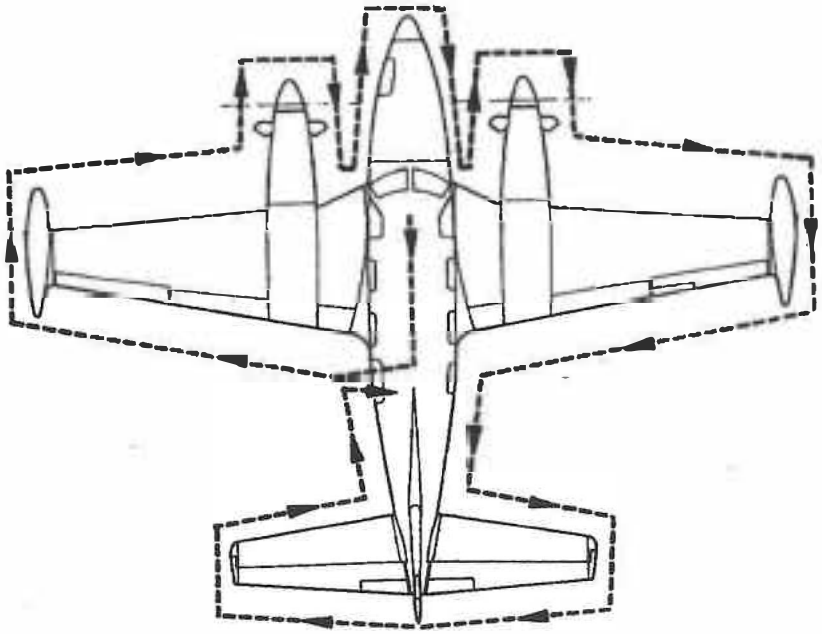

WALK-AROUND

Figure 4-1

4.5 NORMAL PROCEDURES CHECK LIST

PREFLIGHT CHECK

COCKPIT

Flight controls.....free
Electrical switches.....OFF
Avionics.....OFF
Gear handle.....DOWN NEUTRAL

WARNING

No braking will occur if aircraft brakes are applied while parking brake handle is pulled and held.

Brakes.....reset
Flap switch.....test - extend to 15°
Battery master.....ON
Annunciator.....checked
Fuel quantity.....checked
Gear lights.....three green
Battery master.....OFF
Trim.....center of T/O position
Airplane papers.....checked
Oxygen pressure.....checked
Oxygen masks.....checked
SAS override safety wire.....checked
Emergency window.....checked

LEFT WING

Surface condition.....checked
Flap.....checked
Aileron.....checked
Static wicks (if installed).....checked
Tip tank and cap.....checked
Navigation and strobe lights.....checked
Tip tank drain (if installed).....drain and check for water, sediment, and proper fuel
Fuel tank vents.....checked
Tie down.....removed
Outboard fuel tank.....drain and check for water, sediment, and proper fuel
Landing gear.....checked
Chock.....as desired
Fuel filter.....drain and check for water, sediment, and proper fuel
Cowling.....checked
Nacelle tank filler cap.....checked
Inlet and exhaust protectors.....removed

Engine air inlet.....clear
Propeller.....checked
Engine oil and cap .....checked & secure
Inboard fuel tank .....drain and check for water, sediment, and proper fuel
Gear mirror.....in place

NOSE SECTION

General condition .....checked
Baggage .....secured
Baggage door.....locked
Battery vent .....clear
Swing nose.....secure
Radome .....checked
Nose gear .....checked
Chock.....as desired
Pitot tubes .....clear
SAS vane.....checked
Heater inlet and exhaust .....clear
Windshield wipers.....checked

RIGHT WING

Same as Left Wing (in reverse order)

FUSELAGE (RIGHT SIDE)

General condition .....checked
Static openings .....clear
Antennas .....checked

EMPENNAGE

Surface condition .....checked
Tie down .....removed
Trim tabs (1/2" trailing edge down).....checked
Hinges and push rods .....checked

FUSELAGE (LEFT SIDE)

General condition .....checked
Static openings .....clear
Door.....checked

BEFORE STARTING ENGINES

Cabin door .....secure
Baggage .....secure
Passenger briefing.....completed
Seats .....adjusted
Belts and harness .....secure

WARNING

No braking will occur if aircraft brakes are applied while pawing brake handle is pulled and held.

Parking brake .....set
Crossfeed.....OFF
Firewall shutoff valves .....open
Power levers.....IDLE
Prop controls.....full FORWARD
Condition levels.....STOP
Cabin comfort control .....OFF
Electrical switches .....OFF
Circuit breakers.....checked
Avionics master .....OFF
Generator bus ties.....ON
Non-essential bus switch .....ON
Battery master .....ON
Aural warning.....off
Cockpit lights.....check
Seat belts and smoking sign .....ON

ENGINE START

NORMAL START

Battery (24-28V) .....checked
Fuel pump .....ON
Fuel pressure.....checked
Ignition switch.....ON
Starter .....ON
Ng (min . 12%) .....stabilized
Condition lever .....RUN
Ignition light .....ON
ITT (max. 1090° C for 2 sec.) and Ng .....monitored
Starter)at stabilized idle - 52%).....OFF
Ignition .....OFF
Power levers .....advanced to 68% Ng
Generator .....ON
Oil pressure.....checked
Cabin door unsafe light .....out
Gear handle (hyd. pump check) .....DOWN then returned to neutral
Generator (when ammeter at 100 or less) .....OFF
Second engine .....repeat above thru "Oil Pressure - Checked"
Both generators .....ON

APU START

Engine switches .....OFF
Battery master .....OFF
APU .....connected
Voltmeter (27V-30V) .....stabilized
Battery master .....ON
Normal start procedure .....accomplished thru "Ignition - OFF"
Oil pressure .....checked
Battery master .....OFF
APU .....disconnected
Battery master .....ON
Cabin door unsafe light .....out
Generators .....ON

ENGINE CLEARING PROCEDURE

(Allow 30 sec. fuel drain period.)

Condition lever .....STOP
Ignition .....OFF
Battery master .....ON
Fuel pump .....ON
Starter .....ON (15 sec.)
Starter .....OFF
Fuel pump (when Ng is zero) .....OFF

ENGINE CROSS-START
(ONE ENGINE OPERATING)

Fuel pump - inop. eng. .....ON
Ignition switch - inop. eng. .....ON
Generator - op. eng. .....OFF
Power levers - op. eng. .....advanced to 68% Ng
Starter - inop. eng. .....ON
Generator - op. eng. (after 10% Ng on inop. eng.) .....ON
Ng (min. 12%) .....stabilized
Condition lever .....RUN
Ignition light .....ON
2nd eng. ITT (max. 1090° C for 2 sec.) and Ng .....monitored
1st engine ITT & Ng .....monitor
Starter (2nd eng.) (at stabilized idle) .....OFF
Ignition (2nd eng.) .....OFF
Generator (2nd eng.) .....ON after 68% Ng

BEFORE TAXI

APU .....removed
Battery master & generators .....ON
Lights .....as required
Cabin comfort .....ON
Gyros .....set
Altimeter and clock .....set
Avionics master switch .....ON
Electric trim .....ON & checked
Autopilot .....checked & OFF
Radios .....checked
SAS .....checked

TAXIING

Brakes .....checked
Prop reverse .....checked
Flight instruments .....checked
Power levers .....IDLE
Prop controls .....FEATHER
Prop controls .....full FORWARD

ENGINE RUN-UP

Circuit breakers .....IN
Generators .....ON
Ammeters and voltmeter .....checked
Prop sync. .....OFF
Fuel pumps (No. 1 & No. 2) .....checked
Crossfeed .....checked & OFF
Air control .....pressurized
Man. gear ext. cover .....secure
Dump control (if installed) .....in
Power levers .....set at 1625 RPM
Pneumatic gauge .....checked
Overspeed governors .....test
  Prop controls .....full FORWARD
  HTG test switches .....UP
  RPM .....drop observed
  HTG test switches .....released
  RPM 1625
Pressurization system .....checked
Pressurization system .....set
Power levers .....set at 1800 RPM
Ice protection .....checked
Power levers .....IDLE
Secondary low pitch stops
  (one at a time) .....tested
  Power lever (till Beta
    light comes on) .....toward REVERSE
  Test switch .....down and held
  Power lever .....continue
    toward REVERSE
  Prop reverse .....not attained
  Test switch .....released - prop moves
    toward reverse
Power levers .....IDLE
Quadrant friction .....set

BEFORE TAKEOFF

Circuit breakers .....checked
Generators .....ON
Fuel pumps .....ON
Fuel pressure .....checked
Ice protection (windshield, pitot
  heat, eng. ice protection) .....as required
Oil cooler doors (cowl flaps) .....CLOSED
SAS lights .....out
Flight instruments .....checked
Engine gauges .....checked
Warning lights .....checked
Radios, radar and autopilot .....set
Prop sync. .....OFF
Static source .....normal
Props .....full forward (2200 RPM)
Trim .....set
Flaps .....checked and up
Fuel quantity .....checked
Flight controls .....free
Passengers .....ready and
    seat belts fastened
Pressurization system .....set

TAKEOFF AND CLIMB

Dir. gyro .....runway heading
Power levers .....advanced
Torque and ITT .....within limits
Rotation .....91 KIAS min.
Gear (below 139 KIAS) .....up
Climb power .....set
Seat belts and smoking sign .....as required
Prop sync .....as desired
Yaw damper .....as desired

CRUISE

Cruise power .....set
Engine instruments .....checked
Pressurization .....as desired

FLIGHT IN ICING CONDITIONS

Engine ice prot. switch (in
  visible moisture below +5° C) .....ON
Pitot heat .....ON
Windshield heat .....ON
Surface deice .....as required
Oil temp .....monitored
Oil cooler doors (if
  oil temp. high) .....open

DESCENT

Pressurization .....set
Altimeter .....set
Dehumidifier .....as required

BEFORE LANDING

Seat belts and smoking signs .....ON
Prop sync .....OFF
Prop controls .....2000 RPM
Cabin pressure .....check - below 0.3 psi
Flaps (181 KIAS max. app. flaps;
148 KIAS max. full flaps) .....as required

NOTE

(Serial numbers 31T-7720001 through 31T-7820066 and 31T-7820068 through 31T-7820092).

No flap selection with autopilot engaged.

Gear(below 153 KIAS) .....down
Gear lights .....3 green
Nose gear position .....check in mirror
Brakes .....checked
Landing lights .....as required
Autopilot/Yaw damper .....OFF

BALKED LANDING

Power .....as required
Torque and temperatures .....within limits
Flaps .....approach
Gear .....up
Flaps .....full up

AFTER LANDING

Prop controls .....full FORWARD
Reverse thrust (above
40 KIAS) .....as desired
After clearing runway:
Flaps .....up
Heater fuel switch .....OFF
Radar .....OFF
Strobes .....OFF

SHUTDOWN

WARNING

No braking will occur if aircraft brakes are applied while parking brake handle is pulled and held.

Parking brake .....set
Avionics .....OFF
Electrical equipment .....OFF
Battery charge .....checked
ITT below 610° .....one min.
First engine started:
Generator .....OFF
Power lever .....IDLE
Prop .....FEATHERED
Condition lever .....STOP
Fuel pump .....OFF
Gear handle (hyd. pump check) .....DOWN then returned to neutral
Master comfort .....OFF
Second engine .....repeat as first engine
Battery master .....OFF

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4.7 AMPLIFIED NORMAL PROCEDURES (GENERAL)

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

4.9 PREFLIGHT

The airplane should be given a thorough preflight and walk-around check. The preflight should include a determination of the airplane's operational status, a check that necessary papers are on board and in order, and a computation of weight and C.G. limits, takeoff distance and in-night performance. Baggage should be weighed, stowed, and tied down. A weather briefing for the intended flight path should be obtained, and other factors relating to the flight should be checked before takeoff.

Before flying, a pilot should complete a personal check list including the following items:

(a) A current FAA physical.
(b) Sufficient recovery time from debilitating drugs or medication.
(c) No alcohol in the past eight hours.
(d) Physical condition (no colds, etc.).
(e) Emotional condition (ability to devote full concentration to flight).
(f) Sufficient rest for fatigue recovery.
(g) Ability to cope with temporary physical injuries and disabilities.
(h) Ear plugs if necessary.
(i) Spare pair of glasses if required to wear glasses while flying.

COCKPIT

WARNING

No braking will occur if aircraft brakes are applied while parking brake handle is pulled and held.

After entering the cockpit, release the controls if they have been secured. Check that all electrical switches and avionics switches are OFF. Insure that the gear selector lever is in the "DOWN NEUTRAL" position and that the brakes are set. The flap selector switch position should be matched to the position of the wing flaps before the battery master switch is turned ON.

Turn ON the battery master switch, and check fuel quantity gauges. The three green landing gear lights should be lit. If any of the green gear lights are not lit, press them to test the bulb. Burnt out bulbs should be replaced before flight.

Press the annunciator test button. The master caution light should illuminate, and the warning horn should sound. Check the annunciator display. The following lights should illuminate:

(Serial numbers 31T-7720001 through 7720069.)

LEFT ENG FIRE	NOSE BAG. DR AJAR	CABIN DOOR UNSFE	RIGHT ENG FIRE
L. FIRE EXTNG INOP	LEFT FUEL PRESS	RIGHT FUEL PRESS	R. FIRE EXTNG INOP
L. ENG OIL TEMP	CABIN PRESS HIGH	BAT OVER TEMP	R. ENG OIL TEMP
L. ENG OIL PRESS	LEFT GEN INOP	RIGHT GEN INOP	R. ENG OIL PRESS

(Serial numbers 31T-7820001 through 31T-7920094.)

L. ENG DEICE	R. ENG DEICE	OIL DR L. ENG	OIL DR R. ENG	L. ENG FIRE	R. ENG FIRE	L. ENG FUEL PRESS	R. ENG FUEL PRESS

L. ENG OIL PRESS	R. ENG OIL PRESS	L. ENG OIL TEMP	R. ENG OIL TEMP	SAS	FLAP	L. FIRE EXTNG INOP	R. FIRE EXTNG INOP

TRIM	INVERTER POWER	L. GEN INOP	R. GEN INOP	BATTERY OVERTEMP	ANN POWER	CABIN PRESS

CABIN ALT	CABIN DR UNSAFE	NOSE/BAG DR AJAR

Test the flap annunciator with test switch adjacent to the flap position indicator. Set to 15°.

Pressing the master caution light will reset the horn and lights. Turn the battery master switch OFF after these checks.

Set trim controls to takeoff position. Check that necessary papers are on board and in order. Check the oxygen gauge on the lower right instrument panel to ascertain that there is sufficient oxygen for the intended flight. Check that the oxygen flow control knob is pushed in to the OFF position. Be sure that there is a functional oxygen mask for each occupant and that all masks are properly stowed.

Check the SAS override safety wire on the right side of the control pedestal. The safety wire on the access cover should be intact. If the safety wire is broken, remove the access cover and check the second safety wire on the trigger mechanism. If the second safety wire is broken, the CO2 cartridge must be carefully checked. If the seal on the CO_2 cartridge is broken, the system should be serviced and rearmed before flight.

Cockpit and cabin dome lights should be checked. Both of these lights operate even when the battery master switch is off. Check that the emergency exit is properly closed and latched.

A complete walk-around check should be routinely performed during each preflight. A set pattern should be established, starting at the cabin door and proceeding forward, completely around the airplane, and terminating upon return to the cabin door.

LEFT WING

Proceed first along the trailing edge of the left wing, checking the wing, aileron, flap, and hinges for damage and operational interference. The wing and control surfaces should be free of ice, snow, frost, and other extraneous substances. The aileron counterbalance should be secure. Static wicks should be firmly attached and in good condition. Check the tip tank. The fuel cap should be securely in place, and the navigation and strobe lights should be intact. Briefly open the fuel drain in the access doors on the underside of the tip tank to ensure the removal of sediment. It is recommended that at each fuel drain, fuel be collected and examined in a clear container so that it can be visually checked for water, sediment, and proper fuel. Fuel vents should be clear of obstructions. Pneumatic wing deicer boots should be free from defects and flat against the wing surface.

If tie-downs and wheel chocks have been employed, they should be removed before flight.

The landing gear should be examined. The gear strut should be inflated to expose about 3.25 inches of piston tube when supporting an empty airplane with full fuel tanks and full operating fluids. The condition of the components of the strut, the gear doors, the brakes, the gear micro switches, etc., should appear sound, and fittings, attachments, hoses, lines, screws, hinges, etc., should be secure. The tire should be inflated to 80 psi, and should be examined for breaks, cuts, bruises, cracks, and excessive wear. There should be no obvious serious leaks of fluid in the area of the struts and brakes. Check the underside of the airplane and the ground in the area of the airplane for evidence of fuel, oil, or operating fluid leakage. The wheel well should be checked and ensured clear of debris, bird nests, etc.

At the engine nacelle, check the cowling. If should be securely attached and in good condition. The nacelle fuel filler cap should be securely closed. If there is fuel in the tip tank, do not open the nacelle filler cap, as differential pressure will cause fuel to be lost through the nacelle filler.

If the protective covers were installed over the exhausts and inlet, they should be removed. Inlet and exhaust openings should be checked for obstructions. Check the condition of the inlet and propeller deicers.

The propeller blades and spinners should be free of cracks, nicks, dents, or other defects. There should be no indication of leakage of fluid in the area of the propeller hub or on or about the engine nacelle. Oil quantity can be checked by opening the access port on top of the nacelle and removing the combination oil cap/dipstick. After the oil is checked, be sure that the cap is tightly seated in place.

Inboard of the nacelle, the gear mirror should be clean and intact, and the wing root fillet should show no sign of stress. Before leaving the wing area, be sure that all fuel sumps have been drained and that an access panels are secure.

NOSE SECTION

Continue from the left wing forward around the nose section of the airplane. All access plates should be secure, and the general condition of the nose section should appear sound. Baggage should be securely stowed, and the baggage compartment door completely closed and locked. The battery vents and drain and heater inlet and outlet ports should be open and clear. Be sure that the swing open nose cone is closed and latched. Check the radome for damage.

The nose gear should be checked in the same manner as the main gear, the proper strut piston tube exposure being 3.25 inches and the proper tire inflation depending upon the type of tire installed. Refer to the placard on the wheel assembly for the applicable tire pressure. No leakage of hydraulic or brake fluid should be present. If a wheel chock has been employed, it should be removed. Landing and taxi lights should be clean and intact.

If pitot tube covers have been installed, they must be removed and the pitot head openings checked and ensured clear of insects, dirt, and other obstructions. Check the SAS vane on the right side of the nose section. If a protective cover has been instated on the SAS vane, it must be removed . When operation of the pitot heat and SAS vane are to be checked, the master switch and pitot heat switch must be turned ON. Using caution, as the pitot head can become very hot, check that the pitot head is hot to the touch. Depress the right landing gear squat switch by hand for 10 seconds; then check the SAS vane for a temperature rise.

The windshield and pilot and copilot side windows should be clean and the windshield wipers in good condition.

RIGHT WING

Containing aft and around the right wing, the same checks and procedures as performed on the left wing should be completed in reverse order. The right aileron includes a trim tab which must be checked.

FUSELAGE (RIGHT SIDE)

Check the general condition of the right side of the fuselage. The emergency exit window should be secure and flush with the fuselage skin. All side windows should be clean and without defects. Antennas and cables should be in place and securely attached. The openings in the static pads should be clean and unobstructed.

EMPENNAGE

All surfaces of the empennage should be examined for damage and operational interference. Fairings and access covers should be attached and in good condition. Deicer boots should be sound and flat against the surface. The elevator and rudder should be in good condition. With the trim tabs set in take off position, the rudder tab should be even with a neutral rudder, the horizontal stabilizer tab should extend 1/2inch below the trailing edge when the stabilizer is neutral. Check the condition of the tabs and insure that all hinges and push rods are sound and operational. If the tail has been tied down, remove the tie-down rope.

FUSELAGE (LEFT SIDE)

On the left side of the fuselage, the static openings should be clear, side windows clean and sound, and cabin door attachments and hinges operational. If night flight is anticipated, before completing the walk-around, ensure that all exterior lights are operational; the master switch must be ON for this check.

When all occupants are boarded, the pilot should check that the cabin door is properly closed and latched. The door support cables should be held in position, if necessary, so that they will not interfere with the closing of the door.

4.11 BEFORE STARTING ENGINES

After the preflight interior and exterior checks have been completed and the airplane is determined ready for flight, the cabin door should be secured and all occupants seated. Check that the baggage in the aft compartment is properly loaded and secured and, if necessary, tied down. Passengers should be briefed on the use of seat belts and shoulder harnesses, the emergency exit, supplementary oxygen, ventilation controls, seat adjustment, comfort facilities, etc. The pilot should advise the passengers when smoking is prohibited and caution them against handling controls, equipment, door handles, and the emergency exit. It may be advisable to inform passengers of sounds or sensations which may not be familiar to them, but which are associated with normal flight. After all seats are adjusted and secured in position and seat belts and shoulder harnesses are properly fastened, the pilot may prepare to start the engines.

WARNING

No braking will occur if aircraft brakes are applied while parking brake handle is pulled and held.

The parking brake should be set ON by first depressing and holding the toe brake pedals, and then pulling out on the parking brake handle. Check that control levers move smoothly. The crossfeed should be OFF, and the fire wall shutoffs OPEN. Place the power levers on "IDLE," the propeller controls fully forward, and the condition levers on "STOP."

Prior to starting engines check the pressurization control as explained in Paragraph 4.39. Then check that the cabin comfort master switch is OFF, and the cabin air control lever is in the "OUTSIDE AIR" position. Check that all electrical switches and the avionics master switch are OFF, and that all circuit breakers are IN.

Turn ON the generator bus tie switches, the non-essential bus switch, and the battery master switch. If the master caution aural warning horn sounds, press in on the master caution warning light, to silence the horn. Before starting the engines, turn on the seat belts and no smoking signs.

4.13 ENGINE START

NOTE

Starting engines with the propeller controls full forward and avoiding ground operation with the propellers in FEATHER will reduce the hot exhaust exposure to airframe/system components and increase their service life.

NORMAL START

To start the engines by use of the airplane battery, leave the battery master switch ON, and check the voltmeter for a reading between 24 and 28 volts.

Turn ON the fuel pump of the first engine to be started and watch for an indication on the fuel pressure gauge. Switch to the other fuel pump of the same engine and watch for a continued fuel pressure indication. After verifying that both pumps are operative, turn ON the ignition switch and then the starter switch. Observe the starter operating limits set forth in Paragraph 2.9.

When Ng stabilizes above 12%, advance the condition lever to the "RUN" position. Check for the illumination of the ignition light. Monitor ITT and Ng. If ITT exceeds a maximum of 1090°C for more than 2 seconds, pull the condition lever to "STOP." If Ng exceeds 20% immediately after engaging the starter, a sheared shaft is indicated, and the starter must be turned OFF immediately. (Do not go to "GENERATOR" without going to the stop position momentarily.)

If the gas generator fails to light within 10 seconds after moving the condition lever to "RUN," pull the condition lever to "STOP," and turn OFF the starter and the ignition. Clear the engine per Engine Clearing Procedure, below, before attempting another start. If for any reason a starting attempt is discontinued, allow the engine to come to a complete stop, and then accomplish a motoring run. For a subsequent starting attempt, repeat the complete starting sequence.

If the start is proceeding normally when the Ng stabilizes at idle (52% Ng), turn the starter and ignition OFF. Advance the power levers to attain 68% Ng. At a minimum of 68% Ng, turn the generator ON. Check that the oil pressure is reading in the green arc.

NOTE

Always be sure that an engine has attained a minimum Ng of 68% before its generator is turned ON.

To check the function of the hydraulic pump of the first engine started, place the gear selector lever in the "DOWN" position. If the hydraulic pump is functioning properly, the gear lever will automatically return to neutral. The second hydraulic pump can be checked during shutdown.

NOTE

When starting the engines below an ambient temperature of 0°F, sufficient time at engine idle should be given to warm up the hydraulic fluid. Prior to takeoff, the landing gear handle should be cycled down while each engine is running separately and the handle should return within 20 seconds. If the handle does not return, the pump is inoperative and flight must not be initiated.

When the ammeter reads 100 or less, the battery is charged sufficiently and the generator should be turned OFF.

Repeat the above procedures to start the second engine, eliminating the hydraulic pump check. When both engines are running and stabilized, both generators should be ON.

APU START

When an auxiliary power unit (APU) is employed for starting the engines, ensure that the APU is regulated to 28 Vdc and is capable of providing a minimum starting current of 1200 amperes. The generator switches should be OFF until both engines are running and the APU is disconnected. Turn the battery master switch OFF before the APU is connected. After the APU is connected, monitor the airplane voltmeter until the reading stabilizes between 27 and 30 volts; then turn the battery master switch ON.

Proceed as in a normal start; however, leave the generator switches OFF. When both engines are running and stabilized, turn the battery master switch OFF until the APU is disconnected. Then turn the battery master switch and both generators ON.

ENGINE CLEARING PROCEDURE

Before beginning engine clearing procedures, allow 30 seconds for fuel drainage. To clear fuel from the engine, place the condition lever in the STOP position and turn the ignition switch OFF. Turn the battery master switch ON. To prevent damage to the fuel pump, it should be turned ON before the starter is engaged.

Turn the starter ON for 15 seconds; then turn the starter OFF. After Ng has returned to zero, the fuel pump may be turned OFF.

ENGINE CROSS-START (ONE ENGINE OPERATING)

To start the second engine through use of power from the generator of the operating engine, turn ON the fuel pump and the ignition of the engine to be started. Turn OFF the generator of the engine that is operating. Advance the power levers of the operating engine to attain 68% Ng. When the Ng of the operating engine is at 68%, turn ON the starter of the second engine. Monitor Ng and ITT on the operating engine and advance the power lever to maintain 68% Ng and ITT within its limits. After the second engine reaches 10% Ng, turn ON the generator of the first engine started. After the Ng of the second engine stabilizes above a minimum of 12%, advance its condition lever to RUN. Check for the illumination of the ignition light. Monitor ITT and Ng for normal readings as in the Normal Start procedure.

If the start is proceeding normally, when the Ng stabilizes at idle, turn the starter and ignition OFF. At a minimum of 68% Ng, turn ON the generator of the second engine.

4.15 BEFORE TAXI

Before taxiing check that wheel chocks are removed and the APU disconnected, if employed. Check that the battery master and generator switches are ON. All annunciator lights should be extinguished. A press-to-test of the annunciator display will confirm that it is functional.

Turn ON interior and exterior lights as required. Set cabin comfort controls as desired. (Refer to Paragraph 4.41.) Set gyros and clocks as required, and set altimeters to field elevation. The avionics master switch should be turned ON and the electric trim turned ON and checked. Check the autopilot (see Section 9 - Supplements); then turn it OFF. Check the radios and tune them as desired.

Check the Stability Augmentation System using the test devices on the pilot's instrument panel. On serial numbers 31T-7720001 through 7720069, first test the power and ram warning light bulbs by pressing in on the lights. Push the test switch up, simulating a stall condition. The stall margin indicator should read in the red stall arc, and the stall warning devices should activate. Then push the test switch down, simulating 1.3 times the stall speed. The stall margin indicator should read 1.3 + 1/4 the width of the indicator needle. The test switch is momentary and will automatically return to the center position.

CAUTION

Do not test the 1.0 Vs function of SAS in flight. The airplane will nose down.

For a description of the Stability Augmentation System, refer to Section 7, Paragraph 7.21, Figure 7.11

4.17 TAXIING

While taxiing, apply brakes to determine their effectiveness. Observe flight instruments to see if they appear to be functioning properly. Reversing the propellers while taxiing will both allow the reverse function to be tested and also regulate taxiing speed without causing unnecessary wear on the brakes.

While taxiing with the power levers in IDLE, exercise the propeller controls from full INCREASE RPM through FEATHER several times to check the propeller controls and the response of the governors.

During taxi and run-up, the cabin air control may be placed in the RECIRCULATE position for a more rapid warm-up of the cabin in cold weather or a more rapid cool-down in hot weather. Operation in the RECIRCULATE mode must be limited to 15 minutes, after which at least 5 minutes of operation in either the OUTSIDE or the PRESSURIZED mode is required before reselection of the RECIRCULATE mode.

4.19 ENGINE RUN-UP

WARNING

No braking will occur if aircraft brakes are applied while parking brake handle is pulled and held.

During engine run-up, set the parking brake ON. Both generators should be ON and all circuit breakers should be in. Check the ammeters and voltmeter. The propeller synchronizer should be turned OFF. Check both fuel pumps on each engine, making sure that fuel pressure readings remain within limits during operation of each pump. One fuel pump must be ON for an engine any time that engine is in operation.

WARNING

Both fuel pumps for each engine must be operative for takeoff.

Check that the fuel crossfeed valve is OFF. Before takeoff, the cabin air control should be placed in the PRESSURIZED position. To ensure proper pressurization of the cabin, the emergency gear extender cover must be securely in position, and the pressurization DUMP control, if installed, must be pushed in fully. On serial numbers 31T-7820067 and 31T-7920001 through 31T-7920094, the dump/test switch must be in the normal position.

Set the power levers to 1625 RPM. Check that the pneumatic pressure gauge is reading within limits.

To test the propeller overspeed governors, advance the propeller controls fully forward. Pull out and up on the hydraulic topping governor (HTG) test switches and observe a drop of approximately 50 RPM. Release the HTG switches to their normal position and check that the propeller speed returns to 1625 RPM.

NOTE

Observe maximum ITT and torque limits.

In accordance with Paragraph 4.39, check the pressurization system and set the cabin pressurization controls.

Advance the power levers to 1800 RPM for a check of the engine ice protection system. Refer to Paragraph 4.43 for Ice Protection System preflight test procedures.

Set the power levers at IDLE for a secondary low pitch stop check. Test the secondary low pitch stops one at a time. Pull the power lever toward REVERSE until the BETA light illuminates. Press down and hold the secondary low pitch stop switch while continuing to move the power lever toward REVERSE. Propeller reverse should not be attained; and the BETA lights should blink. Resistance should be felt in the power lever. Release the secondary low pitch stop switch when resistance is felt in the power lever. The propeller should go toward reverse as indicated by an increase in propeller speed. Repeat the above test on the second engine.

CAUTION

Do not force the power lever into full REVERSE. Forcing a lever may damage the linkage.

With the power levers set at IDLE, set the friction control knob on the right side of the control pedestal as necessary.

4.21 BEFORE TAKEOFF

Check that all circuit breakers are in, and check voltmeter and ammeter readings. Check that both generators are ON and that a fuel pump for each engine is ON. Check that necessary lights and electrical systems are ON, including ice protection systems if weather conditions warrant.

Oil cooler doors should be CLOSED. SAS warning lights should be out. Check that flight instruments are set and operational. Check engine instruments for readings within limits. Be sure that all warning lights and annunciator display lights are out.

Set radios, radar and autopilot as desired. Be sure that the propeller synchronizer and autopilot are OFF for takeoff. Check that the NORMAL static source is selected.

Set the propeller controls fully forward. Trim should be set to the takeoff (white) range. Check the wing flaps for proper operation. On aircraft serial numbers 31T-7820067, 31T-7920001 through 31T-7920094, move the flap selector switch to an intermediate position and after the flaps begin to move, press and hold the flap test switch. The flaps should stop and the "FLAP" annunciator should illuminate. Release the flap test switch, the annunciator should extinguish and the flaps move to the selected position. Return the flap selector switch to 0° and check that the flaps retract fully.

Check fuel quantity and check that flight controls are free. Seat belt and no smoking signs should be turned on, and the pilot should check that passengers have complied and are ready for takeoff. Double check that the fuel shutoff valves are OPEN and the crossfeed is OFF.

If differential cabin altitude has been preselected (see Paragraph 4.39), the ascend/descend switch should be in the appropriate position for serial numbers 31T-7720001 through 31T-7820066 and 31T-7820068 through 31T-7820092.

4.23 TAKEOFF AND CLIMB

The directional gyro should be set on the runway heading. With propeller levers set fully forward for 2200 RPM, advance the power levers. Refer to the takeoff charts in Section 5.

CAUTION

Do not exceed engine limits.

Maintain torque and ITT within limits. As the airplane accelerates, an increase in torque pressure at a fixed power lever position is normal. Reduce power-setting as required. Attain a minimum airspeed of 91 KIAS before rotating. At an airspeed below 139 BIAS, retract the landing gear. Do not retract the landing gear prematurely.

NOTE

Takeoff Distance Chart values are based on obtaining 102 KIAS at 50 feet above ground level.

Set climb power in accordance with performance information presented in Section 5. Check engine instruments. Adjust oil cooler doors as necessary. To improve visibility, passenger comfort and engine cooling on a hot day, a climb speed of 134 KIAS is recommended. (Refer to page 5-33 for variation of climb speed with altitude.) The minimum airspeed for climb above 20,000 feet is 117 KIAS.

After takeoff, the seat belt and no smoking sign may be turned on or off as required, depending on cargo, oxygen use, etc. The propeller synchronizer and yaw damper may be turned ON, if desired. Propeller speeds should be manually set as close as possible before the propeller synchronizer system is turned ON.

4.25 CRUISE

Set cruise power in accordance with the performance information presented in Section 5. Check the readings of the engine instruments and monitor fuel gauges during flight. Control levers may be secured into their settings by use of the friction knob on the right side of the control pedestal.

Set cabin pressurization in accordance with Paragraph 4.39. Set cabin comfort controls as desired in accordance with Paragraph 4.41.

NOTES

Prior to resetting the directional gyro, turn windshield heat OFF.

If turbulent air is encountered, observe a turbulent air penetration speed of 177 KIAS. Do not exceed Vmo as indicated by the red needle in the airspeed indicator.

Turn ON the ignition switches when penetrating turbulent air in heavy rain or with less than 250 pounds of fuel remaining per tank.

The minimum airspeed for cruise and holding above 20,000 feet is 120 KIAS.

4.27 FLIGHT IN ICING CONDITIONS

For ice protection system operating procedures, refer to Paragraph 4.43.

If visible moisture is encountered at temperatures below +5° C or if icing conditions are encountered or anticipated, turn ON the engine ice protection switches. Turn ON pitot heat, and turn ON windshield heat.

Actuation of engine ice protection, a drop in torque is normal. Power can be regained by advancing the power levers while monitoring ITT to avoid exceeding limits.

Press the surface deice switch to cycle the pneumatic surface deicers as required. Monitor oil temperatures, and open oil cooler doors if necessary to maintain oil temperatures within limits.

4.29 DESCENT

Set the pressurization controls on aircraft with serial numbers 31T-7720001 through 31T-7820066 and 31T-7820068 through 3 IT-7820092, for descent by setting the outer ring of the cabin altitude selector at 1000 feet above the pressure altitude of the landing field and placing the ascend/descend switch in the DESCEND position.

Shortly after letdown is initiated in aircraft with serial numbers 31T-7820067 and 31T-7920001 through 31T-7920094, set the Cabin Altitude Controller to 500 feet above the pressure altitude of the landing field. Adjust the rate control high enough to allow the cabin to descend to the landing setting before the aircraft descends to that altitude. For normal letdown the rate knob should be at the twelve o'clock position. A higher setting should be selected for rapid descents so that the aircraft altitude does not catch up with cabin altitude.

Set the altimeter for landing field elevation. Use the dehumidifier function of the cabin comfort controls and pitot heat and windshield heat as required during descent.

Stalling speeds should be expected to increase with ice accumulation. Stall warning devices are not accurate enough to be relied upon; therefore, in icing conditions a substantial margin of airspeed should be maintained above normal operation stalling speeds.

The minimum airspeed for descent above 20,000 feet is 120 KIAS.

4.31 BEFORE LANDING

Before landing, seat belt and no smoking signs should be ON, and all occupants should comply. The propeller synchronizer, if installed, should be turned OFF.

Before entering the traffic pattern, the function of the hydraulic pumps may be checked by placing the gear selector in the UP position while the gear is still retracted. If the pumps are producing pressure, the selector lever will automatically return to the neutral position. This check will allow time for the gear to be extended with the emergency hand pump if necessary.

Set the propeller controls at 2000 RPM. Check that the cabin has depressurized, as landing should not be attempted when the cabin is pressurized above .3 psi. Extend the wing flaps as required. The maximum speed for 15° flap extension is 181 KIAS; the maximum speed for 40° flap extension is 148 KIAS.

Flaps should be extended in two steps (see Paragraph 7.19) to preclude the possibility of a large asymmetric ("split") flap extension in the event of a failure in the flap actuation system on aircraft serial numbers 31T-7720001 through 31T-7820066 and 31T-7820068 through 31T-7820092.

CAUTION

When selecting an "approach" flap position and the selector is inadvertantly moved beyond the "approach" detent, the selector must be returned to its original position and then back to "approach" in order to re-program the selector. Returning the selector to the "approach" detent without re-programming will return the flaps to their original position.

NOTE

(Serial numbers 31T-7720001 through 31T-7820066 and 31T-7820068 through 31T-7820092).

No flap selection with autopilot engaged.

On aircraft serial numbers 31T-7820067, 31T-7920001 through 31T-7920094, the flaps should be extended as desired.

At speeds below 153 KIAS, the landing gear may be lowered. Check for three green lights indicating that all three legs of the gear are down and locked. Visually confirm gear extension by checking the gear mirror on the inboard side of the left nacelle. Operate the toe brakes to determine if there is sufficient pressure for braking. Be sure that the parking brake is released. Should brake freeze-up (caused by icing of the brake assembly during flight) be suspected, it is recommended that maximum brake pressure be applied several times to "break-up" possible ice accumulation.

Landing lights should be ON as required. Autopilot and yaw damper should be OFF for landing.

NOTE

Demonstrated crosswind component for landing is 16 KTS. This was the maximum crosswind component available during FAA Certification but is not considered a limitation.

4.33 BALKED LANDING

In a balked landing situation, apply power as required (maximum continuous power) and maintain torque and engine temperatures within allowable limits. The flap position in a balked landing situation will be 40°. After establishing power, retract the flaps to 15°, then retract the landing gear, and then retract the flaps full "UP."

4.35 AFTER LANDING

After the landing touchdown the propeller controls should be moved full FORWARD to the full "INCREASE" RPM position. Reverse thrust may be used as necessary above 40 KIAS.

When clear of the active runway the flaps should be retracted and the heater fuel switch and strobe lights turned OFF. The landing lights should be turned OFF and trim set to neutral.

4.37 SHUTDOWN

WARNING

No braking will occur if aircraft brakes are applied while parking brake handle is pulled and held.

After the airplane is taxied to a stop, set the parking brake. If the temperature is below freezing and the brakes are wet, they should not be set if there is a possibility of the brakes being frozen. Turn OFF the avionics master switch and all other radio and electrical switches.

Check the voltmeter for proper electrical system condition. Monitor the inter turbine temperature. When the ITT has dropped below 610° C for a minimum of one minute, the shutdown of the engine that was started first can be accomplished. The engine that was started first should be shut down first since the hydraulic pump check on this engine was made on start and the opposite hydraulic pump should be checked on shutdown.

Turn OFF the generator on the engine to be shut down first. Pull the power lever aft to IDLE and the propeller control to FEATHER. Pull the condition lever to STOP. Turn off the fuel pump, after Ng is zero.

NOTE

Avoid ground operation with the propellers in FEATHER to reduce the hot exhaust exposure to airframe/system components and increase their service life.

Move the gear selector handle to the DOWN position to check the hydraulic pump of the operating engine. The gear selector handle should return to the neutral position. Turn OFF the cabin comfort panel master switch.

The preceding shutdown procedure should be followed for the second engine. After the engine has been shut down turn OFF the fuel pump after Ng is zero, and turn off the battery master switch.

While the aircraft is unattended, insure that the ground covers are installed to prevent propeller windmilling with zero oil pressure and cover the intake and exhaust openings.

WARNING

If there is evidence of fire within the engine after shutdown proceed immediately with the "Engine Clearing Procedure" (Paragraph 4.13).

4.39 CABIN PRESSURIZATION SYSTEM

AIRCRAFT WITH SERIAL NUMBERS 31T-7720001 THROUGH 31T-7820066 AND 31T-7820068 THROUGH 31T-7820092

Cabin pressurization system controls, gauges and switches are located in the lower left corner of the instrument panel adjacent to the control wheel. (Refer to Section 7, Figure 7-31.)

The emergency gear extender cover, used to dump cabin pressure, is located on the floor between the pilot and copilot seats.

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

(a) Cabin Altitude Selector
(b) Rate of Change Control
(c) Cabin "Ascend/Descend" Switch
(d) Cabin Pressure Altitude/Differential Pressure Gauge
(e) Cabin Rate of Climb Gauge
(f) Test Switch (Manual Override)
(g) Air Control Lever
(h) Dump Control (early models only)
(i) Emergency Gear Extender Cover

Prior to starting engines, set the pressurization Air Control Lever to each of its three positions. Note that a firm effort is required to move the lever out of either the outside air or the pressurized air position. This control is spring-loaded to warn the pilot of a failure in the Air Control system. If little effort is required to move the lever, be suspicious of a broken control cable. If a cable is broken, the air control valve may be failed in either the open or closed position. If open, pressurized flight will not be possible, but unpressurized flight will be safe. If the air control valve is failed closed, pressurized flight would be possible but not recommended, as it may not be possible to stop the source of contaminated air should contamination occur.

NOTE

It is not advisable to attempt flight if the pressurization system tests indicate proper functioning but the Air Control Lever tests above indicate a broken cable.

After engine start, set the Air Control to the "Pressurized Air" position. Set Cabin Altitude to 500 feet ABOVE field pressure altitude. Be sure that the Emergency Gear Extender cover is in place and, on airplanes with the Dump Control installed, be sure that the control is closed. With the engines turning approximately 80% Ng, actuate the switch labeled "Pressurization Test" for about 10 seconds. A rate of descent should be observed on the Cabin Rate of Climb gauge, and then the gauge should start back toward zero. (The rate of cabin descent should not exceed -2000 feet per minute, nor should the cabin pressure altitude go more than 300 feet below field elevation. If both of the above values are exceeded, immediately reduce the throttles to idle, and position the Air Control to "Outside." Do not attempt pressurized flight until maintenance has been accomplished.

If all tests show proper functioning, then before takeoff set "Cabin Altitude" 500 feet ABOVE the field pressure altitude. (Cabin pressurization will begin as the cabin passes through the altitude selected.) Cabin altitude will remain at the selected altitude until maximum cabin differential (5.5 PSI) is reached, at which time the cabin altitude will begin to climb until at 29,000 feet pressure altitude the cabin pressure altitude will be 10,000 feet. For flight below an airplane altitude of 13,000 feet, the cabin altitude control should be left at the takeoff setting. For flight above 13,000 feet, at which point maximum differential will be exceeded, consult the Cabin Altitude Vs. Airplane Altitude graph in Section 5, and set the cabin altitude at 500 feet above the cabin altitude indicated on the graph.

To descend for landing be certain that "Selected" cabin altitude is higher than the pressure altitude of the landing field.

NOTES

Turning the inner knob of the cabin altitude selector while the airplane is pressurized will result in a rapid, uncomfortable change in cabin altitude.

A residual pressure of approximately .25 PSI will show on the differential pressure gauge at any time "Pressurization" is selected and the aircraft is operating lower than the cabin altitude selected.

Do not land when aircraft is pressurized above .3 PSI.

To re-pressurize while in flight, lift the emergency gear extender cover or (on early models) pull "Dump Control" out if engaged, then set "Cabin Altitude Selector" to 10,000 feet, set "Air Control Lever" to pressurized.

If aircraft is below 10,000 feet pressure altitude, replace the emergency gear extender cover or (on early models) push "Dump Control" in, slowly turn center knob of "Cabin Altitude Selector" to a lower altitude until a cabin descent is observed on the "Cabin Rate of Climb" gauge. Set altitude change ring of the "Cabin Altitude Selector" to the desired altitude and engage the "Ascend/Descend" switch.

If aircraft is above 10,000 feet pressure altitude, replace the emergency gear extender cover or (on early models) push "Dump Control" in. (Slowly as it approaches the closed position.) Set the altitude change ring of the "Cabin Altitude Selector" to the desired altitude and turn the "Ascend/Descend" switch to "Descend."

AIRCRAFT WITH SERIAL NUMBERS 31T-7820067, 31T-7920001 THROUGH 31T-7920094

Cabin pressurization system controls, gauges and switches are located in the lower left corner of the instrument panel adjacent to the control wheel. (Refer to Section 7, Figure 7-32.)

The emergency gear extender cover, used to dump cabin pressure, is located on the floor between the pilot and copilot seats.

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

(a) Cabin Altitude Controller
(b) Rate of Change Control
(c) Cabin Pressure Altitude/Differential Pressure Gauge
(d) Cabin Rate of Climb Gauge
(e) Test/ Dump Switch
(f) Air Control Lever
(g) Emergency Gear Extender Cover

Prior to starting engines, set the pressurization Air Control Lever to each of its three positions. Note that a firm effort is required to move the lever out of either the outside air or the pressurized air position. This control is spring-loaded to warn the pilot of a failure in the Air Control system. If little effort is required to move the lever, be suspicious of a broken control cable. If a cable is broken, the air control valve may be failed in either the open or closed position. If open, pressurized flight will not be possible, but unpressurized flight will be safe. If the air control valve is failed closed, pressurized flight would be possible but not recommended, as it may not be possible to stop the source of contaminated air should contamination occur.

NOTE

It is not advisable to attempt flight if the pressurization system tests indicate proper functioning but the Air Control Lever tests above indicate a broken cable.

After engine start, set the Air Control to the "Pressurized Air" position. Set Cabin Altitude to 500 feet ABOVE field pressure altitude. Be sure that the Emergency Gear Extender cover is in place and that the Test/Dump Switch is in the normal position. With the engines turning approximately 70% Ng, actuate the switch labeled "Pressurization Test" for about 10 seconds. A rate of descent should be observed on the Cabin Rate of Climb gauge, and then the gauge should start back toward zero. (The rate of cabin descent should not exceed 500 feet per minute, nor should the cabin pressure altitude go more than 300 feet below field elevation. If both of the above values are exceeded, immediately reduce the throttles to idle, and position the Air Control to "Outside." Do not attempt pressurized flight until maintenance has been accomplished.

If all tests show proper functioning, then before takeoff set "Cabin Altitude" 500 feet ABOVE the field pressure altitude. (Cabin pressurization will begin as the cabin passes through the altitude selected.) Cabin altitude will remain at the selected altitude until maximum cabin differential (5.5 PSI) is reached, at which time the cabin altitude will begin to climb until at 29,000 feet pressure altitude the cabin pressure altitude will be 10,000 feet. For flight below an airplane altitude of 12,000 feet, the cabin altitude control should be left at the takeoff setting. For flight above 12,000 feet, at which point maximum differential will be exceeded, set the Cabin Altitude Controller to the cruise cabin altitude and adjust the cabin rate of climb as desired. It is recommended that this setting be made during climb out after the controller has captured isobaric control.

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

NOTES

A residual pressure of approximately .25 PSI will show on the differential pressure gauge at any time "Pressurization" is selected and the aircraft is operating lower than the cabin altitude selected.

Do not land when aircraft is pressurized above .3 PSI.

To re-pressurize while in flight, set the air control lever to "Pressurized Air."

4.41 ENVIRONMENTAL CONTROL SYSTEM OPERATION

Environmental system controls and switches are located in the lower right hand corner of the instrument panel in the Cabin Comfort Panel. (Refer to Section 7, Figure 7-27.)

The environmental system controls and switches are as follows:

(a) Master Switch
(b) Mode Switch (Manual-Automatic)
(c) Dehumidifier Switch
(d) Heater-Air Conditioner Manual Switch
(e) Heater Full "ON-OFF" Switch
(f) Temperature Control

NORMAL OPERATION

Under normal conditions, the environmental control system will maintain a preset temperature automatically. For automatic operation, turn the heater fuel switch ON, the climate control master switch ON, and the mode switch to "AUTO." Set the temperature control to the desired temperature. (After the mode switch is set to "AUTO," a ten second delay will occur prior to either heater or air conditioner operation.)

When descending from high altitude/cold temperature/low humidity to low altitude/warm temperature/high humidity, turn the dehumidifier switch ON. Do not turn the dehumidifier switch on until outside ambient temperature reaches 45°F or higher.

NOTES

Dehumidifier function will not operate properly unless the mode switch is set to automatic and the heater fuel switch is ON.

For most efficient windshield defrosting: turn the heater fuel switch ON, turn the dehumidifier ON (above 45°F), and turn the windshield heat switch ON.

During ground operation only, for rapid warmup in cold weather or rapid cooling in warm weather, position the cabin air control to "RECIRCULATED AIR." Relocate the cabin air control before flight.

To avoid fumes in the cabin during ground operation, position the cabin air control to "RECIRCULATED AIR." Relocate the cabin air control before flight.

Maximum continuous operation with the cabin air control in the "RECIRCULATED AIR" position should be limited to 15 minutes. At least 5 minutes in either "OUTSIDE AIR" or "PRESSURIZED AIR" is required after each 15 minutes in "RECIRCULATED AIR."

MANUAL OPERATION

For manual control of the environmental control system, place the mode switch in the "MANUAL" position with the climate control master switch ON.

For heat, turn the air conditioner/heater "MANUAL" switch to HEATER, and turn the heater fuel switch on or off as desired.

For air conditioning, turn the heater fuel switch OFF. Turn the air conditioner/heater "MANUAL" switch to AIR CONDITIONER to obtain air conditioning, and to HEATER to turn air conditioning off. With the heater fuel switch OFF, the HEATER position will function as an OFF position for the air conditioner.

NOTES

In the manual mode, the dehumidifier function is not operative.

In the manual mode the cabin temperature function is not operative.

Defrosting air is supplied to the windshield by manual selection of heat or air conditioning.

IMPROPER COOLING

If the air conditioner is not cooling properly in either the automatic or manual mode, maximum cabin comfort may be obtained by placing the cabin air control in the "OUTSIDE AIR" position at airplane altitudes below 10,000 feet, or by maintaining the highest practicable altitude and lowest practicable power settings with the cabin air control in the "PRESSURIZED AIR" position at altitudes above 10,000 feet.

CAUTION

If there is any indication that the air conditioner is not cooling properly, the unit should be turned OFF by placing the mode control in the MANUAL position and placing the air conditioner/heater switch in the HEATER position with the heater fuel switch OFF. The air conditioner should not be operated until the refrigerant charge of the system has been checked. Continued operation of the system with a low refrigerant charge will result in oil starvation of the compressor and subsequent failure of the compressor.

4.43 ICE PROTECTION SYSTEM

When properly equipped and when equipment is functioning properly, operation is approved for flight into known or forecast icing conditions. Section 2 - Limitations - specifies required equipment.

(a) Engine Anti-Icing System

During Run-up (1800 RPM Np):

(1) Left Engine Ice Protection Switch - ON.
(2) Check ICE DEFLECTOR DOWN light.
(3) Observe torque drop.
(4) Monitor deicer ammeter for sequenced operation of the electrically heated prop and engine inlet boots:
   a. Ammeter switch set to LEFT.
   b. Ground test button - PRESS AND HOLD. (3 min.)
   c. Check ammeter for IN-THE-GREEN indication, then release button.
(5) Left Engine Ice Protection Switch - OFF.
(6) Observe regain of original torque.
(7) Repeat Steps (1) through (6) above for Right Engine.

CAUTION

Engine Inlet Lip Deicers can be damaged if heated without the cooling effect of propeller slipstream. Do not press Ground Test button at lower than 1800 RPM Np.

In Flight (+5°C or below in visible moisture or when ice conditions are anticipated):

(1) Engine Ice Protection Switches - Both ON. System may be operated continuously in flight and will function automatically until the switches are turned off.
(2) Observe torque drop.
(3) Check ammeter occasionally (left then right) for IN-THE-GREEN and to check timer operation.
(4) Relieve propeller imbalance due to ice accumulation by increasing RPM briefly. Repeat as required.

(b) Pneumatic Wing and Tail Deicing System

Before Takeoff:

(1) Set power so that pneumatic pressure gauge shows IN-THE-GREEN.
(2) Check surface deice indicator light - PRESS-TO-TEST.
(3) Surface Deice Switch - PRESS. (Two-second manual operation required for each cycle.)
(4) Check indicator light and pneumatic pressure gauge.
(5) Visually check the Deicer Boots for inflation and hold-down. (Must observe vertical stabilizer from outside the airplane.)
(6) Ice inspection light (night operation) - ON to check, then OFF.

In flight:

When wing leading edge accumulates to approximately 1/4 inch to 1/2 inch of ice, press SURFACE DEICE switch and hold for 2 seconds. Allow boots to cycle, check blue surface deice light - ON. Repeat cycle as necessary.

CAUTION

Operation of the pneumatic deicing system is not approved in temperatures below -40° C. Such operation may result in damage to the deicer boots.

(c) Electric Heated Windshield

Before Takeoff:

(1) Windshield Switch - ON
(2) Check windshield - WARN to the touch.
(3) Windshield Switch - OFF

In Flight: Windshield Switch - ON in visible moisture below +5°C or when ice conditions are anticipated.

NOTE

Under rare meteorological conditions and below -18°C, if ice accumulation rate should exceed the windshield's ability to anti-ice and visibility becomes limited, a reduction of airspeed will reduce the heat input required.

(d) Pitot and SAS Vane Heat - ON in visible moisture below +5°C or when ice condition are anticipated.

Before Engine Start:

(1) Pitot Heat Switch - ON.
(2) Check pitot tubes - HOT to the touch.
(3) Right landing gear squat switch - DEPRESS for 10 seconds.
(4) Check SAS vane - Temperature RISE.

In Flight:

ON in visible moisture below +5°C or when ice conditions are anticipated.

4.45 V_{SSE} - INTENTIONAL ONE ENGINE INOPERATIVE SPEED

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

The intentional one engine inoperative speed, V_{SSE}, for the PA-31T is 113 KIAS.

4.47 VMCA AIR MINIMUM CONTROL SPEED

VMCA is the minimum flight speed at which a twin-engine airplane is directionally controllable as determined in accordance with Federal Aviation Regulations. Airplane certification conditions include one engine becoming inoperative and windmilling; not more than a 5° bank toward the operative engine; landing gear up; flaps in takeoff position; and most rear card center of gravity.

VMCA for the PA-31T has been determined to be 91 KIAS.

The VMCA demonstration which may be required for the FAA flight test for the multi-engine rating approaches an uncontrolled flight condition with power reduced on one engine. The demonstration and all intentional one engine operations should not be performed at an altitude of less than 7000 feet above the ground. The recommended procedure for VMCA demonstration is to reduce the power to idle on the simulated inoperative engine at or above the intentional one engine inoperative speed, VSSE, and slow down to approximately one knot per second until the FAA Required Demonstration Speed, VMCA, or stall warning is obtained.

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

VSSE for the PA-31T is 113 KIAS.

VMCA DEMONSTRATION

(a)	Landing Gear	UP
(b)	Flaps	UP
(c)	Airspeed	at or above 113 KIAS (VSSE)
(d)	Propeller Controls	HIGH RPM
(e)	Power Lever (Simulated Inoperative Engine)	IDLE
(f)	Power Lever (Other Engine)	MAX ALLOWABLE
(g)	Airspeed	reduce approximately 1 knot per second until either VMCA or STALL WARNING is obtained

CAUTIONS

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

One engine inoperative stalls are not recommended.

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

Normal Procedure Section AFM Additions Required By AD's

AD 99-14-01 – Flight Into Icing Warning

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

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

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

Procedures for Exiting the Severe Icing Environment

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

- Immediately request priority handling from Air Traffic Control to facilitate a route or an altitude change to exit the severe icing conditions in order to avoid extended exposure to flight conditions more severe than those for which the airplane has been certificated.

- Avoid abrupt and excessive maneuvering that may exacerbate control difficulties.

- Do not engage the autopilot.

- If the autopilot is engaged, hold the control wheel firmly and disengage the autopilot.

- If an unusual roll response or uncommanded roll control movement is observed, reduce the angle-of-attack.

- Do not extend flaps when holding in icing conditions. Operation with flaps extended can result in a reduced wing angle-of-attack, with the possibility of ice forming on the upper surface further aft on the wing than normal, possibly aft of the protected area.

- If the flaps are extended, do not retract them until the airframe is clear of ice.

- Report these weather conditions to Air Traffic Control.

SECTION 5

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SECTION 5

PERFORMANCE

5.1 GENERAL

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

5.3 INTRODUCTION TO PERFORMANCE AND FLIGHT PLANNING

The performance information 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 airplane. This performance can, however, be duplicated by following the stated procedures in a properly maintained airplane.

Effects of conditions not considered on the charts, such as the effect of a soft or grass runway surface on takeoff and landing performance, or the effect of winds aloft on cruise and range performance, must be evaluated by the pilot.

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

The information provided in item 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.

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5.5 FLIGHT PLANNING EXAMPLE

The following Flight Planning Example illustrates the correct utilization of pertinent data presented in this section of the manual.

(a) Associated Conditions

Certain basic information must be gathered when planning a flight. This information includes departure and destination airport conditions, en route conditions, and basic aircraft conditions. Such factors as weather, the status of the runway, the distance of the flight, the number of passengers, etc., must be determined. Assume, for example, the following conditions:

(1) Departure Airport Conditions

Outside Air Temperature	17°C
Pressure Altitude	2000 ft.
Wind and Direction	15 kts at 360°
Runway Direction	300°

(2) Cruise Conditions

Outside Air Temperature	-7°C
Pressure Altitude	16,000 ft.
En route Distance	700 naut. mi.
Power Setting	Maximum Cruise (2000 RPM)

(3) Destination Airport Conditions

Outside Air Temperature	20°C
Pressure Altitude	2000 ft.
Wind and Direction	10 kts at 330°
Runway Direction	270°

(4) Aircraft Configuration

Basic Weight (Assumed)	5070 lbs.
Fuel Tanks	366 gal
Occupants	4 at 170 lbs. each
Baggage	120 lbs.

(b) Aircraft Loading

The airplane weight and center of gravity may be determined by utilizing the information given in Section 6 (Weight and Balance) of this handbook.

The basic empty weight for the airplane as delivered from the factory has been entered in Figure 6-7. If any alterations to the airplane affecting weight and balance have been made, reference to the aircraft logbook and Weight and Balance Record (Figure 6-9) should be made to determine the current basic empty weight of the airplane.

Use the Weight and Balance Loading Chart (Figure 6-15) and the Weight, Moment and C.G. Limit graph (Figure 6-17) to determine the total weight of the airplane and the center of gravity position.

After proper utilization of the information provided, assume that the following weights have been determined for consideration in the Flight Planning Example:

(1)	Basic Weight	5070 lbs.
(2)	Occupants (4 at 170 lbs. each)	680 lbs.
(3)	Baggage	227 lbs.
(4)	Fuel (366 gal. at 6.7 lbs/gal.)	2452 lbs.
(5)	Ramp Weight (total of above)	8429 lbs.
(6)	Landing Weight (takeoff weight minus Item (h), Total Fuel Required)	6870 lbs.

The landing weight cannot be determined until the weight of the fuel to be used has been established.

Ramp weight is below the approved maximum of 9050 lbs. Determine that weight and balance calculations have shown the C.G. position to be within the approved limits.

(c) Takeoff Distance

After determining the aircraft loading, all aspects of takeoff must be considered. Conditions of the departure airport and takeoff weight should be applied to the appropriate Takeoff Distance graph to determine the length of runway necessary. Takeoff conditions for the Flight Planning Example are listed below:

(1)	Wind	15 kts at 360°
(2)	Angle between Flight Path and Wind	360° -300° = 60°
(3)	Head Wind Component (from Wind Component Graph Figure 5-13)	8 kts
(4)	Outside Air Temperature	17°C
(5)	Pressure Altitude	2000 ft.

Using the Normal Takeoff over 50 Feet graph (Figure 5-23) the takeoff distances are as follows:

Total Distance	1950 ft.
Ground Run	1450 ft.

(d) Climb

Entering the example conditions of the departure airport and the cruise altitude into the ISA conversion graph (Figure 5-11) and the Time, Fuel and Distance to Climb graph (Figure 5-45) yields the following:

(1)	Time to Climb	9.0 - 1.0	=	8.0 minutes
(2)	Fuel to Climb	90 - 20	=	70 lbs.
(3)	Distance to Climb	30.0 - 2.0	=	28.0 naut. miles

NOTE

The effect of winds aloft must be considered by the pilot when computing climb, cruise, and descent performance.

(e) Descent

Entering the cruise and destination airport conditions into the Time, Fuel and Distance to Descend graph (Figure 5-125) yields the following:

(1)	Time to Descend	16 - 2	=	14 minutes
(2)	Fuel to Descend	155 - 20	=	135 lbs.
(3)	Distance to Descend	66 - 9	=	57 naut. miles

(f) Cruise

Subtracting the previously calculated distance to climb and distance to descend figures from the total en route distance yields the total cruise distance. For example:

Cruise Distance = En route Distance - Climb Distance - Descent Distance
= 700 - 28.0 - 57.0
= 615 naut. miles

From the Pressure Altitude vs. OAT Chart (Figure 5-11) and the Power Setting Table (Figure 5-55) for Maximum Cruise (2000 RPM, ISA + 10°C) the cruise airspeeds are 272 kts. at 8000 lbs. and 276 kts. at 7000 lbs. Extrapolating these values for 7500 lbs. (estimated average cruise weight), the cruise speed is 274 Kts.

From the same table, Fuel Flow is 572 lbs./hour (total)

Cruise time and fuel may be calculated by the following formula:

Cruise Time = Cruise Distance/Cruise Speed
= 615/274
= 2.245 hours or 134.7 minutes

Cruise Fuel = Fuel Flow x Cruise Time
= 572 x 2.245
= 1284 lbs.

The above data can be used to verify the estimated average cruise weight in the following manner:

$$\text{Average Cruise Weight} = \text{Takeoff Weight} - (\text{Ramp Fuel} + \text{Climb Fuel}) - \frac{\text{Cruise Fuel}}{2}$$

$$= 8429 - (65 + 70) - \frac{1284}{2}$$

$$= 7652 \text{ lbs.}$$

From the Power Setting Table (Figure 5-55), the cruise speed is now 273 kts. for 7652 lbs. Applying the above cruise time and cruise fuel formula results in the following figures:

Cruise Time = 2.253 hours or 135.2 minutes

Cruise Fuel = 572 x 2.253
= 1289 lbs.

(g) Total Flight Time

The total flight time is determined by adding the time to climb, cruise time, and time to descend. The following flight time is required for this Flight Planning Example:

Total Flight Time = Time to Climb + Cruise Time + Time to Descent
= 8.0 + 135.2 + 14.0
= 157.2 minutes

(h) Total Fuel Required

Determine the total fuel required by adding fuel for taxi and takeoff, fuel to climb, cruise fuel, and fuel to descend. When the total fuel (in lbs.) is determined, dividing this value to 6.7 will give the total fuel in gallons to be used for the flight. Total fuel calculations for the Flight Planning Example are shown below:

Total Fuel Required = Fuel for taxi and takeoff + Fuel to Climb + Cruise Fuel + Fuel to Descend
= 65 + 70 + 1289 + 135
= 1559 lbs. (232.7 gallons)

(i) Landing Distance

Subtracting the total fuel required from the takeoff weight of the airplane gives the landing weight:

Landing Weight = Takeoff Weight - Total Fuel Required
= 8429 - 1559
= 6870 lbs.

Destination airport conditions applied to the Wind Component graph (Figure 5-13) gives the following headwind component for the Flight Planning Example:

The angle between the flight path and wind is 330° - 270° or 60°.

Therefore, the Head Wind Component is 5 kts.

From the Landing Distance over 50 Feet (with Reversing) graph (Figure 5-133), with the destination airport conditions, the distances required for landing for the Flight Plan Example are as follows:

(1) Total Distance 1580 ft.
(2) Ground Roll 660 ft.

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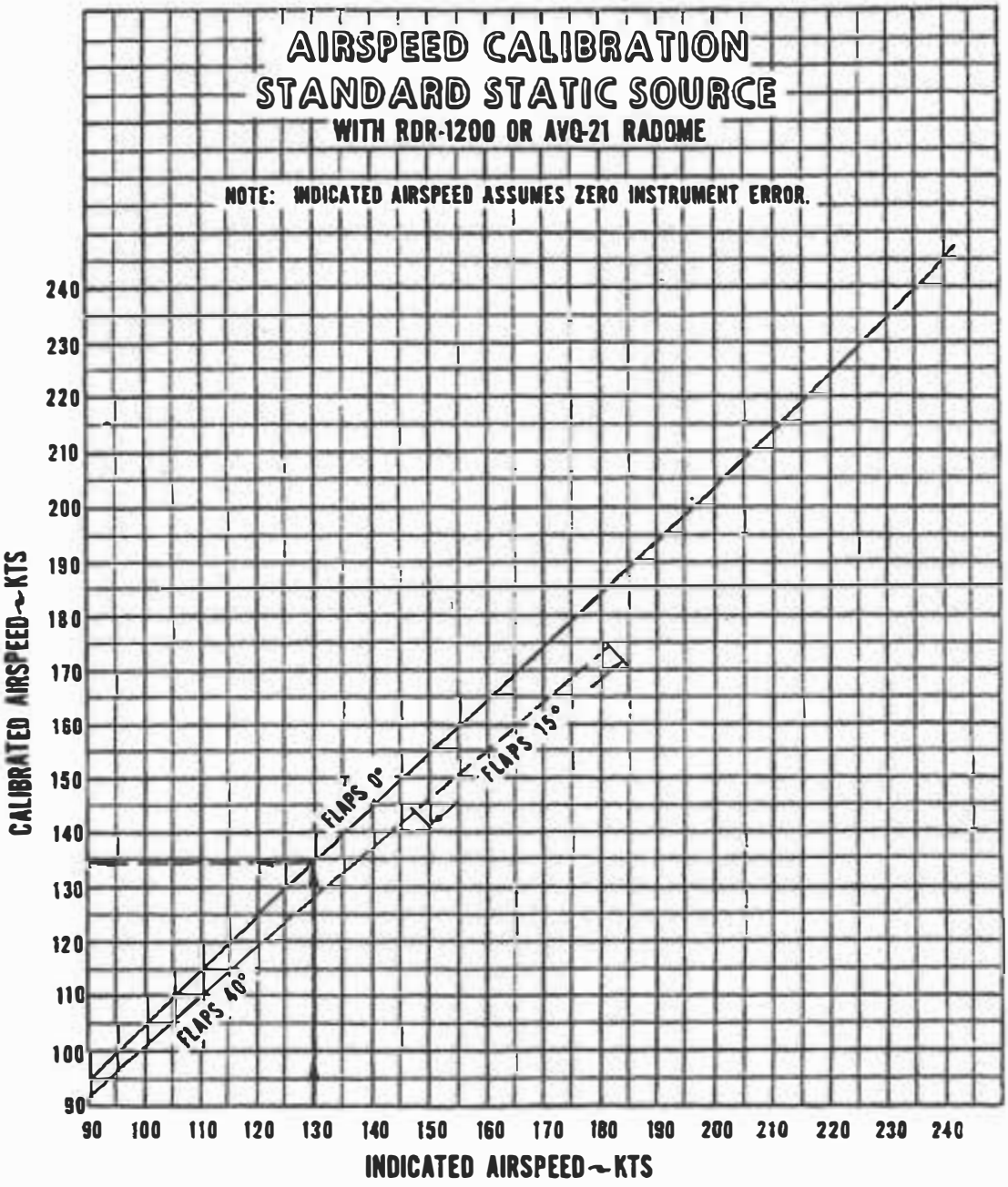
PA-31T

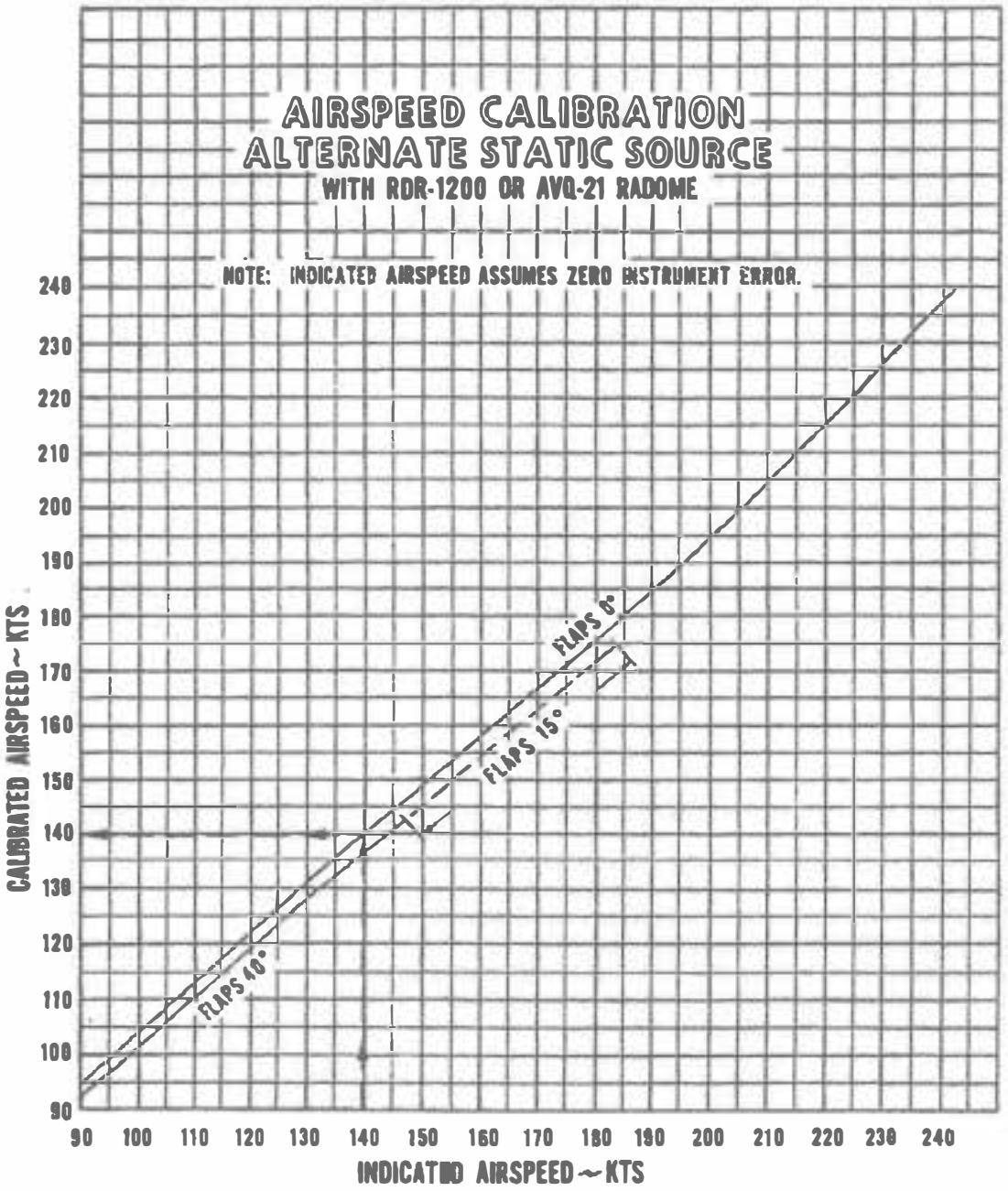


Example:
Indicated airspeed: 130 knots
Flaps: 0°
Calibrated airspeed: 134 knots

AIRSPEED CALIBRATION - STANDARD STATIC SOURCE

Figure 5-1

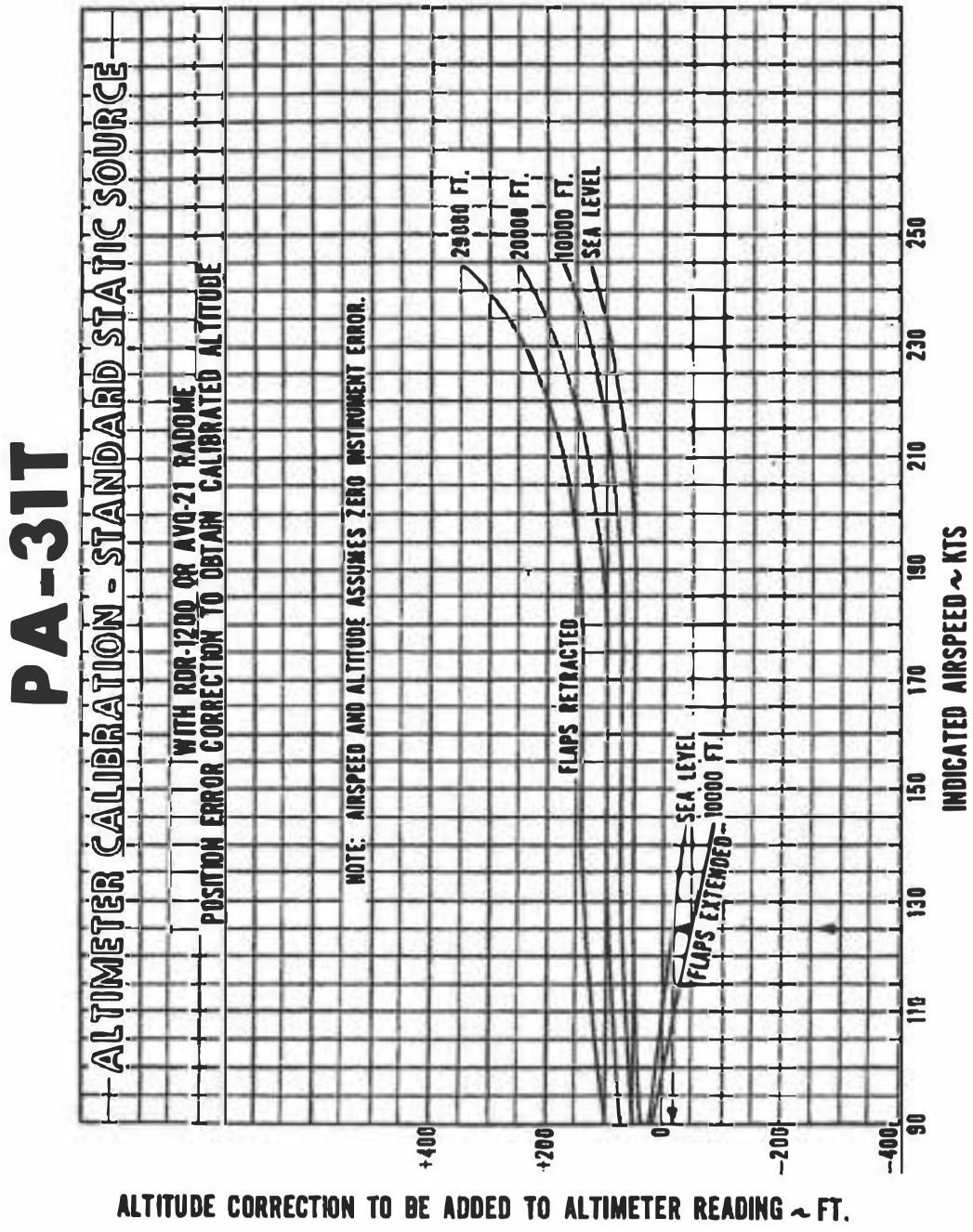
PA-31T



Example:
Indicated airspeed: 140 knots
Flaps: 0°
Calibrated airspeed: 140 knots

AIRSPEED CALIBRATION - ALTERNATE STATIC SOURCE

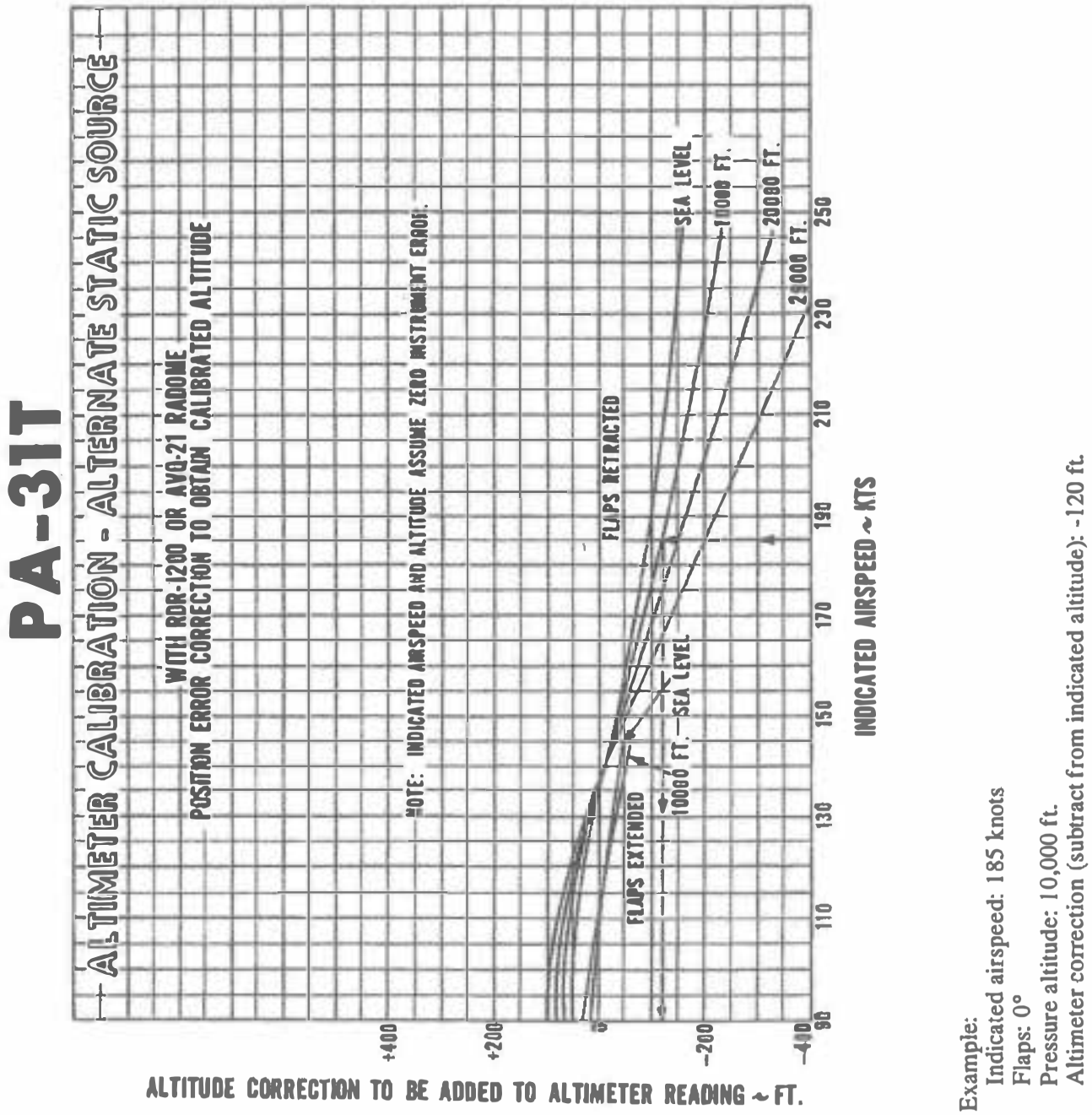
Figure 5-3



Example:
Indicated airspeed: 125 knots
Flaps: 40°
Pressure altitude: sea level
Altimeter correction (subtract from indicated altitude): -20 ft.

ALTIMETER CALIBRATION - STANDARD STATIC SOURCE

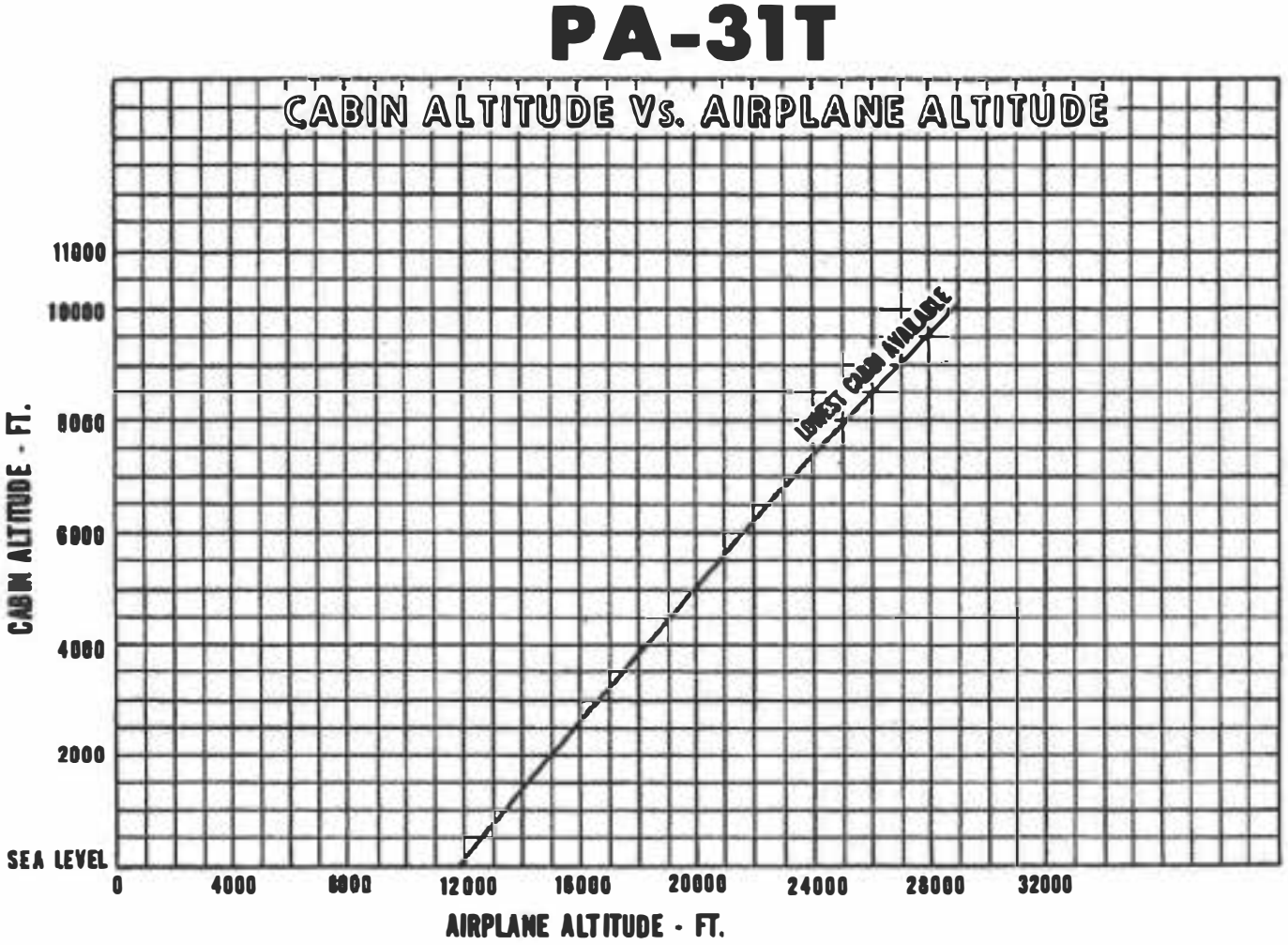
Figure 5-5



Example:
Indicated airspeed: 185 knots
Flaps: 0°
Pressure altitude: 10,000 ft.
Altimeter correction (subtract from indicated altitude): -120 ft.

ALTIMETER CALIBRATION - ALTERNATE STATIC SOURCE

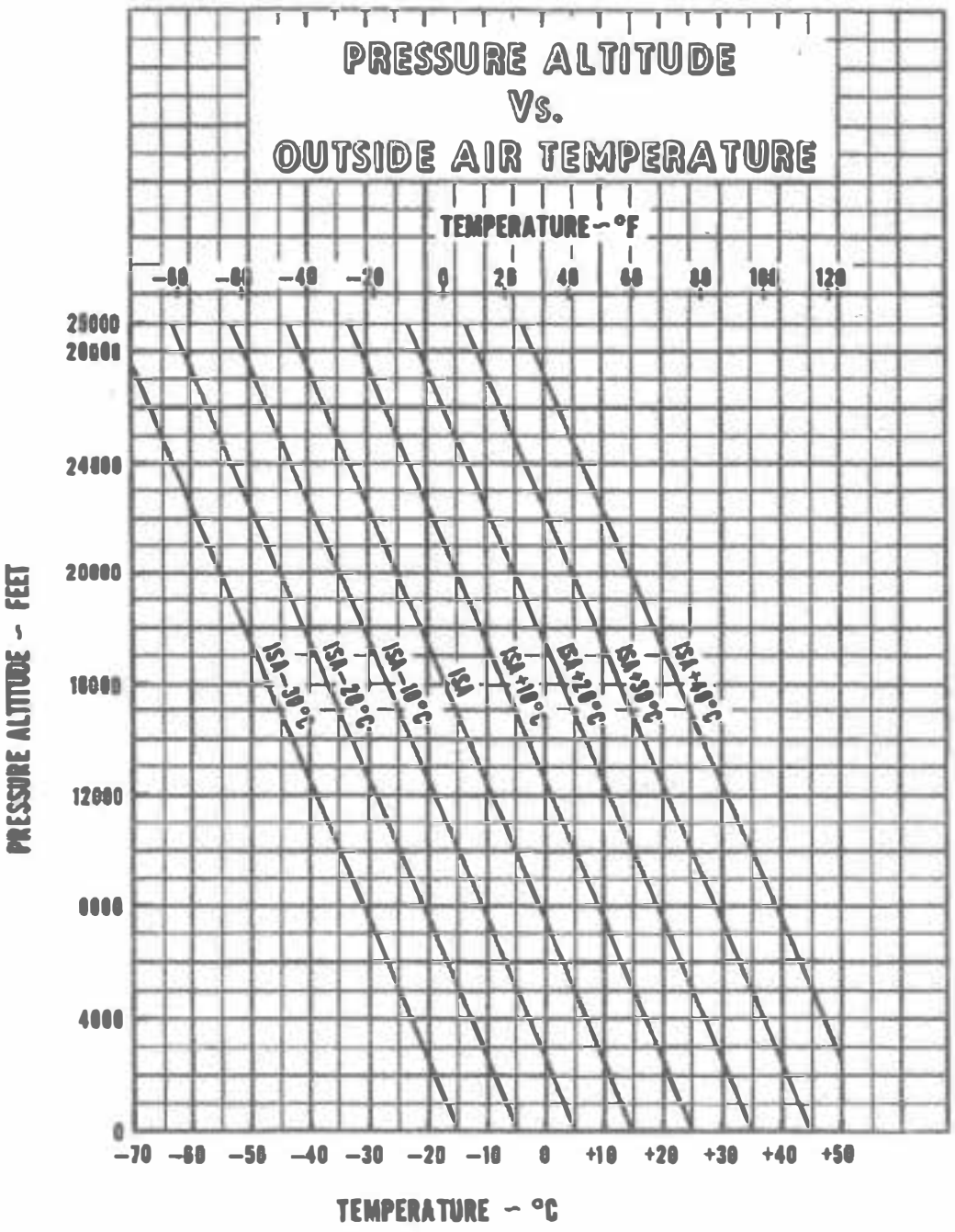
Figure 5-7



CABIN ALTITUDE VS. AIRPLANE ALTITUDE

Figure 5-9

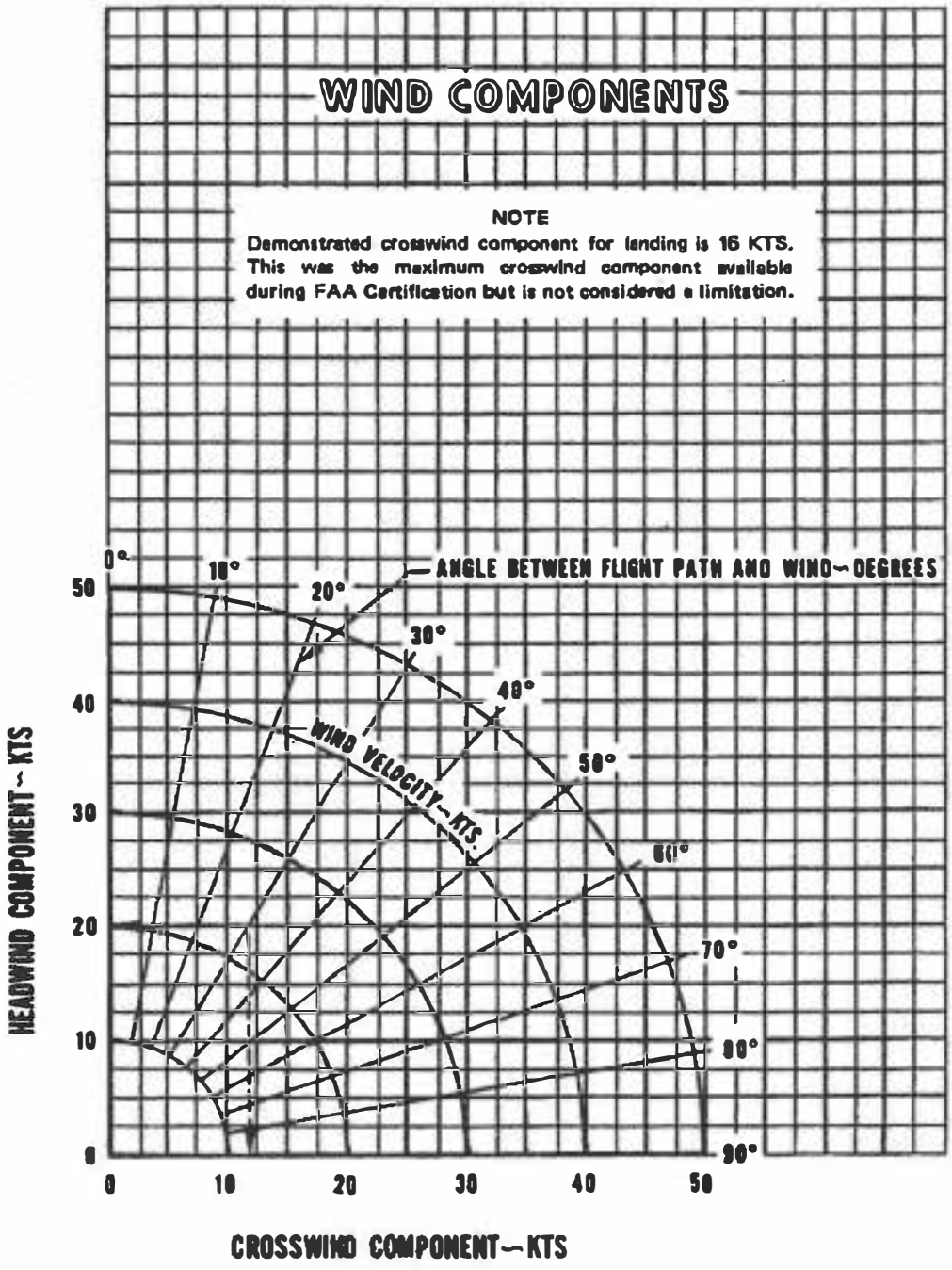
ISA CONVERSION



PRESSURE ALTITUDE VS. OUTSIDE AIR TEMPERATURE

Figure 5-11

PA-31T

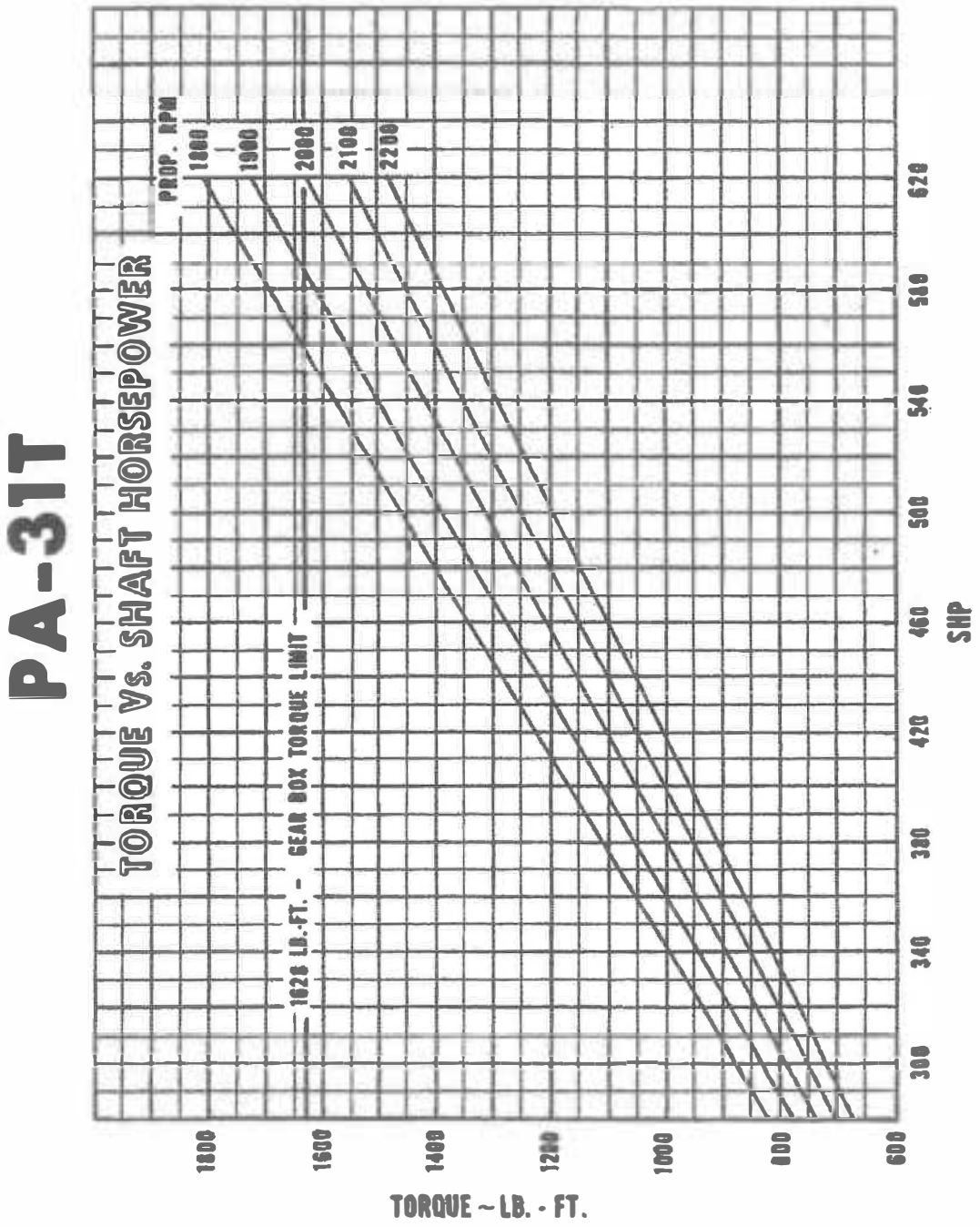


Example:

Wind velocity: 23 knots
Angle between flight path and wind: 30°
Headwind component: 20 knots
Crosswind component: 12 knots

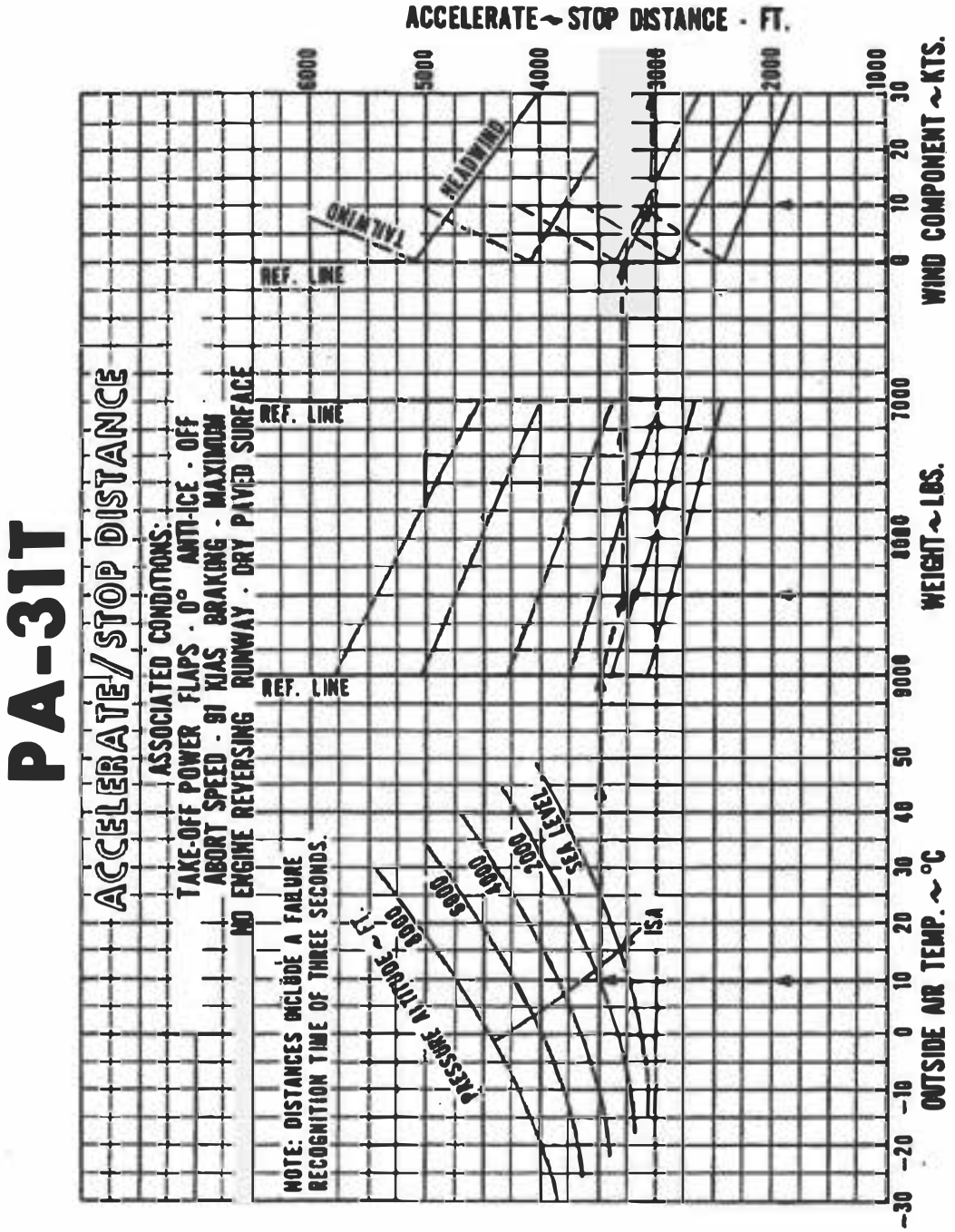
WIND COMPONENTS

Figure 5-13



TORQUE VS. SHAFT HORSEPOWER

Figure 5-15

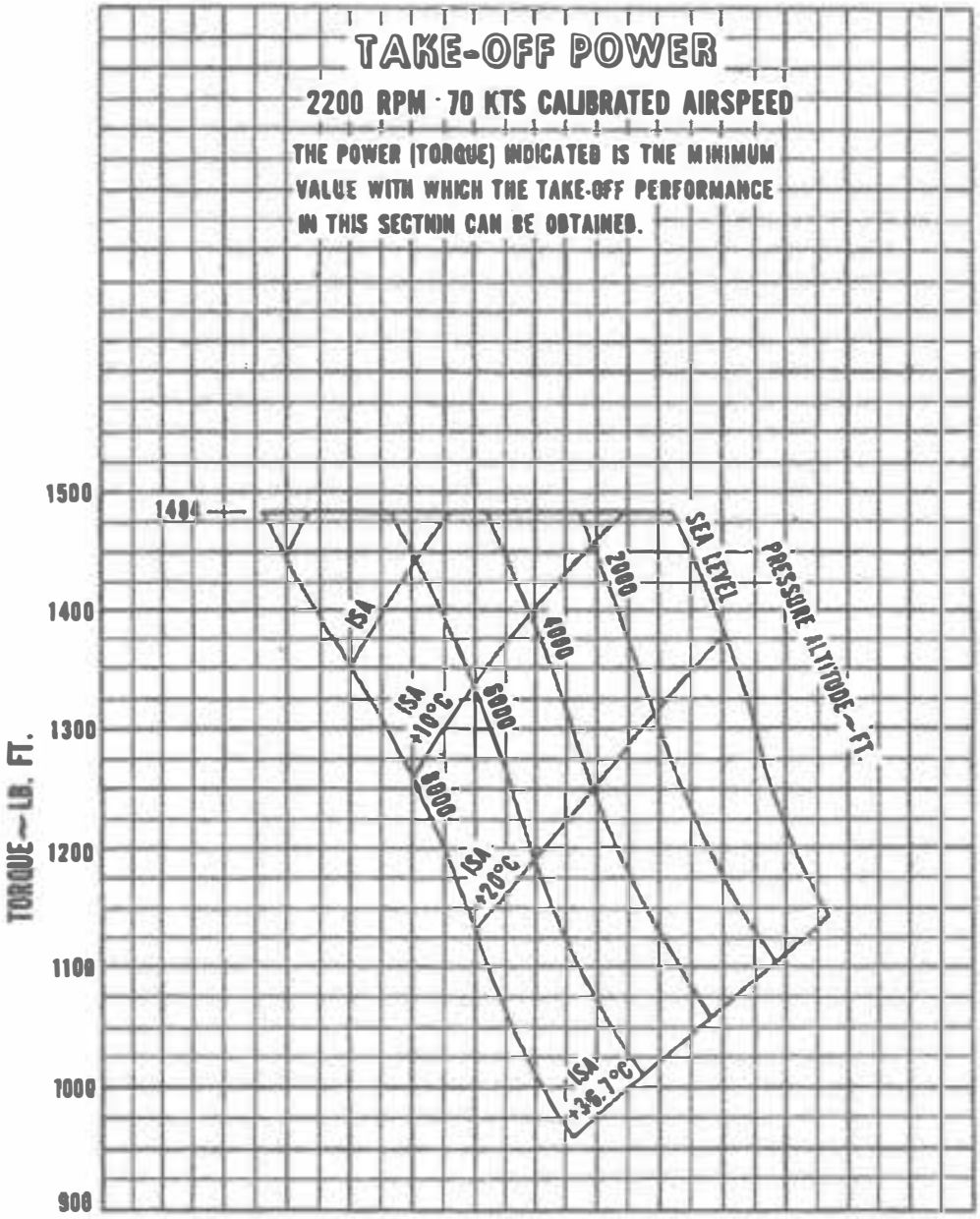


Example:
OAT: 10°C
Pressure altitude: 2000 ft.
Weight: 8400 lbs.
Wind: +10 knots
Accelerate - stop distance: 3025 ft.

ACCELERATE/STOP DISTANCE

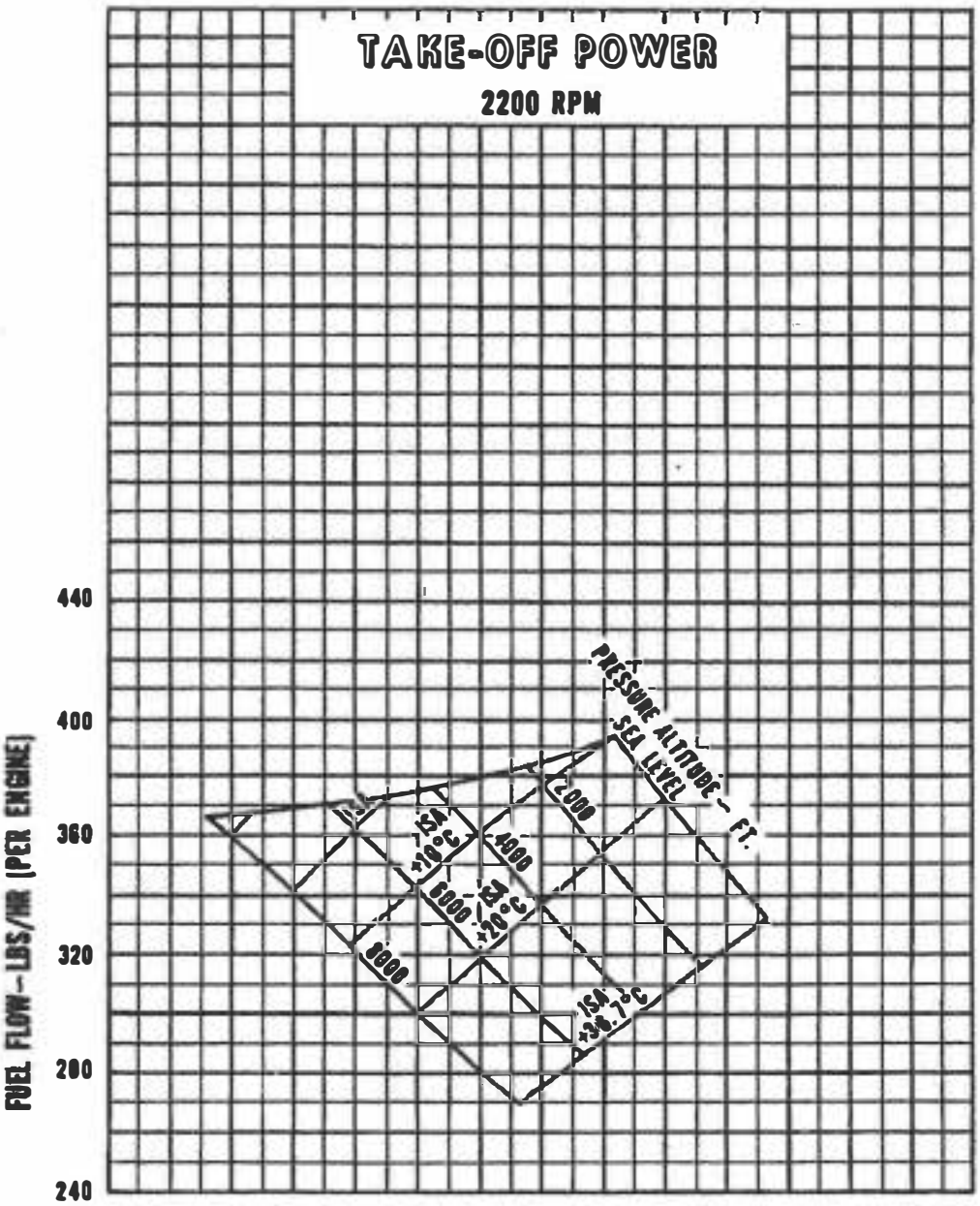
Figure 5-17

PT6A-28



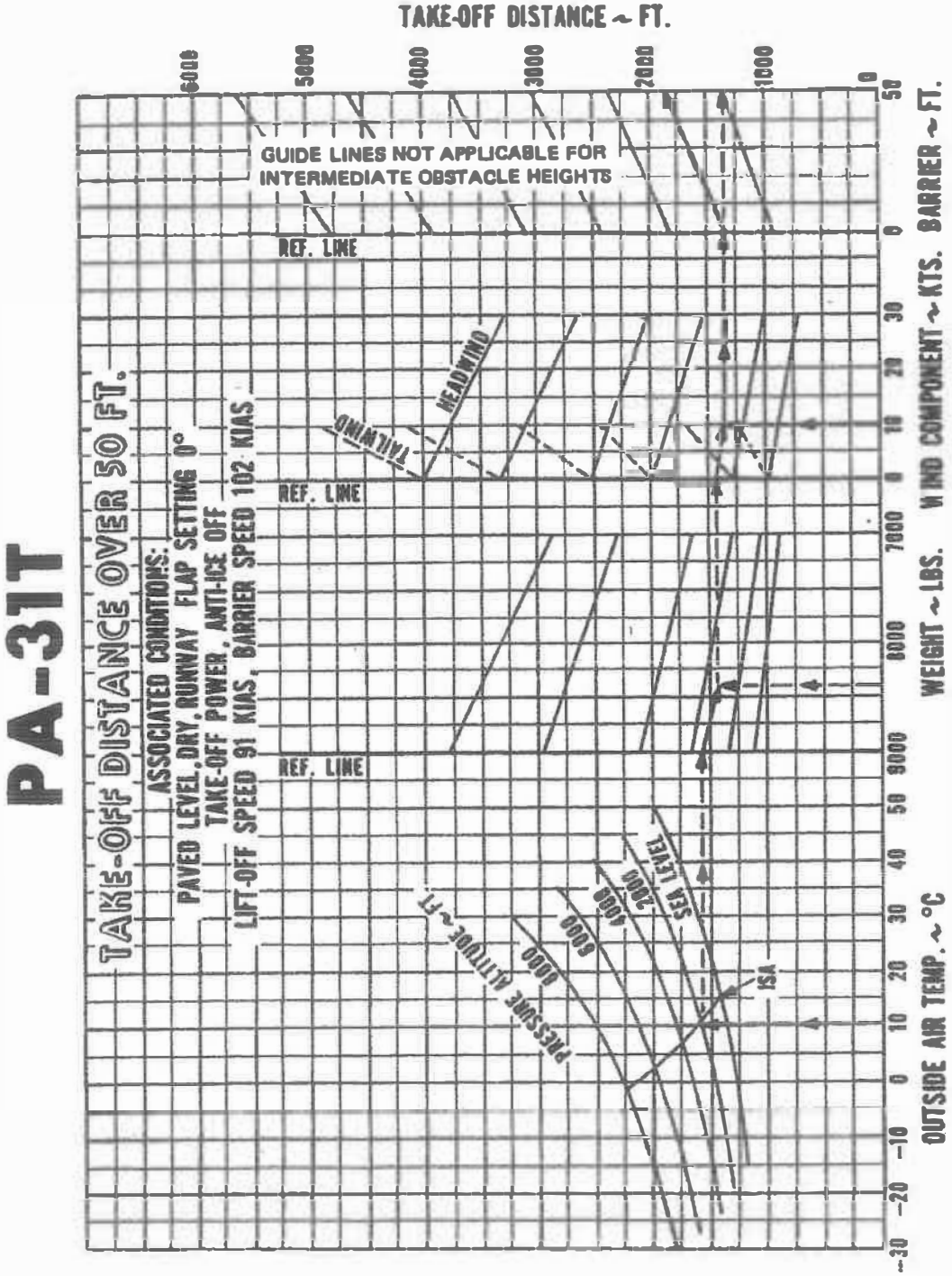
TAKEOFF POWER (TORQUE)
Figure 5-19

PT6A-28



TAKEOFF POWER (FUEL FLOW)

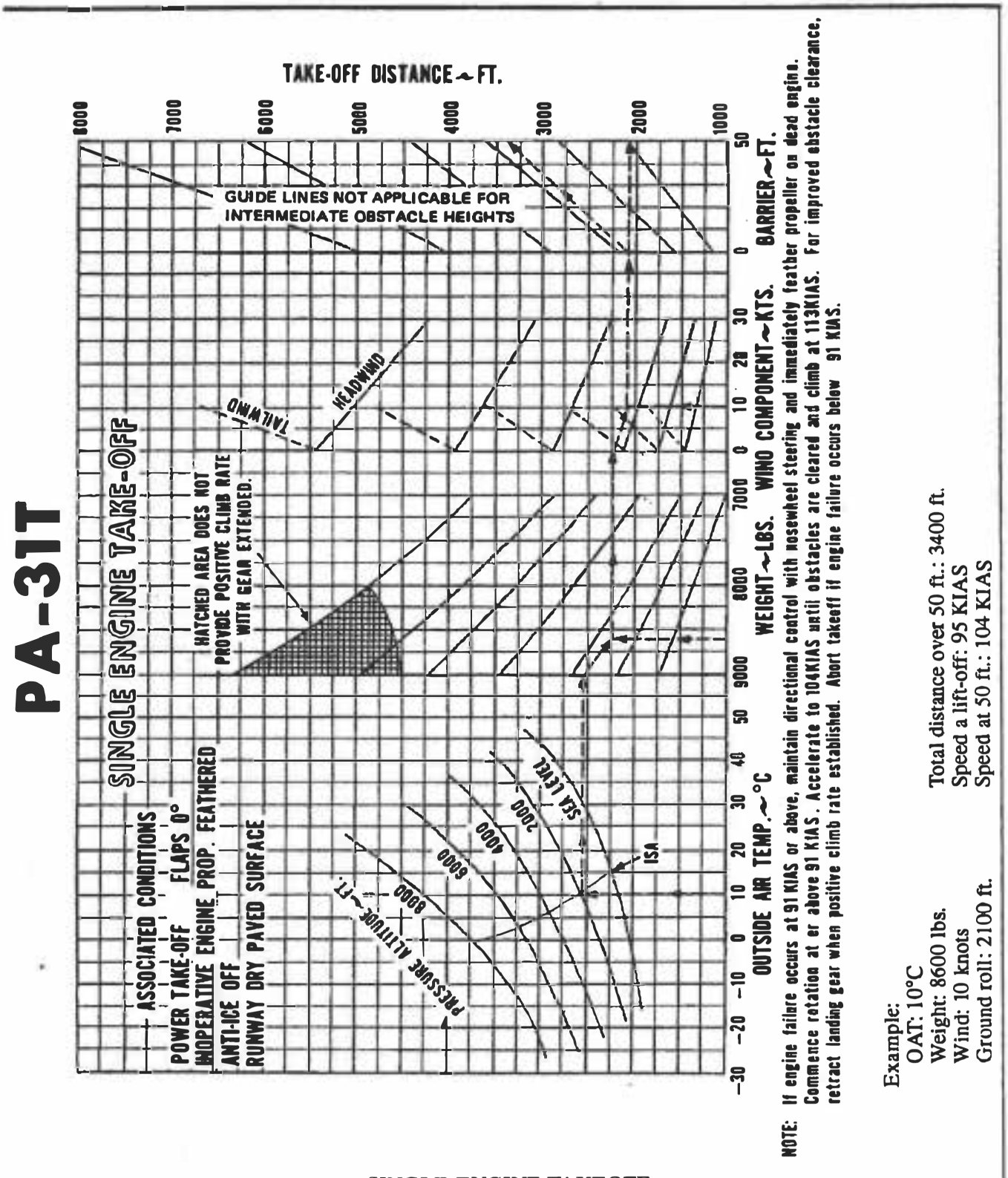
Figure 5-21



Example:
OAT: 10°C
Pressure altitude: 2000 ft.
Weight: 8400 lbs.
Wind: +10 knots
Ground roll: 1350 ft.
Distance over 50 ft.: 1850 ft.

TAKEOFF DISTANCE OVER 50 FEET

Figure 5-23



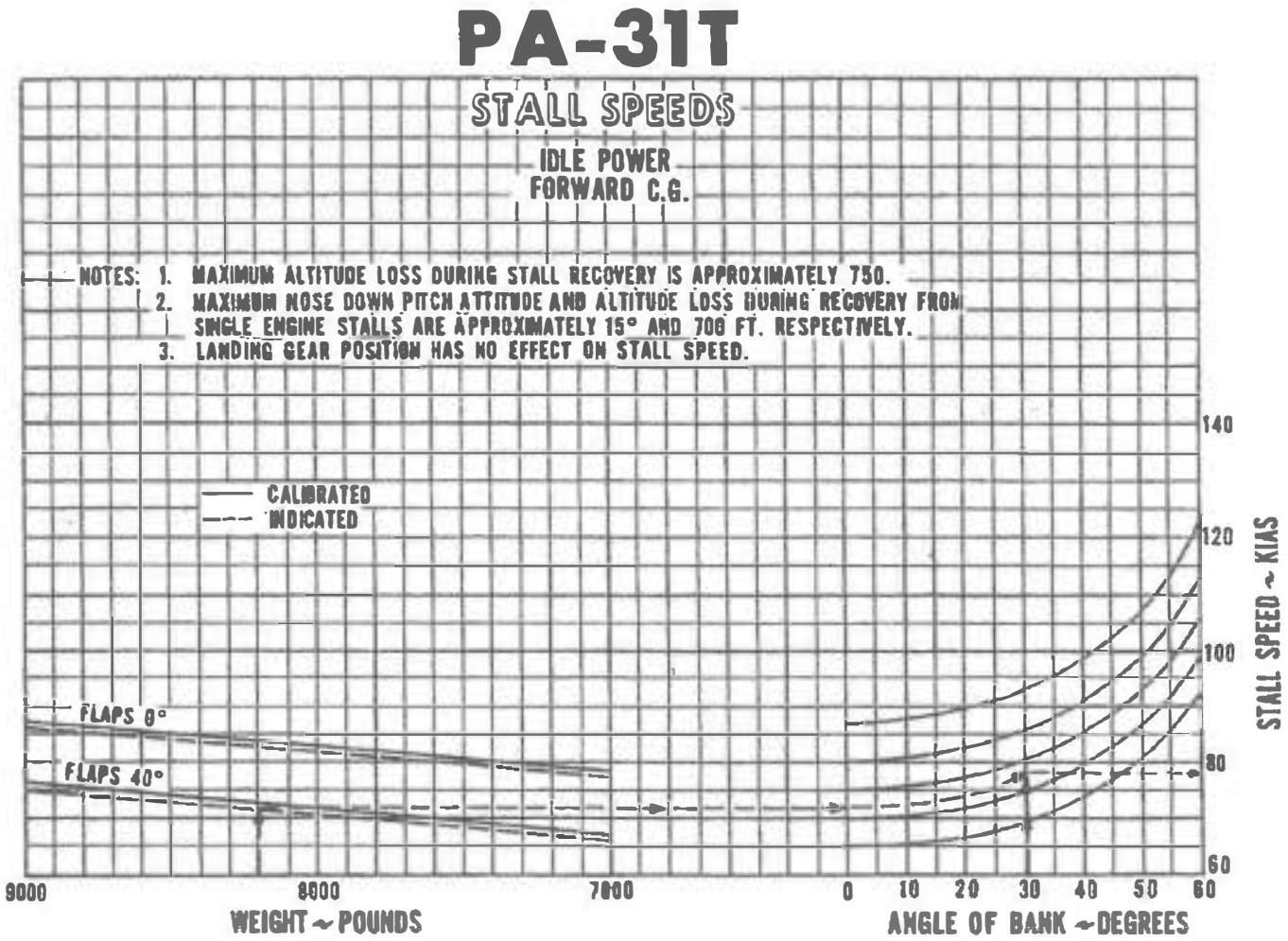
NOTE: If engine failure occurs at 91 KIAS or above, maintain directional control with nosewheel steering and immediately feather propeller on dead engine. Commence rotation at or above 91 KIAS. Accelerate to 104KIAS until obstacles are cleared and climb at 113KIAS. For improved obstacle clearance, retract landing gear when positive climb rate established. Abort takeoff if engine failure occurs below 91 KIAS.

Example:
OAT: 10°C
Weight: 8600 lbs.
Wind: 10 knots
Ground roll: 2100 ft.

Total distance over 50 ft.: 3400 ft.
Speed a lift-off: 95 KIAS
Speed at 50 ft.: 104 KIAS

SINGLE-ENGINE TAKEOFF

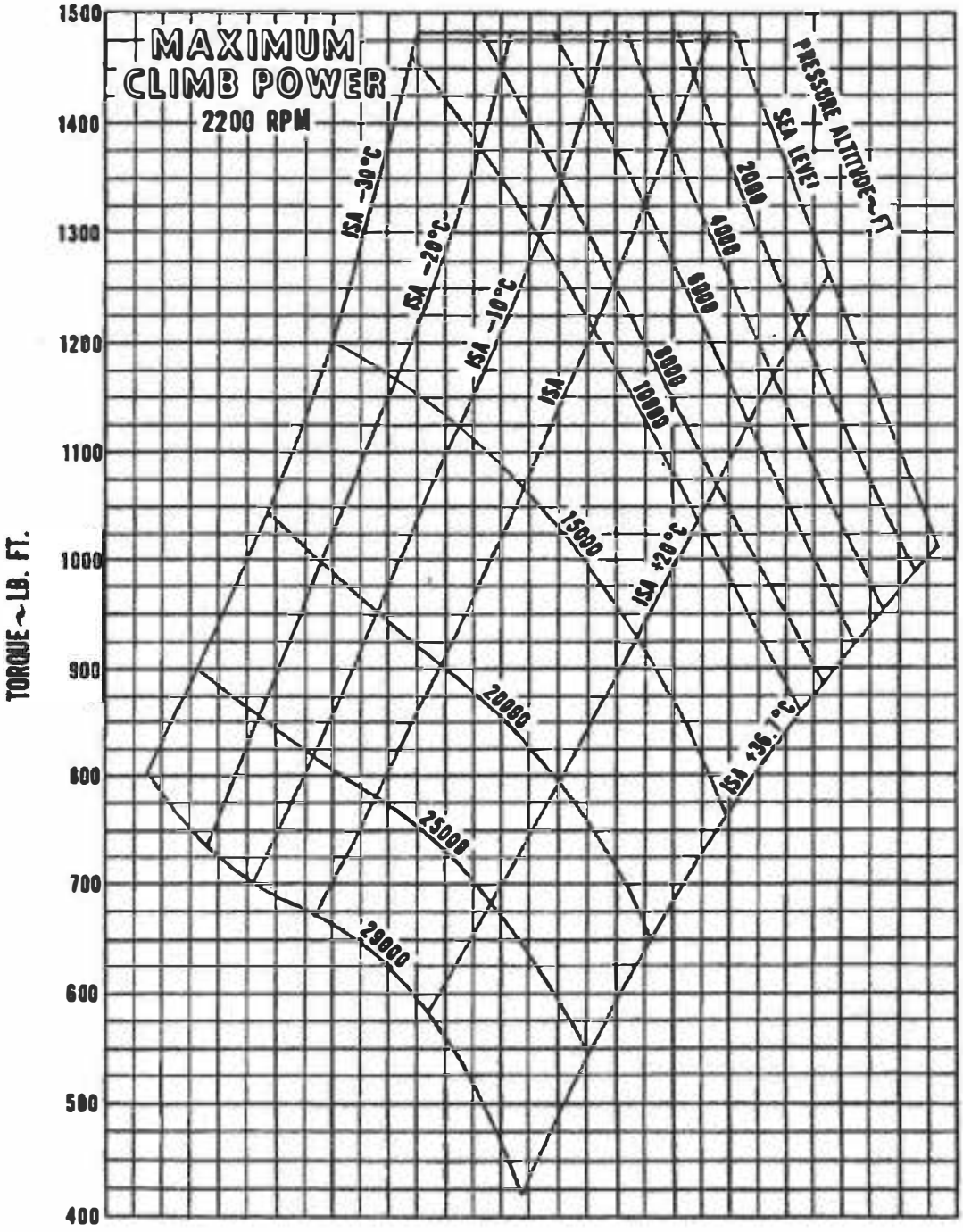
Figure 5-25



Example:
Weight: 8200 lbs.
Flaps: 40 °
Angle of bank: 30°
KIAS: 78

STALL SPEEDS
Figure 5-27

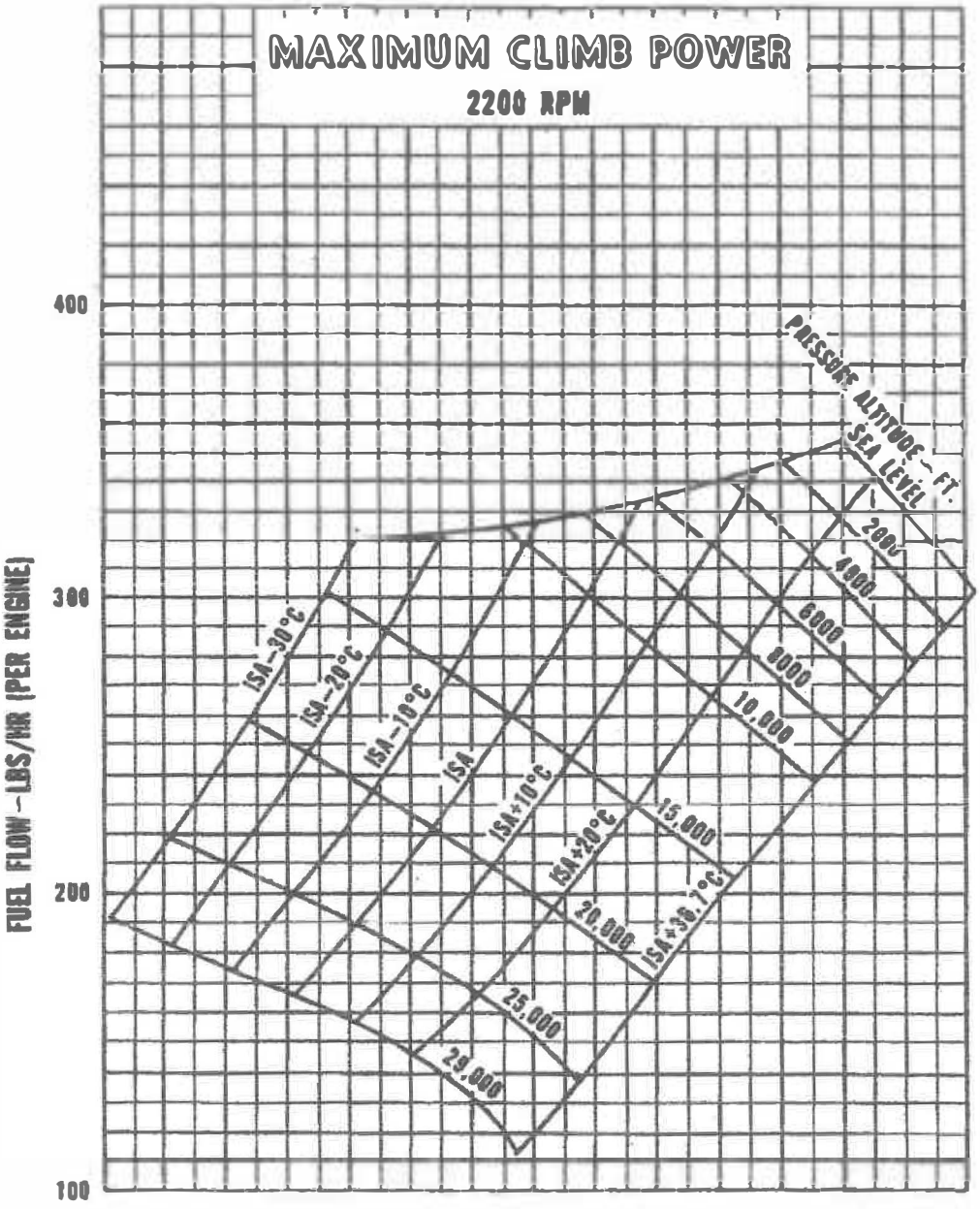
PT6A-28



MAXIMUM CLIMB POWER (TORQUE)

Figure 5-29

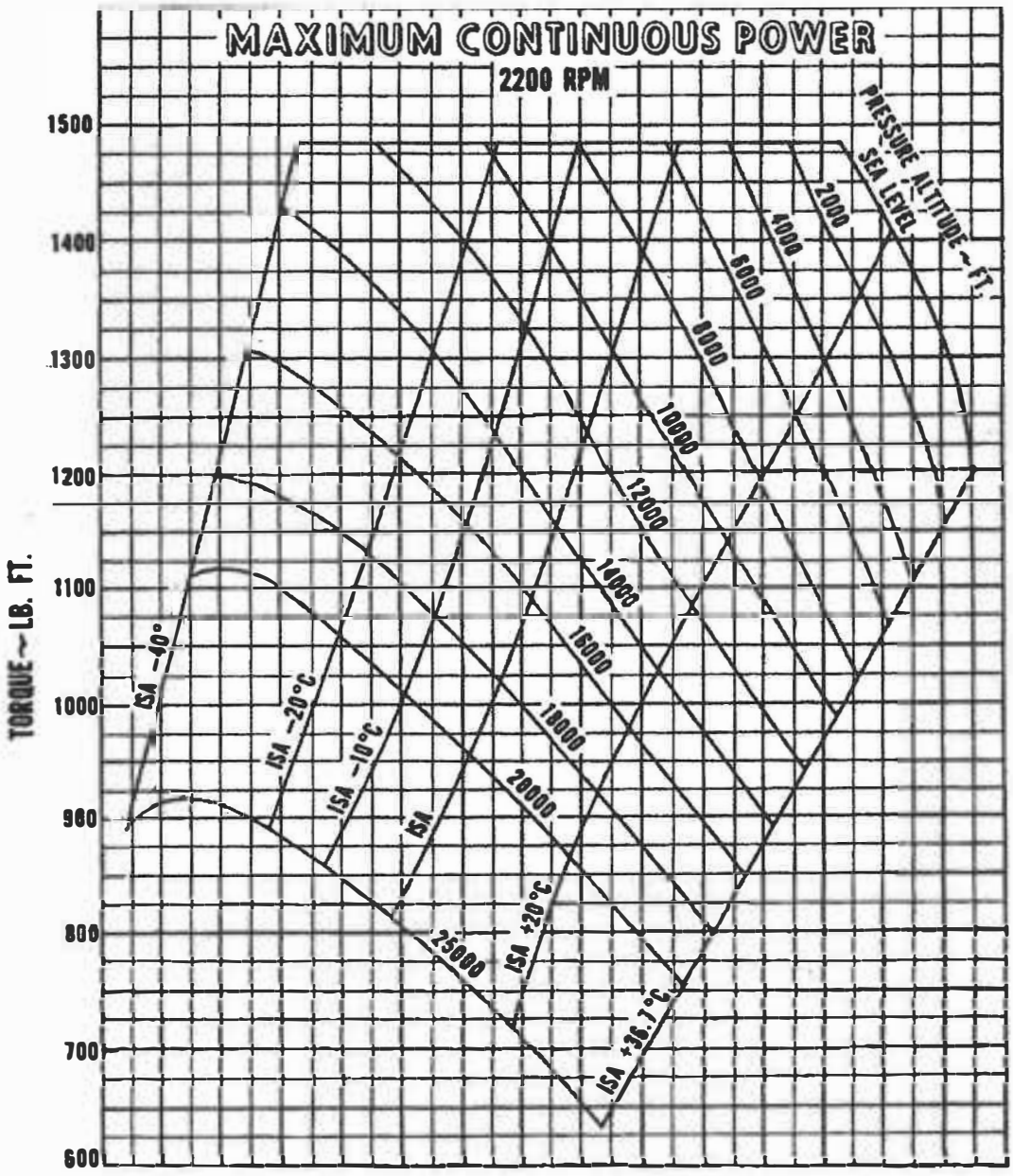
PT6A-28



MAXIMUM CLIMB POWER (FUEL FLOW)

Figure 5-31

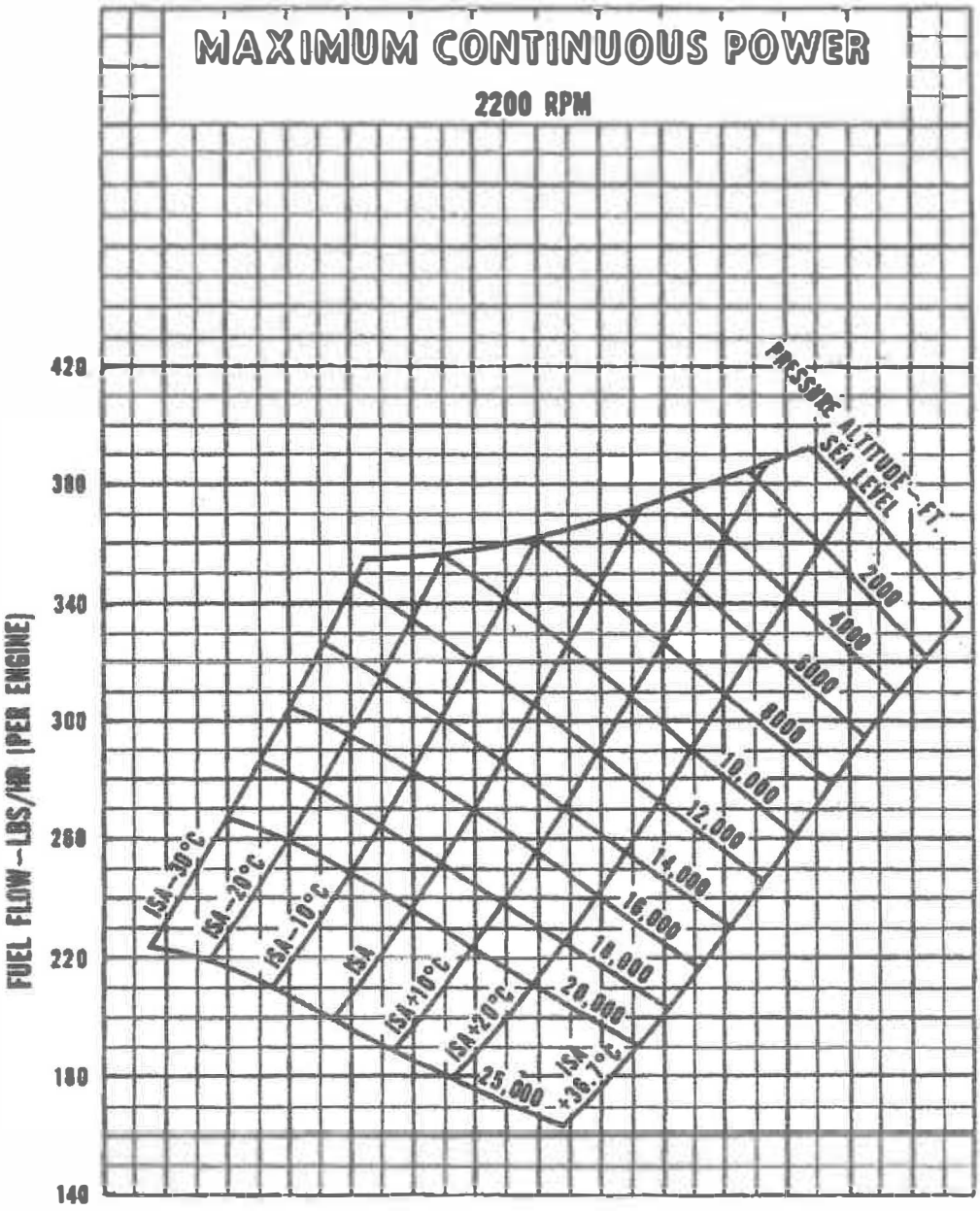
PT6A-28



MAXIMUM CONTINUOUS POWER (TORQUE)

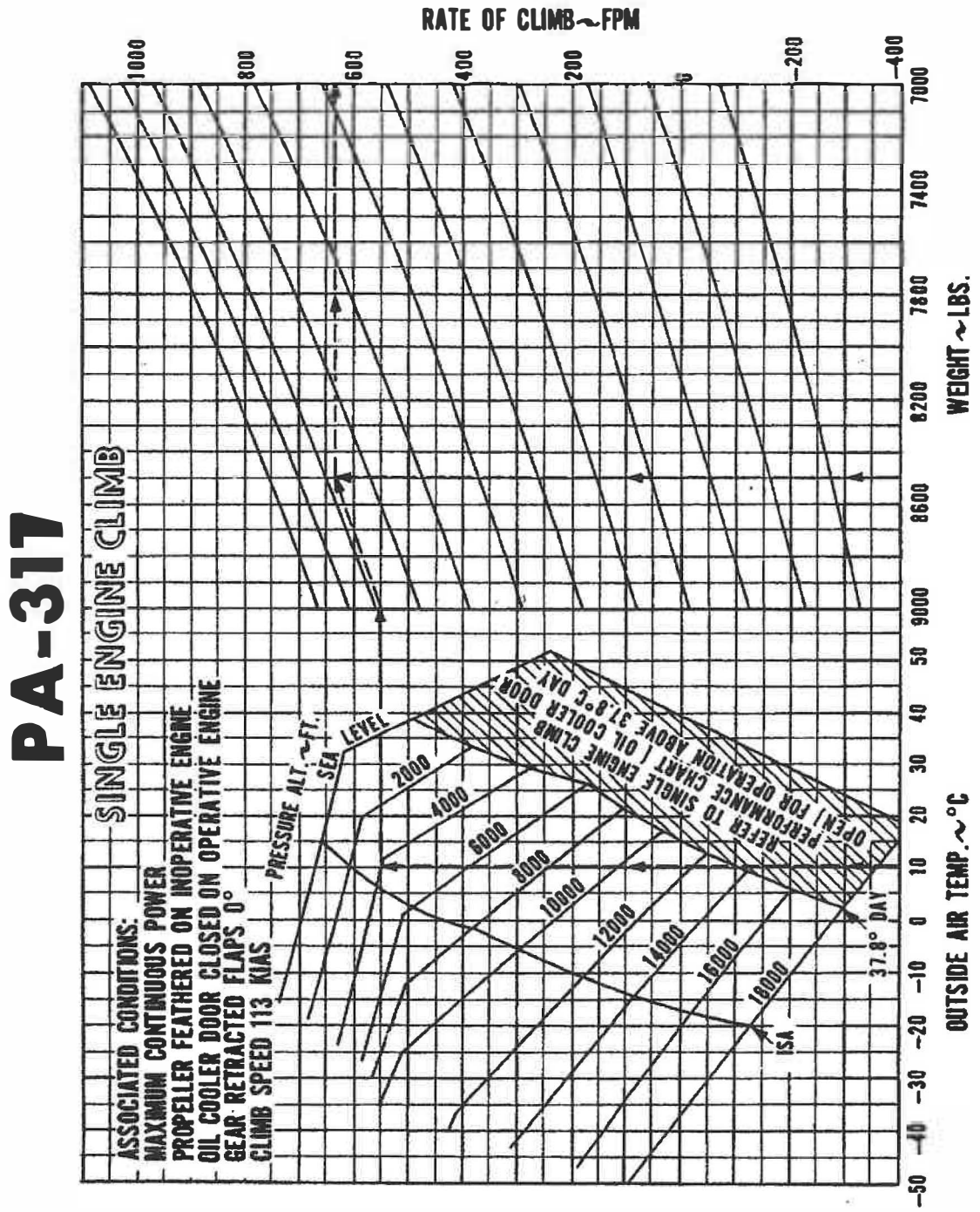
Figure 5-33

PT6A-28



MAXIMUM CONTINUOUS POWER (FUEL FLOW)

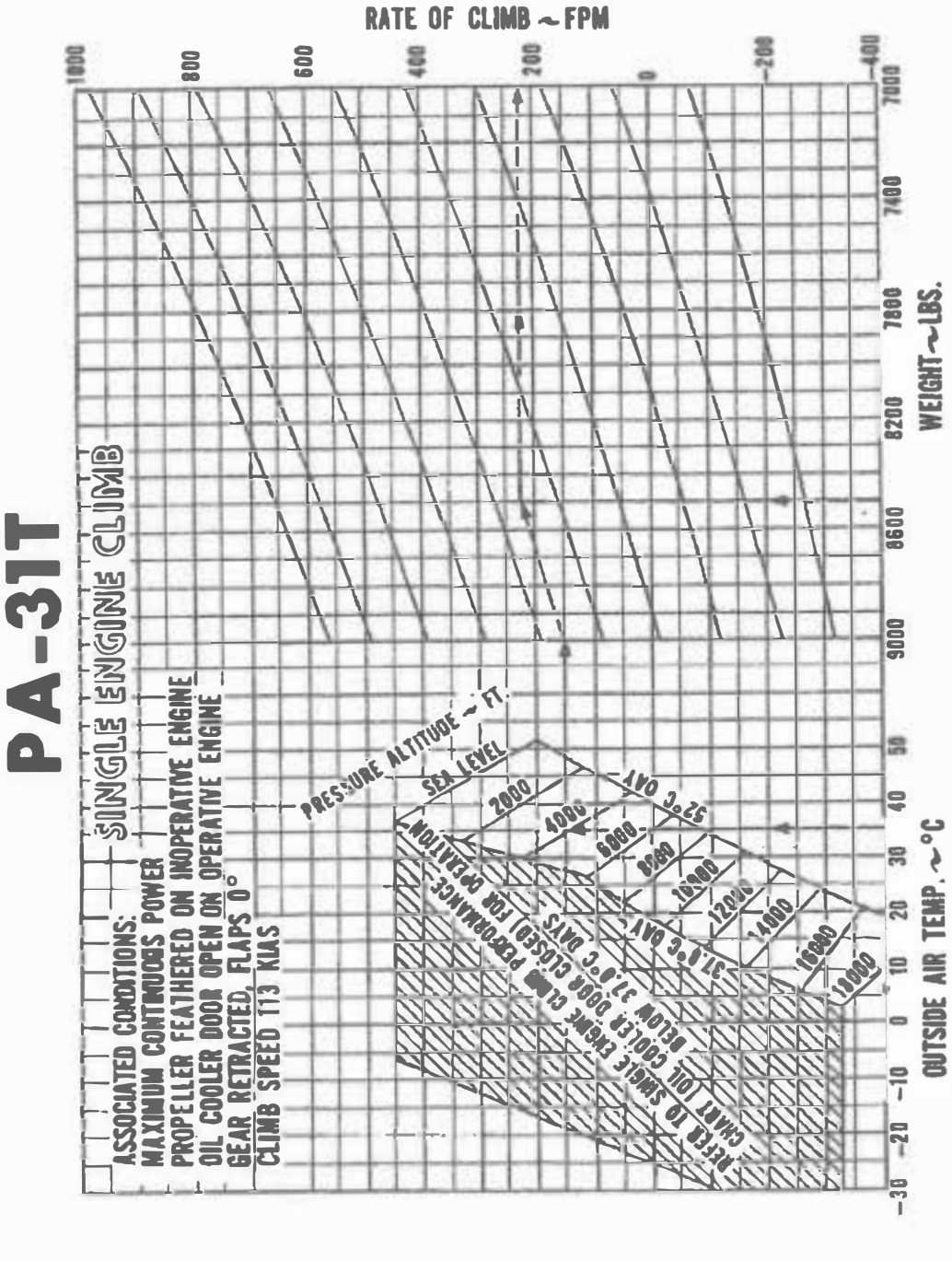
Figure 5-35



Example:
OAT: +10°C
Pressure altitude: 4000 ft.
Weight: 8500 lbs.
Rate of climb: 640 F.P.M.

SINGLE-ENGINE CLIMB (OIL COOLER DOOR CLOSED ON OPERATIVE ENGINE)

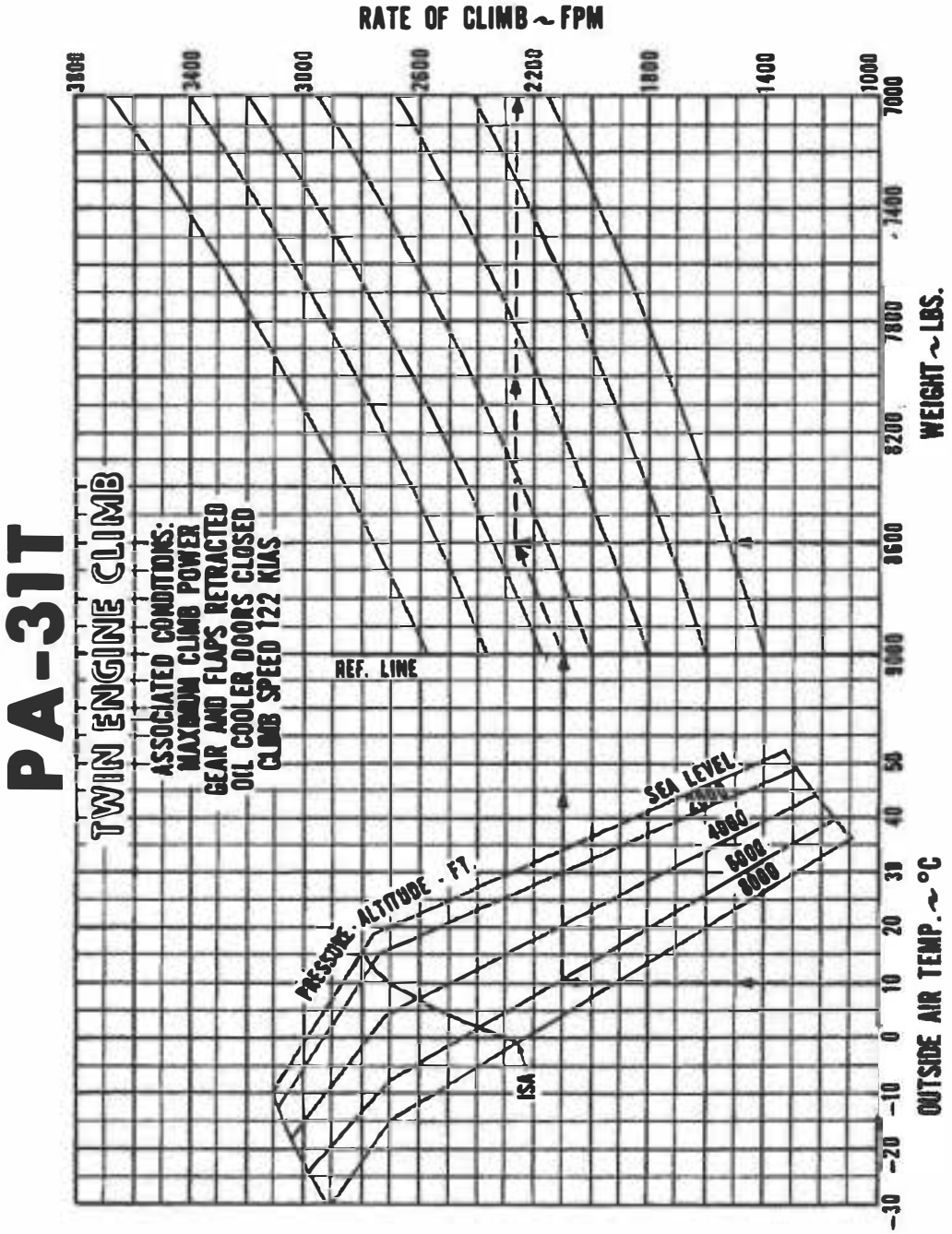
Figure 5-37



Example:
OAT: +35°C
Pressure altitude: 4000 ft.
Weight: 8500 lbs.
Rate of climb: 220 F.P.M.

SINGLE-ENGINE CLIMB (OIL COOLER DOOR OPEN ON OPERATIVE ENGINE)

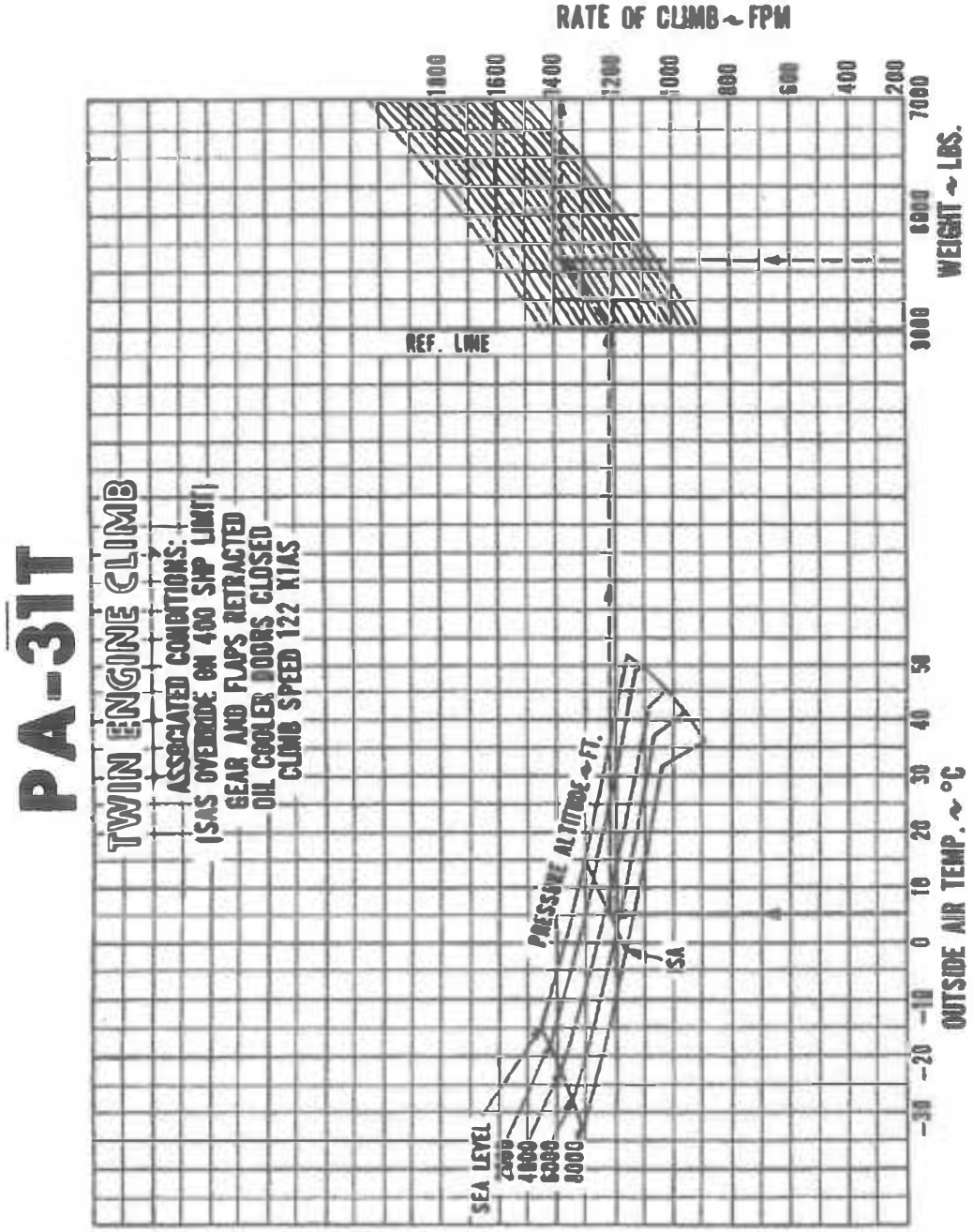
Figure 5-39



Example:
OAT: +10°C
Pressure altitude: 6000 ft.
Weight: 8600 lbs.
Rate of climb: 2260 F.P.M.

TWIN-ENGINE CLIMB

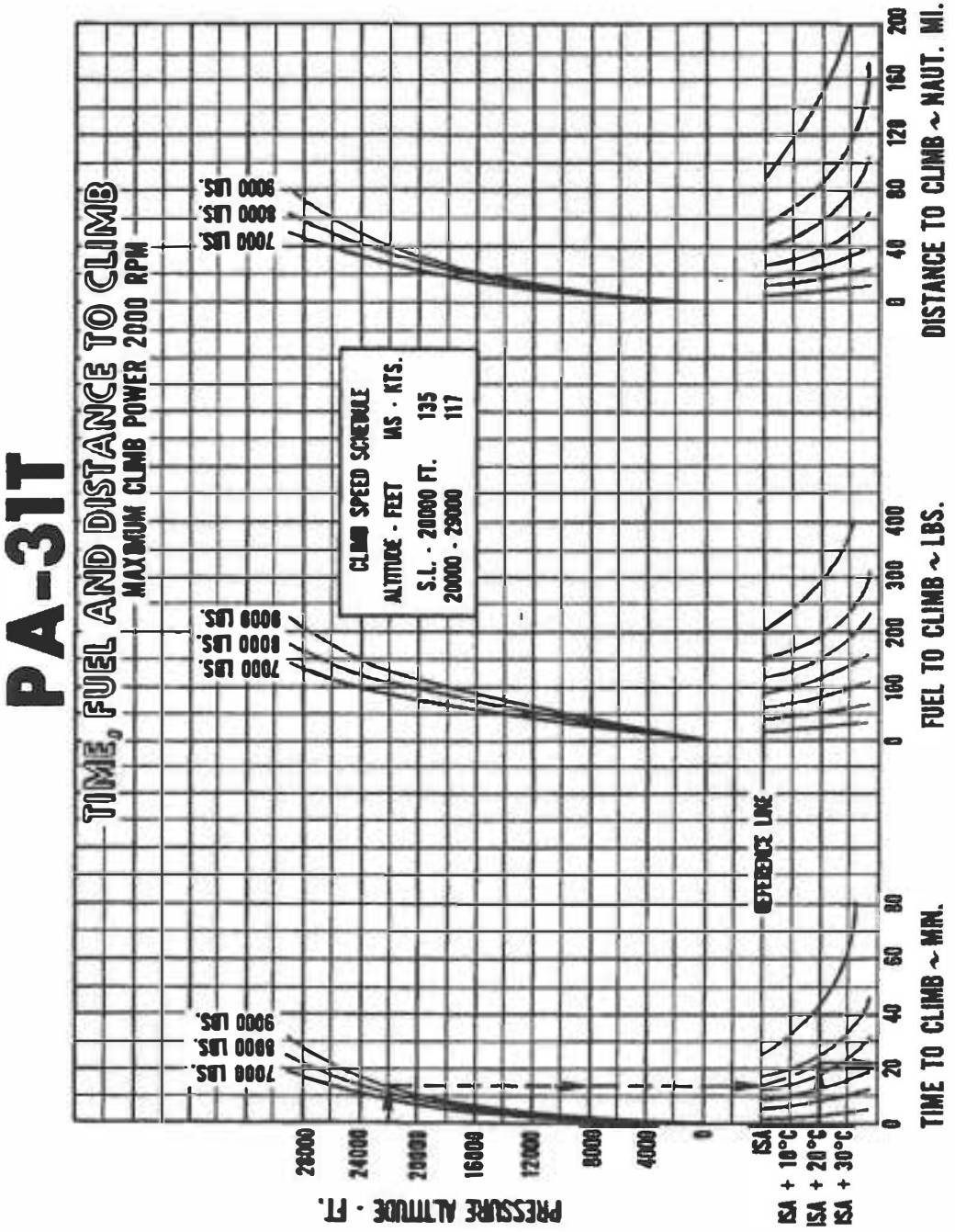
Figure 5-41



Example:
OAT: +5°C
Pressure altitude: 5000 ft.
Weight: 8400 lbs.
Rate of climb: 1380 F.P.M.

TWIN-ENGINE CLIMB (SAS OVERRIDE ON)

Figure 5-43



Example:
Altitude: 22,000 ft.
Weight: 9000 lbs.
Temperature: ISA +20°C
Time to climb: 22 minutes

TIME, FUEL AND DISTANCE TO CLIMB
Figure 5-45

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MAXIMUM CRUISE POWER • 2000 RPM • ISA -30°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level											
2000											
4000	FOR VALUES BELOW 10,000 FT. REFER TO ECONOMY CRUISE POWER TABLES.										
6000											
8000											
10,000	-26	-32	1628	361	722	244	268	246	270	246	270
12,000	-33	-36	1628	360	720	241	273	244	276	246	278
14,000	-40	-40	1628	358	716	238	278	241	282	244	285
16,000	-47	-44	1575	346	692	232	323	235	284	238	287
18,000	-54	-48	1485	323	646	223	278	227	282	230	287
20,000	-61	-52	1380	303	606	213	274	216	278	220	283
22,000	-69	-56	1285	281	562	203	270	208	276	212	281
24,000	-76	-60	1180	258	516	192	264	197	271	202	277
26,000	-85	-65	1065	236	472	180	256	185	263	189	270
29,000	-98	-72	825	196	392	150	226	156	235	163	245

MAXIMUM CRUISE POWER - 2000 RPM - ISA -30° C

Figure 5-47

MAXIMUM CRUISE POWER • 2000 RPM • ISA -20°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level											
2000											
4000	FOR VALUES BELOW 10,000 FT. REFER TO ECONOMY CRUISE POWER TABLES.										
6000											
8000											
10,000	- 8	-22	1628	361	722	242	271	245	274	246	275
12,000	-15	-26	1628	361	722	239	276	242	280	245	283
14,000	-22	-30	1600	354	708	235	279	238	284	241	287
16,000	-29	-34	1495	333	666	226	278	228	281	231	284
18,000	-36	-38	1405	312	624	216	275	220	279	223	283
20,000	-43	-42	1315	292	584	206	271	210	276	214	281
22,000	-51	-46	1220	272	544	196	267	201	273	205	279
24,000	-58	-50	1130	252	504	186	261	191	268	195	275
26,000	-67	-55	1035	231	462	175	256	181	263	186	270
29,000	-80	-62	865	201	402	154	235	159	245	166	255

MAXIMUM CRUISE POWER - 2000 RPM - ISA -20° C

Figure 5-49

MAXIMUM CRUISE POWER • 2000 RPM • ISA -10°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level											
2000											
4000	FOR VALUES BELOW 10,000 FT. REFER TO ECONOMY CRUISE POWER TABLES.										
6000											
8000											
10,000	10	-12	1628	363	726	241	275	243	278	246	281
12,000	3	-16	1615	360	720	236	278	240	283	245	289
14,000	- 4	-20	1525	340	680	228	277	231	281	235	285
16,000	-13	-25	1420	320	640	218	274	221	279	225	283
18,000	-20	-29	1340	298	596	208	271	213	276	216	281
20,000	-27	-33	1245	278	556	200	268	204	273	208	280
22,000	-35	-37	1180	260	520	191	266	196	272	200	277
24,000	-42	-41	1105	242	484	182	261	187	268	191	275
26,000	-49	-45	1010	227	454	170	254	175	261	181	269
29,000	-61	-52	880	202	404	153	240	159	251	165	259

MAXIMUM CRUISE POWER - 2000 RPM - ISA -10° C
Figure 5-51

MAXIMUM CRUISE POWER • 2000 RPM • ISA

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level											
2000											
4000	FOR VALUES BELOW 10,000 FT. REFER TO ECONOMY CRUISE POWER TABLES.										
6000											
8000											
10,000	28	- 2	1628	365	730	238	277	241	281	244	285
12,000	21	- 6	1535	344	688	231	277	235	281	238	286
14,000	14	-10	1445	322	644	222	274	226	279	229	284
16,000	7	-14	1350	304	608	212	271	216	277	220	281
18,000	0	-18	1260	284	568	202	267	207	273	211	279
20,000	-9	-23	1180	265	530	192	262	196	269	202	276
22,000	-17	-27	1100	248	496	182	258	188	266	193	273
24,000	-24	-31	1040	232	464	172	253	174	262	184	270
26,000	-31	-35	960	217	434	163	248	169	257	175	267
29,000	-42	-41	870	196	392	149	240	156	250	162	261

MAXIMUM CRUISE POWER - 2000 RPM - ISA

Figure 5-53

MAXIMUM CRUISE POWER • 2000 RPM • ISA + 10°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level											
2000											
4000	FOR VALUES BELOW 10,000 FT. REFER TO ECONOMY CRUISE POWER TABLES.										
6000											
8000											
10,000	46	8	1525	342	684	230	273	234	277	236	279
12,000	39	4	1430	322	644	221	271	225	275	228	279
14,000	32	0	1350	304	608	212	268	216	274	220	278
16,000	23	-5	1260	286	572	202	265	208	272	211	276
18,000	16	-9	1180	268	536	193	261	198	268	202	273
20,000	8	-13	1105	251	502	184	258	189	265	194	271
22,000	1	-17	1035	237	474	175	254	181	261	186	268
24,000	- 6	-21	970	222	444	166	249	172	258	177	266
26,000	-13	-25	905	208	416	156	243	162	253	168	262
29,000	-26	-32	825	188	376	142	235	150	248	157	259

MAXIMUM CRUISE POWER - 2000 RPM - ISA +10°C

Figure 5-55

MAXIMUM CRUISE POWER • 2000 RPM • ISA + 20°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level											
2000											
4000	FOR VALUES BELOW 10,000 FT. REFER TO ECONOMY CRUISE POWER TABLES.										
6000											
8000											
10,000	64	18	1390	321	642	219	264	223	269	227	274
12,000	57	14	1315	302	604	211	263	215	268	219	273
14,000	49	9	1235	285	570	202	260	207	266	210	270
16,000	41	5	1155	268	536	193	256	198	263	202	268
18,000	34	1	1090	252	504	184	254	189	261	194	266
20,000	27	- 3	1025	236	472	175	250	181	257	186	264
22,000	19	- 7	960	222	444	166	245	172	254	177	261
24,000	11	-12	895	208	416	156	240	162	248	168	258
26,000	3	-16	840	194	388	147	233	154	244	160	256
29,000	- 8	-22	760	178	356	130	218	141	235	148	248

MAXIMUM CRUISE POWER - 2000 RPM - ISA +20°C
Figure 5-57

MAXIMUM CRUISE POWER • 2000 RPM • ISA + 30°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level											
2000											
4000	FOR VALUES BELOW 10,000 FT. REFER TO ECONOMY CRUISE POWER TABLES.										
6000											
8000											
10,000	82	28	1285	302	604	210	258	215	263	219	268
12,000	75	24	1215	284	568	202	256	206	261	210	267
14,000	66	19	1145	268	536	193	253	198	259	205	265
16,000	59	15	1075	252	504	184	249	189	256	195	263
18,000	52	11	1010	236	472	175	247	181	254	186	261
20,000	45	7	950	222	444	167	242	173	251	178	259
22,000	37	3	895	208	416	158	238	164	248	169	256
24,000	29	- 2	835	194	388	148	232	155	242	161	252
26,000	21	- 6	780	182	364	137	222	146	236	153	248
29,000	10	-12	705	167	334	—	—	131	225	141	241

MAXIMUM CRUISE POWER - 2000 RPM - ISA +30°C
Figure 5-59

MAXIMUM CRUISE POWER • 2000 RPM • ISA + 37°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level											
2000											
4000	FOR VALUES BELOW 10,000 FT. REFER TO ECONOMY CRUISE POWER TABLES.										
6000											
8000											
10,000	93	34	1220	290	580	204	254	209	259	212	263
12,000	86	30	1140	272	544	195	250	200	256	204	261
14,000	79	26	1075	256	512	186	248	191	254	195	260
16,000	72	22	1010	240	480	178	244	182	250	188	257
18,000	64	18	945	226	452	168	240	174	247	179	255
20,000	56	13	895	212	424	159	235	161	244	171	252
22,000	48	9	840	198	396	151	230	158	241	164	249
24,000	41	5	790	185	370	142	224	149	236	156	247
26,000	34	1	735	173	346	—	—	139	228	148	241
29,000	21	- 6	655	158	316	—	—	—	—	133	230

MAXIMUM CRUISE POWER - 2000 RPM - ISA +37°C

Figure 5-61

MAXIMUM CRUISE POWER • 1900 RPM • ISA - 30°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
FOR VALUES BELOW 10,000 FT. REFER TO ECONOMY CRUISE POWER TABLES.											
10,000	-26	-32	1628	350	700	238	261	241	264	244	268
12,000	-33	-36	1628	348	696	235	265	238	269	241	272
14,000	-40	-40	1628	346	692	231	270	235	273	237	277
16,000	-47	-44	1590	338	676	226	272	229	276	233	281
18,000	-54	-48	1495	315	630	217	270	221	276	225	281
20,000	-61	-52	1385	294	588	206	265	210	270	214	275
22,000	-69	-56	1280	272	544	196	261	201	267	204	272
24,000	-76	-60	1170	249	498	184	254	189	261	194	267
26,000	-85	-65	1050	226	452	171	244	177	253	182	259
29,000	-98	-72	800	190	380	140	211	149	223	158	237

MAXIMUM CRUISE POWER - 1900 RPM - ISA -30° C

Figure 5-63

MAXIMUM CRUISE POWER • 1900 RPM • ISA - 20°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
FOR VALUES BELOW 10,000 FT. REFER TO ECONOMY CRUISE POWER TABLES.											
10,000	- 8	-22	1628	356	712	236	265	239	268	241	270
12,000	-15	-26	1628	356	712	233	268	236	273	239	276
14,000	-22	-30	1628	354	708	229	274	234	279	236	282
16,000	-29	-34	1520	326	652	220	270	224	275	227	279
18,000	-36	-38	1425	305	610	210	267	215	273	218	277
20,000	-43	-42	1325	284	568	200	263	205	270	209	274
22,000	-51	-46	1220	264	528	189	257	195	264	199	270
24,000	-58	-50	1125	244	488	179	252	184	259	188	265
26,000	-67	-55	1025	222	444	168	244	174	253	179	261
29,000	-80	-62	840	191	382	145	224	153	236	159	245

MAXIMUM CRUISE POWER - 1900 RPM - ISA -20° C
Figure 5-65

MAXIMUM CRUISE POWER • 1900 RPM • ISA - 10°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
FOR VALUES BELOW 10,000 FT. REFER TO ECONOMY CRUISE POWER TABLES.											
10,000	10	-12	1628	359	718	234	267	236	270	240	274
12,000	3	-16	1628	356	712	231	272	235	276	237	280
14,000	- 4	-20	1555	336	672	223	272	227	276	230	280
16,000	-13	-25	1445	315	630	214	268	217	273	221	277
18,000	-20	-29	1360	292	584	204	265	209	271	212	275
20,000	-27	-33	1255	272	544	194	260	199	267	202	272
22,000	-35	-37	1185	253	506	184	256	189	263	194	270
24,000	-42	-41	1105	235	470	175	253	181	260	185	266
26,000	-49	-45	1005	219	438	163	243	170	253	175	254
29,000	-61	-52	865	194	388	142	222	151	237	158	248

MAXIMUM CRUISE POWER - 1900 RPM - ISA -10°C
Figure 5-67

MAXIMUM CRUISE POWER • 1900 RPM • ISA

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
FOR VALUES BELOW 10,000 FT. REFER TO ECONOMY CRUISE POWER TABLES.											
10,000	28	- 2	1628	365	730	233	271	236	274	239	278
12,000	21	- 6	1580	341	682	227	272	229	275	233	280
14,000	14	-10	1485	318	636	218	270	221	273	225	279
16,000	7	-14	1380	300	600	207	266	212	272	215	276
18,000	0	-18	1280	280	560	199	263	202	268	206	273
20,000	- 9	-23	1195	260	520	188	258	193	264	197	271
22,000	-17	-27	1115	243	486	178	253	183	260	188	267
24,000	-24	-31	1045	227	454	168	248	175	256	180	264
26,000	-31	-35	960	211	422	159	243	166	252	171	260
29,000	-42	-41	870	190	380	145	233	152	244	158	254

MAXIMUM CRUISE POWER - 1900 RPM - ISA

Figure 5-69

MAXIMUM CRUISE POWER • 1900 RPM • ISA + 10°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
FOR VALUES BELOW 10,000 FT. REFER TO ECONOMY CRUISE POWER TABLES.											
10,000	46	8	1580	341	682	228	269	231	274	234	277
12,000	39	4	1475	320	640	219	268	222	272	226	276
14,000	32	0	1390	302	604	209	265	214	270	217	274
16,000	23	- 5	1295	283	566	200	261	205	268	208	272
18,000	16	- 9	1205	265	530	189	256	195	263	199	269
20,000	8	-13	1125	247	494	180	252	185	259	189	266
22,000	1	-17	1050	233	466	170	247	176	256	182	262
24,000	- 6	-21	980	217	434	160	241	168	251	173	260
26,000	-13	-25	910	203	406	150	234	157	245	163	254
29,000	-26	-32	825	182	364	133	219	145	235	150	248

MAXIMUM CRUISE POWER - 1900 RPM - ISA +10°C
Figure 5-71

MAXIMUM CRUISE POWER • 1900 RPM • ISA + 20°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
FOR VALUES BELOW 10,000 FT. REFER TO ECONOMY CRUISE POWER TABLES.											
10,000	64	18	1445	321	642	217	262	221	262	224	270
12,000	57	14	1360	301	602	209	260	213	265	215	268
14,000	49	9	1280	284	568	200	257	204	262	207	266
16,000	41	5	1190	266	532	190	253	195	259	198	263
18,000	34	1	1120	250	500	181	248	186	256	190	261
20,000	27	- 3	1050	234	468	171	244	176	251	182	259
22,000	19	- 7	980	219	438	161	238	168	248	173	256
24,000	11	-12	910	205	410	152	233	158	242	164	251
26,000	3	-16	850	189	378	141	223	148	236	154	246
29,000	- 8	-22	760	173	346	—	—	135	227	142	237

MAXIMUM CRUISE POWER - 1900 RPM - ISA +20°C

Figure 5-73

MAXIMUM CRUISE POWER • 1900 RPM • ISA + 30°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
FOR VALUES BELOW 10,000 FT. REFER TO ECONOMY CRUISE POWER TABLES											
10,000	82	28	1340	303	606	209	256	212	260	219	264
12,000	75	24	1270	285	570	200	254	203	258	208	263
14,000	66	19	1190	268	536	191	250	195	256	200	261
16,000	59	15	1115	252	504	182	246	187	253	191	259
18,000	52	11	1045	235	470	173	242	178	250	182	256
20,000	45	7	980	221	442	164	239	170	248	175	255
22,000	37	3	920	206	412	155	235	161	244	166	251
24,000	29	- 2	855	192	384	145	227	151	235	156	244
26,000	21	- 6	795	180	360	132	214	141	228	148	239
29,000	10	-12	710	164	328	—	—	—	—	134	230

MAXIMUM CRUISE POWER - 1900 RPM - ISA +30°C

Figure 5-75

MAXIMUM CRUISE POWER • 1900 RPM • ISA + 37°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
FOR VALUES BELOW 10,000 FT. REFER TO ECONOMY CRUISE POWER TABLES											
10,000	93	34	1280	292	584	203	253	208	258	211	263
12,000	86	30	1195	274	548	195	249	198	255	203	261
14,000	79	26	1125	257	514	184	245	189	251	193	257
16,000	72	22	1055	241	482	175	241	180	247	185	257
18,000	64	18	980	226	452	166	237	171	243	176	251
20,000	56	13	925	212	424	157	231	163	240	168	248
22,000	48	9	870	197	394	148	227	155	237	160	244
24,000	41	5	815	184	368	138	219	146	230	152	241
26,000	34	1	750	171	342	—	—	134	219	142	233
29,000	21	- 6	665	155	310	—	—	—	—	127	220

MAXIMUM CRUISE POWER - 1900 RPM - ISA + 37°C
Figure 5-77

ECONOMY CRUISE POWER • 2000 RPM • ISA - 30°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level	9	-13	1628	391	782	246	233	246	233	246	233
2000	1	-17	1628	385	770	246	241	246	241	246	241
4000	- 6	-21	1628	380	760	246	248	246	248	246	248
6000	-13	-25	1628	375	750	246	255	246	255	246	255
8000	-18	-28	1628	371	742	246	261	246	261	246	261
10,000	-26	-32	1628	367	734	244	268	246	270	246	270
12,000	-13	-36	1540	345	690	236	268	239	270	241	273
14,000	-42	-41	1450	325	650	227	265	230	269	233	272
16,000	-49	-45	1360	305	610	218	262	221	268	225	271
18,000	-56	-49	1280	286	572	209	261	214	267	217	270
20,000	-63	-53	1210	268	536	201	258	205	264	209	269
22,000	-71	-57	1125	251	502	191	255	196	261	201	267
24,000	-78	-61	1050	234	468	182	249	187	257	191	263
26,000	-86	-66	975	219	438	172	245	177	253	182	260
29,000	-99	-73	820	195	390	147	221	153	230	160	240

ECONOMY CRUISE POWER - 2000 RPM - ISA -30°C

Figure 5-78

ECONOMY CRUISE POWER • 2000 RPM • ISA - 20°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level	28	- 2	1628	387	774	246	237	246	237	246	237
2000	21	- 6	1628	381	762	246	245	246	245	246	245
4000	14	-10	1628	376	752	246	252	246	252	246	252
6000	6	-15	1628	372	744	246	259	246	259	246	259
8000	- 2	-19	1628	368	736	246	267	246	267	246	267
10,000	- 9	-23	1560	349	698	238	267	241	270	244	274
12,000	-17	-27	1470	328	656	229	265	233	269	236	273
14,000	-24	-31	1385	308	616	221	263	224	268	228	271
16,000	-31	-35	1300	290	580	211	260	215	265	219	269
18,000	-38	-39	1225	272	544	202	257	207	263	211	268
20,000	-45	-43	1150	256	512	194	255	198	261	202	267
22,000	-53	-47	1075	240	480	184	250	189	257	195	264
24,000	-60	-51	1005	225	450	175	247	181	254	186	261
26,000	-69	-56	935	211	422	166	241	172	250	177	258
29,000	-81	-63	840	190	380	150	230	157	241	163	250

ECONOMY CRUISE POWER - 2000 RPM - ISA -20° C

Figure 5-78a

ECONOMY CRUISE POWER • 2000 RPM • ISA - 10°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level	45	7	1628	381	762	246	241	246	241	246	241
2000	37	3	1628	375	750	246	248	246	248	246	248
4000	30	- 1	1628	370	740	246	256	246	256	246	256
6000	23	- 5	1628	366	732	246	264	246	264	246	264
8000	16	- 9	1555	350	700	239	264	241	268	244	270
10,000	9	-13	1470	331	662	231	264	234	268	236	270
12,000	1	-17	1375	312	624	221	261	225	265	228	268
14,000	- 6	-21	1295	293	586	212	258	216	262	220	267
16,000	-13	-25	1220	275	550	203	255	208	261	211	265
18,000	-20	-29	1145	258	516	195	253	199	258	203	263
20,000	-29	-34	1080	242	484	186	249	191	256	194	261
22,000	-36	-38	1010	228	456	176	245	182	254	187	260
24,000	-44	-42	950	213	426	168	241	174	250	179	257
26,000	-51	-46	885	199	398	159	236	165	246	170	254
29,000	-63	-53	800	181	362	144	227	152	239	158	248

ECONOMY CRUISE POWER - 2000 RPM - ISA -10°C

Figure 5-78b

ECONOMY CRUISE POWER • 2000 RPM • ISA

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level	63	17	1628	377	754	246	246	246	246	246	246
2000	55	13	1628	372	744	246	253	246	253	246	253
4000	48	9	1590	363	726	245	261	246	261	246	261
6000	41	5	1515	346	692	237	261	241	263	243	266
8000	34	1	1444	328	656	230	260	234	263	236	266
10,000	27	- 3	1365	311	622	221	258	225	262	228	265
12,000	19	- 7	1285	292	584	213	255	216	260	220	264
14,000	12	-11	1215	275	550	204	254	208	258	212	263
16,000	5	-15	1140	259	518	195	250	200	255	204	261
18,000	- 2	-19	1055	243	486	187	248	191	253	195	259
20,000	-11	-24	1015	230	460	178	244	183	250	188	257
22,000	-18	-28	950	215	430	169	240	175	248	180	255
24,000	-26	-32	890	202	404	160	235	167	245	172	252
26,000	-33	-36	830	189	378	151	229	157	239	163	248
29,000	-44	-42	755	171	342	137	220	144	231	151	242

ECONOMY CRUISE POWER - 2000 RPM - ISA
Figure 5-78c

ECONOMY CRUISE POWER • 2000 RPM • ISA + 10°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level	81	27	1575	369	738	246	250	246	250	246	250
2000	73	23	1520	356	712	245	256	246	257	246	257
4000	66	19	1465	341	682	235	254	239	258	242	261
6000	59	15	1400	325	650	228	254	232	258	235	261
8000	52	11	1330	309	618	221	254	224	258	228	261
10,000	45	7	1260	292	584	212	251	216	256	220	260
12,000	37	3	1190	276	552	203	248	208	255	212	259
14,000	30	- 1	1130	259	518	195	247	200	253	204	258
16,000	21	- 6	1065	244	488	187	244	192	251	196	257
18,000	14	-10	1010	230	460	178	241	183	248	188	256
20,000	7	-14	945	216	432	169	237	175	246	181	253
22,000	0	-18	890	203	406	161	233	167	242	172	249
24,000	- 8	-22	840	190	380	152	228	159	239	165	247
26,000	-15	-26	785	178	356	143	221	150	235	157	243
29,000	-27	-33	710	162	324	—	—	135	221	143	235

ECONOMY CRUISE POWER - 2000 RPM - ISA +10°C

Figure 5-78d

ECONOMY CRUISE POWER • 2000 RPM • ISA + 20°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level	99	37	1425	347	694	237	246	240	248	242	251
2000	91	33	1385	333	666	232	247	235	250	238	254
4000	84	29	1335	318	636	225	247	228	250	231	254
6000	77	25	1285	303	606	218	247	221	250	224	254
8000	70	21	1225	287	574	211	247	215	250	217	254
10,000	63	17	1160	272	544	203	245	207	249	210	253
12,000	55	13	1100	257	514	195	242	199	248	203	253
14,000	48	9	1040	242	484	186	239	191	246	195	251
16,000	41	5	980	228	456	177	235	182	242	188	249
18,000	32	0	930	215	430	168	232	175	240	180	248
20,000	25	- 4	875	202	404	161	228	167	237	172	245
22,000	18	- 8	820	190	380	152	224	159	235	164	242
24,000	9	-13	775	178	356	143	220	151	231	156	240
26,000	1	-17	730	167	334	131	209	142	225	148	235
29,000	- 9	-23	655	150	300	—	—	125	209	136	228

ECONOMY CRUISE POWER - 2000 RPM - ISA +20°C

Figure 5-78e

ECONOMY CRUISE POWER • 2000 RPM • ISA + 30°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level	117	47	1285	326	652	226	235	229	239	232	241
2000	109	43	1245	313	626	220	238	223	241	227	245
4000	102	39	1215	299	598	215	239	218	242	221	246
6000	95	35	1175	284	568	208	240	213	244	216	248
8000	88	31	1120	269	538	202	239	206	244	210	248
10,000	81	27	1065	256	512	194	238	198	243	202	248
12,000	73	23	1010	240	480	185	235	190	241	195	247
14,000	66	19	960	225	450	176	231	182	239	187	245
16,000	57	14	900	210	420	168	228	174	235	179	242
18,000	50	10	850	197	394	159	223	165	232	171	240
20,000	43	6	795	184	368	150	219	156	228	162	236
22,000	36	2	740	171	342	140	211	148	222	155	233
24,000	28	- 2	690	158	316	126	196	138	215	146	228
26,000	19	- 7	640	146	292	—	—	127	205	137	222
29,000	9	-13	565	129	258	—	—	—	—	—	—

ECONOMY CRUISE POWER - 2000 RPM - ISA +30° C

Figure 5-78f

ECONOMY CRUISE POWER • 2000 RPM • ISA + 37°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level	128	53	1180	312	624	218	228	221	232	225	235
2000	120	49	1155	299	598	212	230	215	235	219	238
4000	113	45	1120	286	572	206	231	210	236	214	240
6000	106	41	1090	273	546	200	232	204	237	208	242
8000	99	37	1050	260	520	193	232	198	238	202	244
10,000	91	33	1005	244	488	186	231	191	237	195	243
12,000	84	29	950	228	456	178	228	183	235	188	242
14,000	77	25	900	214	428	169	226	175	233	181	241
16,000	70	21	840	200	400	161	221	167	228	173	237
18,000	63	17	785	186	372	151	215	158	224	164	233
20,000	54	12	735	173	346	141	207	149	220	155	228
22,000	46	8	670	160	320	126	192	138	210	146	222
24,000	39	4	617	147	294	—	—	125	197	135	214
26,000	32	0	562	135	270	—	—	—	—	—	—
29,000	19	- 7	460	116	232	—	—	—	—	—	—

ECONOMY CRUISE POWER - 2000 RPM - ISA +37°C

Figure 5-78g

ECONOMY CRUISE POWER • 1900 RPM • ISA - 30°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level	9	-13	1628	386	772	246	233	246	233	246	233
2000	1	-17	1628	381	762	246	241	246	241	246	241
4000	- 6	-21	1628	376	752	246	248	246	248	246	248
6000	-13	-25	1628	370	740	246	255	246	255	246	255
8000	-18	-28	1628	365	730	241	257	244	260	246	262
10,000	-26	-32	1628	360	720	238	261	241	264	244	268
12,000	-13	-36	1570	341	682	231	261	234	265	237	268
14,000	-42	-41	1475	321	642	222	260	226	264	229	268
16,000	-49	-45	1380	300	600	214	258	217	261	221	266
18,000	-56	-49	1295	280	560	204	255	208	260	213	264
20,000	-63	-53	1220	262	524	195	251	200	257	204	263
22,000	-71	-57	1130	244	488	185	247	190	254	195	259
24,000	-78	-61	1050	227	454	175	241	181	248	186	256
26,000	-86	-66	965	211	422	165	235	171	244	176	251
29,000	-99	-73	800	190	380	140	211	149	223	158	237

ECONOMY CRUISE POWER - 1900 RPM - ISA -30°C

Figure 5-78i

ECONOMY CRUISE POWER • 1900 RPM • ISA - 20°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level	28	- 2	1628	382	764	246	237	246	237	246	237
2000	21	- 6	1628	375	750	246	245	246	245	246	245
4000	14	-10	1628	370	740	246	252	246	252	246	252
6000	6	-15	1628	365	730	241	255	244	257	246	259
8000	- 2	-19	1628	360	720	239	259	241	262	244	265
10,000	- 9	-23	1605	347	694	235	263	237	266	241	269
12,000	-17	-27	1505	326	652	225	260	228	264	231	267
14,000	-24	-31	1415	305	610	216	258	220	262	223	266
16,000	-31	-35	1325	287	574	207	255	211	259	215	264
18,000	-38	-39	1245	268	536	197	251	202	256	206	262
20,000	-45	-43	1165	252	504	188	248	194	255	198	261
22,000	-53	-47	1085	235	470	180	245	185	252	189	258
24,000	-60	-51	1010	219	438	170	240	175	245	181	255
26,000	-69	-56	935	204	408	160	233	166	241	171	249
29,000	-81	-63	830	182	364	144	221	151	232	158	243

ECONOMY CRUISE POWER - 1900 RPM - ISA -20°C

Figure 5-78i

ECONOMY CRUISE POWER • 1900 RPM • ISA - 10°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level	45	7	1628	376	752	246	241	246	241	246	241
2000	37	3	1628	370	740	246	248	246	248	246	248
4000	30	- 1	1628	364	728	242	253	246	256	246	256
6000	23	- 5	1628	358	716	240	257	242	261	245	263
8000	16	- 9	1610	350	700	235	261	238	264	241	267
10,000	9	-13	1525	331	662	227	261	230	263	233	267
12,000	1	-17	1420	311	622	217	256	221	261	224	264
14,000	- 6	-21	1330	292	584	208	253	212	258	216	263
16,000	-13	-25	1255	273	546	199	251	203	255	208	261
18,000	-20	-29	1170	256	512	190	248	195	252	200	260
20,000	-29	-34	1100	239	478	182	244	187	251	191	257
22,000	-36	-38	1030	225	450	172	239	178	248	183	255
24,000	-44	-42	960	209	418	163	235	169	244	175	252
26,000	-51	-46	890	194	388	154	228	160	238	166	247
29,000	-63	-53	800	175	350	137	215	146	229	153	240

ECONOMY CRUISE POWER - 1900 RPM - ISA -10°C

Figure 5-78j

ECONOMY CRUISE POWER • 1900 RPM • ISA

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level	63	17	1628	368	736	246	246	246	246	246	246
2000	55	13	1628	362	724	242	249	246	253	246	253
4000	48	9	1628	356	712	241	256	243	258	246	261
6000	41	5	1580	346	692	235	257	238	261	241	263
8000	34	1	1500	328	656	227	256	230	260	234	263
10,000	27	- 3	1420	310	620	218	254	221	258	226	263
12,000	19	- 7	1330	291	582	209	252	214	257	217	261
14,000	12	-11	1255	273	546	201	249	205	255	209	260
16,000	5	-15	1175	257	514	192	247	196	252	201	258
18,000	- 2	-19	1085	240	480	182	242	188	249	192	256
20,000	-11	-24	1040	227	454	174	239	180	247	184	253
22,000	-18	-28	975	212	424	165	235	171	243	176	250
24,000	-26	-32	905	198	396	155	228	162	239	168	248
26,000	-33	-36	840	185	370	147	223	154	234	160	243
29,000	-44	-42	760	165	330	128	205	139	223	147	235

ECONOMY CRUISE POWER - 1900 RPM - ISA

Figure 5-78k

ECONOMY CRUISE POWER • 1900 RPM • ISA + 10°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level	81	27	1628	362	724	246	250	246	250	246	250
2000	73	23	1600	358	716	241	252	243	255	246	257
4000	66	19	1540	343	686	234	252	237	256	240	259
6000	59	15	1470	326	652	227	252	230	256	233	259
8000	52	11	1395	310	620	219	250	222	256	226	259
10,000	45	7	1315	292	584	209	248	214	254	217	257
12,000	37	3	1240	276	552	201	246	205	252	209	256
14,000	30	- 1	1175	258	516	193	244	197	250	202	256
16,000	21	- 6	1110	243	486	184	241	189	248	194	255
18,000	14	-10	1045	228	456	175	238	181	246	186	253
20,000	7	-14	970	214	428	167	235	173	242	178	249
22,000	0	-18	910	201	402	157	229	163	238	169	245
24,000	- 8	-22	860	187	374	148	223	155	234	161	242
26,000	-15	-26	795	175	350	137	214	146	227	153	238
29,000	-27	-33	715	158	316	—	—	130	215	139	228

ECONOMY CRUISE POWER - 1900 RPM - ISA +10°C

Figure 5-78

ECONOMY CRUISE POWER • 1900 RPM • ISA + 20°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level	99	37	1510	349	698	236	245	239	248	241	250
2000	91	33	1460	335	670	230	245	234	248	236	252
4000	84	29	1410	319	638	224	246	228	249	230	253
6000	77	25	1355	304	608	217	246	221	249	223	253
8000	70	21	1290	288	576	209	245	213	248	215	252
10,000	63	17	1220	273	546	202	243	205	248	208	251
12,000	55	13	1155	257	514	193	241	197	247	202	251
14,000	48	9	1090	242	484	184	237	189	244	194	249
16,000	41	5	1025	228	456	175	233	180	240	185	247
18,000	32	0	970	214	428	166	229	172	236	177	245
20,000	25	- 4	910	201	402	157	226	163	234	169	242
22,000	18	- 8	850	188	376	148	221	155	230	161	238
24,000	9	-13	800	176	352	139	214	148	227	154	235
26,000	1	-17	750	165	330	128	203	140	221	147	233
29,000	- 9	-23	665	147	294	—	—	—	—	132	221

ECONOMY CRUISE POWER - 1900 RPM - ISA +20°C

Figure 5-78m

ECONOMY CRUISE POWER • 1900 RPM • ISA + 30°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level	117	47	1370	330	660	226	235	229	239	232	241
2000	109	43	1325	317	634	220	238	223	242	227	245
4000	102	39	1295	302	604	215	239	218	242	221	246
6000	95	35	1245	287	574	208	239	212	243	215	248
8000	88	31	1190	272	544	200	237	204	242	208	247
10,000	81	27	1130	258	516	192	236	196	242	201	247
12,000	73	23	1070	242	484	183	233	188	239	193	245
14,000	66	19	1015	227	454	175	229	180	237	185	243
16,000	57	14	950	211	422	166	226	172	234	177	241
18,000	50	10	895	198	396	157	221	163	230	169	238
20,000	43	6	835	184	368	148	217	155	226	161	235
22,000	36	2	775	171	342	138	209	146	221	153	231
24,000	28	- 2	720	157	314	—	—	136	214	144	226
26,000	19	- 7	660	145	290	—	—	—	—	135	218
29,000	9	-13	580	127	254	—	—	—	—	—	—

ECONOMY CRUISE POWER - 1900 RPM - ISA +30°C

Figure 5-78n

ECONOMY CRUISE POWER • 1900 RPM • ISA + 37°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Per Engine Lb./Hr.	Total Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
Sea Level	128	53	1265	317	634	218	228	221	232	225	235
2000	120	49	1240	304	608	212	230	215	234	219	238
4000	113	45	1200	290	580	206	231	210	236	214	240
6000	106	41	1165	277	554	199	231	203	236	208	241
8000	99	37	1120	264	528	192	231	197	237	202	243
10,000	91	33	1070	247	494	185	230	190	236	195	242
12,000	84	29	1010	231	462	177	227	182	234	188	241
14,000	77	25	955	216	432	168	224	174	231	179	239
16,000	70	21	890	202	404	158	219	165	227	171	235
18,000	63	17	830	187	374	149	213	156	222	162	231
20,000	54	12	775	174	348	139	205	148	218	154	227
22,000	46	8	705	160	320	—	—	136	208	144	221
24,000	39	4	645	147	294	—	—	—	—	134	212
26,000	32	0	585	135	270	—	—	—	—	—	—
29,000	19	- 7	475	115	230	—	—	—	—	—	—

ECONOMY CRUISE POWER- 1900 RPM - ISA +37°C
Figure 5-78o

MAXIMUM RANGE POWER • 1900 RPM • ISA - 30°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	9000 Pounds Torque Per Engine Lb. Ft.	9000 Pounds Fuel Flow Total Lb./Hr.	9000 Pounds Airspeed KTS CAS	9000 Pounds Airspeed KTS TAS	8000 Pounds Torque Per Engine Lb. Ft.	8000 Pounds Fuel Flow Total Lb./Hr.	8000 Pounds Airspeed KTS CAS	8000 Pounds Airspeed KTS TAS	7000 Pounds Torque Per Engine Lb. Ft.	7000 Pounds Fuel Flow Total Lb./Hr.	7000 Pounds Airspeed KTS CAS	7000 Pounds Airspeed KTS TAS
Sea Level	9	-13	760	478	175	166	690	454	169	160	600	424	165	156
2000	1	-17	740	458	171	168	670	436	165	161	580	406	160	157
4000	- 6	-21	720	440	168	168	650	416	162	164	560	386	157	158
6000	-13	-25	710	424	163	169	640	402	158	165	550	368	154	158
8000	-18	-28	700	406	159	170	630	380	155	166	540	352	151	160
10,000	-26	-32	690	390	156	172	620	366	152	167	530	338	148	162
12,000	-13	-36	680	378	153	173	610	354	149	169	520	324	145	164
14,000	-42	-41	670	362	150	175	600	338	146	170	520	314	142	167
16,000	-49	-45	665	348	147	177	600	326	142	172	520	304	141	169
18,000	-56	-49	660	336	143	177	600	314	139	173	520	294	139	173
20,000	-63	-53	655	324	141	181	600	304	135	175	520	282	136	175
22,000	-71	-57	655	314	138	183	600	292	133	176	520	276	134	178
24,000	-78	-61	655	306	134	185	600	288	129	178	520	264	131	181
26,000	-86	-66	655	298	132	188	600	274	127	181	520	256	128	182
29,000	-99	-73	655	290	128	192	600	266	—	—	520	246	—	—

MAXIMUM RANGE POWER - 1900 RPM - ISA -30°C
Figure 5-79

MAXIMUM RANGE POWER • 1900 RPM • ISA - 20°C

			9000 Pounds				8000 Pounds				7000 Pounds			
Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Per Engine Lb. Ft.	Fuel Flow Total Lb./Hr.	Airspeed KTS CAS	Airspeed KTS TAS	Torque Per Engine Lb. Ft.	Fuel Flow Total Lb./Hr.	Airspeed KTS CAS	Airspeed KTS TAS	Torque Per Engine Lb. Ft.	Fuel Flow Total Lb./Hr.	Airspeed KTS CAS	Airspeed KTS TAS
Sea Level	28	- 2	770	482	175	169	700	458	169	163	610	428	165	159
2000	21	- 6	750	462	171	170	680	440	165	164	590	410	160	159
4000	14	-10	730	444	167	171	660	420	162	167	570	390	157	161
6000	6	-15	720	428	163	172	650	406	158	168	560	372	154	161
8000	- 2	-19	710	410	159	174	640	384	155	168	550	356	154	164
10,000	- 9	-23	700	394	156	175	630	370	152	170	540	342	148	165
12,000	-17	-27	690	382	153	176	620	358	149	173	530	328	145	168
14,000	-24	-31	680	366	150	179	610	342	146	174	520	312	142	168
16,000	-31	-35	675	352	147	181	605	328	142	175	520	302	139	171
18,000	-38	-39	670	340	143	182	605	316	139	176	520	292	137	175
20,000	-45	-43	665	328	140	184	605	306	135	178	520	280	134	177
22,000	-53	-47	665	318	137	187	605	294	133	181	520	274	132	180
24,000	-60	-51	665	310	134	188	605	290	129	182	520	262	129	182
26,000	-69	-56	665	302	131	191	605	276	127	185	520	254	126	183
29,000	-81	-63	665	294	126	193	605	268	—	—	520	244	—	—

MAXIMUM RANGE POWER - 1900 RPM - ISA -20°C

Figure 5-81

MAXIMUM RANGE POWER • 1900 RPM • ISA - 10°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	9000 Pounds Torque Per Engine Lb. Ft.	9000 Pounds Fuel Flow Total Lb./Hr.	9000 Pounds Airspeed KTS CAS	9000 Pounds Airspeed KTS TAS	8000 Pounds Torque Per Engine Lb. Ft.	8000 Pounds Fuel Flow Total Lb./Hr.	8000 Pounds Airspeed KTS CAS	8000 Pounds Airspeed KTS TAS	7000 Pounds Torque Per Engine Lb. Ft.	7000 Pounds Fuel Flow Total Lb./Hr.	7000 Pounds Airspeed KTS CAS	7000 Pounds Airspeed KTS TAS
Sea Level	45	7	780	486	175	173	710	462	169	167	620	432	165	162
2000	37	3	760	466	171	173	690	444	165	167	600	414	160	162
4000	30	-1	740	448	167	174	670	424	162	169	580	394	157	164
6000	23	-5	730	432	163	175	660	410	158	170	570	376	154	165
8000	16	-9	720	414	159	177	650	388	155	172	560	360	151	167
10,000	9	-13	710	398	156	179	640	374	152	174	550	346	148	168
12,000	1	-17	700	386	153	180	630	362	149	176	540	332	145	171
14,000	- 6	-21	690	370	150	182	620	346	146	177	530	316	142	172
16,000	-13	-25	685	356	147	185	615	332	142	179	525	302	139	175
18,000	-20	-29	680	344	143	186	615	320	139	181	520	290	135	176
20,000	-29	-34	675	332	140	188	615	310	135	182	520	278	133	178
22,000	-36	-38	675	322	137	190	615	298	133	185	520	272	130	181
24,000	-44	-42	675	314	134	193	615	294	129	186	520	260	127	182
26,000	-51	-46	675	306	130	194	615	280	127	188	520	252	—	—
29,000	-63	-53	675	298	125	196	615	272	—	—	520	242	—	—

MAXIMUM RANGE POWER - 1900 RPM - ISA -10°C

Figure 5-83

MAXIMUM RANGE POWER • 1900 RPM • ISA

Pressure Altitude Ft.	IOAT °F	IOAT °C	9000 Pounds Torque Per Engine Lb. Ft.	9000 Pounds Fuel Flow Total Lb./Hr.	9000 Pounds Airspeed KTS CAS	9000 Pounds Airspeed KTS TAS	8000 Pounds Torque Per Engine Lb. Ft.	8000 Pounds Fuel Flow Total Lb./Hr.	8000 Pounds Airspeed KTS CAS	8000 Pounds Airspeed KTS TAS	7000 Pounds Torque Per Engine Lb. Ft.	7000 Pounds Fuel Flow Total Lb./Hr.	7000 Pounds Airspeed KTS CAS	7000 Pounds Airspeed KTS TAS
Sea Level	63	17	790	490	175	175	720	466	169	169	630	436	165	165
2000	55	13	770	470	171	176	700	448	165	170	610	418	160	166
4000	48	9	750	452	167	177	680	428	162	172	590	398	157	167
6000	41	5	740	436	163	179	670	410	158	174	575	380	154	168
8000	34	1	730	418	159	181	660	392	155	175	565	362	151	170
10,000	27	- 3	720	402	156	182	650	378	152	177	555	348	148	172
12,000	19	- 7	710	390	153	184	640	366	149	179	545	334	145	174
14,000	12	-11	700	374	150	186	630	350	146	181	540	320	142	175
16,000	5	-15	695	360	147	188	625	336	142	182	535	306	139	178
18,000	- 2	-19	690	348	143	190	620	324	139	184	535	294	135	180
20,000	-11	-24	685	336	140	192	615	314	135	186	530	282	133	182
22,000	-18	-28	685	326	137	195	615	302	133	188	530	276	130	184
24,000	-26	-32	685	318	134	196	615	294	129	190	530	264	127	186
26,000	-33	-36	685	310	130	198	615	284	127	193	530	256	—	—
29,000	-44	-42	685	302	125	201	615	276	—	—	530	246	—	—

MAXIMUM RANGE POWER - 1900 RPM - ISA

Figure 5-85

MAXIMUM RANGE POWER • 1900 RPM • ISA + 10°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	9000 Pounds Torque Per Engine Lb. Ft.	9000 Pounds Fuel Flow Total Lb./Hr.	9000 Pounds Airspeed KTS CAS	9000 Pounds Airspeed KTS TAS	8000 Pounds Torque Per Engine Lb. Ft.	8000 Pounds Fuel Flow Total Lb./Hr.	8000 Pounds Airspeed KTS CAS	8000 Pounds Airspeed KTS TAS	7000 Pounds Torque Per Engine Lb. Ft.	7000 Pounds Fuel Flow Total Lb./Hr.	7000 Pounds Airspeed KTS CAS	7000 Pounds Airspeed KTS TAS
Sea Level	81	27	800	494	175	179	730	470	169	173	640	440	165	168
2000	73	23	780	474	171	179	710	452	165	173	620	422	160	168
4000	66	19	760	456	167	180	690	432	162	175	600	402	157	169
6000	59	15	750	440	163	182	680	414	158	176	590	384	154	171
8000	52	11	740	422	159	183	670	396	155	179	580	366	151	174
10,000	45	7	730	406	156	185	660	382	152	180	570	352	148	175
12,000	37	3	720	394	153	187	650	370	149	183	560	338	145	177
14,000	30	- 1	710	378	149	189	640	354	146	185	550	324	142	179
16,000	21	- 6	705	364	146	191	635	340	142	187	545	310	139	182
18,000	14	-10	700	352	142	193	630	328	139	188	540	298	135	183
20,000	7	-14	695	340	139	195	625	318	135	189	540	286	132	185
22,000	0	-18	695	330	136	198	625	306	132	191	540	280	129	188
24,000	- 8	-22	695	322	133	200	625	298	129	193	540	268	126	189
26,000	-15	-26	695	314	129	202	625	288	126	196	540	260	—	—
29,000	-27	-33	695	306	—	—	625	280	—	—	540	250	—	—

MAXIMUM RANGE POWER - 1900 RPM - ISA +10°C

Figure 5-87

MAXIMUM RANGE POWER • 1900 RPM • ISA + 20°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	9000 Pounds Torque Per Engine Lb. Ft.	9000 Pounds Fuel Flow Total Lb./Hr.	9000 Pounds Airspeed KTS CAS	9000 Pounds Airspeed KTS TAS	8000 Pounds Torque Per Engine Lb. Ft.	8000 Pounds Fuel Flow Total Lb./Hr.	8000 Pounds Airspeed KTS CAS	8000 Pounds Airspeed KTS TAS	7000 Pounds Torque Per Engine Lb. Ft.	7000 Pounds Fuel Flow Total Lb./Hr.	7000 Pounds Airspeed KTS CAS	7000 Pounds Airspeed KTS TAS
Sea Level	99	37	810	498	175	182	740	474	169	175	650	444	165	171
2000	91	33	790	478	171	182	720	456	165	175	630	426	160	171
4000	84	29	770	460	167	182	700	436	162	178	610	406	157	172
6000	77	25	760	444	163	185	690	418	158	180	600	388	154	174
8000	70	21	750	426	159	187	680	400	155	182	590	370	151	176
10,000	63	17	740	410	156	188	670	386	152	183	580	356	148	178
12,000	55	13	730	398	152	189	660	374	149	186	570	342	145	181
14,000	48	9	720	382	148	191	650	358	146	188	560	328	142	182
16,000	41	5	715	368	146	194	645	344	142	189	555	314	139	185
18,000	32	0	710	356	142	196	640	332	139	191	550	302	135	187
20,000	25	- 4	705	346	139	198	635	322	135	193	550	290	132	188
22,000	18	- 8	705	334	136	202	635	310	132	195	550	284	129	191
24,000	9	-13	705	326	133	203	635	302	129	197	550	272	126	193
26,000	1	-17	705	318	129	204	635	292	126	200	550	260	—	—
29,000	FOR VALUES ABOVE 26,000 FT. REFER TO ECONOMY CRUISE POWER TABLES.													

MAXIMUM RANGE POWER - 1900 RPM - ISA +20°C

Figure 5-89

MAXIMUM RANGE POWER • 1900 RPM • ISA + 30°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	9000 Pounds Torque Per Engine Lb. Ft.	9000 Pounds Fuel Flow Total Lb./Hr.	9000 Pounds Airspeed KTS CAS	9000 Pounds Airspeed KTS TAS	8000 Pounds Torque Per Engine Lb. Ft.	8000 Pounds Fuel Flow Total Lb./Hr.	8000 Pounds Airspeed KTS CAS	8000 Pounds Airspeed KTS TAS	7000 Pounds Torque Per Engine Lb. Ft.	7000 Pounds Fuel Flow Total Lb./Hr.	7000 Pounds Airspeed KTS CAS	7000 Pounds Airspeed KTS TAS
Sea Level	117	47	820	502	175	182	750	478	169	176	660	448	165	172
2000	109	43	800	482	171	185	730	460	165	179	640	430	160	174
4000	102	39	780	464	167	186	710	440	162	181	620	410	157	175
6000	95	35	770	448	163	188	700	422	158	182	610	392	154	176
8000	88	31	760	430	159	189	690	404	155	184	600	374	151	179
10,000	81	27	750	414	156	192	680	390	152	187	590	360	148	182
12,000	73	23	740	402	152	193	670	378	149	189	580	346	145	184
14,000	66	19	730	386	148	195	660	362	146	191	570	332	142	186
16,000	57	14	725	372	146	197	655	348	142	193	565	318	139	188
18,000	50	10	720	360	142	199	650	336	139	195	560	306	135	190
20,000	43	6	715	350	139	202	645	326	135	197	560	294	132	192
22,000	36	2	715	338	136	205	645	314	132	199	560	288	129	195
24,000	28	- 2	715	330	133	208	645	306	129	201	560	276	126	196
26,000														
29,000			FOR VALUES ABOVE 24,000 FT. REFER TO ECONOMY CRUISE POWER TABLES											

MAXIMUM RANGE POWER - 1900 RPM - ISA +30°C

Figure 5-91

MAXIMUM RANGE POWER • 1900 RPM • ISA + 37°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	9000 Pounds Torque Per Engine Lb. Ft.	9000 Pounds Fuel Flow Total Lb./Hr.	9000 Pounds Airspeed KTS CAS	9000 Pounds Airspeed KTS TAS	8000 Pounds Torque Per Engine Lb. Ft.	8000 Pounds Fuel Flow Total Lb./Hr.	8000 Pounds Airspeed KTS CAS	8000 Pounds Airspeed KTS TAS	7000 Pounds Torque Per Engine Lb. Ft.	7000 Pounds Fuel Flow Total Lb./Hr.	7000 Pounds Airspeed KTS CAS	7000 Pounds Airspeed KTS TAS
Sea Level	128	53	825	504	175	182	755	480	169	177	665	450	165	173
2000	120	49	805	484	170	185	735	462	165	180	645	432	160	175
4000	113	45	785	466	167	188	715	442	162	182	625	412	157	176
6000	106	41	775	450	163	190	705	424	158	185	615	394	154	179
8000	99	37	765	432	159	193	695	406	155	188	605	376	151	182
10,000	91	33	755	416	156	195	685	392	152	188	595	362	148	183
12,000	84	29	745	404	152	195	675	380	149	192	585	348	145	186
14,000	77	25	735	388	148	198	665	364	146	195	575	334	142	188
16,000	70	21	730	374	145	199	660	350	142	195	570	320	139	190
18,000	63	17	725	362	142	202	655	338	139	197	565	308	135	193
20,000	54	12	725	352	137	202	650	328	134	198	560	296	132	195
22,000														
24,000														
26,000			FOR VALUES ABOVE 20,000 FT. REFER TO ECONOMY CRUISE POWER TABLES											
29,000														

MAXIMUM RANGE POWER - 1900 RPM - ISA +37°C

Figure 5-93

SINGLE ENGINE CRUISE POWER

2000 RPM • ISA -30°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Lb./Ft.	Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
10,000	-26	-32	1628	374	175	192	177	195	180	197
12,000	-33	-36	1610	364	171	194	174	196	176	200
14,000	-42	-41	1500	345	162	189	166	194	169	198
16,000	-49	-45	1400	321	153	184	158	189	161	195
18,000	-56	-49	1290	299	142	177	148	183	154	191
20,000	-63	-53	1185	280	129	167	136	175	145	187

SINGLE-ENGINE CRUISE POWER - 2000 RPM - ISA -30° C

Figure 5-95

SINGLE ENGINE CRUISE POWER

2000 RPM • ISA - 20°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Lb./Ft.	Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
10,000	- 9	-23	1628	374	173	194	175	196	178	200
12,000	-17	-27	1525	350	165	190	168	194	171	197
14,000	-24	-31	1430	328	156	187	160	191	165	195
16,000	-31	-35	1340	306	148	182	152	188	157	194
18,000	-38	-39	1235	285	135	172	142	181	149	190
20,000	-45	-43	1135	264	—	—	129	170	140	184

SINGLE-ENGINE CRUISE POWER - 2000 RPM - ISA -20° C

Figure 5-97

SINGLE ENGINE CRUISE POWER

2000 RPM • ISA - 10°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Lb./Ft.	Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
10,000	9	-13	1555	356	168	192	170	195	174	199
12,000	1	-17	1450	332	158	188	162	191	166	195
14,000	- 6	-21	1360	310	150	182	154	188	158	194
16,000	-13	-25	1270	290	140	176	145	182	152	191
18,000	-20	-29	1175	272	127	165	134	175	143	186
20,000	-29	-34	1070	250	—	—	—	—	134	180

SINGLE-ENGINE CRUISE POWER - 2000 RPM - ISA -10°C

Figure 5-99

SINGLE ENGINE CRUISE POWER

2000 RPM • ISA

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Lb./Ft.	Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
10,000	27	- 3	1460	340	160	187	164	191	168	195
12,000	19	- 7	1375	314	152	182	156	188	160	193
14,000	12	-11	1280	297	142	176	148	182	154	190
16,000	5	-15	1190	278	130	167	137	175	146	187
18,000	- 2	-19	1110	260	—	—	125	166	137	182
20,000	-11	-24	1000	236	—	—	—	—	126	173

SINGLE-ENGINE CRUISE POWER - 2000 RPM - ISA

Figure 5-101

SINGLE ENGINE CRUISE POWER

2000 RPM • ISA + 10°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Lb./Ft.	Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
10,000	45	7	1375	323	154	182	157	186	161	191
12,000	37	3	1285	301	144	176	149	183	154	189
14,000	30	- 1	1205	283	134	169	140	177	148	187
16,000	21	- 6	1120	265	—	—	128	167	139	182
18,000	14	-10	1040	247	—	—	—	—	131	177
20,000	7	-14	945	226	—	—	—	—	—	—

SINGLE-ENGINE CRUISE POWER - 2000 RPM - ISA +10°C

Figure 5-102

SINGLE ENGINE CRUISE POWER

2000 RPM • ISA + 20°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Lb./Ft.	Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
10,000	63	17	1280	307	145	175	150	181	155	188
12,000	55	13	1200	288	134	168	141	175	148	185
14,000	48	9	1125	270	—	—	131	168	141	181
16,000	41	5	1045	252	—	—	—	—	132	176
18,000	32	0	970	234	—	—	—	—	—	—
20,000										

SINGLE-ENGINE CRUISE POWER - 2000 RPM - ISA +20°C

Figure 5-103

SINGLE ENGINE CRUISE POWER

2000 RPM • ISA + 30°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Lb./Ft.	Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
10,000	81	27	1190	291	135	166	142	174	148	182
12,000	73	23	1120	275	—	—	132	168	142	180
14,000	66	19	1040	260	—	—	—	—	134	175
16,000	57	14	955	240	—	—	—	—	—	—
18,000										
20,000										

SINGLE-ENGINE CRUISE POWER - 2000 RPM - ISA +30°C

Figure 5-104

SINGLE ENGINE CRUISE POWER

2000 RPM • ISA + 37°C

Pressure Altitude Ft.	IOAT °F	IOAT °C	Torque Lb./Ft.	Fuel Flow Lb./Hr.	Airspeed - KTS 9000 Lb. CAS	9000 Lb. TAS	8000 Lb. CAS	8000 Lb. TAS	7000 Lb. CAS	7000 Lb. TAS
10,000	91	33	1130	280	128	158	135	168	144	179
12,000	84	29	1060	267	—	—	—	—	136	175
14,000	77	25	980	254	—	—	—	—	127	169
16,000										
18,000										
20,000										

SINGLE-ENGINE CRUISE POWER - 2000 RPM - ISA +37°C

Figure 5-105

SPECIFIC RANGE

MAXIMUM CRUISE POWER 2000 RPM 8000 LBS.

Pressure Altitude Ft.	SPECIFIC RANGE — NAU. MI./LB.							
	ISA -30°C	ISA -20°C	ISA -10°C	ISA	ISA +10°C	ISA +20°C	ISA +30°C	ISA +37°C
0								
2000								
4000								
6000								
8,000								
10,000	.374	.380	.383	.385	.405	.419	.435	.447
12,000	.383	.388	.393	.408	.427	.443	.459	.471
14,000	.394	.401	.413	.433	.451	.467	.483	.496
16,000	.410	.422	.436	.456	.476	.491	.508	.521
18,000	.437	.447	.463	.481	.500	.518	.538	.546
20,000	.459	.473	.491	.508	.528	.544	.565	.575
22,000	.491	.502	.523	.536	.551	.572	.596	.609
24,000	.525	.532	.554	.565	.581	.596	.624	.638
26,000	.557	.569	.575	.592	.608	.629	.648	.659
29,000	.599	.609	.621	.638	.659	.660	.674	—

SPECIFIC RANGE - MAXIMUM CRUISE POWER - 2000 RPM - 8000 LBS.
Figure 5-106

SPECIFIC RANGE

MAXIMUM CRUISE POWER 1900 RPM 8000 LBS.

Pressure Altitude Ft.	SPECIFIC RANGE — NAU. MI./LB.							
	ISA -30°C	ISA -20°C	ISA -10°C	ISA	ISA +10°C	ISA +20°C	ISA +30°C	ISA +37°C
0								
2000								
4000								
6000								
8,000								
10,000	.377	.376	.376	.375	.402	.408	.429	.442
12,000	.386	.383	.388	.403	.425	.440	.452	.465
14,000	.395	.394	.410	.429	.447	.461	.478	.488
16,000	.408	.421	.433	.453	.473	.487	.502	.512
18,000	.438	.448	.464	.479	.496	.512	.532	.537
20,000	.459	.475	.491	.508	.524	.536	.561	.566
22,000	.491	.500	.520	.538	.549	.566	.592	.601
24,000	.524	.530	.553	.564	.578	.590	.612	.625
26,000	.560	.570	.575	.597	.603	.624	.633	.640
29,000	.587	.617	.611	.642	.646	.656	—	—

SPECIFIC RANGE - MAXIMUM CRUISE POWER - 1900 RPM - 8000 LBS.
Figure 5-107

SPECIFIC RANGE

ECONOMY CRUISE POWER 2000 RPM 8000 LBS.

Pressure Altitude Ft.	SPECIFIC RANGE—NAU. MI./LB.							
	ISA -30°C	ISA -20°C	ISA -10°C	ISA	ISA +10°C	ISA +20°C	ISA +30°C	ISA +37°C
0	.298	.306	.316	.326	.339	.357	.367	.372
2000	.313	.321	.331	.340	.361	.375	.385	.393
4000	.326	.335	.346	.360	.378	.393	.405	.413
6000	.340	.348	.361	.380	.397	.413	.430	.434
8000	.352	.362	.383	.401	.417	.436	.454	.458
10,000	.368	.378	.405	.421	.438	.458	.475	.486
12,000	.389	.410	.425	.445	.462	.482	.502	.515
14,000	.414	.435	.447	.469	.488	.508	.531	.544
16,000	.439	.457	.475	.492	.514	.531	.560	.570
18,000	.461	.483	.500	.521	.539	.558	.589	.602
20,000	.493	.510	.529	.543	.569	.587	.620	.636
22,000	.520	.535	.557	.577	.596	.618	.649	.656
24,000	.549	.564	.587	.606	.624	.649	.680	.670
26,000	.578	.592	.618	.632	.660	.674	.702	—
29,000	.590	.634	.660	.675	.682	.697	—	—

SPECIFIC RANGE - ECONOMY CRUISE POWER - 2000 RPM - 8000 LBS.
Figure 5-108

SPECIFIC RANGE

ECONOMY CRUISE POWER 1900 RPM 8000 LBS.

Pressure Altitude Ft.	SPECIFIC RANGE—NAU. MI./LB.							
	ISA -30°C	ISA -20°C	ISA -10°C	ISA	ISA +10°C	ISA +20°C	ISA +30°C	ISA +37°C
0	.302	.310	.320	.334	.345	.355	.362	.366
2000	.316	.327	.335	.349	.356	.370	.382	.385
4000	.330	.341	.351	.362	.373	.390	.401	.407
6000	.345	.352	.365	.377	.393	.410	.423	.426
8000	.356	.364	.377	.396	.413	.431	.445	.449
10,000	.367	.383	.397	.416	.435	.454	.469	.478
12,000	.389	.405	.420	.442	.456	.481	.494	.506
14,000	.411	.430	.438	.467	.484	.504	.522	.535
16,000	.435	.451	.467	.490	.510	.526	.555	.562
18,000	.464	.478	.492	.519	.539	.551	.581	.595
20,000	.490	.506	.525	.544	.565	.582	.614	.626
22,000	.521	.536	.551	.573	.592	.612	.646	.650
24,000	.546	.559	.584	.604	.627	.645	.682	
26,000	.578	.591	.613	.632	.649	.670		—
29,000	.587	.637	.654	.675	.680	—	—	—

SPECIFIC RANGE - ECONOMY CRUISE POWER - 1900 RPM - 8000 LBS.
Figure 5-109

SPECIFIC RANGE

MAXIMUM RANGE POWER 1900 RPM 8000 LBS.

Pressure Altitude Ft.	SPECIFIC RANGE — NAU. MI./LB.							
	ISA -30°C	ISA -20°C	ISA -10°C	ISA	ISA +10°C	ISA +20°C	ISA +30°C	ISA +37°C
0	.352	.356	.361	.363	.368	.369	.369	.369
2000	.369	.373	.376	.379	.383	.384	.389	.390
4000	.394	.398	.399	.402	.405	.408	.411	.412
6000	.410	.414	.415	.424	.425	.431	.431	.436
8000	.437	.438	.443	.446	.452	.455	.458	.463
10,000	.456	.459	.465	.468	.471	.474	.478	.480
12,000	.477	.483	.486	.489	.495	.497	.500	.505
14,000	.503	.509	.512	.517	.523	.525	.528	.536
16 000	.528	.534	.539	.542	.550	.549	.555	.557
18 000	.551	.557	.566	.568	.573	.575	.580	.574
20,000	.576	.582	.587	.592	.594	.599	.604	.604
22,000	.603	.616	.621	.623	.624	.629	.634	–
24,000	.618	.628	.633	.646	.648	.652	.657	–
26,000	.661	.667	.671	.678	.681	.685	–	–
29,000							–	–

SPECIFIC RANGE - MAXIMUM RANGE POWER - 1900 RPM - 8000 LBS.
Figure 5-110

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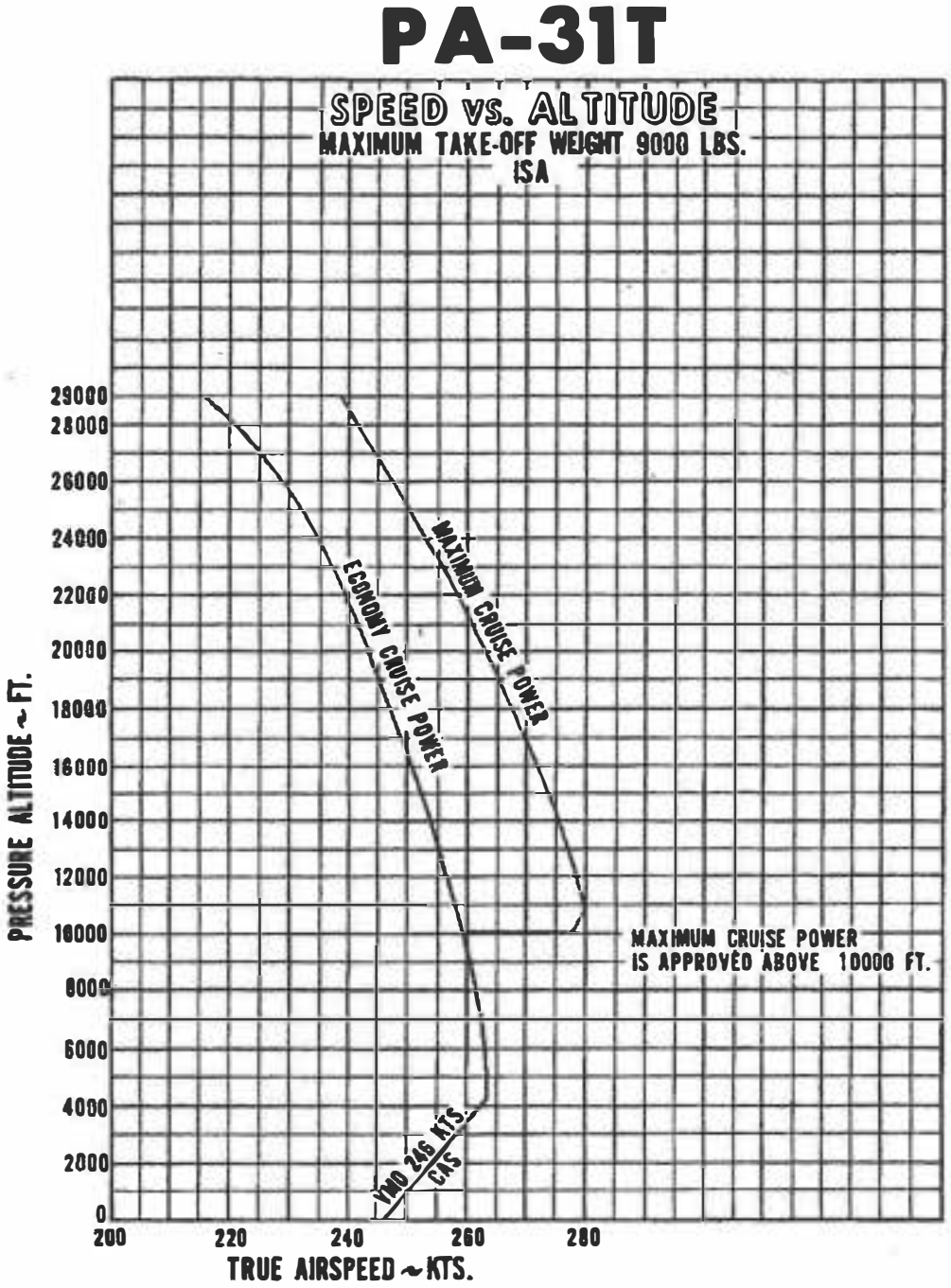
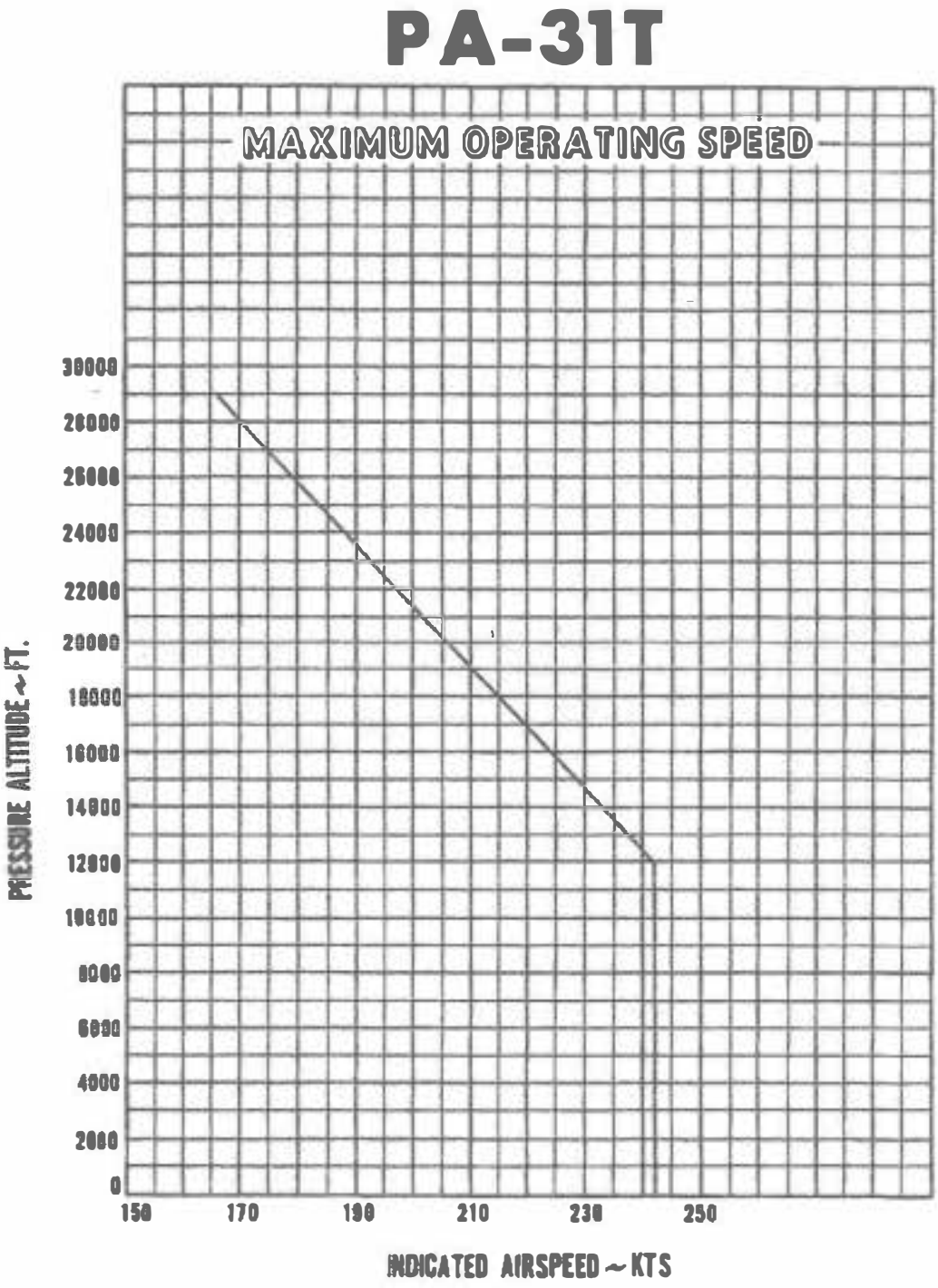


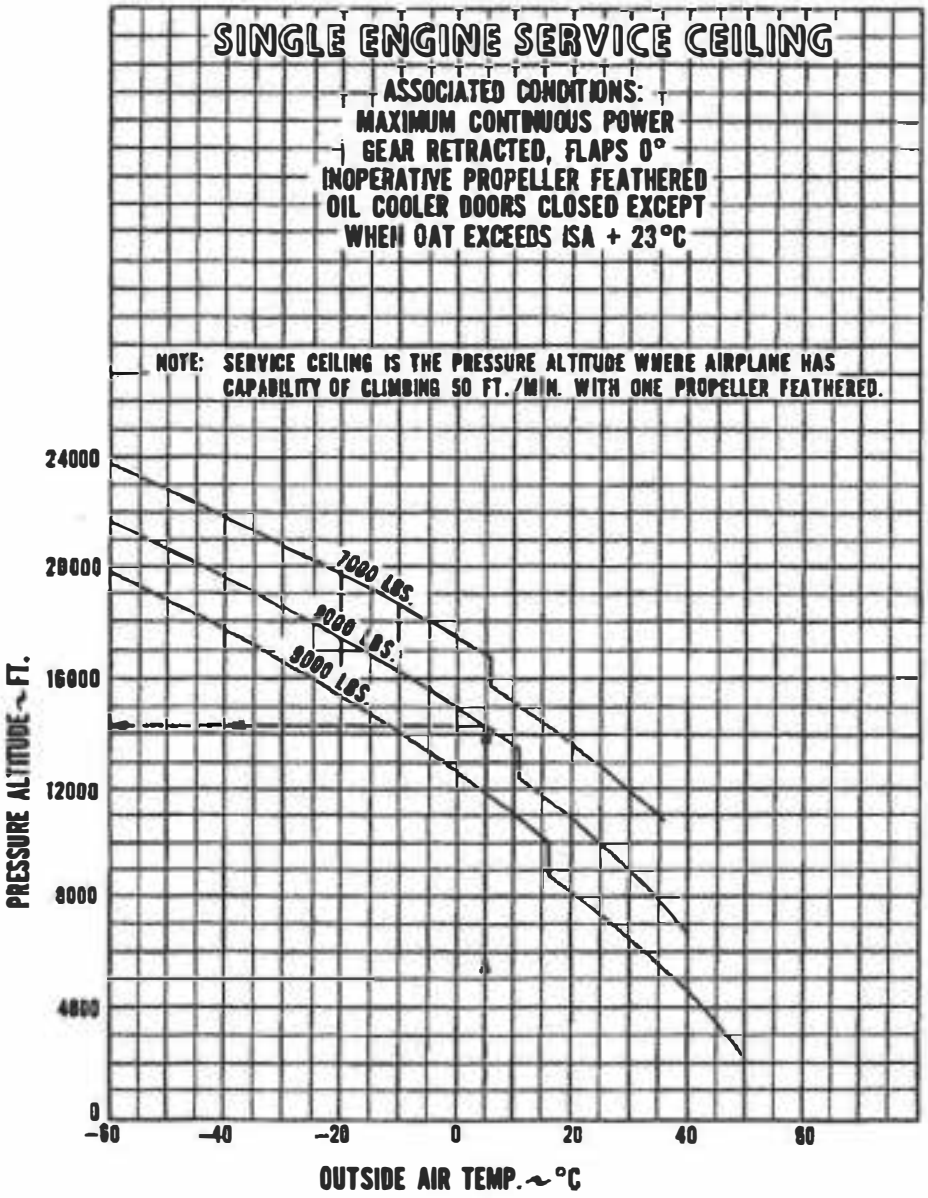
SPEED VS. ALTITUDE

Figure 5- 111



MAXIMUM OPERATING SPEED
Figure 5-113

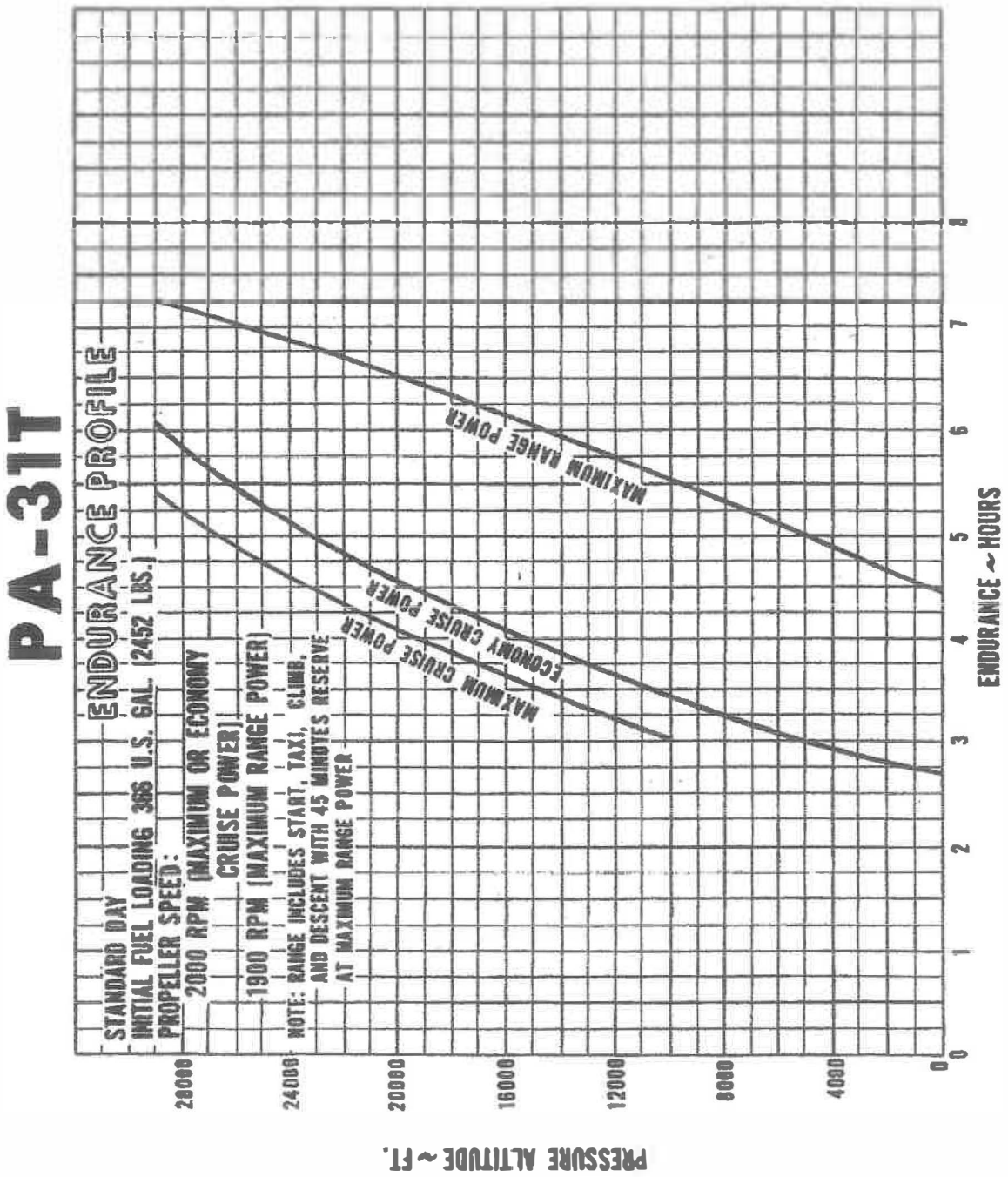
PA-31T



Example:
Outside air temperature: +5°C
Weight: 8000 lbs.
Service ceiling: 14,400 ft.

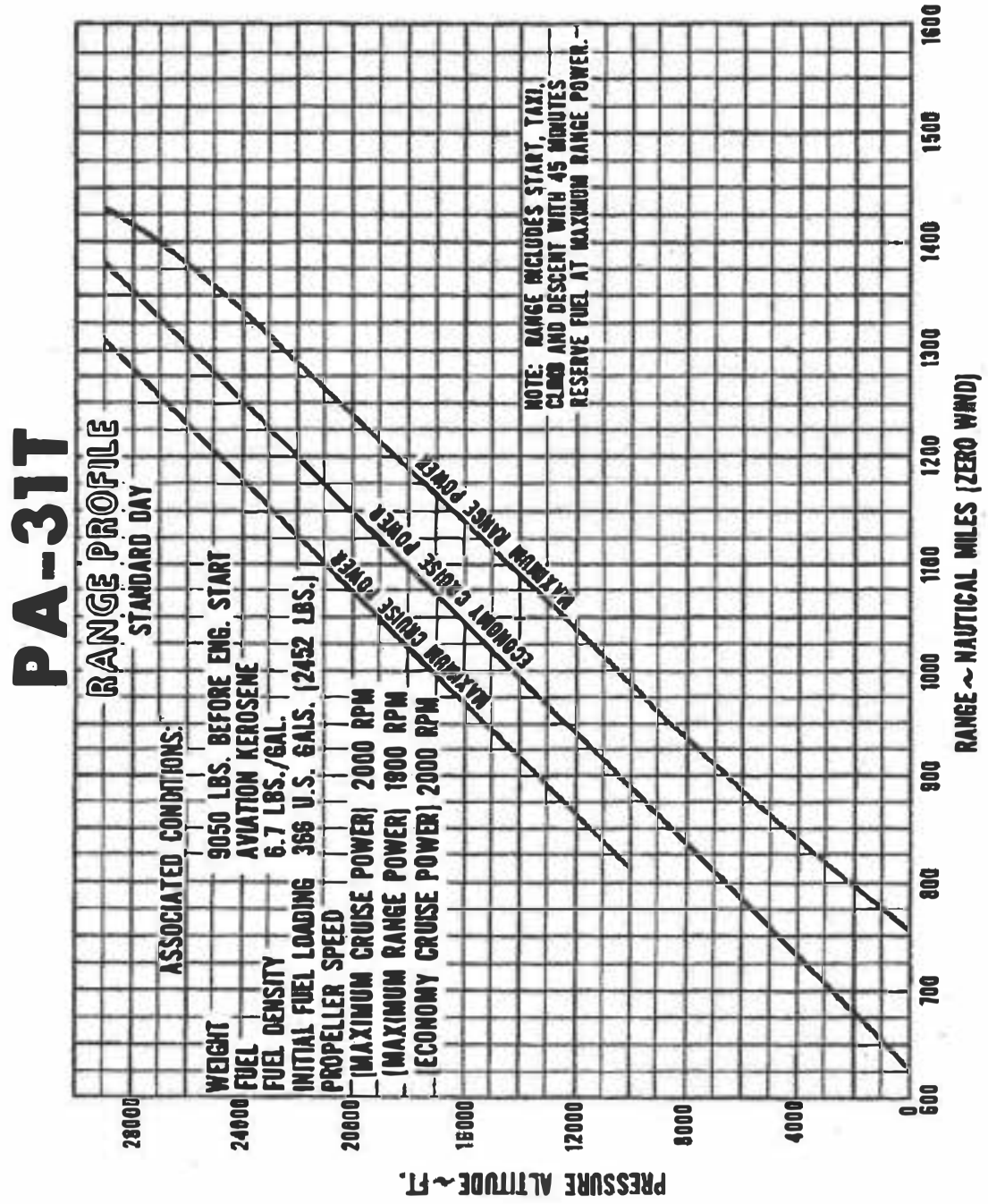
SINGLE-ENGINE SERVICE CEILING

Figure 5-115



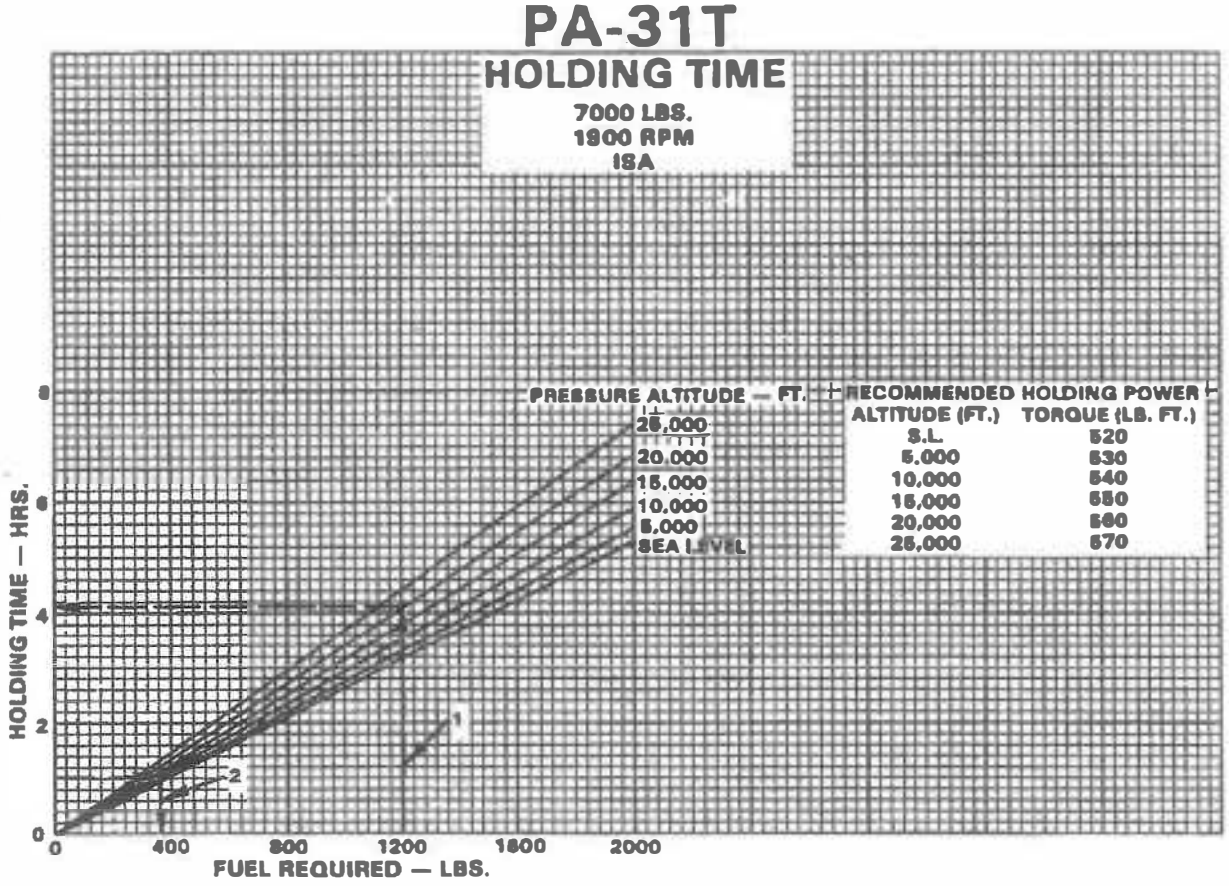
ENDURANCE PROFILE

Figure 5-117



RANGE PROFILE

Figure 5-119



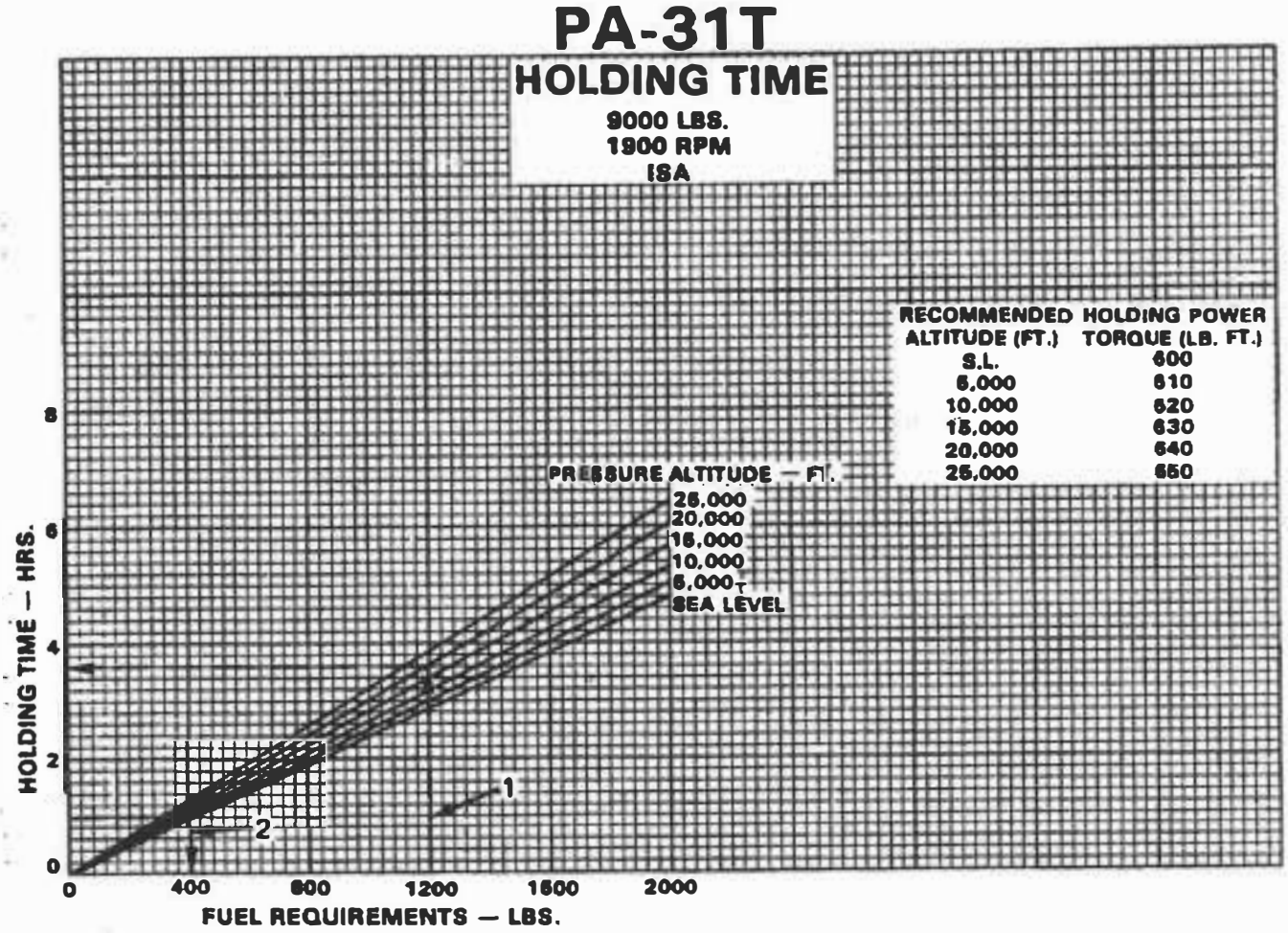
Examples:

1. Fuel available for holding: 1200 lbs.
   Pressure altitude: 20,000 ft.
   Holding time: 4.1 hrs.

2. Required holding time: 1 hr.
   Pressure altitude: 5,000 ft.
   Fuel required: 360 lbs.

HOLDING TIME - 7000 LBS

Figure 5-121



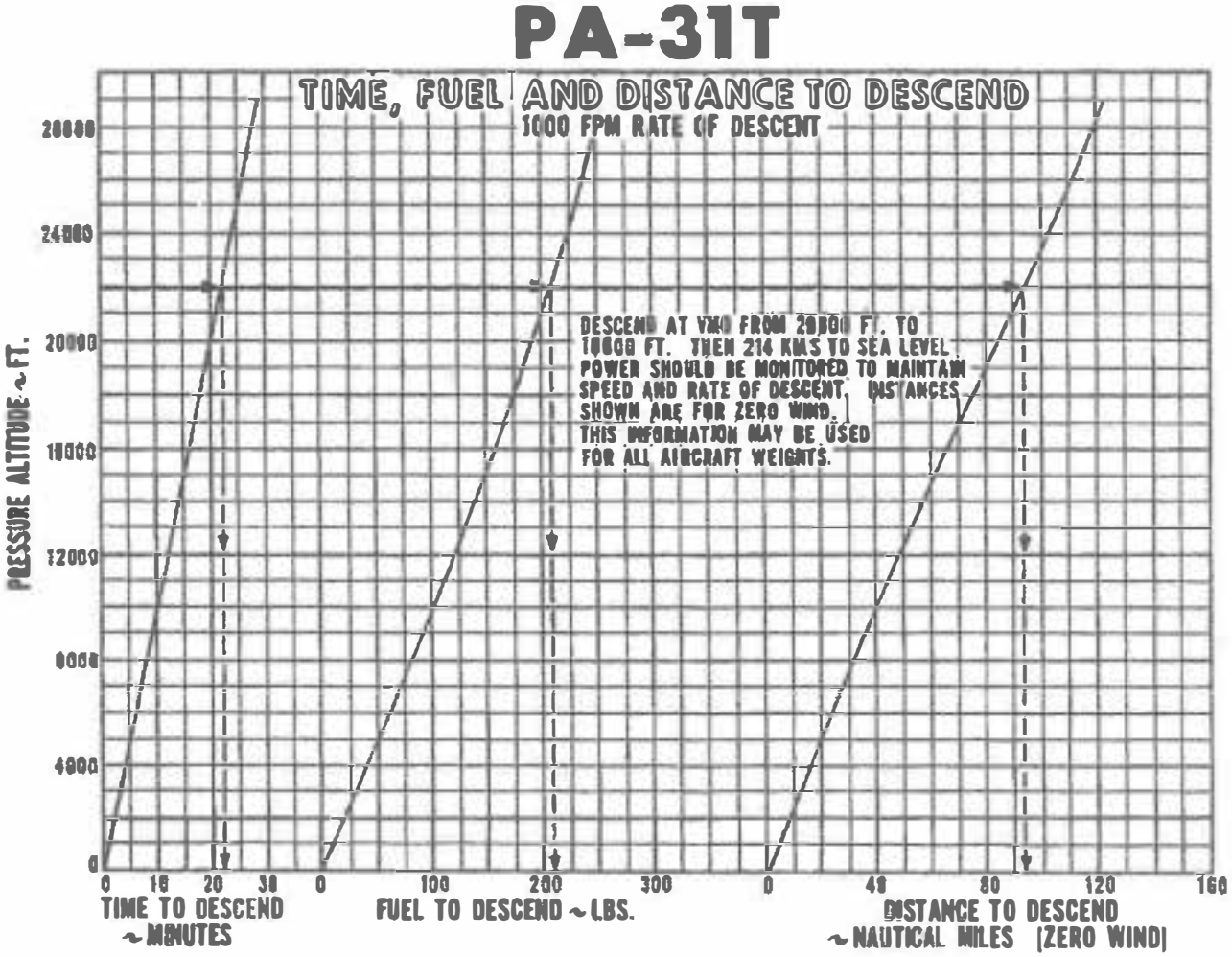
Examples:

1. Fuel available for holding: 1200 lbs.
   Pressure altitude: 20,000 ft.
   Holding time: 3.6 hrs.

2. Required holding time: 1 hr.
   Pressure altitude: 5,000 ft.
   Fuel required: 400 lbs.

HOLDING TIME - 9000 LBS

Figure 5-123

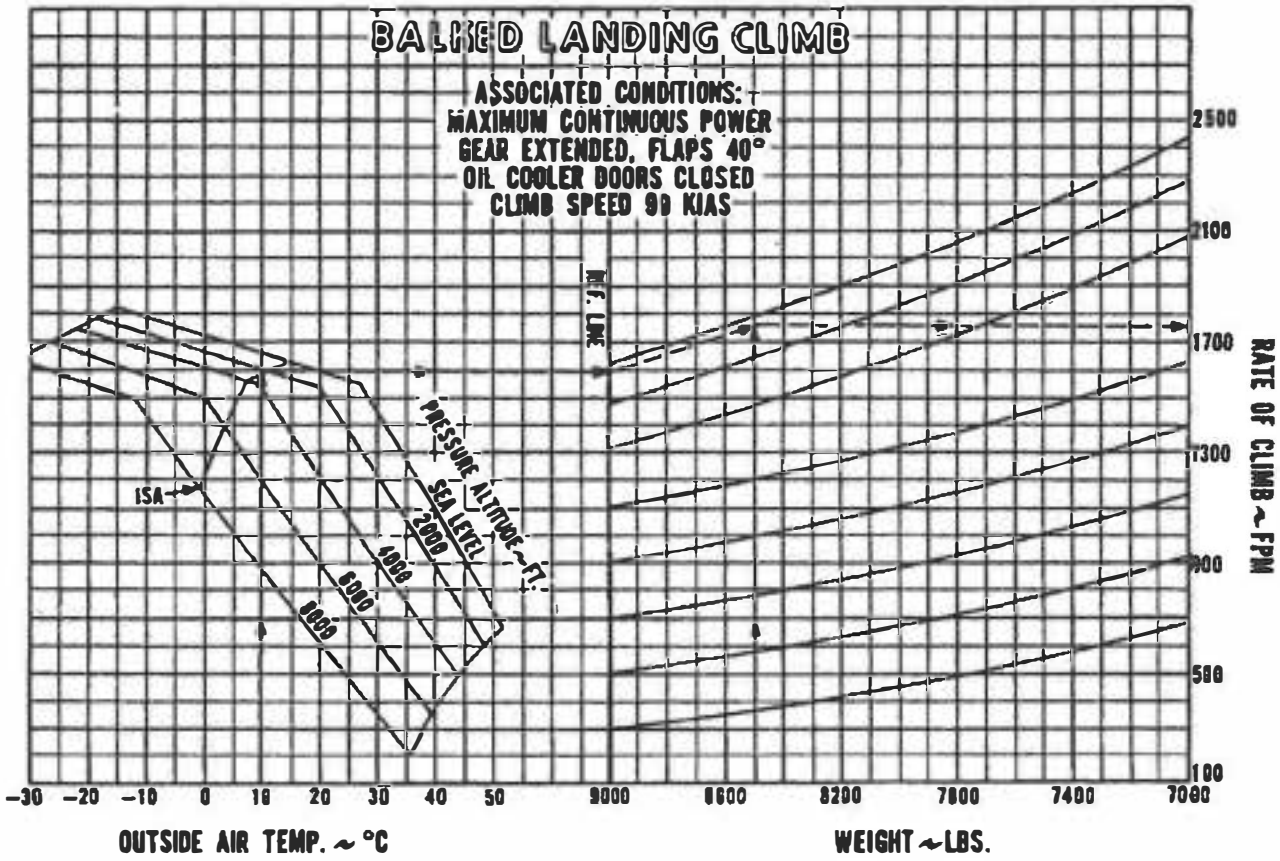


Example:
- Altitude: 22,000 ft.
- Weight: all
- Wind: zero
- Time to descend: 22 minutes
- Fuel to descend: 210 lbs.
- Distance to descend: 94 nautical miles

TIME, FUEL AND DISTANCE TO DESCEND

Figure 5-125

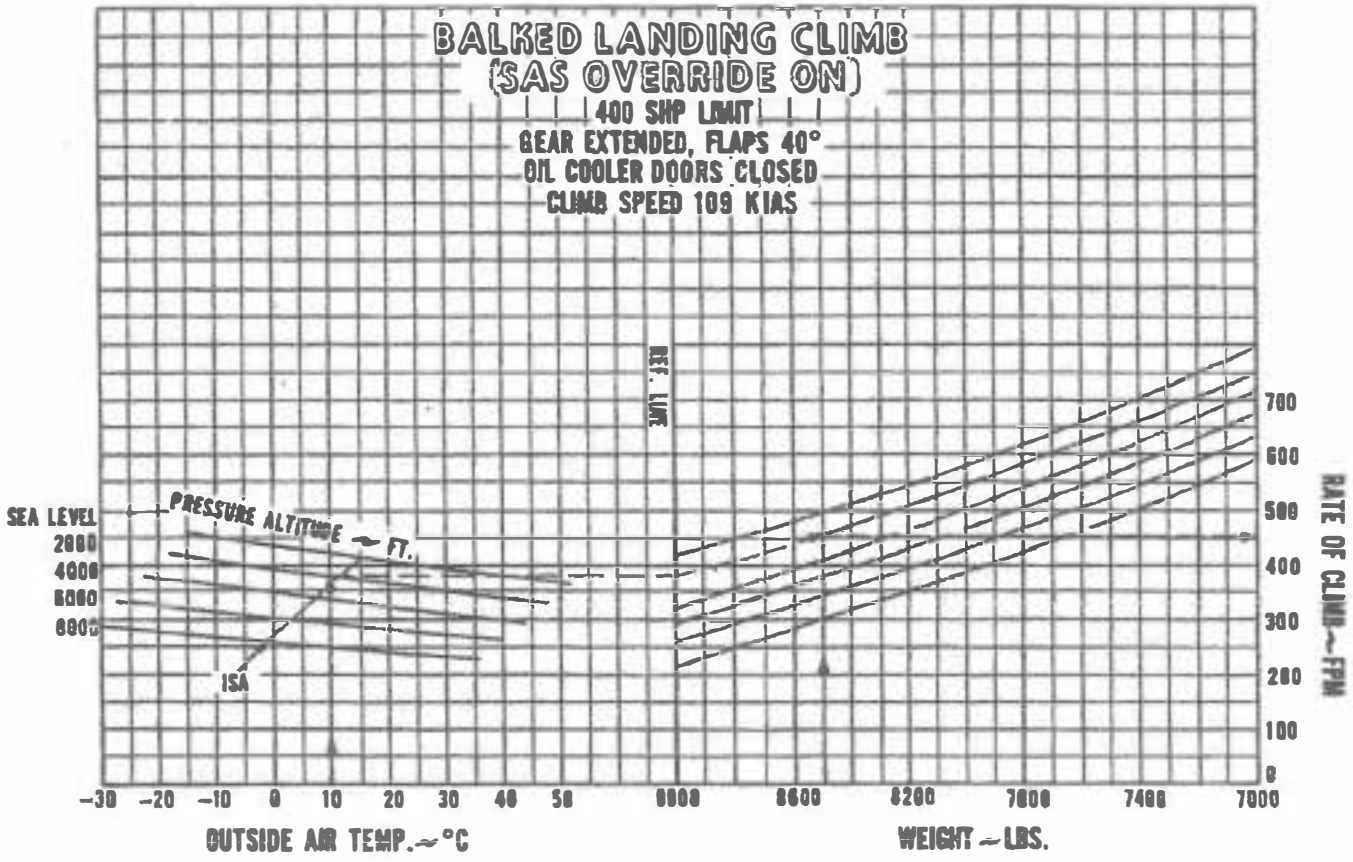
PA-31T



Example:
OAT: +10°C
Pressure altitude: 2000 ft.
Weight: 8500 lbs.
Rate of climb: 1760 F.P.M.

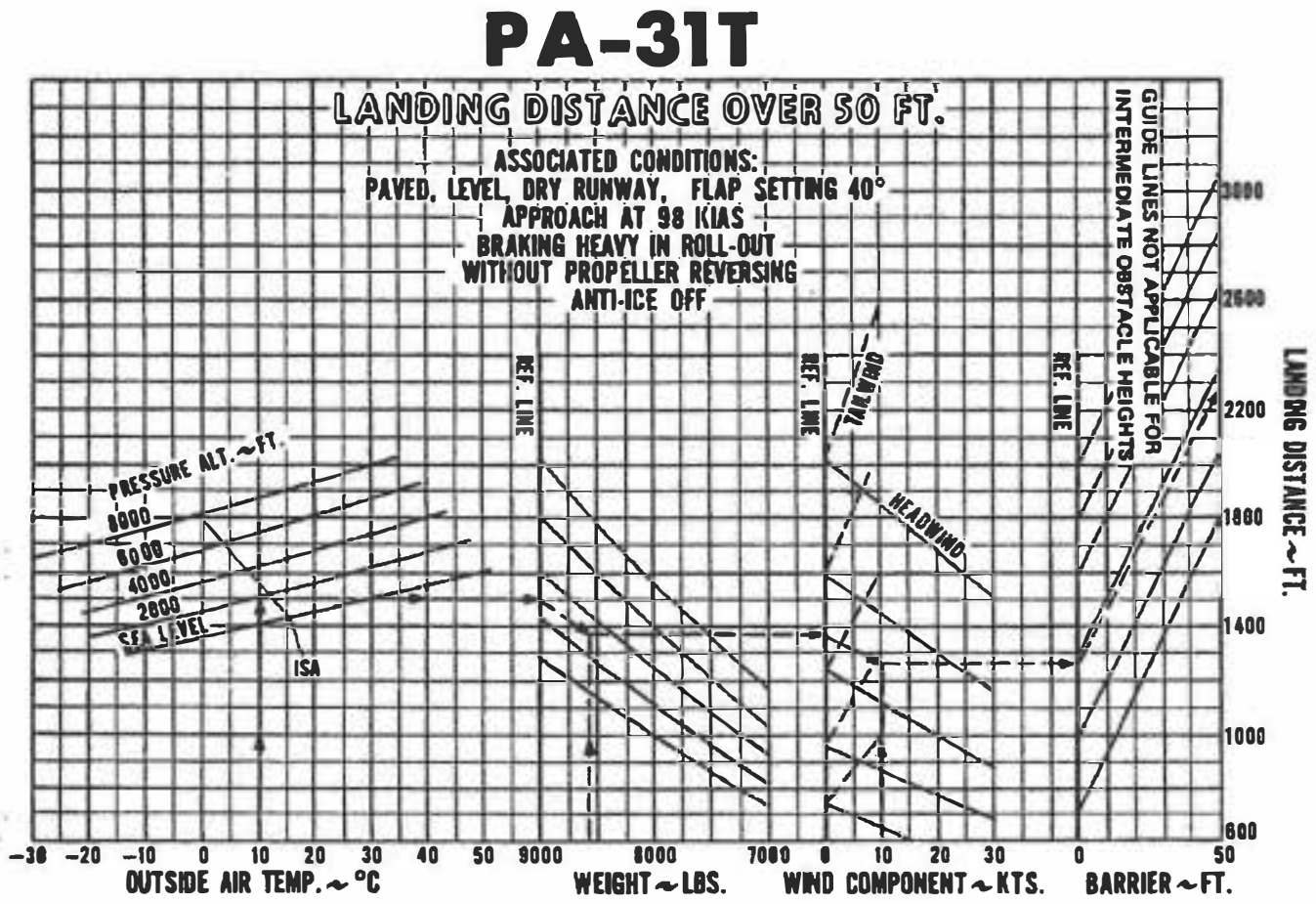
BALKED LANDING CLIMB
Figure 5-127

PA-31T



Example:
OAT: +10°C
Pressure altitude: 2000 ft.
Weight: 8500 lbs.
Rate of climb: 455 F.P.M.

BALKED LANDING CLIMB (SAS OVERRIDE ON)
Figure 5-129

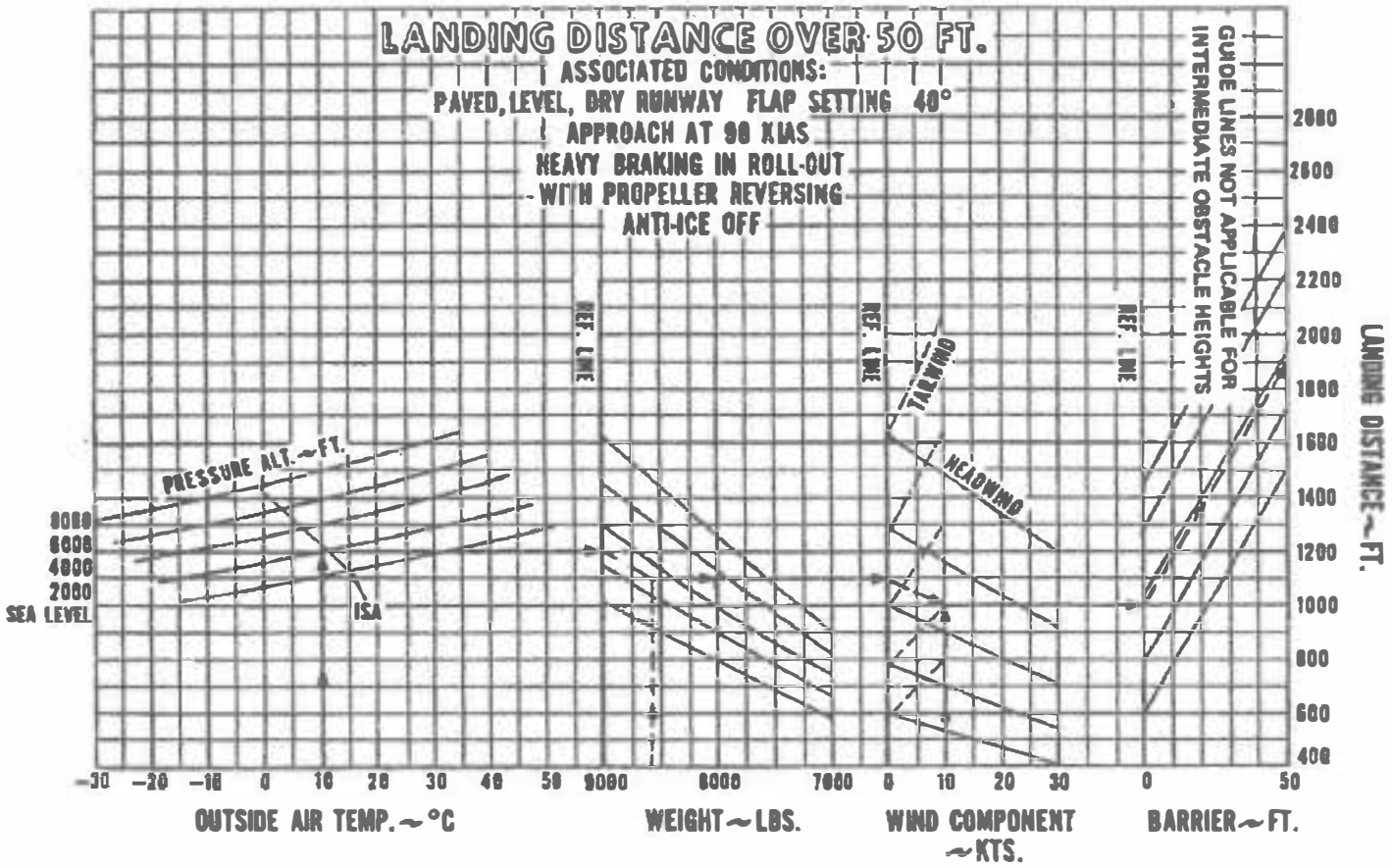


Example:
OAT: 10°C
Pressure altitude: 2000 ft.
Weight: 8600 lbs.
Wind: 10 knots
Ground roll: 1260 ft.
Total distance: 2270 ft.

LANDING DISTANCE OVER 50 FEET (WITHOUT PROPELLER REVERSING)

Figure 5-131

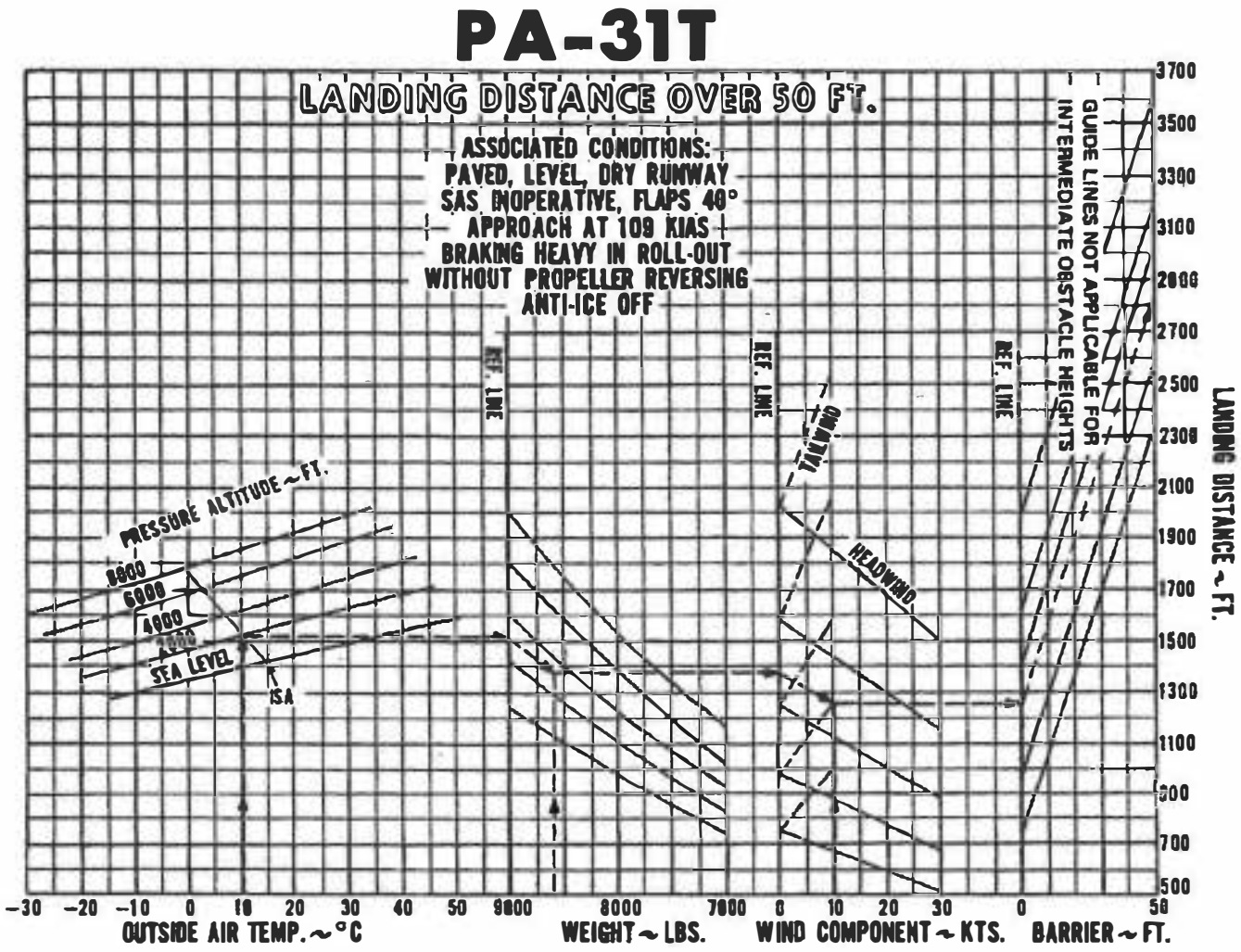
PA-31T



Example:
OAT: 10°C
Pressure altitude: 2000 ft.
Weight: 8600 lbs.
Wind: 10 knots
Ground roll: 1000 ft.
Total distance: 1900 ft.

LANDING DISTANCE OVER 50 FEET (WITH FULL PROPELLER REVERSING)

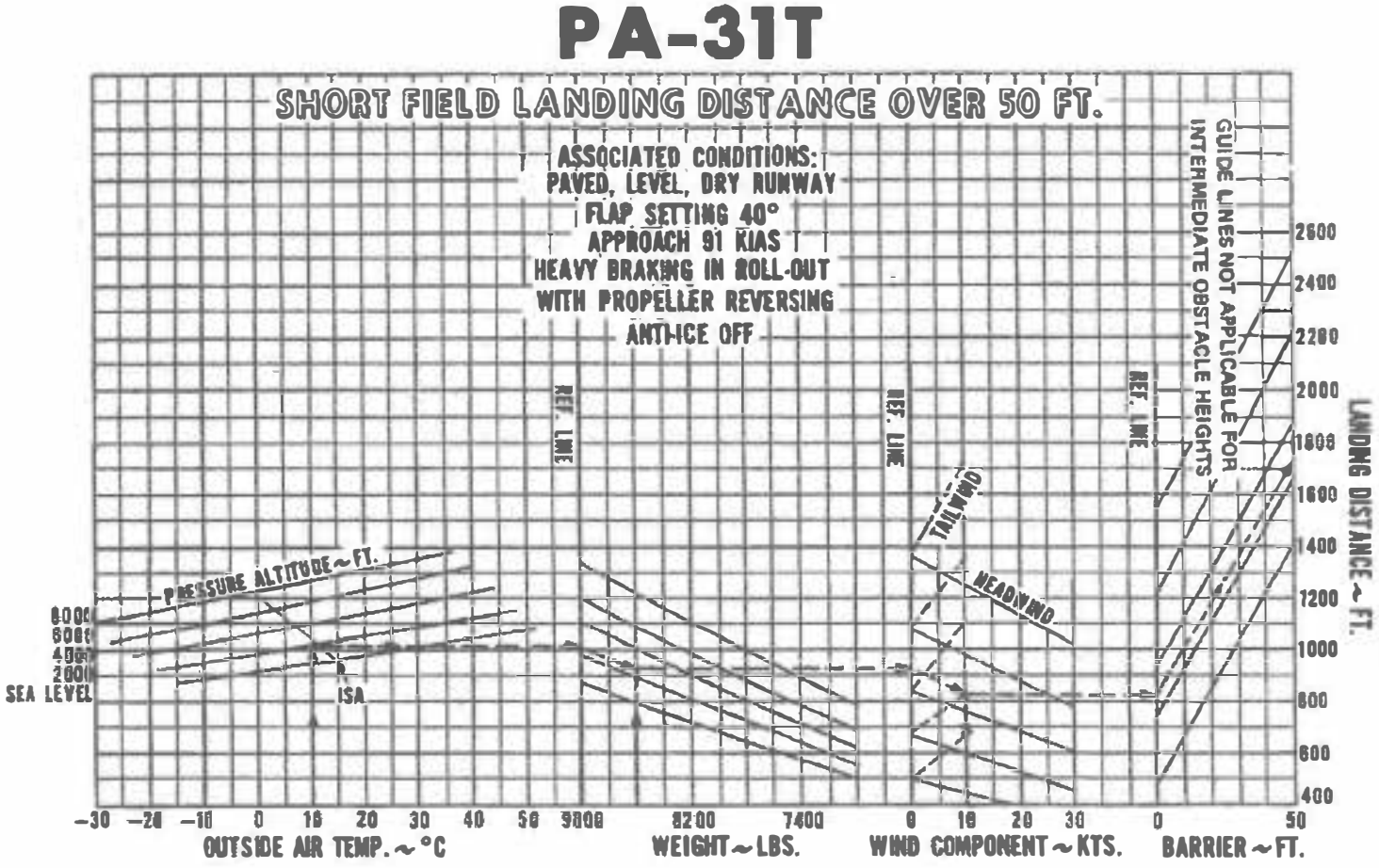
Figure 5-133



Example:
OAT: 10°C
Pressure altitude: 2000 ft.
Weight: 8600 lbs.
Wind: 10 knots
Ground roll: 1250 ft.
Total distance: 2830 ft.

LANDING DISTANCE OVER 50 FEET (SAS OVERRIDE ON)

Figure 5-135



Example:
OAT: 10°C
Pressure altitude: 2000 ft.
Weight: 8600 lbs.
Wind: 10 knots
Ground run: 840 ft.
Total distance: 1740 ft.

SHORT FIELD LANDING DISTANCE OVER 50 FEET

Figure 5- 137

SECTION 6

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SECTION 6

WEIGHT AND BALANCE

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FRIEND AIRCARE

Weight and Balance Record
and Equipment List Supplement

REVISED WEIGHT & BALANCE

Date: 09/28/2023

AIRCRAFT OWNER: Tim Rooney
SERIAL #: PA31T-7820056

AIRCRAFT MAKE/MOD.: Piper / PA31T
REGISTRATION#: N781CK

	WEIGHT	E.W.C.G	MOMENT
PREVIOUS:	**5551.00**	**131.12**	**727823.60**
REMOVED EQUIPMENT		ARM	
INSTALL EQUIPMENT		ARM	
Left Aft Fwd Facing Passenger Seat	27.00	198.00	5346.00
		E.W.C.G	
TOTALS	**5578.00**	**131.44**	**733169.60**

NEW EMPTY WEIGHT: **5578.00**
NEW C.G.: **131.44**

FRIEND AIRCARE W/O: 10840
FAA CRS NO. GW1R181K
Inspector John M Scott

FRIEND AIRCARE INC.

Weight and Balance Record

N781CK MODEL: PA31T S/N: PA31T-7820056 DATE:04/14/23

DATE	DESCRIPTION	WEIGHT	LONGITUDE ARM	LONGITUDE MOMENT	LATERAL ARM	LATERAL MOMENT
	Weighed Aircraft with Fuel Drained And All Operable Fluids					
	Scales: Evergreen Weigh, Inc P/N 3-0057-BA-3C Calibration Due: June 2023					
	LT Main Jack Point – Scale S/N 1126-R (734)	2183	152.0	331816.0		
	RT Main Jack Point – Scale S/N 1154-G (719)	2249	152.0	341848.0		
	Nose Jack Point – Scale S/N 1127-Y (776)	1119	48.4	54159.6		
	New Empty Weight	**5551**	**131.1**	**727823.6**		
	Unusable Fuel	54	126	6804.0		
	Ramp Weight	**5605**	**131.06**	**734627.6**		
	Useful Load	3445				
	Max. Weight	9050				

REVISED 9/26/23 BDS

FRIEND AIRCARE WO 10739
FAC CRS NO. GW1R181K
Inspector

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 tremendous 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 a takeoff.

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

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

A properly loaded airplane, however, will perform as intended. Before the airplane is delivered, 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 easily 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 6-7) and the Weight and Balance Record (Figure 6-9). The current values should always be used. Whenever new equipment is added or any modification work is done, the mechanic responsible for the work is required to compute a new basic empty weight and C.G. position and to write these in the Aircraft Log Book and the Weight and Balance Record. The owner should make sure that it is done.

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

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

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6.3 AIRPLANE WEIGHING PROCEDURES

At the time of delivery, Piper Aircraft Corporation provides each airplane with the basic empty weight and center of gravity location. This data is supplied by Figure 6-7.

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.

(4) Fill to full capacity with oil and operating fluids.

(5) Place pilot and copilot seats in a center position on the seat tracks. 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 tires to center bubble on level.

(c) Weighing Airplane

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

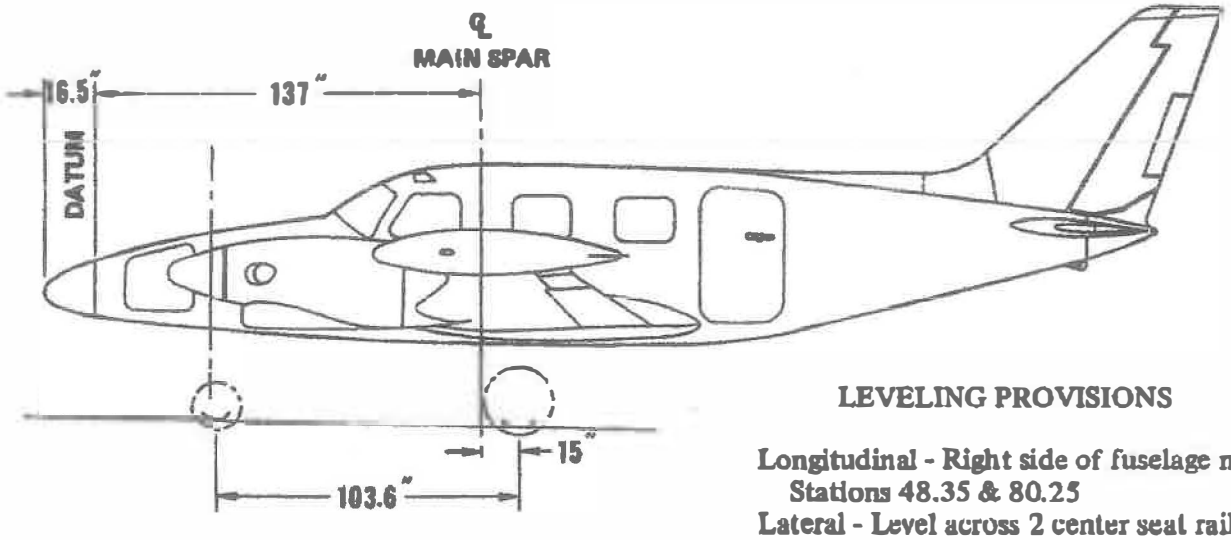
AIRPLANE AS WEIGHED
(Including full oil and operating fluids but no fuel)

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

WEIGHING FORM
Figure 6-1

(d) Center of Gravity

(1) The following geometry applies to the PA-31T airplane when it is level. Refer to Leveling paragraph 6.3 (b).



LEVELING PROVISIONS

Longitudinal - Right side of fuselage nose Stations 48.35 & 80.25
Lateral - Level across 2 center seat rails

LEVELING DIAGRAM
Figure 6-3

(2) C.G. Arm of airplane as weighed =

$$(137 + 15) - \frac{(103.6)\ (N)}{T} =$$

Inches Aft of Datum

(e) Basic Empty Weight

Item	Weight (Lbs)	x	Arm (Inches Aft of Datum)	=	Moment (In-Lbs)
Weight (as Weighed)					
Unusable Fuel (8 gal.)	54		126		6804
Basic Empty Weight					

BASIC EMPTY WEIGHT

Figure 6-5

6.5 WEIGHT AND BALANCE DATA AND RECORD

The Basic Empty Weight, Center of Gravity Location and Useful Load listed in Figure 6-7 are for the airplane as delivered from the factory. These figures apply only to the specific airplane serial number and registration number shown.

The basic empty weight of the airplane as delivered from the factory has been entered in the Weight and Balance Record (Figure 6-9). 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-31T CHEYENNE

Airplane Serial Number 31T7820056

Registration Number _____

Date _____

AIRPLANE BASIC EMPTY WEIGHT

Item	Weight (Lbs)	x	C.G. Arm (Inches Aft of Datum)	=	Moment (In-Lbs)
Standard Empty Weight*					
Optional Equipment (if applicable)					
Basic Empty Weight					

*The standard empty weight includes full 6.5 gallon oil capacity, full operating fluids, and 8 gallons of unusable fuel.

AIRPLANE USEFUL LOAD - NORMAL CATEGORY OPERATION

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

(9050 lbs) - (lbs) = lbs.

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

WEIGHT AND BALANCE DATA FORM

Figure 6-7

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PA-31T			Serial Number		Registration Number								Page Number		
Date	Item No.		Description of Article or Modification	Weight Change Added (+)			Weight Change Removed (-)			Running Basic Empty Weight		
	In	Out		Wt. (Lb.)	Arm (In.)	Moment /100	Wt. (Lb.)	Arm (In.)	Moment /100	Wt. (Lb.)	Moment /100
			As Delivered								

PA-31T	Serial Number	Registration Number	Page Number

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

6.7 GENERAL LOADING RECOMMENDATIONS

Load occupants from front to rear progressively and observe zero fuel weight limitations.

(a) 1 to 5 Occupants

Load rear baggage compartment to capacity first.

(b) 6 Occupants

Load front and rear baggage compartments equally.

(c) 7 Occupants

Load front baggage compartment first and locate heaviest occupants forward. Fuel or baggage may have to be reduced.

(d) 8 Occupants

Load front baggage compartment to bring C.G. within 138 inches rearward limit. Fuel must be reduced to keep the total weight within the 9050 lb. Ramp Weight limit. Locate heaviest occupants forward.

NOTE

These general loading recommendations suggest normal proper loading procedures. The charts, graphs, instructions, and plotter should be checked to assure that the airplane is within the allowable weight vs. center of gravity envelope.

6.9 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 Chart (Figure 6-15) 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 Weight, Moment and C.G. Limits graph (Figure 6-17). If the point falls within the C.G. envelope, the loading meets the weight and balance requirements.

(f) Location of the point on the Weight, Moment, and C.G. Limits graph indicates whether the airplane is slightly nose heavy or slightly tail heavy and can assist in setting pitch trim for takeoff.

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

ITEM	WT. LBS.	ARM-IN.	MOMENT
Basic Airplane	5129	129.1	662154
Revised Airplane			
Pilot's Seat	170	119.0	20230
Copilot's Seat	170	119.0	20230
Seat No. 3		166/159 (Reversed)	
Seat No. 4		166/159 (Reversed)	
Seat No. 5	170	198.0	33660
Seat No. 6	170	198.0	33660
Seat No. 7		229.0	
Seat No. 8		242.0	
Fwd. Baggage		30.0	
Rwd. Baggage	120	255.0	30600
Fuel Gal.	2010		278200
Total Wt.	7939	Total Moment	1078734
C.G. Location for Take-off		135.9	

SAMPLE LOADING PROBLEM

Figure 6-11

ITEM	WT. LBS.	ARM-IN.	MOMENT
Basic Airplane			
Revised Airplane			
Pilot's Seat		119.0	
Copilot's Seat		119.0	
Seat No. 3		166./159 (Reversed)	
Seat No. 4		166./159 (Reversed)	
Seat No. 5		198.0	
Seat No. 6		198.0	
Seat No. 7		229.0	
Seat No. 8		242.0	
Fwd. Baggage		30.0	
Rwd. Baggage		255.0	
Fuel Gal.			
Total Wt.		Total Moment	

C.G. Location for Take-off

WORK SHEET

Figure 6-13

OCCUPANTS

Weight Lbs.	Crew Seat Arm 119	Seats 3 & 4 Fwd Facing Arm 166	Seats 3 & 4 Aft Facing Arm 159	Seats 5 & 6 Arm 198	Seat 7 Arm 229	Seat 8 Arm 242
	Moment / 100					
120	143	199	191	238	275	290
130	155	216	207	257	298	315
140	167	232	223	277	321	339
150	179	249	239	297	344	363
160	190	266	254	317	366	387
170	202	282	270	337	389	411
180	214	299	286	356	412	436
190	226	315	302	376	435	460
200	238	332	318	396	458	484

USABLE FUEL

Gal.	Weight Lbs.	Moment / 100
50	335	445
100	670	893
150	1005	1361
200	1340	1844
250	1675	2320
300	2010	2782
336	2251	3113
350	2345	3243
366	2452	3391

8 gal. unusable fuel (54 lbs., 6804 in.-lbs.) included in basic weight.

LOADING CHART

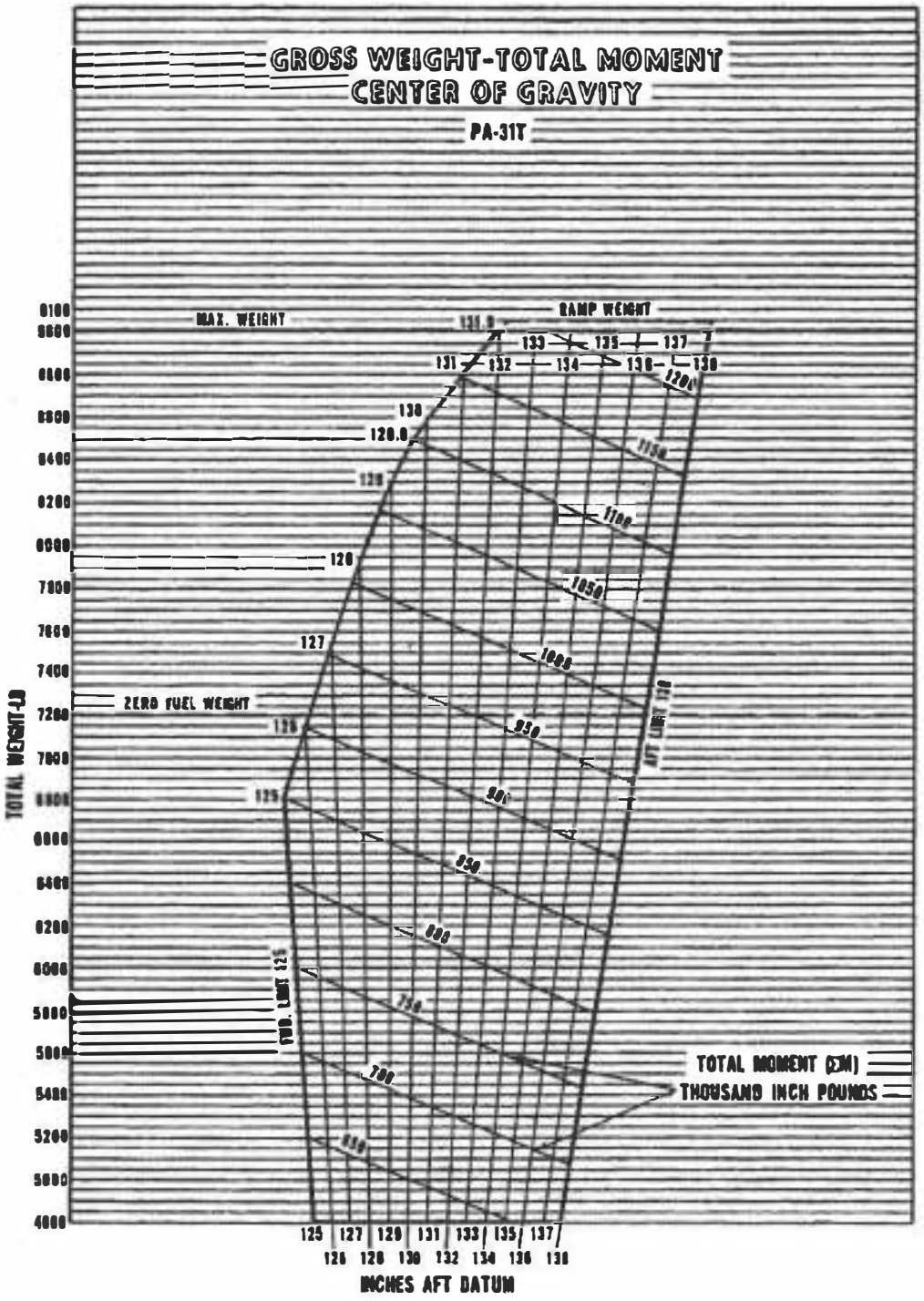
Figure 6-15

BAGGAGE

Weight Lbs.	Fwd Arm = 30	Rear Arm = 255
	Moment / 100	
10	3	26
20	6	51
30	9	77
40	12	102
50	15	128
60	18	153
70	21	179
80	24	204
90	27	230
100	30	255
110	33	281
120	36	306
130	39	332
140	42	357
150	45	383
160	48	408
170	51	434
180	54	459
190	57	485
200	60	510
210	63	
220	66	
230	69	
240	72	
250	75	
260	78	
270	81	
280	84	
290	87	
300	90	

LOADING CHART (cont)

Figure 6-15 (cont)



C.G. LIMITS GRAPH

Figure 6-17

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6.11 WEIGHT AND BALANCE VISUAL PLOTTER

The Weight and Balance Visual Plotter (Figure 6-19) furnished with the airplane will enable the pilot to graphically determine whether or not his proposed loading will fall within the allowable envelope. It will also allow him to easily determine the necessary adjustments to make if his first proposed loading is not within this envelope. On the back of the plotter are printed instructions for use and general loading recommendations.

When plotting successive points, the pilot is graphically adding weights and corresponding moments. As the weight increases, through the addition of various items of disposable load, the pilot will see the shift in the center of gravity.

Going clockwise around the envelope, the heavy lines represent allowable weight at the forward C.G. limit (125 in.), the maximum allowable weight as the C.G. shifts rearward, the maximum weight with no fuel, the ramp weight (9050 lbs.), the gross weight (9000 lbs.), and the maximum rearward C.G. limit (138 in.).

Before arranging his load, the pilot should consult the General Loading Recommendations.

IT IS THE RESPONSIBILITY OF THE OWNER AND PILOT TO ASCERTAIN THAT THE AIRPLANE ALWAYS REMAINS WITHIN THE ALLOWABLE WEIGHT VS. CENTER OF GRAVITY ENVELOPE WHILE IN FLIGHT.

6.13 INSTRUCTION FOR USING PLOTTER

(a) Locate and mark on the face of the plotter the point corresponding with the Basic Empty Weight and C.G. Location. This weight and C.G. includes oil, operating fluids, and 54 pounds (8 gallons) of unusable fuel. The mark may be made in ink, as this is the point which all computations are started.

(b) Locate the base (zero pound mark) of the 1ST & 2ND SEAT slot over the starting point, and establish a second (new) point at the weight corresponding to the combined weight of the font seat occupants.

(c) The base (zero pound mark) of the applicable 3RD & 4TH SEAT slot, AFT (aft facing) or FORE (forward facing), is then centered over the second point, and a new point is established at the combined weight of the seat occupants.

(d) Similarly, the base (zero pound mark) of the 5TH & 6TH SEAT, 7TH SEAT, and 8TH SEAT slots are moved over each preceding point and a new point established at the appropriate weight.

(e) Center the base (zero pound mark) of the FORE BAGGAGE slot over the point of the last seat point plotted. Establish a point in the slot corresponding to the nose compartment baggage weight.

(f) Rear baggage is then plotted using the same procedure as above with the base (zero pound mark) of the AFT BAGGAGE slot centered at the point established for the FORE BAGGAGE.

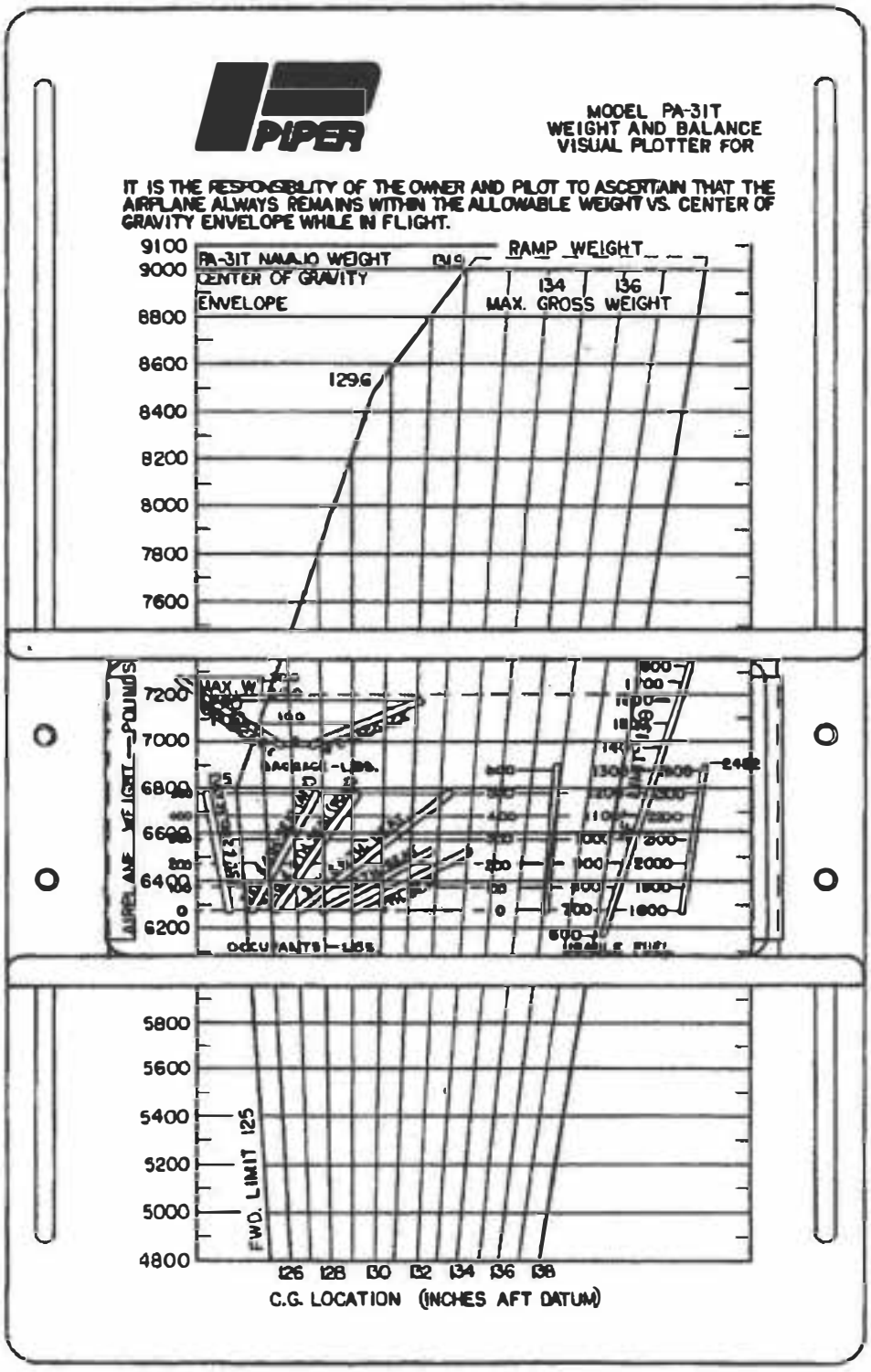
(g) Place the base (zero pound mark) of the "A" fuel slot at the point where AFT BAGGAGE was marked; plot fuel "A." Using point marked for "A" fuel, plot fuel "B", and subsequently plot fuel "C." (See Paragraph 6.7 - General Loading Recommendations - for baggage and fuel loading.)

NOTES

Should the fuel slot leave the C.G. envelope (outlined in red) between 131.9 and 138 inches, the fuel indicated at the exit point is the maximum allowable.

Should the fuel slot leave the C.G. envelope other than between 131.9 and 138 inches, the baggage or passenger load should be redistributed forward or aft, as required, to allow a higher load up to 9000 pounds Ramp Weight.

The dotted outline at 9050 pounds provides an additional 50 pounds of fuel for taxiing purposes only when fuel is limited in favor of payload. In no case shall the payload result in a zero fuel airplane weight in excess of 7200 pounds.



WEIGHT AND BALANCE VISUAL PLOTTER

Figure 6-19

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6.15 EQUIPMENT LIST

The following is a list of equipment which may be installed in the PA-31T. It consists of those items used for defining the configuration of an airplane when the basic empty weight is established at the time of delivery. Items marked with an "X" are those items which were installed on the airplane described below as delivered by the manufacturer.

PIPER AIRCRAFT CORPORATION PA-31T, CHEYENNE

SERIAL NO._____ REGISTRATION NO._____ DATE:_____

(a) Propeller and Propeller Accessories

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
1	Two Propellers, Hartzell Model HC-B3TN-3B/T10173-HB8 or HC-B3TN-3B/T10173B-8 Per PAC Dwg. 50836 Cert. Basis - TC P15EA	X	119.0 ea.	41.3	4915
3	Two Hydraulic Propeller Governors Woodward Model 210590, Per PAC Dwg. 50898 Cert. Basis - TC A8EA	X	2.6 ea.	50.0	130
5	Two Propeller Spinners Per PAC Dwg. 51085 Cert. Basis - TC A8EA	X	8.0 ea.	41.3	330
7	Two Propeller Spinner Rear Bulkheads Per PAC Dwg. 51083 Cert. Basis - TC A8EA	X	1.2 ea.	55.5	67

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(b) Engine and Engine Accessories

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
21	Two Engines, Per PAC Dwg. 50497 (Left) and 50497-1 (Right) Cert. Basis - E4EA	X	317.0 ea.	72.9	23109
23	Two Oil Coolers, Harrison, Per PAC Dwg. 51173-2 Cert. Basis - TC A8EA	X	9.3 ea.	107.5	1000
25	Four Fuel Pumps, Electric a. Airborne Manuf. Per PAC Dwg. 55428-2	—	2.5 ea.	135.0	338
	b. Lear-Siegler Per PAC Dwg. 50595-2 Cert. Basis - TC A8EA	X	3.4 ea.	135.0	459
27	Two Hydraulic Pumps, Eastern Industries Model 1213, HBG Type 294, Per PAC Dwg. 26802-5 Cert. Basis - TC A8EA	X	1.8 ea.	98.3	177
29	Two Tachometer Generators (Ng) Per PAC Dwg. 50196 Cert. Basis - TC A8EA	X	.8 ea.	98.3	79
31	Two Tachometer Generators (Np) Per PAC Dwg. 50196 Cert. Basis - TC A8EA	X	.8 ea.	52.1	42
33	Freon Compressor, Drive, Electromagnetic Clutch and Oil Per PAC Dwg. 50135 and 50900 Cert. Basis - TC A8EA	X	51.6*	98.3	5072
35	Torquemeter Transducer BEN 7749-80A5-1 Cert. Basis - TC A8EA	X	1.0 ea.	52.1	52

*Included in Air Conditioning, Item No. 169.

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(c) Landing Gear and Brakes

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
51	Two Main Wheel Assemblies, Cleveland Wheel No. 40-106 Per PAC Dwg. 45519-8 (Left) and 45519-9 (Right) Cert. Basis - TSO C26a	— —	20.8 ea.	152.0	3162
53	Two Main Tires, 6.50 x 10, 10-Ply Rating, Type III with Regular Tubes Cert. Basis - TSO C62b	X	17.8 ea.	152.0	2706
55	One Nose Wheel Assembly, B. F. Goodrich Company No. 3-1331 Per PAC Dwg. 45520-4 Cert. Basis - TSO C26a	—	8.2 ea.	48.5	397
57	One Nose Tire, 18 x 4.4 6-Ply Rating, Type VII Tubeless Cert. Basis - TSO C62b	—	8.2 ea.	48.5	397
59	Two Brake Assemblies, Cleveland Brake No. 30-106 Per PAC Dwg. 45519-8 (Left) and 45519-9 (Right) Cert. Basis - TC A8EA	—	11.9 ea.	152.0	1809

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(d) Electrical Equipment

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
71	Two Starter/Generators 200 Amp ea., Lear Siegler Cert. Basis - TC A8EA	X	27.0 ea.	100.9	2724
73	Two Landing Lights, 28 Volt, 250-Watt GE No. 4596 Cert. Basis - TC A8EA	X	2.0 ea.	50.5	101
75	Windshield Wiper Per PAC Dwg. 46285 Cert. Basis - TC A8EA	X	5.5	81.1	446
77	Two Wing Tip Position/Anti-Collision (Strobe) Lights Per PAC Dwg. 51210-2 and -3 and Two Power Supplies Per PAC Dwg. 51212 Cert. Basis - TC A8EA	X	2.9	142.5	413
79	One Tail Position/Anti-Collision (Strobe) Light Per PAC Dwg. 51213 or 51213-2 and One Power Supply Per PAC Dwg. 51212 Cert. Basis - TC A8EA	X	1.4	368.4	516
81	One Battery, 24 Volt Per PAC Dwg. 50930 Cert. Basis - TC A8EA	X	80.0	6.0	480
83	Electric Propeller Deicing System Per PAC Dwg. 55110 Cert. Basis - TC A8EA	X	11.2	55.3	619

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(e) Instruments

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
91	Airspeed Indicator Per Piper PS50099-4 Cert. Basis - TC A8EA	X	1.5	96.0	144
93	Magnetic Compass Per PAC Dwg. 42580 Cert. Basis - TC A8EA	X	.8	96.0	77
95	Sensitive Altimeter Per Piper PS50008-4 Cert. Basis - TC A8EA		1.3	96.0	125
97	Turn and Rate Indicator Per Piper PS50030-10-2 Cert. Basis - TC A8EA	X	2.3	96.0	221
98	Turn and Bank Indicator Per Piper PS50128-13 Cert. Basis - TSO C3b	X	1.8	96.0	173
99	Rate of Climb Per Piper PS50104-3 Cert. Basis - TC A8EA	X	1.0	96.0	96
101	Eight-Day Clock - Wakmann W-33-7510ET or Longines ALL-90P-ET Cert. Basis - TC A8EA	X	.4	96.0	38
103	Outside Air Temp Per PAC Dwg. 46457 Cert. Basis - TC A8EA	X	.3	96.0	29
105	Electrical System Monitor Indicator Per PAC Dwg. 51051 Cert. Basis - TC A8EA	X	.5	96.0	48
107	Two Ammeters Per PAC Dwg. 51050 Cert. Basis - TC A8EA	X	.5 ea.	96.0	48
109	Two Torque Gauges Per PAC Dwg. 51198 Cert. Basis - TC A8EA	X	.5 ea.	96.0	48

(e) Instruments (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
111	Two Tachometers (Ng) Per PAC Dwg. 51000 Cert. Basis - TC A8EA	X	1.0 ea.	96.0	96
113	Two Tachometer (Np) Per PAC Dwg. 50998 Cert. Basis - TC A8EA	X	1.0 ea.	96.0	96
115	Engine Hour Recorder Per PAC Dwg. 51006 Cert. Basis - TC A8EA	X	.4	95.0	38
117	Dual Fuel Quan. Gauge Per PAC Dwg. 51010 Cert. Basis - TC A8EA	X	1.5	96.0	144
119	Fuel Totalizer Per PAC Dwg. 54871-2 Cert. Basis - TC A8EA		.8	96.0	77
121	Two Fuel Pressure Gauges Per PAC Dwg. 50555 Cert. Basis - TC A8EA		.4 ea.	96.0	38
122	Two Fuel Pressure Gauges And Transducer Per PAC Dwg. 55569-02 Cert. Basis - TC A8EA	X	1.4 ea.	105.9	148
123	Two Fuel Flow Gauges Per PAC Dwg. 54872-2 Cert. Basis - TC A8EA	X	.8 ea.	96.0	77
125	Two Inter Turbine Temp. Gauges Per PAC Dwg. 50565 Cert. Basis - TC A8EA	X	.8 ea.	96.0	77
127	Cowl Flap Position Indicator Per PAC Dwg. 48132 Cert. Basis - TC A8EA	X	.2	96.0	19
129	Wing Flap Position Indicator Per PAC Dwg. 51185 Cert. Basis - TC A8EA	X	.2	96.0	19

(e) Instruments (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
131	Cabin Altitude Control Per PAC Dwg. 48317 Cert. Basis - TC A8EA	X	2.0	96.0	192
133	Cabin Differential Pressure and Cabin Altitude Gauge Per PAC Dwg. 50589 Cert. Basis - TC A8EA	X	.5	96.0	48
135	Cabin Rate of Climb Per Piper PS50094-2 Cert. Basis - TC A8EA	X	.7	96.0	67
137	Two Oil Pressure Gauges Per PAC Dwg. 50561 Cert. Basis - TC A8EA		.4 ea.	96.0	38
138	Two Oil Pressure Gauges And Transducer Per PAC Dwg. 55571-02 Cert. Basis - TC A8EA	X	1.4 ea.	105.9	148
139	Two Oil Temp. Gauges Per Piper PS50100-2-2 or -2-3 Cert. Basis - TC A8EA	X	.4 ea.	96.0	38
141	Annunciator Display Per PAC Dwg. 51179 Cert. Basis - TC A8EA		1.5	96.0	144
142	Annunciator Controller Per PAC Dwg. 49284-2 And Annunciator Display Per PAC Dwg. 55929-2 Cert. Basis - TC A8EA	X	3.0	81.3	244
143	Gyro Horizon Per PAC Dwg. 51186 Cert. Basis - TC A8EA		2.3	96.0	220
145	Directional Gyro Per PAC Dwg. 46911 Cert. Basis - TC A8EA		3.4	96.0	326

(e) Instruments (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
147	Gyro Suction Gauge Per PAC Dwg. 55456-2 Cert. Basis - TC A8EA	X	.1	96.0	10
149	Pneumatic Pressure Gauge Per PAC Dwg. 46319-3 Cert. Basis - TC A8EA	X	.1	96.0	10
151	Stall Margin Indicator Rosemount 32G Cert. Basis - TC A8EA	X	.6	96.0	58

(f) Miscellaneous

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
163	D.O.A. EA-1 Approved Pilot's Operating Handbook Report: 2048	X	Neglect Weight Change		
165	Cabin Heater, 28 Volt, Janitrol No. 62D33-1 or -2 Per PAC Dwg. 46382-5 Cert. Basis - TSO C20	X	15.9	70.0	1113
166	Cabin Heater, 28 Volt, Janitrol No. 10E21-1 Per PAC Dwg. 49600 Cert. Basis - TSO C20	X	17.1	70.0	1197
167	Oxygen System Installed Per PAC Dwg. 51245 Cert. Basis - TC A8EA	X	39.0	81.2	3167
168	Oxygen System Installation Per PAC Dwg. 51245-3 Cert. Basis - TC A8EA	X	23.0	91.8	2111
169	Air Conditioning Per PAC Dwg. 50499 Cert. Basis - TC A8EA	X	118.2	103.6	12246
171	Stall Margin Sensor Rosemount Eng. Co. 861 CD-0002 Cert. Basis - TC A8EA	X	Neglect Weight Change		
173	Stall Warning Horn, Safe Flight Instr. Corp. *02054-3 Cert. Basis - TC A8EA	X	2.0	90.0	180
175	Heated Pitot Tube Per PAC Dwg. 46609 Cert. Basis - TC A8EA	X	1.0	64.3	64
177	Cargo Net Per PAC Dwg. 47357 Cert. Basis - TC A8EA	X	2.3	250.3	576

(f) Miscellaneous

Item No.		Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
179	Aft Cabin Divider Per PAC Dwg. 49080-4 or -8 Cert. Basis - TC A8EA	X	10.0	249.6	2496

(g) Engine and Engine Accessories (Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
191	Power Plant Fire Extinguisher System Per PAC Dwg. 50906 Cert. Basis - TC A8EA	_____	10.5	91.3	959

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(h) Propeller and Propeller Accessories (Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
201	Propeller Synchronizer Per PAC Dwg. 50915 Cert. Basis - TC A8EA	X	5.8	81.0	470
202	Propeller Synchrophaser (Type I) Per PAC Dwg. 49792-2 Cert. Basis - TC A8EA		5.8	81.0	470
203	Propeller Synchrophaser (Type II) Per PAC Dwg. 49387-2 Cert. Basis - TC A8EA		1.5	81.0	122
204	Two Hydraulic Propeller Governors, Woodward Model 210598, Per PAC Dwg. 50722 Cert. Basis - TC A8EA	X	2.6 ea.	50.0	130

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(i) Landing Gear and Brakes
(Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
211	Dual Brake Installation Per PAC Dwg. 47245 Cert. Basis - TC A8EA	X	1.8	86.9	156
213	One Nose Wheel Assembly, Cleveland Aircraft Products No. 40-120A Cert. Basis - TSO C62b	X	3.8	48.5	184
214	One Nose Wheel Assembly Goodrich No. 3-1076 Cert. Basis - TSO C26b	—	6.3	48.5	306
215	One Nose Tire, 17.5 x 6.25-6 10 Ply Rating, Type III with Regular Tube Cert. Basis - TSO C62b	X	12.5	48.5	606
217	Two Main Wheel Assemblies, Goodyear Wheel No. 9544171-1 Per PAC Dwg. 45519-6 (Left) and 45519-7 (Right) Cert. Basis - TSO C26a	X	10.5 ea.	152.0	1596
219	Two Brake Assemblies, Goodyear Brake No. 5002376 Per PAC Dwg. 45519-6 (Left) and 45519-7 (Right) Cert. Basis - TC A8EA	X	16.4 ea.	152.0	2493

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(j) Electrical Equipment
(Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
223	Dual Windshield Wiper Instl. Per PAC Dwg. 47241 Cert. Basis - TC A8EA	X	3.1	82.6	256
225	Copilot Heated Windshield, Per PAC Dwg. 51169 Cert. Basis - TC A8EA	X	3.0	76.3	229
227	Wing Ice Inspection Light Per PAC Dwg. 50592 Cert. Basis - TC A8EA	X	.6	119.5	72
229	Emergency Locator Transmitter Instl. Per PAC Dwg. 53730-5 or 55675-5 Cert. Basis - TSO C91	X	2.0	309.5	619
231	Emergency Locator Transmitter Instl. Per PAC Dwg. 49736-4 Cert. Basis - TC A8EA	____	4.2	308.7	1297
233	Recognition Beacon, Tail Per PAC Dwg. 61866 Cert. Basis - STC SA1008EA	____	1.8	283.0	509
235	Ground Recognition Beacon Instl., Per PAC Dwg. 49512-4	____	.8	329.7	264

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(k) Instruments
(Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
251	Airspeed Indicator Per Piper PS50099-4 Cert. Basis - TC A8EA	X	1.5	96.0	144
253	Sensitive Altimeter Per Piper PS50008-4 Cert. Basis - TC A8EA	X	1.3	96.0	125
255	Electric Turn and Bank Per PAC Dwg. 43220 or 32737-6 or 44378 Cert. Basis - TC A8EA	X	2.3	96.0	221
257	Rate of Climb Per Piper PS50104-3 Cert. Basis - TC A8EA	X	1.0	96.0	96
259	Eight-Day Clock - Wakmann W-33-7510ET or Longines ALL-90P-ET Cert. Basis - TC A8EA	X	.4	96.0	38
261	Gyro Horizon Per PAC Dwg. 51186 Cert. Basis - TC A8EA	X	2.3	96.0	221
263	Directional Gyro Per PAC Dwg. 46911 Cert. Basis - TC A8EA	X	2.9	96.0	278
265	Dual Fuel Quantity Gage Dwg 51010 Cert. Basis - TCA8EA	X	1.5	96.0	144

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(l) Autopilots
(Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
291	Bendix M4D AP/FD Instl. Per PAC Dwg. 55700-2 Cert. Basis - STC SA578SO	_____	125.1	229.5	28710
293	Bendix M4D AP/FD Instl. Per PAC Dwg. 55700-3 Cert. Basis - STC SA578SO	_____	126.3	228.2	28822
295	SPZ-200 AP/FD Instl. Per PAC Dwg. 51700-3 Cert. Basis - TC A8EA	_____	125.1	231.4	28948
297	Atitude Director Indicator (Single Cue) with Sperry AP/FD only, Per PAC Dwg. 54666-2 Cert. Basis - TC A8EA	_____	1.2	92.0	110
299	King KFC-300 AP/FD Instl. per PAC Dwg. CA-31T-5-224-3 or CA-31T-5-224-5 or CA-31T-5-222-3 or 09436-2 & -3 or 09437-2, -3, -4 & -5 Cert. Basis - STC SA1188CA	_____	163.2	248.6	40572
301	King KFC-300 AP/FD Instl. per PAC Dwg. CA-31T-5-224-2 or CA-31T-5-224-4 or CA-31T-5-222-2 or 09436-2 & -3 or 09437-2, -3, -4 & -5 Cert. Basis - STC SA1188CE	_____	168.5	243.0	40946

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(m) Radio Equipment
(Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
321	KTG-2-31T Basic Avionics Group Installation (Includes all standard group components. Does not include standard features) Per PAC Dwg. 55461-2 Cert. Basis - TC A8EA	_____	119.7	80.6	9648
323	KTG-3-31T Basic Avionics Group Installation (Includes all standard group components. Does not include standard features) Per PAC Dwg. 55462-2 Cert. Basis - TC A8EA	_____	109.3	83.7	9148
325	KTG/D-1-31T Basic Avionics Group Installation (Includes all standard group components. Does not include standard features) Per PAC Dwg. 55463-2 Cert. Basis - TC A8EA	_____	130.5	80.7	10531
327	CT-1-31T Basic Avionics Group Installation (Includes all standard group components. Does not include standard features) Per PAC Dwg. 55464-2 Cert. Basis - TC A8EA	_____	102.4	84.7	8673
329	KTS-4-31T Basic Avionics Group Installation (Includes all standard group components. Does not include standard features) Per PAC Dwg. 49907-2 Cert. Basis - TC A8EA	_____	85.2	93.0	7924
331	CTM-3-31T Basic Avionics Group Installation (Includes all standard group components. Does not include standard features) Per PAC Dwg. 49905-2 Cert. Basis - TC A8EA	_____	44.6	88.4	3943

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
333	KTG-3-31T Basic Avionics Group Installation (Includes all standard group components except single control heads. Does not include standard features) Per PAC Dwg. 49909-2 Cert. Basis - TC A8EA	_____	104.7	83.0	8690

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
335	ADF Instl. (Second) Per PAC Dwg. 54783-3 Cert. Basis - TC A8EA	_____	14.9	105.4	1570
337	ADF Instl. (Second) Per PAC Dwg. 49873-2 Cert. Basis - TC A8EA	_____	9.4	128.3	1206
339	Transponder Instl. (Second) Per PAC Dwg. 55533-2 or 55539-2 or 55541-2 Cert. Basis - TC A8EA	_____	5.1	68.0	347
341	Transponder Instl. (Second) Per PAC Dwg. 55534-2 Cert. Basis - TC A8EA	_____	5.3	65.7	348
343	Transponder Instl. (Second)(Collins) Per PAC Dwg. 29082-2 Cert. Basis - TC A8EA	_____	2.9	86.7	-- 251
345	Transponder Instl. (Dual) (King) Per PAC Dwg. 29054-2 Cert. Basis - TC A8EA	_____	3.9	88.3	344
347	R-Nav Instl. (KNC-610) Per PAC Dwg. 55531-2 Cert. Basis - TC A8EA	_____	6.3	83.4	525
349	R-Nav Instl. (KN-74) Per PAC Dwg. 29080-2 or 29040-2 Cert. Basis - TC A8EA	_____	4.5	85.9	387
351	R-Nav Instl. (KNC-610) Per PAC Dwg. 49934-2 or 29071-2 Cert. Basis - TC A8EA	_____	6.8	81.7	556
353	Copilot Marker Beacon Instl. Per PAC Dwg. 55538-2 Cert. Basis - TC A8EA	X	.3	95.6	29

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
355	Radar Instl. (RDR-1200) Per PAC Dwg. 55536-2 Cert. Basis - TC A8EA	_____	39.7	26.0	1032
357	Radar Instl. (RDR-1200B) Per PAC Dwg. 49878-2 Cert. Basis - TC A8EA	_____	39.7	26.0	1032
359	Radar Instl. (RDR-1200B) Colored Per PAC Dwg. 49884-2 Cert. Basis - TC A8EA	_____	42.7	30.9	1319
361	Radar Instl. (RDR-1100) Per PAC Dwg. 49880-2 Cert. Basis - TC A8EA	_____	33.9	23.1	783
363	Radar Instl. (RDR-1100) Colored Per PAC Dwg. 49883-2 Cert. Basis - TC A8EA	_____	36.9	29.0	1070
365	Radar Instl. (RDR-1300) Per PAC Dwg. 49881-2 Cert. Basis - TC A8EA	_____	39.7	26.0	1032
367	Radar Instl. (RDR-150) Per PAC Dwg. 49879-2 Cert. Basis - TC A8EA	_____	28.6	31.8	909
369	Radar Instl. (RDR-150) Colored Per PAC Dwg. 49882-2 Cert. Basis - TC A8EA	_____	33.1	39.4	1304
371	Radar Instl. (Primus 30A) Per PAC Dwg. 49885-2 Cert. Basis - TC A8EA	_____	37.3	25.7	959
373	Radar Instl. (Primus 300) Colored Per PAC Dwg. 49886-2 Cert. Basis - TC A8EA	_____	41.8	33.3	1392
375	Radio Altimeter Instl. (Collins) Per PAC Dwg. 51788-5 Cert. Basis - TC A8EA	_____	15.1	109.1	1647

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
377	Radio Altimeter Instl. (Sperry) Per PAC Dwg. 51801-2 Cert. Basis - TC A8EA	_____	15.9	229.5	3649
379	Radio Altimeter Instl. (KRA-405) Per PAC Dwg. 29045-2 Cert. Basis - TC A8EA	_____	15.8	108.0	1706
381	Encoding Altimeter (IDC) Per PAC Dwg. 51771-4 Cert. Basis - TC A8EA	_____	3.7	97.2	360
383	Encoding Altimeter (IDC) with Alt. Alerter Per PAC Dwg. 51771-5 Cert. Basis - TC A8EA	_____	5.4	95.5	516
385	Encoding Altimeter (Aero Mech) Per PAC Dwg. 15564-17 Cert. Basis - TC A8EA	_____	2.0	95.0	190
387	Encoding Altimeter (Aero Mech) Per PAC Dwg. 29018-2 Cert. Basis - TC A8EA	_____	2.0	95.0	190
389	Encoding Altimeter (Aero Mech) with Altitude Alerter Per PAC Dwg. 29018-3 Cert. Basis - TC A8EA	_____	4.0	95.0	380
391	Encoding Altimeter (Smith) Per PAC Dwg. 29021-2 Cert. Basis - TC A8EA	_____	3.8	96.0	365
393	Encoding Altimeter (Smith) With Altitude Alerter Per PAC Dwg. 29021-3 Cert. Basis - TC A8EA	_____	4.8	75.7	363
395	Encoding Altimeter (Smith) Per PAC Dwg. 29023-2 Cert. Basis - TC A8EA	_____	3.8	96.0	365

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
396	Emergency Avionics Battery Instl. Per PAC Dwg. 55795 Cert. Basis - TC A8EA	____	15.5	30.8	477
397	Encoding Altimeter (Smith) with Altitude Alerter Per PAC Dwg. 29023-3 Cert. Basis - TC A8EA	____	4.8	75.7	363
399	Encoding Altimeter (IDC) with Altitude Alerter and IVSI Per PAC Dwg. 29025-2 Cert. Basis - TC A8EA	____	7.6	95.5	726
401	Encoding Altimeter (IDC) without Altitude Alerter and with IVSI Per PAC Dwg. 29025-3 Cert. Basis - TC A8EA	____	5.6	95.3	534
403	Radio Telephone Instl. (King) Per PAC Dwg. 54811-3 Cert. Basis - TC A8EA	X	26.4	110.2	2909
405	Radio Telephone Instl. (King) Per PAC Dwg. 29098-2 or -3 Cert. Basis - TC A8EA	____	6.7	99.2	665
407	Radio Telephone Instl. (Flitefone III) Per PAC Dwg. 29097-2 Cert. Basis - TC A8EA	____	24.5	112.4	2754
409	Radio Telephone Instl. (Flitefone III) Per PAC Dwg. 29097-3 Cert. Basis - TC A8EA	____	24.5	112.0	2744
411	Copilot Electric Trim Instl. Per PAC Dwg. 51805-2 Cert. Basis - TC A8EA	____	2.0	98.2	196
413	Copilot Electric Trim Instl. Per PAC Dwg. 51805-3 Cert. Basis - TC A8EA	X	3.5	104.6	366

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
415	Copilot Electric Trim Instl. Per PAC Dwg. 51805-4 Cert. Basis - TC A8EA	____	4.6	106.6	490
417	Copilot Mike and Headset Instl. Per PAC Dwg. 48737 Cert. Basis - TC A8EA	X	1.2	110.5	133
419	Pilot Boom Mike Instl. Per PAC Dwg. 51807-2 Cert. Basis - TC A8EA	X	1.6	113.0	181
421	Pilot Boom Mike Instl. (with Oxygen) Per PAC Dwg. 51807-3 Cert. Basis - TC A8EA	____	2.7	113.0	305
423	Copilot Boom Mike Instl. Per PAC Dwg. 51807-4 Cert. Basis - TC A8EA	X	1.6	113.0	181
425	Copilot Boom MIke Instl. (with Oxygen) Per PAC Dwg. 51807-5 Cert. Basis - TC A8EA	____	2.7	113.0	305
427	External Mike and Phone Jack Instl. Per PAC Dwg. 55537-2 Cert. Basis - TC A8EA	X	.4	49.0	20
429	Ramp Hailer Instl. Per PAC Dwg. 51796-3 Cert. Basis - TC A8EA	X	3.8	34.7	132
431	Copilot Autopilot Gyro Instl. Per PAC Dwg. 55535-2 Cert. Basis - TC A8EA	____	15.9	150.3	2390
433	Copilot Autopilot Gyro Instl. Per PAC Dwg. 55535-3 Cert. Basis - TC A8EA	____	15.9	150.3	2390

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
435	Copilot Autopilot Gyro Instl. Per PAC Dwg. 55535-4 Cert. Basis - TC A8EA	____	15.9	150.3	2390
437	Glideslope Instl. (Second) Per PAC Dwg. 54996-3 Cert. Basis - TC A8EA	X	1.0	72.0	72
439	Glideslope Instl. (Second)(King) Per PAC Dwg. 29037-2 Cert. Basis - TC A8EA	____	2.0	65.0	130
441	Glideslope Instl. (Second) (Collins) Per PAC Dwg. 29076-2 Cert. Basis - TC A8EA	____	2.0	65.0	130
443	Nav Transfer Switching Instl. Per PAC Dwg. 55532-2, -3 or -4 Cert. Basis - TC A8EA	____	3.7	70.1	259
445	Nav Transfer Switching Instl. Per PAC Dwg. 29083-2 or 29086-2 Cert. Basis - TC A8EA	____	3.7	70.1	259
447	Data Input/Output System: Instl. Per PAC Dwg. 55342-3 Cert. Basis - TC A8EA	____	1.8	96.0	173
449	Static Wicks Instl. Per PAC Dwg. 42387 Cert. Basis - TC A8EA	X	.4	240.0	96
451	Static Wicks Instl. Per PAC Dwg. 49916-2 Cert. Basis - TC A8EA	____	0.4	240.0	96
453	Emergency Avionics Battery Instl. Per PAC Dwg. 55795 Cert. Basis - TC A8EA	____	15.5	30.8	477

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
455	RMI Instl. Per PAC Dwg. 29030-2 or 29027-2 or 49935-2 or 49870-2 Cert. Basis - TC A8EA	_____	Neg. Weight Change		
457	HF COMM Instl. (ASB-130) Per PAC Dwg. 49944-2 or -3 or -4 Cert. Basis - TC A8EA	_____	31.1	270.7	8419
459	VOR Repeater Instl. (KI-207) Per PAC Dwg. 49945-2 Cert. Basis - TC A8EA	_____	1.0	96.0	96
461	DME Hold Instl. Per PAC Dwg. 29043-2 or 29075-2 Cert. Basis - TC A8EA	_____	0.4	96.0	38
463	Ground Clearance Energy Saver System Per PAC Dwg. 49834-2 Cert. Basis - TC A8EA	_____	.3	100.0	30

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(n) Miscellaneous
(Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
497	Pneumatic Deicing System Per PAC Dwg. 50918 Cert. Basis - TC A8EA	X	21.7	194.2	4214
499	Second Heated Pitot Tube Per PAC Dwg. 50907 Cert. Basis - TC A8EA	X	1.0	63.4	63
501	Fire Extinguisher Per PAC Dwg. 52719 Cert. Basis - TC A8EA	X	5.1	137.5	701
503	Oxygen System Installation Per PAC Dwg. 51245-2 Cert. Basis - TC A8EA	____	39.0	81.2	3167
505	Cabin Door Snubber Instl. Per PAC Dwg. 48575 Cert. Basis - TC A8EA	X	5.0	217.0	1085
507	Toilet Seat Per PAC Dwg. 49104-2 Cert. Basis - TC A8EA	____	19.0	228.2	4336
509	Seventh Seat Per PAC Dwg. 49107-2 Cert. Basis - TC A8EA	____	25.5	229.0	5840
511	Eighth Seat Per PAC Dwg. 49107-3 Cert. Basis - TC A8EA	X	25.0	242.0	6050
513	Storage Cabinet Per PAC Dwg. 49078-5 Cert. Basis - TC A8EA	____	8.25	146.0	1205
514	Seventh Seat Toilet Per PAC Dwg. 55628-3 Cert. Basis - TC A8EA	____	27.0	229.0	6183

(n) Miscellaneous
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
515	Storage Cabinet Per PAC Dwg. 49078-6 Cert. Basis - TC A8EA	____	8.75	146.0	1278
516	Storage Cabinet For Use With Seventh Seat Toilet Per PAC Dwg. 49360-2 Cert. Basis - TC A8EA	____	39.0	244.0	9516
517	Forward Cabin Divider Combination Unit Per PAC Dwg. 49078-3 and -4 Cert. Basis - TC A8EA	____	41.3	140.0	5782
519	Aft Cabin Divider Combination Unit (Includes Weight Of Toilet) Per PAC Dwg. 49080-3 and -7 Cert. Basis - TC A8EA	X	74.6	239.8	17889
521	Folding Table Per PAC Dwg. 49079-3 Cert. Basis - TC A8EA	____	9.5 ea.	179.2	1702
523	Ice Shield Instl. Per PAC Dwg. 51373 Cert. Basis - TC A8EA	X	2.0	49.0	98
525	Refreshment Cabinet Per PAC Dwg. 49078-9 Cert. Basis - TC A8EA	X	31.0	144.0	4464
527	Storage Cabinet Per PAC Dwg. 49078-10 Cert. Basis - TC A8EA	X	22.5	144.0	3240
529	Fwd. Cabin Divider Per PAC Dwg. 49078-11 or -12 Cert. Basis - TC A8EA	X	2.0	143.0	286
531	Folding Table Per PAC Dwg. 49227-4 and -5 Cert. Basis - TC A8EA	X	9.5 ea.	179.8	1708

SECTION 7

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SECTION 7

DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

7.1 THE AIRPLANE

The PA-31T Cheyenne is a twin-engine, retractable landing gear, low wing turbine-powered airplane. It has a pressurized cabin available with a variety of optional cabin arrangements and furnishings to allow the airplane to be equipped to serve the individual needs of the owner.

7.3 AIRFRAME

The primary structure is of all metal construction. The nose, the tail cone, some fairings, and some extremities - tips of the stabilizer and the tip of the vertical fin - are fiberglass.

The fuselage is an all metal, semi-monocoque structure with riveted skin. It consists of three basic units: the nose section, the pressurized cabin section, and the tail section. The cabin section is sealed to maintain pressurization.

The standard six-place seating arrangement includes two crew seats and four passenger seats. The third and fourth seats may be reversed to face aft. The addition of an optional seventh and eighth seat allows seating to be expanded to seven or eight place capacity.

Windows include a two piece windshield, a pilot storm window, four large passenger windows on the right side and three on the left.

A large one piece cabin door on the left side of the fuselage and aft of the third passenger window swings down and automatically extends three steps for boarding and exiting. An optional pneumatic door extender is available to facilitate opening the cabin door.

On the right side, the second side window aft of the windshield is a 25 by 19 inch combination window/emergency exit which can be removed inward after pulling the release above the window.

Each wing is an all metal, full cantilever, semi-monocoque structure. Each wing carries four fuel tanks: one wing tip fuel pod, two bladder type fuel cells, and one engine nacelle tank. The main landing gear retract into wheel wells in the bottoms of the wings. Within each wing is an I-beam main spar which extends into center of the fuselage where the spars are joined with butt fittings, making in effect one continuous main spar. The main spar is also attached at each side of the fuselage. Additional wing support is provided by front and rear spars.

Ailerons are all metal and are mass balanced.

The metal flaps are electrically activated by an airfoil shaped control on the instrument panel to three positions: UP (retracted), APPROACH (15° down), and DOWN (40° extension).

The engine nacelles are integral parts of the wings. They provide efficient streamlined structures for mounting the engines and for fuel storage.

The empennage consists of a vertical stabilizer (fin), a rudder, a horizontal stabilizer and elevators. The rudder and elevators both have trim tabs which are controlled from the cockpit. The empennage group components are metal cantilever structures with removable fiberglass tips. Both the vertical and horizontal stabilizers incorporate two main spars that run the length of the stabilizer and attach to the bulkhead assemblies in the fuselage.

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

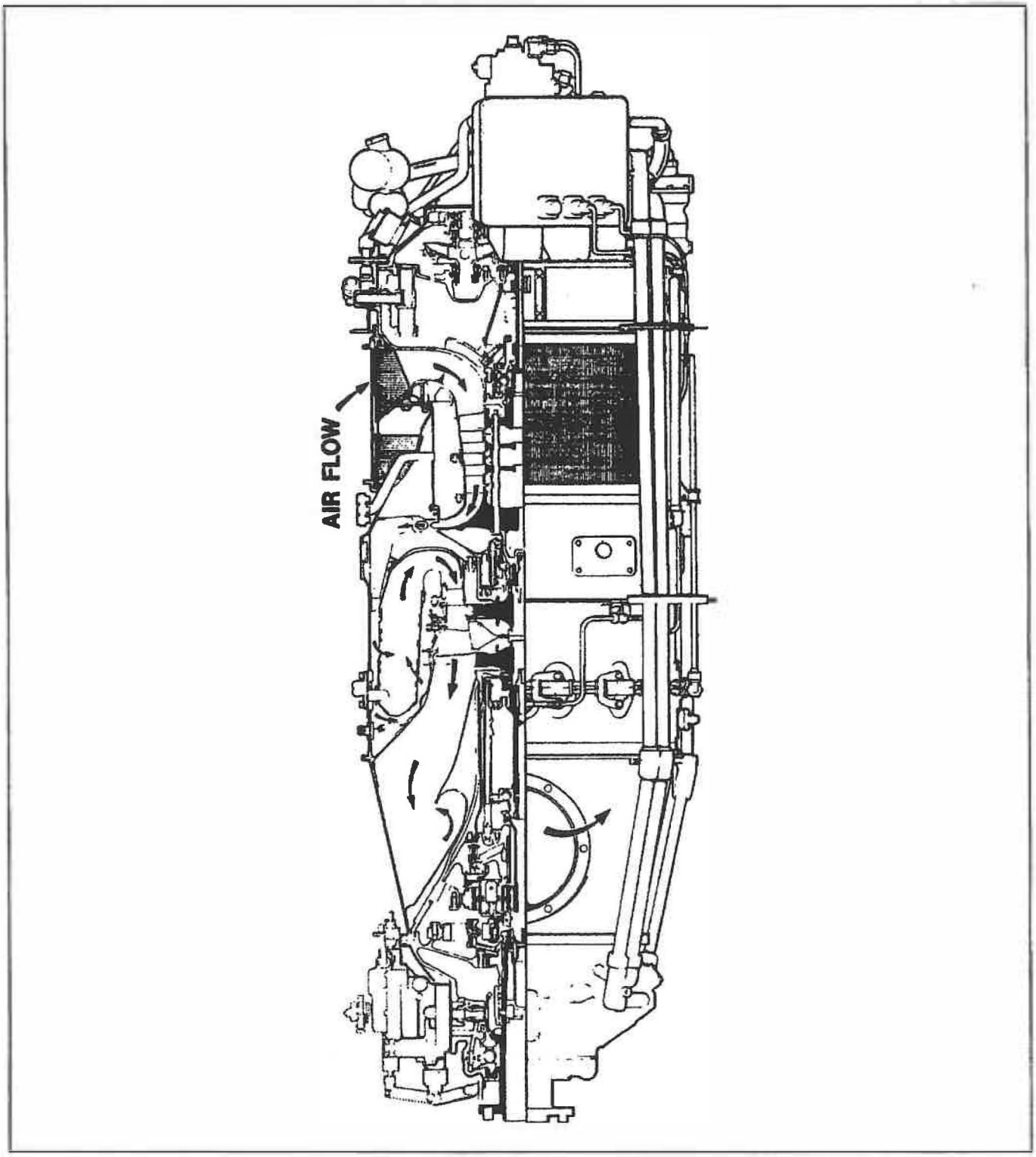
Lightning strike bonding is comprised of metal webbing between structures. Its function is to give the airplane a continuous metal surface. Anti-static wicks attached to the trailing edges of wing and tail surfaces are designed to clear the airplane of surface static electricity that might disrupt low frequency reception or cause VHF interference.

7.5 POWER PLANT

The Cheyenne is powered by two Pratt & Whitney PT6A-28 turboprop engines, each rated at 620 horsepower and with a maximum propeller speed of 2200 RPM. This engine has a reverse flow, free turbine arrangement.

As air enters through an intake screen, it is ducted into a three-stage axial and single-stage centrifugal compressor driven by a single-stage reaction turbine. Another single-stage reaction turbine counter-rotating with the first drives the propeller through a two-stage reduction gear. Fuel is sprayed into the annular combustion chamber by fourteen individual removable fuel nozzles mounted around the gas generator case. Only seven of the fuel nozzles are used for starting; the remaining nozzles cut in as the engine accelerates. The spark-type ignition system used to start combustion permits starts on a variety of fuels.

A hydropneumatic fuel control schedules fuel flow to maintain the power set by the gas generator power lever. The accessory section and an integral oil tank are located on the aft end of the gas generator.



POWER PLANT

Figure 7-1

The ignition system consists of one exciter box, two ignition leads and two spark igniters for each engine.

The igniters are of the low voltage or shunted surface gap type, requiring about 8000-volts to spark. Ignition is by both igniters simultaneously.

D.C. Power is delivered to the exciter box from the essential bus through a series hook-up of an ignition selector switch in the engine control switch panel and a micro switch located on the condition control lever, so that no power is available to the exciter box until both switches have been actuated. The condition control switch will not be actuated until the lever has been moved out of the stop position.

An inertial separation system is built into each engine air inlet to prevent moisture particles under freezing conditions from entering the engine inlet plenum. This is done by introducing a sudden turn in the airstream to the engine, causing the moisture particles to continue on undeflected because of their greater momentum and to be discharged overboard.

During normal operation of the inertial separation system, a movable vane is retracted out of the direct ram airstream. For cold weather (+5° C or below) operation in visible moisture, the vanes should be lowered into the airstream. This is done by actuating on the overhead switch panel the engine ice protection switch for each engine.

When the engine ice protection switch is actuated, a torque drop will accompany the extension of the bypass door. This is normal and the power can be regained by advancing the power levers while monitoring the interstage turbine temperature.

Engine instruments, located at the left of the center panel, are grouped according to their function. Located at top of the stack is engine torque, followed by I.T.T. (interstage turbine temperature), propeller RPM, gas generator RPM and fuel flow. Fuel pressure, oil pressure, and oil temperature are indicated by smaller instruments located at the extreme bottom of the engine instrument stack.

The gas generator RPM and the I.T.T. gauges give an indication of gas generator operation, while the power turbine is monitored by the torquemeters and propeller RPM. The Ng or gas generator tachometer is read in percent of RPM, based on a figure of 37,500 RPM at 100%. The propeller tachometer is read directly in RPM.

Fire warning is provided by three 450°F thermal switches wired in parallel and located in the most likely fire areas of each engine compartment. Indication is provided by the annunciator display system. The press to test circuit of this system not only checks the condition of the indicator lights, but also the complete wiring circuit to the probes.

7.7 ENGINE ICE PROTECTION

The ice deflector and control, air intake deice, and propeller deice systems are presented here as a group because even though each circuit is protected by a separate circuit breaker, they are operated simultaneously by a single switch. The complete engine ice protection system consists of electrically heated boots on each prop blade and on the lip of the engine air intake duct, and an ice deflector vane located inside the air intake duct coupled to a bypass door on the outside of the engine nacelle.

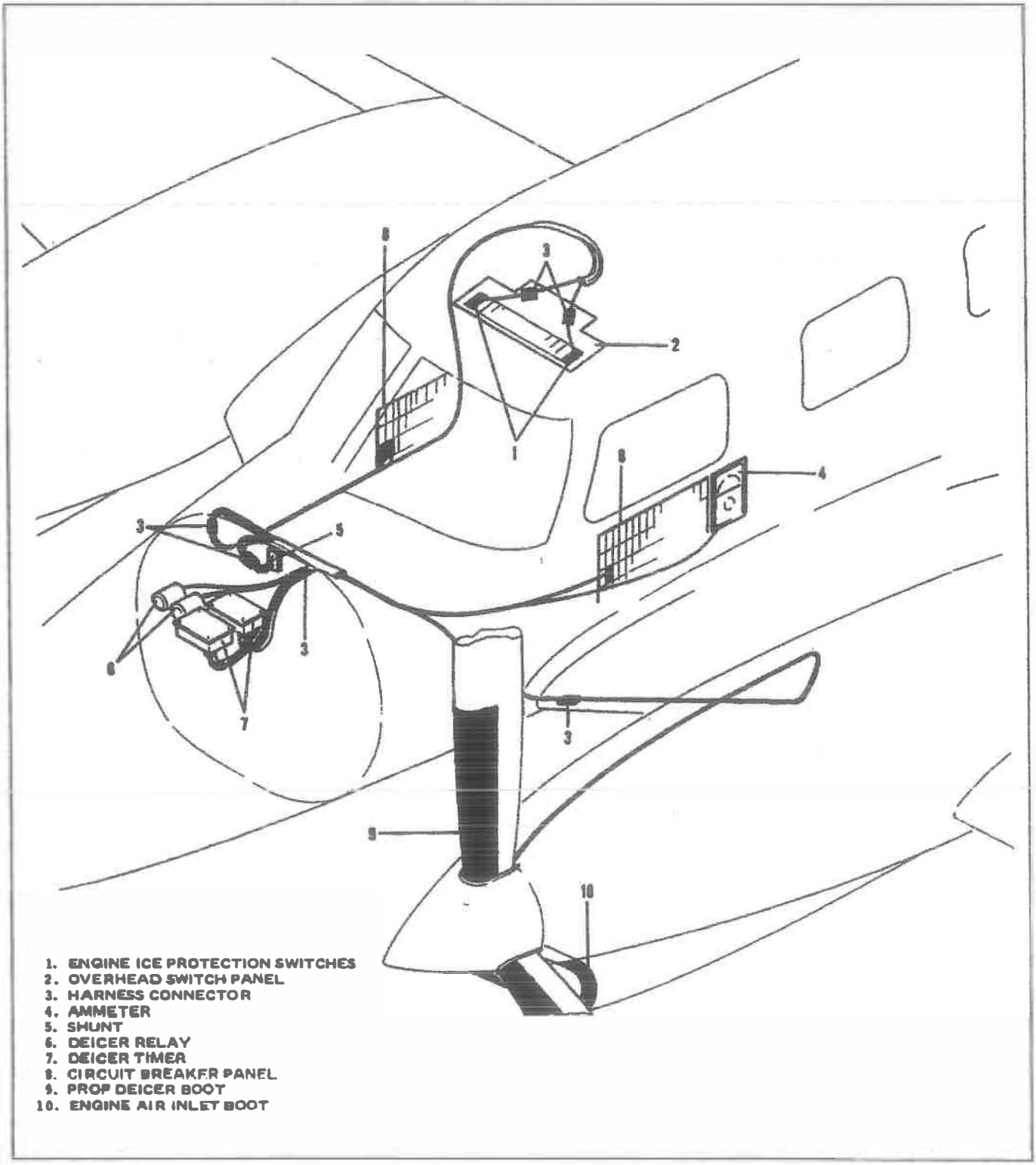
Engine ice protection functions are controlled by two control switches on the overhead switch panel, one for each engine. Each switch operates two relays, a motor control relay and a power control relay, and it also reverses the field for the motor that controls the ice deflector vane and bypass door.

The motor control relay delivers power to the motor that operates the mechanism that extends and retracts the ice deflection vane and bypass door. Coupled to this mechanism are two limit switches whose functions are to automatically turn off the motor control relay when the deflector vane and bypass door have reached an extreme position, either up or down depending on which has been selected.

The sequence of operation is as follows: The selector switch is moved from the "OFF" position to "ON;" the deflector vane and bypass door extend into the airstream, and when the switch is returned to "OFF," the doors retract into the normal position. (Note: A torque loss will be noted when deflector vane and bypass door extend.) The down or extended limit switch also activates an indicator light in the cockpit telling the operator that the deflector door is in proper position for ice protection.

The power control relay delivers power on the electrically heated boots system. The boot on the air intake lip is divided into three separate sections: the parting strip or the area most forward on the lip and two shedding areas. When the power relay is activated, it delivers power directly to the parting strip and to a deicer timer relay. This relay in turn delivers power to the prop deice boots and the two parting strips in a timer sequence of 34 seconds each, i.e., shedding area I is on for 34 seconds, shedding area II for 34 seconds, then the outboard elements of the prop boots for 34 seconds, and finally the inboard elements of the prop boots for 34 seconds. This sequence is repeated until the system is turned off. The ground for the power relay is wired through a landing gear squat switch so that neither the engine air intake lip deicer nor the prop deicer boots can be activated on the ground. However, to check the system, override is provided by means of a ground test switch located on the left side panel below the prop deicer ammeter.

An ammeter, placarded with a green arc at the proper power consumption point on the dial, is provided to monitor the operation of the prop boots and the inlet air boot. The ground leads of the prop and inlet boots are run to ground through a common shunt on each engine and the shunt leads are returned to a switch so that the operator may monitor each engine separately.



ENGINE ICE PROTECTION

Figure 7-3

7.9 PROPELLERS

The propellers are Hartzell three blade, 93 inch diameter, constant speed, reversing and full feathering. Propeller speed is kept constant by a governor which controls the pressure of engine oil to the hub. When the oil pressure generated and controlled by the governor is increased, the blades are moved to the low pitch (increased rpm) hydraulic stop, and when the oil pressure is decreased, feathering springs and centrifugal counterweights allow the blades to move into the high pitch (decreased rpm) position.

Beta and reverse blade angles are also controlled by engine oil pressure to the propeller hub. Selection of the reverse range provides a complete modulation of thrust from full forward to full reverse. Reverse operation of the propellers is obtained by bringing the power levers rearward to the gate stop, lifting and going through the gate into the reverse range. When reverse range is selected, a switch on the power lever opens, removing positive voltage from the solenoid and allowing the propeller to go into reverse. Reverse pitch is locked out in flight by landing gear squat switches on the nose gear and right main gear. These switches maintain positive voltage directly to the solenoid, bypassing the power lever. A test switch is provided to allow testing this lock out feature on the ground.

Back-up governors and overspeed protection, the in-flight reverse lock out feature, a secondary low pitch stop and the ground test switch are incorporated in the propeller controls to insure against malfunction.

7.11 ENGINE CONTROLS

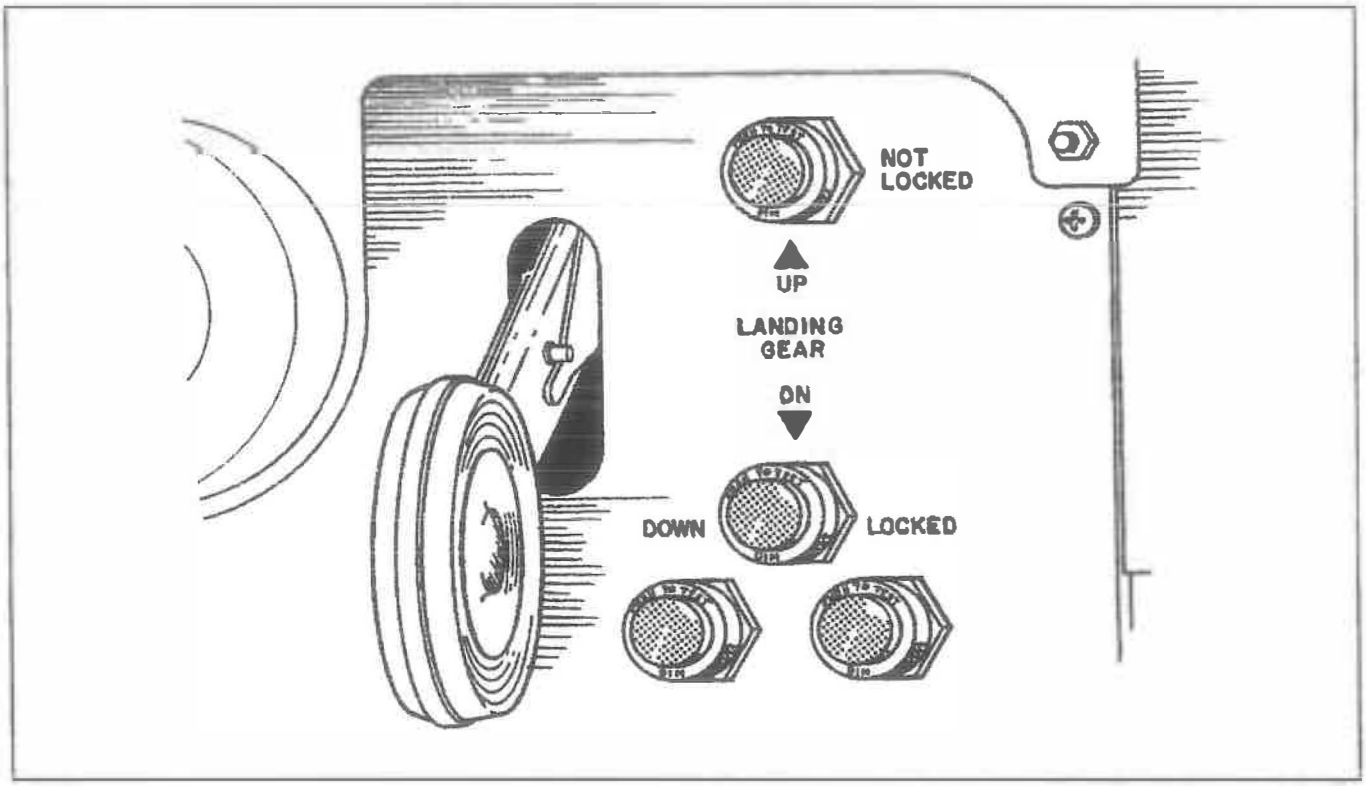
The engines and propellers are operated by three sets of controls mounted on a control pedestal below and to the center of the instrument panel: power levers, propeller controls and condition levers. The power levers work at the fuel control unit on the engine accessory case to control engine power. The propeller controls are operated conventionally and control constant speed propellers through the primary governors. The condition levers work the start controls.

The power levers provide control of the engine power from idle through takeoff power. This is accomplished by operating the Ng speed governor in the fuel control unit. Increasing Ng RPM results in increased engine power.

Each propeller lever operates a speeder spring inside the primary governor to reposition the pilot valve, which results in an increase or decrease of propeller RPM. For propeller feathering, each propeller lever manually lifts the pilot valve to a position which causes a complete dumping of high pressure oil. Increased friction at the rear of the lever travel prevents inadvertent movement into the feathering range.

The condition lever has two positions, stop and run. This lever controls the idle cut-off function of the engine and the micro switch that provides electrical power for engine ignition.

Each engine has an oil cooler door that can be opened on hot days to maintain oil temperature within limits.



LANDING GEAR SELECTOR

Figure 7-5

7.13 LANDING GEAR

The Cheyenne is equipped with hydraulically actuated, fully retractable tricycle landing gear, the nose gear retracting aft into the nose section and the main gear retracting inboard into the wings. Doors completely cover the retracted gear. The nose and outboard main gear doors operate by mechanical linkage to the gear and remain open when the gear is extended. The inboard main gear doors are hydraulically operated, opening during gear extension and closing when the gear is fully extended.

All three landing gear struts are of the air-oil oleo type and require an extension of about 3.25 inches of tube exposure when properly inflated under normal static load.

The nose gear is steerable through a 28 degree arc by use of rudder pedals and an 80 degree arc by use of differential engine power and brakes. When the gear is retracted, the steering linkage separates from the nose gear so that rudder pedals may be operated without being impeded by any connection with the nose gear.

To guard against inadvertent retraction of the landing gear when the airplane is on the ground, a solenoid latch is positioned just above the control lever. A switch on the landing gear must operate this latch before the landing gear selector control can be moved upward. The landing gear control knob is in the shape of a wheel to differentiate it from the flap control, which has a knob in the shape of an airfoil.

On the instrument panel, above and to the right of the landing gear selector control, are one red and three green indicator lights. The red light indicates that the gear is in transit between the "UP LOCKED" and "DOWN LOCKED" positions. The green lights indicate when each of the three gears is down and locked. When the gear is up and locked, there is no indication light. A gear unsafe horn will sound if the power in one or both of the engines is reduced below a setting sufficient to maintain flight while the landing gear is not in the "DOWN LOCKED" position. If the gear selector has been forced into the up position with the airplane on the ground, the gear unsafe horn will sound when the battery master switch is turned on.

NOTE

In the event of electrical failure or with the master switch OFF, there will be no indication of the down and locked position of the gear.

The main wheels are 6.50 x 10 units with disc brakes and carry 6.60 x 10 tube-type tires with 10 ply rating.

The nose wheel is an 18 x 4.4 unit fitted with an 18 x 4.4 tubeless 6 ply rating tire.

A 17.23 x 6.31 high flotation tire is available as optional equipment on the nose wheel for airplanes that will be operated out of soft airfields.

CAUTION

Although the optional 17.23 x 6.31 nose wheel offers less penetration of soft terrain than the standard 18 x 4.4 tire, it also carries the penalty of 2 inches less propeller to ground clearance under the condition of a fully deflected or a flat tire as the wheel is of a smaller diameter.

7.15 BRAKE SYSTEM

The brakes are hydraulically operated by individual cylinders mounted on the left set of rudder pedals. They are actuated by toe brakes on the pilot's side. There are provisions for an optional installation of master cylinder and toe brakes for the copilot's side.

A brake fluid reservoir which supplies fluid to each master cylinder is accessible through an access door atop the nose section.

From the master cylinders, hydraulic fluid is routed through lines and hoses to a parking brake valve located on the left aft side of the forward cabin bulkhead, then through the cabin and wings to the brake assembly on each main landing gear.

To set the parking brake, first depress and hold the toe brake pedals, and then pull out on the parking brake handle located on the left face of the instrument panel. To release the parking brake, first depress and hold the toe brake pedals, and then push in on the parking brake handle.

WARNING

No braking will occur if aircraft brakes are applied while parking brake handle is pulled and held.

CAUTION

The rudder pedals are suspended from a torque tube which extends across the fuselage. The pilot should become familiar with the proper positioning of the feet on the rudder pedals so as to avoid interference with the torque tube when moving the rudder pedals or operating the toe brakes.

7.17 HYDRAULIC SYSTEM

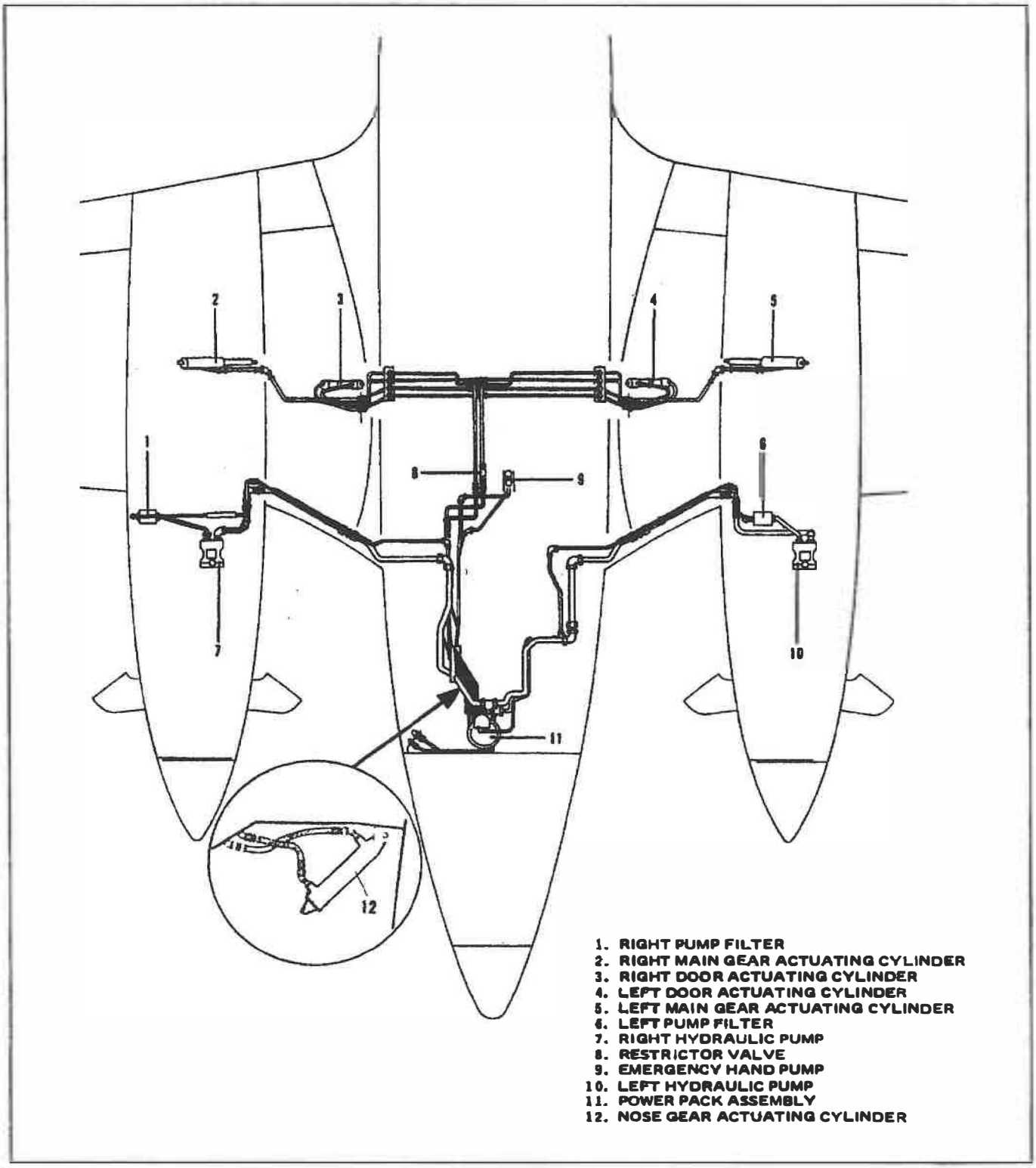
The hydraulic system consists of two hydraulic pumps, a power pack, an emergency hand pump, actuating cylinders and filters. The hydraulic pumps which supply the pressure required for gear operation are engine driven. The power pack is the central control unit for the hydraulic system. It contains the valves, manifold, fluid reservoir, and necessary controls for operation of the landing gear.

Fluid is taken from the reservoir by the pumps and is passed through a filter to the power pack, which then directs the fluid to the appropriate actuator, depending on the sequence and gear selector position.

The reservoir contains a standpipe which retains sufficient fluid to operate the emergency hand pump in case of a loss of fluid. The engine-driven pumps are supplied through the standpipe; so if the fluid level is below the standpipe, the only way to operate the gear is by using the hand pump.

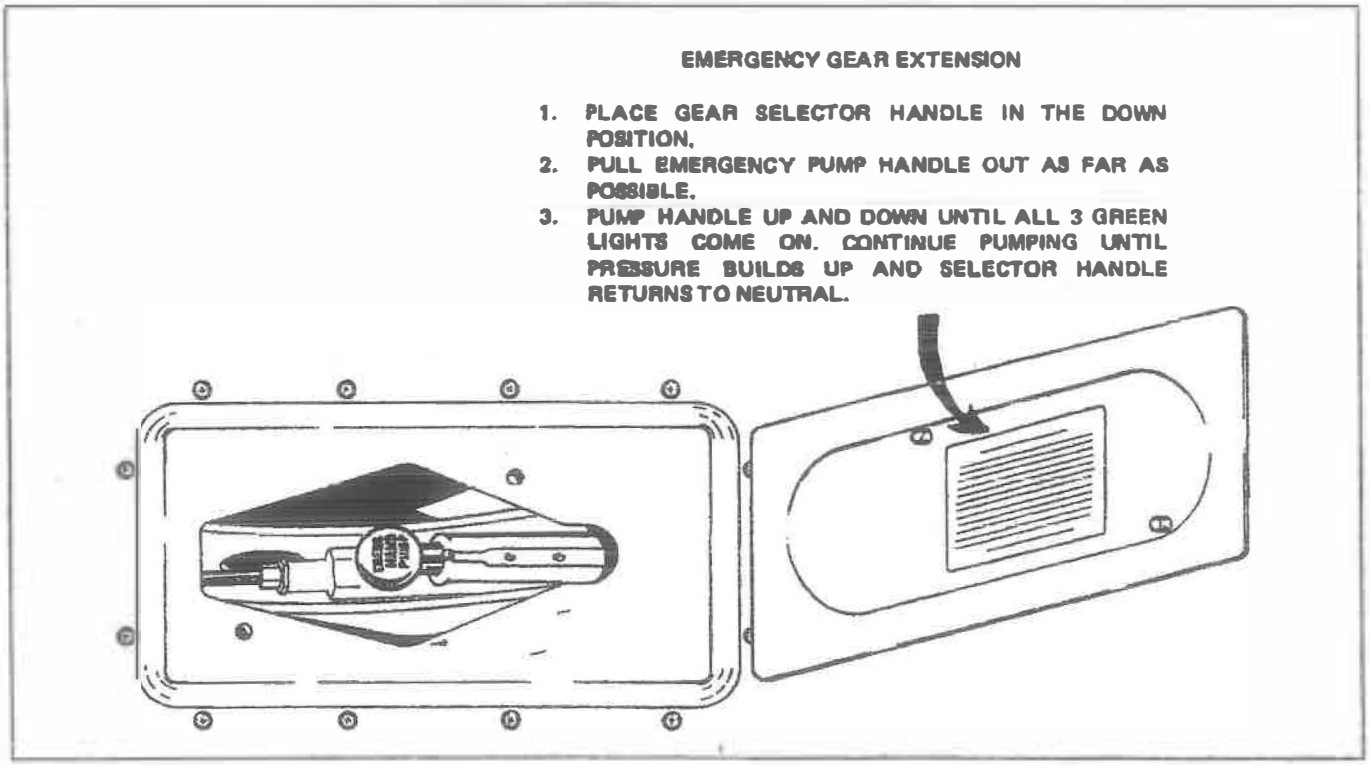
A door solenoid valve is electrically operated and is spring-loaded to the door open position. Should an electrical failure occur, the solenoid valve will move to the door open position to allow the gear to be lowered either normally or with the hand pump. For a more detailed description, refer to the PA-31T Service Manual.

To operate the gear, pull out the wheel shaped gear selector mounted on the left instrument panel, and move it from the neutral position to the "UP" landing gear or "DOWN" landing gear position. When the desired position of the gear is obtained, the handle is forced back to the neutral position by a spring. The hydraulic fluid then circulates freely between the pump and control unit. Gear extraction or extension will occur normally in approximately 6 seconds.



HYDRAULIC SYSTEM

Figure 7-7



EMERGENCY LANDING GEAR HAND PUMP

Figure 7-9

NOTE

In the event of electrical failure or when the master switch is OFF, the selector handle will not return to neutral and the gear doors will not close, and the gear down lights will not illuminate.

When the selector handle returns to neutral, it relieves all pressure in the system. The gear is held in position by mechanical locks. The return of the control handle to the neutral position is an indication that the components have reached full extension or retraction. However, the landing gear position lights should be used as primary indications.

To check the function of the engine-driven hydraulic pumps, after starting one engine before flight, and before shutting down the other engine after flight, place the gear selector in the "DOWN" position. If a pump is operating properly, the gear lever will return to the neutral position.

CAUTION

When retracting the landing gear be sure that the gear unsafe light is out before exceeding the maximum gear operating speed.

The emergency hydraulic hand pump is used to obtain hydraulic pressure in the event of failure of the engine-driven hydraulic pumps. This hand pump is located between the pilot's and copilot's seats. An access cover marked "Emergency Gear Extension" must be lifted to gain access to the pump handle. Follow instructions on the underside of the access plate to lower the gear. The hand pump should not be used to retract the gear in flight. (See Section 3 - Emergency Procedures - for manual gear extension procedure.)

NOTE

Depressurize the cabin prior to lifting the emergency gear access cover.

7.19 FLIGHT CONTROL SYSTEM

The primary flight controls are conventional and are operated by dual control wheels and rudder pedals. The control wheel operates the ailerons and the elevators; the rudder pedals operate the rudder and the nose wheel steering. The toe brakes, which are an integral part of the pedals, operate the wheel brakes. The ailerons and rudder are interconnected through a cable-spring system to provide coordination in normal turns.

Secondary control is provided by the aileron, elevator, and rudder trim tabs. Trim is operated by knobs or wheels on the control pedestal which turn cable-wrapped drums located inside the pedestal. With rotation of the drums, screws are moved forward or aft to position the trim tabs. The rudder trim wheel, for nose left or nose right correction, is located below the power controls. The aileron trim wheel, for right wing down or left wing down correction, is located below the rudder trim control. The elevator trim wheel, for nose up or nose down correction, is located on the left side of the pedestal. To show the position of the trim tab, an indicator is mounted next to each trim control on the control pedestal.

AIRCRAFT WITH SERIAL NUMBERS 31T-7720001 THROUGH 31T-7820066 AND 31T-7820068 THROUGH 31T-7820092

The wing flaps are controlled by an airfoil shaped selector switch mounted on the instrument panel to the right of the control pedestal. The switch activates an electric motor under the center floor panel of the cabin. This motor drives a screw transmission in the trailing edge of each wing. Relays external to the motor limit the travel of the flaps. The flaps extend or retract by the rotation of the gears in the transmission, while a sender unit, attached to the left flap, transmits a signal to the indicator on the instrument panel just above the flap selector switch. The flap selector switch has three positions: fully retracted, 15 degrees down (approach position), and 40 degrees (full extension).

CAUTION

When selecting an "approach" flap position and the selector is inadvertently moved beyond the "approach" detent, the selector must be returned to its original position and then back to "approach" in order to re-program the selector. Returning the selector to the "approach" detent without re-programming will return the flaps to their original position.

The flap electrical system includes a device to prevent an asymmetric flap condition. Should the left flap fail to move from either the up or the down limit switch, a time delay relay will interrupt power to the flap drive

motor. This interruption of power will occur within one second, or after approximately 9 degrees of right flap travel, after flap selection. The flap selector switch will remain inoperative until the time delay relay is reset by pulling the flap control circuit breaker and then resetting it.

CAUTION

Do not reset the flap system until the airplane has landed and the malfunction has been corrected, as reactivation of the flap selector switch will allow another one second of operation, causing the asymmetric differential to become more severe.

Since the limit switches are on the left flap only, failure of the right flap system can be compensated for by use of the flap selector switch to position the left flap symmetrically with the right flap.

The system is not affected by the time delay switch if failure occurs when the left flap is between the up and down limit switches. If failure occurs in either flap system when the left flap is not in contact with a limit switch, use the flap selector switch to bring the functioning flap into a symmetrical configuration with the inoperative flap.

To preclude the possibility of encountering large asymmetric ("split") flap angles due to a failure in the flap actuating system, the following procedures should be followed for flap extensions/retractions:

(a) Actuate the flaps only while the airplane is under manual control, not while the autopilot is engaged (the autopilot will mask the high control forces created by an asymmetric flap condition).

(b) Select flap position in two stage steps only.
   1. Extension:
      Step 1. Up to Approach
      Step 2 Approach to Down
   2. Retraction (flight only):
      Step 1. Down to Approach
      Step 2. Approach to Up

CAUTION

Do not exceed the approach detent selector position when making selection. If this should occur, return the selector to its original position prior to selection, then return to the approach position.

(c) When making the selection to the approach position, continuously monitor the flap position indicator pointer for proper movement. The pointer should begin to move smoothly toward the approach dial mark immediately upon selection. If the pointer stops before reaching the approach position, immediately return the flap selector switch to its original position. ie., If selecting from Up to Approach, return to Up. If selecting from Down to Approach, return to Down.

(d) Do not extend the flaps beyond 15° if the flap motor circuit breaker has a history of "popping" (a "popped" circuit breaker is indicative of excessive actuation loads on one or both flaps; such loads are most likely at flap angles in excess of 15°) The airplane should not be flown until the cause of the high loads is determined and repairs effected.

AIRCRAFT WITH SERIAL NUMBERS 31T-7820067, 31T-7920001 THROUGH 31T-7920094

Wing flap position is controlled by a selector switch mounted on the instrument panel immediately to the right of the control pedestal. The flap position indicator located to the left and above the selector switch. The position indicator 40° arc is segmented at the approach (15°) flap range and in increments of 5° between the 15° and 40° arcs. An OFF position is also provided to indicate zero (0) voltage to the system. The selector switch provides for variable wing flap positioning in as little as 2° increments from 0° to 40°. Detent positions are provided at the most commonly used positions of 0°, 15°, and 40°. A wing flap position change is made by moving the selector handle to any desired position (marked on the switch selector gaurd). The flaps will automatically move to the selected position and indicator will display the actual flap position. The entire system is electronically monitored for system component failures and will prevent an asymmetric flap position greater than 5° differential.

The basic electronic control system consists of an amplifier, three rheostats, two power solenoids, and one motor. The motor is of a D.C. permanent magnet type and extends or retracts the flaps through a pair of flexible shafts attached to jackscrew, transmission assemblies located on each wing flap.

The amplifier is the heart of the control system. It provides a regulated voltage supply for the three external rheostats, circuit logic to analyze the system condition and position; povides commands to the power solenoids to actuate the motor for extensions and retractions and contains its own monitoring system to ascertain the condition of critical components.

The three rheostats feed back to the amplifier the signals necessary to operate the system. One rheostat is located in the flap position selector and one each is located so as to sense the positions of the right and left flaps independently. The selector rheostat tells the amplifier where it wants the flaps to be. The left flap rheostat controls flap position in relation to the selector rheostat position and provides information to the amplifier to drive the position indicator. The right flap rheostat must agree with the left flap rheostat within 5° at all times or the system will shut down and cannot be reactivated until the imbalance and/or the cause has been corrected.

The system also incorporates an annunciator light that will illuminate when an imbalance exists between the right and left wing flap rheostats or a critical component of the amplifier has failed.

The operation of the flaps may be checked with a test switch before takeoff. This switch is located adjacent the position indicator.

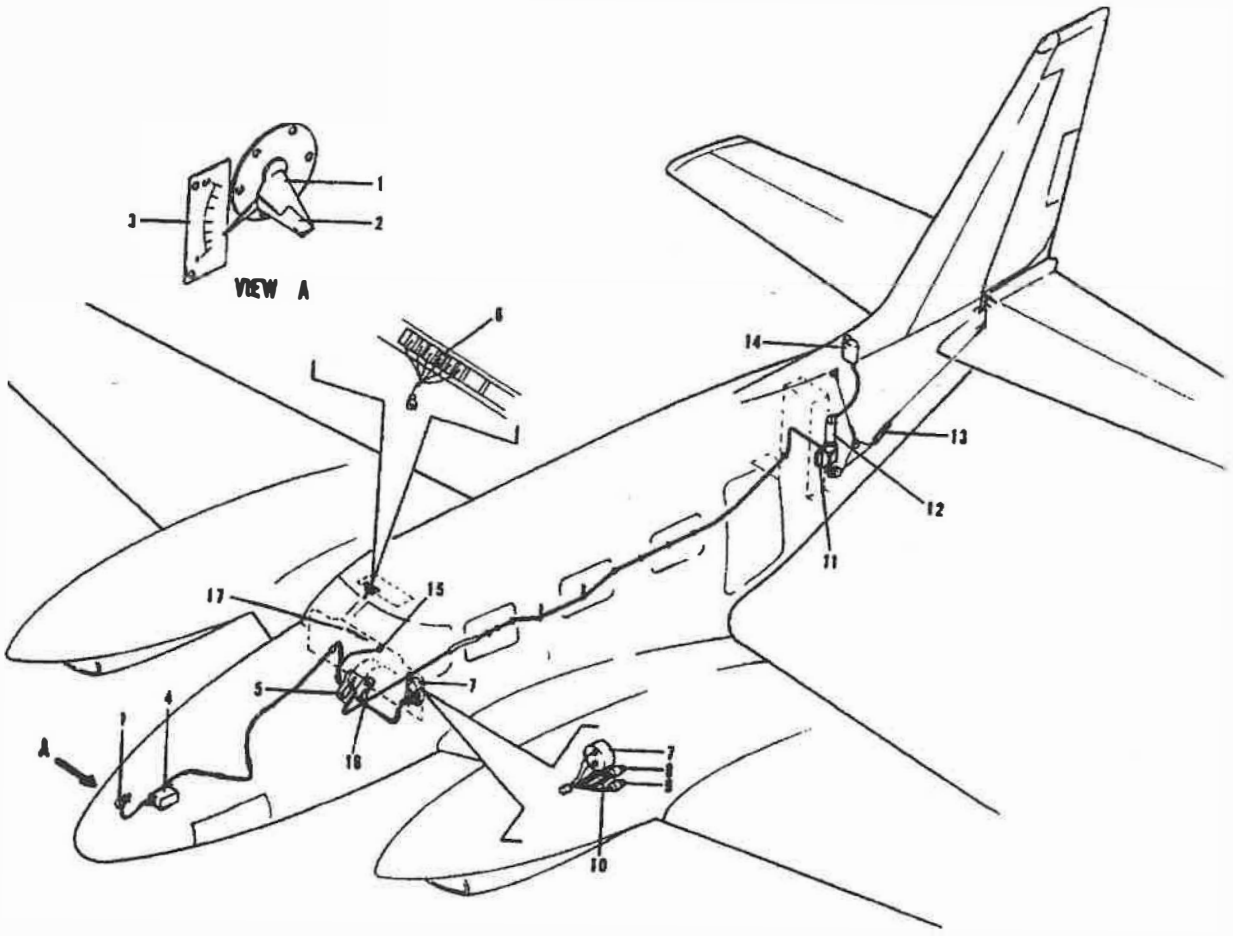
7.21 STABILITY AUGMENTATION SYSTEM

The Stability Augmentation System (SAS) automatically improves the static longitudinal stability of the airplane by providing variable elevator force. This is accomplished through tension changes in an elevator down spring. An angle-of-attack sensing vane on the right side of the fuselage nose section signals the SAS computer, which powers the elevator down spring servo. Other functions of the SAS computer are activation of the stall warning horn and providing the signal for the visual stall margin indicator on the upper left side of the instrument panel. Sensing vane heat is controlled by the left pitot heat switch.

A SAS test panel, located in the pilot's instrument panel, provides a test switch for preflight checking of the SAS, and, on serial numbers 31T-7720001 through 7720069, fault lights to indicate SAS malfunctions. Should the SAS malfunction, the lights will illuminate continuously until the malfunction is corrected. If the malfunction is due to a power failure, the "power" warning light will illuminate; if the malfunction is due to a computer, sensing vane, and/or servo failure, the "ram" warning light will illuminate. On serial numbers 31T-7820001 through 31T-7920094, a single SAS malfunction warning light is located on the annunciator panel. Any SAS malfunction will illuminate this light.

NOTE

Very rapid changes in angle of attack may cause a brief "RAM" warning and should not be mistaken for a system malfunction.



1. ANGLE OF ATTACK VANE (SENSOR)
2. POINTER ASSEMBLY
3. VANE CALIBRATOR PROTRACTOR
4. SAS COMPUTER
5. SAS OVERRIDE ACTUATOR
6. LEFT PITOT/SAS VANE SWITCH
7. STALL MARGIN INDICATOR
8. POWER WARNING LIGHT (SER. NOS. 31T-7720001 THRU 31T-7720069)
9. RAM WARNING LIGHT (SER. NOS. 31T-7720001 THRU 31T-7720069)
10. SAS TEST SWITCH
11. SAS SERVO MOTOR
12. SAS OVERRIDE HYDRAULIC CYLINDER
13. ELEVATOR DOWN SPRING
14. SAS OVERRIDE HYDRAULIC FLUID RESERVOIR
15. STALL WARNING LIGHT (SER. NOS. 31T-7720001 THRU 31T-7720069)
16. STALL WARNING HORN
17. ANNUNCIATOR PANEL SAS WARNING LIGHT (SER. NOS. 31T-7820001 THRU 31T-7920094)

STABILITY AUGMENTATION SYSTEM

Figure 7-11

The stall margin indicator is mounted on the upper left hand side of the pilot's instrument panel. The indicator receives it's signal from the angle-of-attack vane through the conditioning computer and presents a visual indication of the ratio of present speed to the stall speed in the same configuration (V/Vs). The instrument is color coded as follows: Solid red indicates the stall area, red with black barber pole stripes indicates the stall warning area, yellow indicates the slow area, white indicates the 1.3 Vs reference area in the particular configuration, and green indicates a value greater than 30 percent above the stalling speed.

During cruise flight, the pointer should be in the green area. During the landing approach with power on and a shallow flight path (approximately 3 degrees) the needle will normally be in the green area at any speed above 95 KIAS reflecting the margin between stall (with the same power on) and the approach speed. Stall speeds with power on will always be lower than with power off. When power is removed the aircraft must nose down to maintain the same stall margin.

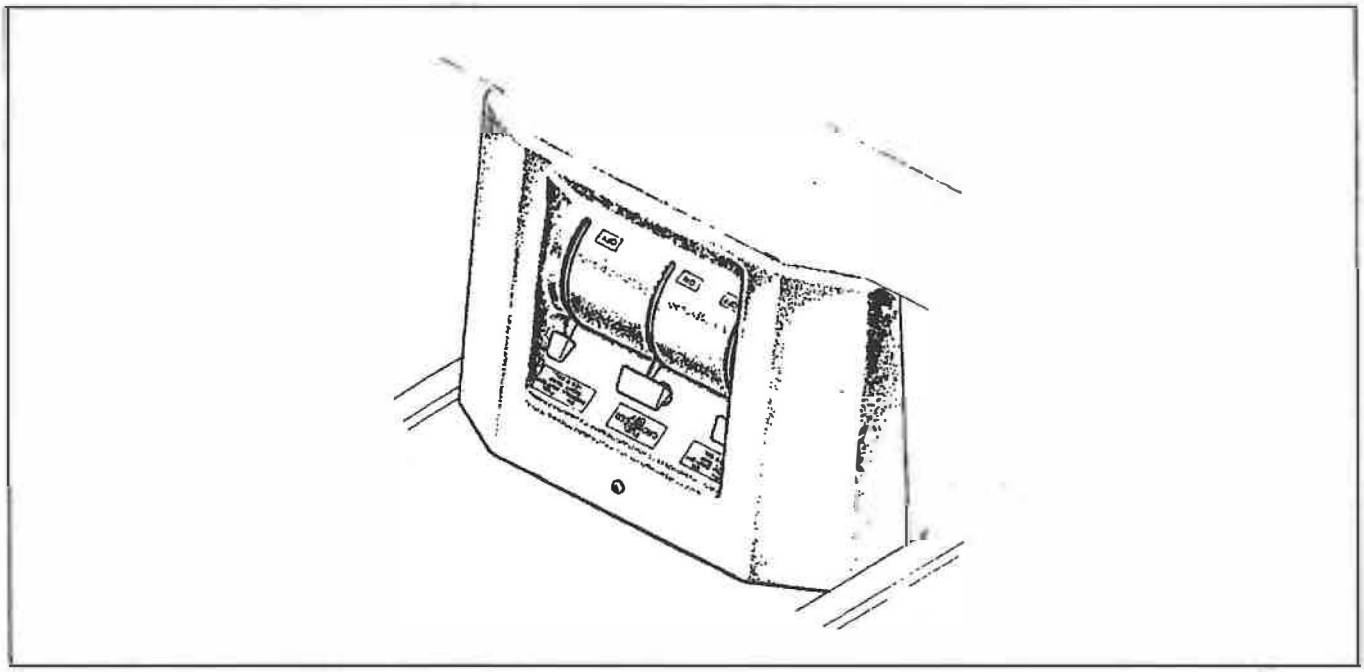
As the stall is approached in any configuration, the pointer will rotate counterclockwise toward the "stall" area. The stall warning horn will indicate when the stall margin indicator enters the stall warning area. On serial numbers 31T-7720001 through 7720069, there is also a stall warning light, which is located on the upper portion of the pilot's instrument panel.

The SAS is equipped with a stability augmenter override system. Should the SAS fail to function satisfactorily during flight, the pilot can override the system by removing the access cover on the right side of the control pedestal and pulling the lanyard actuator handle. Before the access cover can be removed, a cover release pin/ring must be pulled. This ring is safety-wired. If during preflight inspection the safety wire is found to be broken, the cover should be removed and a safety wire on the trigger mechanism examined. If this second safety wire is broken, the CO_2 cartridge must be removed and carefully checked. If the seal is not intact, the faulty cartridge should be replaced with a fully charged cartridge, and the access plate in the tail section of the airplane removed to assure that the override system is deactivated.

The stability augmentor override is pneumatically operated. Pulling the lanyard actuator handle releases compressed gas from a CO_2 cartridge into a cylinder located in the aft section of the fuselage. Under normal operating conditions, the cylinder is filled with hydraulic fluid and the piston and rod assembly in the cylinder is in the down position, where it has no effect on the elevator down spring. When the lanyard actuator is pulled, the CO_2 is discharged through a line and into the cylinder, driving the piston and rod assembly upward. The rod locks into place, keeping a constant tension on the elevator down spring, thus providing suitable handling characteristics for the rest of the flight. At the same time, the hydraulic fluid is forced from the cylinder into a reservoir on top of the fuselage, where it is held until the override system is rearmed.

If the override system has been actuated due to a SAS malfunction or for any other reason, the SAS should be serviced and the override system should be rearmed and the CO_2 cartridge replaced upon completion of the flight. This assures the pilot of complete system capabilities in future flights. When the override system has been rearmed, the cylinder in the tail section of the airplane should be visually checked to confirm that it is in the down position and that it is not exerting tension on the elevator down spring. After the system has been rearmed, safety wires on both the trigger mechanism and the lanyard actuator access cover should be resecured.

For further information on the Stability Augmentation System, refer to the PA-31T Service Manual.



FUEL MANAGEMENT CONTROLS

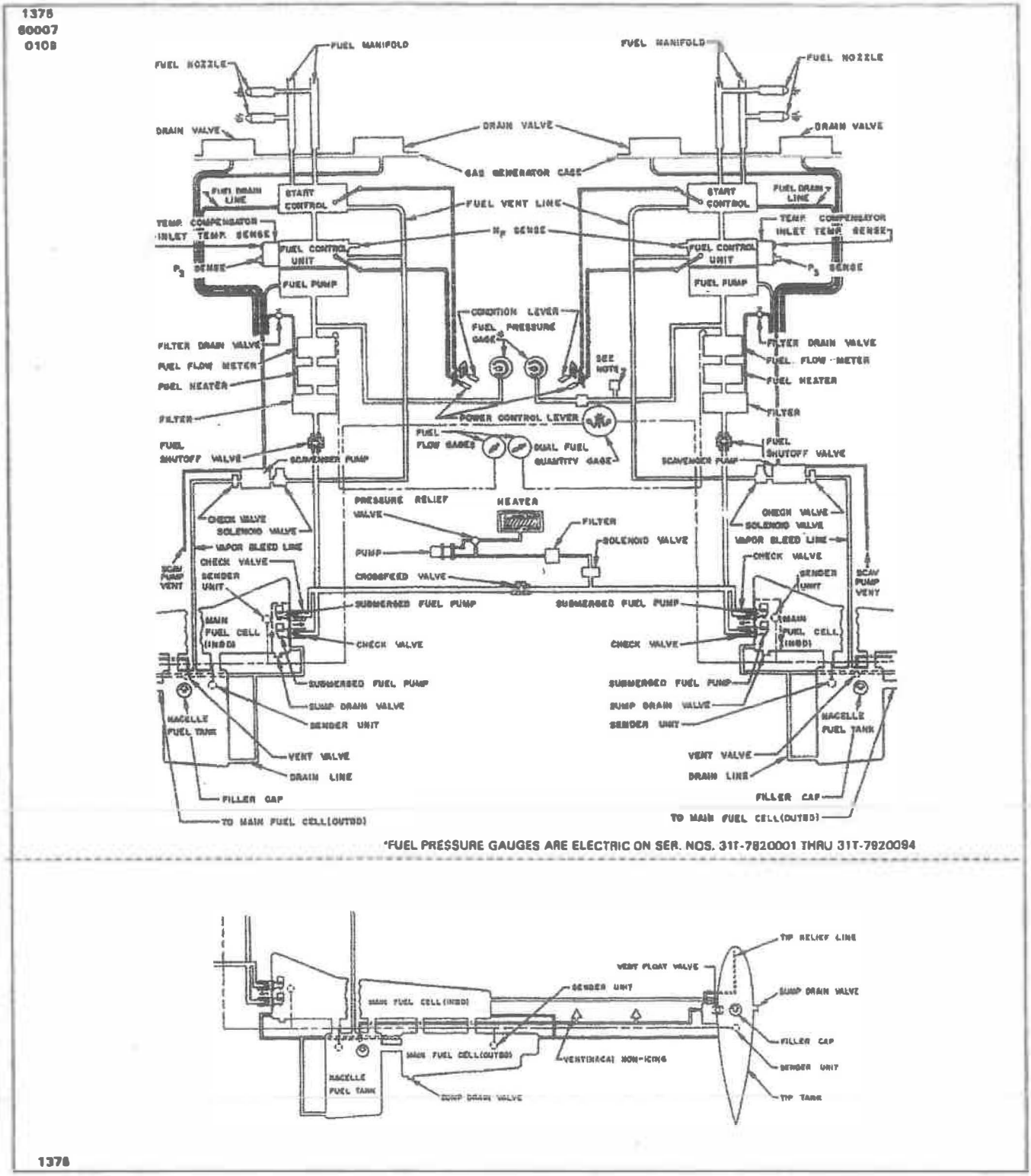
Figure 7- 13

7.23 FUEL SYSTEM

The fuel system for the turbine powered PA-31T has a total capacity of 374 U.S. gallons when filled to the tip tank fillers. When filled to the nacelle tank fillers, the fuel quantity is 336 U.S. gallons. Fuel is carried in eight tanks - four individual interconnected tanks in each wing: a wing tip fuel tank, a wet nacelle tank, and two bladder-type fuel cells. The right and left wing fuel systems are independent of each other and are connected only when a crossfeed system is activated. Fuel to the engines is supplied from the inboard fuel cells.

When filling the fuel system, always fill first through the nacelle tank fillers. When the nacelle tanks are full, the complete system, with the exception of the wing tip tanks, will be full. Final filling must be done through the tip tank fillers. Be sure that the nacelle filler cap is secure when there is more than two inches of fuel in the tip tank. Otherwise, differential pressure will cause fuel to be lost through the nacelle tank filler.

Each inboard main tank has two submerged boost pumps to supply fuel to the engine. In each inboard cell, a rubber baffle with a gate valve traps fuel around the pumps during fast turning takeoffs or other maneuvers which might tend to move fuel away from the pumps and interrupt fuel flow. One of the boost pumps must be operating any time the engine is in operation so that fuel under pressure is being supplied to the engine-driven fuel pump. The engine-driven fuel pump supplies fuel to the engine fuel nozzles.



FUEL SYSTEM SCHEMATIC

Figure 7-15

Vents for the fuel system are NACA type, anti-icing, non-siphoning vents which incorporate flame arrestors.

A scavenger pump with a reservoir for fuel storage picks up the fuel which drains from the engine after shutdown. During starting, this fuel is pumped back to the fuel cells. If any fuel is observed to drain overboard, a need for maintenance work on the scavenger pump is indicated.

Six fuel sump drains for the fuel tanks are located along the bottom of the wings: one under each tip tank, one just outboard of each wheel well, and one on the inboard of each wing near the junction of wing and fuselage. On the fuel filter assemblies, forward of each engine fire wall, are main fuel filter drains, accessible through a door on the left side of each engine cowling.

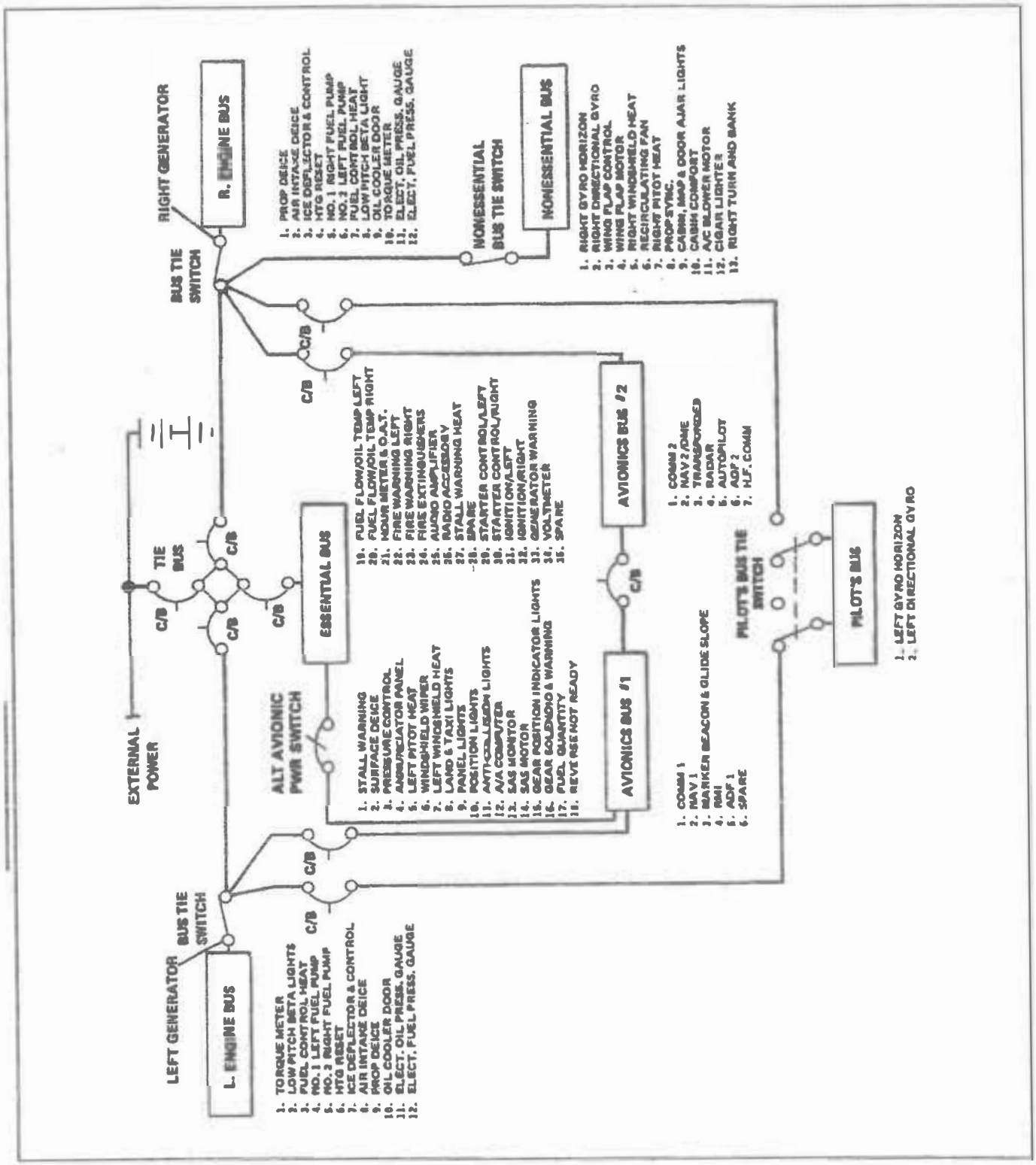
Fuel flow is controlled by a separate fuel shutoff valve for each engine. These valves are controlled from the cockpit by controls mounted between the front seats on the forward edge of the wing spar carry-through cover. The fuel shutoff valves function as fire wall shutoffs and as on-off valves for the fuel sytem.

The only other control valve on the fuel system is the fuel crossfeed, also mechanically operated from a control on the spar carry-through. This valve should always remain "OFF" except during single-engine operation when crossfeed to the operating engine is necessary.

The fuel system can be monitored through several gauges on the instrument panel. A dual needle type fuel quantity indicator, mounted on the copilot's side just above the control wheel, has its own A.C. inverter to power a capacitance probe system. This system transmits to the gauge an indication in pounds of the amount of fuel in the tanks.

Two fuel flow gauges are located in the lower portion of the gauge cluster to the left of the radio stack. They measure fuel flow in pounds per hour to each engine.

Immediately below the fuel flow gauges are two fuel pressure gauges which indicate in pounds per square inch the pressure at which fuel is being supplied to each engine fuel pump.



POWER DISTRIBUTION DIAGRAM

Figure 7-17

7.25 ELECTRICAL SYSTEM

Electrical power is supplied by a 28 volt, direct current, negative ground electrical system. Two 30 volt, 200 ampere, D.C. starter/generators in parallel provide torque for engine starting and generate D.C. electrical power. One 24 volt, 43 ampere hour air-cooled nickel-cadmium battery, located in the nose section behind the nose cone, furnishes power for engine starting and also serves as a reserve source of emergency electrical power in the event of a dual generator failure. The electrical system is automatically protected from overvoltage and reverse current.

An external power receptacle, located on the underside of the nose section, allows the use of an external auxiliary power source for starting the engines or to allow an extended ground check of electrical equipment.

CAUTION

Do not allow external auxiliary power to be applied to the airplane before ensuring that the battery master switch, condition levers, ignition switches, starter switches and radio master switch are all "OFF." During an external start, monitor the airplane voltmeter until the reading stabilizes (27 volts minimum - 30 volts maximum), and then turn the battery master switch "ON." Generator switches are to be "OFF" until the engines are running and the external power source is disconnected.

NOTE

External power source used for engine starting must have a minimum starting capacity of 1200 amperes at 28 Volts dc.

The electrical system is primarily controlled by three switches in the overhead panel, labeled "BATTERY MASTER SWITCH," "RIGHT STARTER-GENERATOR SWITCH, " and "LEFT STARTER-GENERATOR SWITCH." The battery master switch connects the battery to the tie bus. The starter-generator switches determine the mode of operation of the D.C. starter/generators. These are three-position switches labeled "START" and "GENERATOR" with the middle position "OFF." (Refer to Section 4 Paragraph 4.13 for starting procedures.)

Electrical switches are located in an overhead panel just above the windshield (Figure 7-19) and in panels on the sides of the cockpit (Figure 7-21). The overhead panel includes two ammeters and one voltmeter for monitoring of the electrical system. The ammeters provide an independent output check of each generator, and the voltmeter indicates electrical bus voltage as well as battery condition prior to engine starting. Individual circuit protectors for the airplane's various electrical devices are mounted in circuit breaker panels on the sides of the cockpit. These circuit protectors are of the press-to-reset type.

The standard electrical system is divided into four separate buses (left engine, right engine, essential and non-essential) all being fed from a central tie bus, in order to provide a safer electrical distribution and to eliminate the necessity of protecting a single bus system for 400 amperes. Four bus tie circuit breakers, one each for the essential bus, the battery bus, the left generator bus, and the right generator bus, are located on the floor between the pilot and copilot seats. The left and right generator output and the battery lead are fed unto the tie bus through 200 amp thermal breakers. The essential bus is fed from this tie bus through a 105 amp thermal breaker. Either or both generators may be switched on or off the tie bus by means of a switch on the circuit breaker panel. This switch will not remove its associated generator from its own engine support bus; it only disconnects from the tie bus system. A switch is also provided to remove the non-essential bus from the system. The essential bus is connected directly to the tie bus and cannot be removed unless all electrical power is removed from the tie bus system. Refer to the Power Distribution Diagram (Figure 7-17) for the individual circuit. In the event of a ground fault on a generator feeder lead between the generator and its associated bus tie switch, an overload sensor will open and automatically remove the generator from the line. If the ground fault were to occur between the bus tie switch and the tie bus, the associated bus tie circuit breaker would open and the fault would be isolated by opening the bus tie switch.

Overvoltage protection is provided by voltage sensitive relays. Should an overvoltage condition occur, the affected relay will open and remain open until all voltage is removed from the affected generator by turning OFF the generator-starter switch.

Lighting includes standard navigation lights, a landing and a taxi light on the nose gear strut housing, and strobe-type anti-collision lights on both wing tips and the tail. Cabin lighting includes two dome lights and four reading lights. Cockpit lighting consists of various indicator lights, instrument panel lighting, and two map lights. The overhead switch panel and circuit breaker panels are electroluminescent. The courtesy lights are a baggage compartment light in the nose section and a passenger entrance light. There is also a 50 watt wing ice inspection light located outboard in the left engine nacelle.

CAUTION

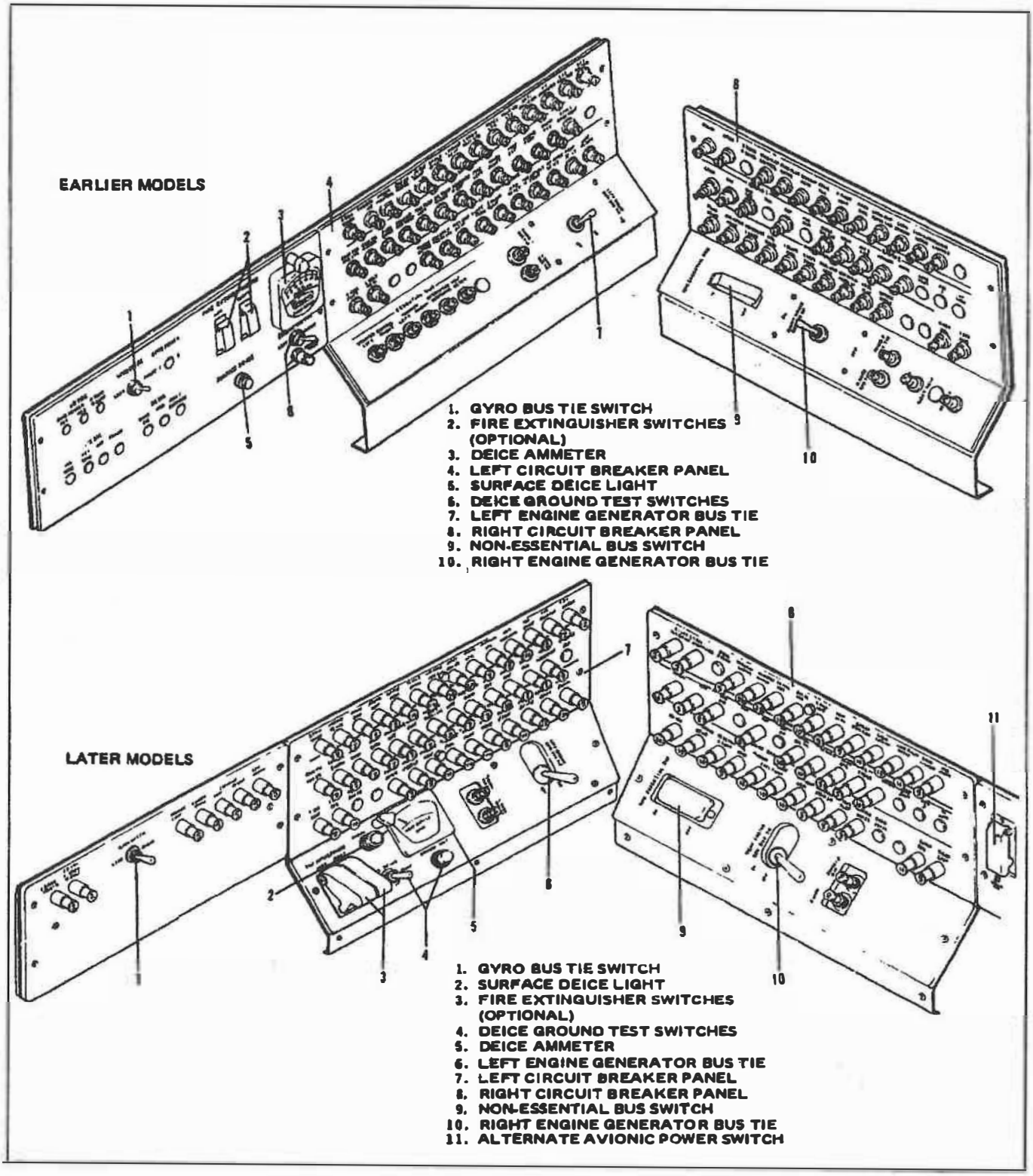
Strobe lights should not be operating when flying through overcast and clouds, since reflected light can produce spacial disorientation. Do not operate strobe lights when taxiing in the vicinity of other aircraft.

Other electrical accessories include pitot heat, a heated pilot's windshield, a gear warning horn, a stall warning horn, a rheostat switch to control instrument panel lighting, and other assorted systems, controls, and lights.

The electrical system provides for the addition of optional electrical accessories.

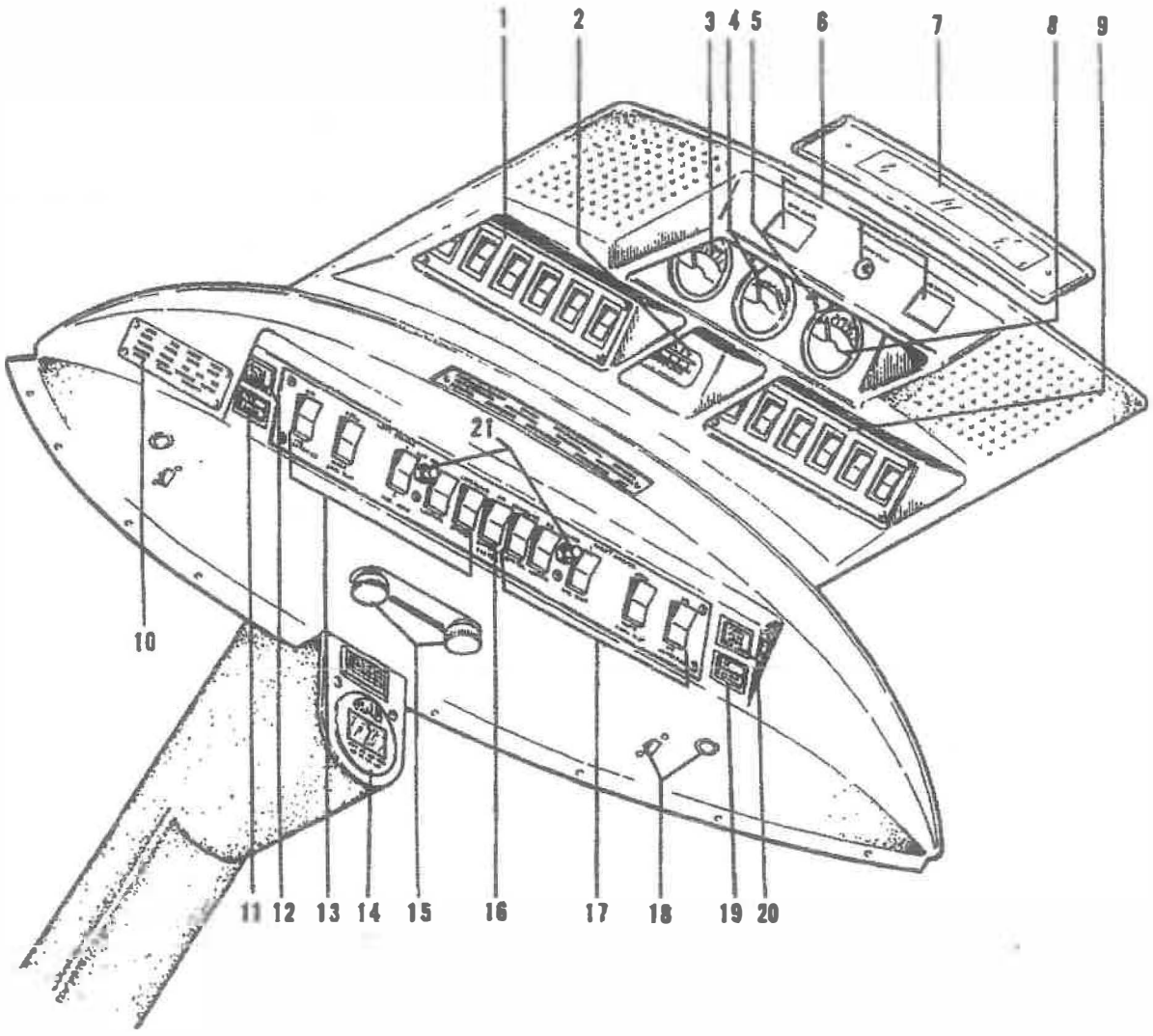
CAUTION

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.



TYPICAL COCKPIT SIDE PANELS

Figure 7-19



1. LIGHT SWITCHES
2. ENGINE HOURMETER
3. LEFT GENERATOR AMMETER
4. VOLTMETER
5. ELT REMOTE SWITCH
6. NO SMOKING, SEAT BELT AND DOME LIGHT SWITCH
7. DOME LIGHT
8. RIGHT GENERATOR AMMETER
9. DEICING SYSTEM SWITCHES
10. SPEED PLACARD
11. LEFT ENGINE ICE DEFLECTOR INDICATOR (SER. NOS. 31T-7720001 THRU 7720069)
12. LEFT OIL COOLER DOOR INDICATOR (SER. NOS. 31T-7720001 THRU 7720069)
13. LEFT ENGINE SWITCHES
14. COMPASS
15. INSTRUMENT LIGHT DIMMERS
16. BATTERY MASTER SWITCH
17. RIGHT ENGINE SWITCHES
18. MAP LIGHT AND SWITCH
19. RIGHT ENGINE ICE DEFLECTOR INDICATOR (SER. NOS. 31T-7720001 THRU 7720069)
20. RIGHT OIL COOLER DOOR INDICATOR (SER. NOS. 31T-7720001 THRU 7720069)
21. IGNITION INDICATORS

OVERHEAD SWITCH PANEL

Figure 7-21

7.27 INSTRUMENT PANEL

The instrument panel will accommodate complete intruments and avionics for VFR and IFR flights.

Flight instruments are on the left side, directly in front of the pilot. A complete set of flight instruments for the copilot may be installed on the right instrument panel as optional equipment. With the exception of the pilot's turn and bank indicator, all of the gyro instruments are electric.

Engine monitoring gauges are mounted toward the center of the instrument panel, to the right of the pilot's flight instruments. Two Starter Energized indicator lights are located near the engine instruments. These lights illuminate individually when one or both of the starter switches are in the "ON" position.

Radio navigational instruments are in the center of the instrument panel, and radio and radar installations are to the right of center. Microphone and headphone jacks are provided for both the pilot and the copilot. These jacks are installed toward the extreme left and right sides of the instrument panel.

Autopilot controls are grouped on the control pedestal. For some installations additional autopilot controls are mounted on the left instrument panel.

Pressurization system controls and gauges are situated to the lower left of the pilot's control wheel. Cabin comfort controls are mounted on the right side of the instrument panel in the area of the copilot's control wheel.

Extending across the lower section of the instrument panel are various system controls. These include landing gear and wing flap control levers, an oxygen system control knob, the parking brake handle, alternate static source selector, and the windshield wiper control.

Stability Augmentation System (SAS) instruments include the visual stall margin indicator and a system test. These are grouped on the upper left section of the instrument panel. In airplanes with serial numbers 31T-7720001 through 31T-7720069, SAS warning lights are mounted in the same area. In airplanes with serial numbers 31T-7820001 through 31T-7920094 the SAS warning light is incorporated in the annunciator display.

NOTE

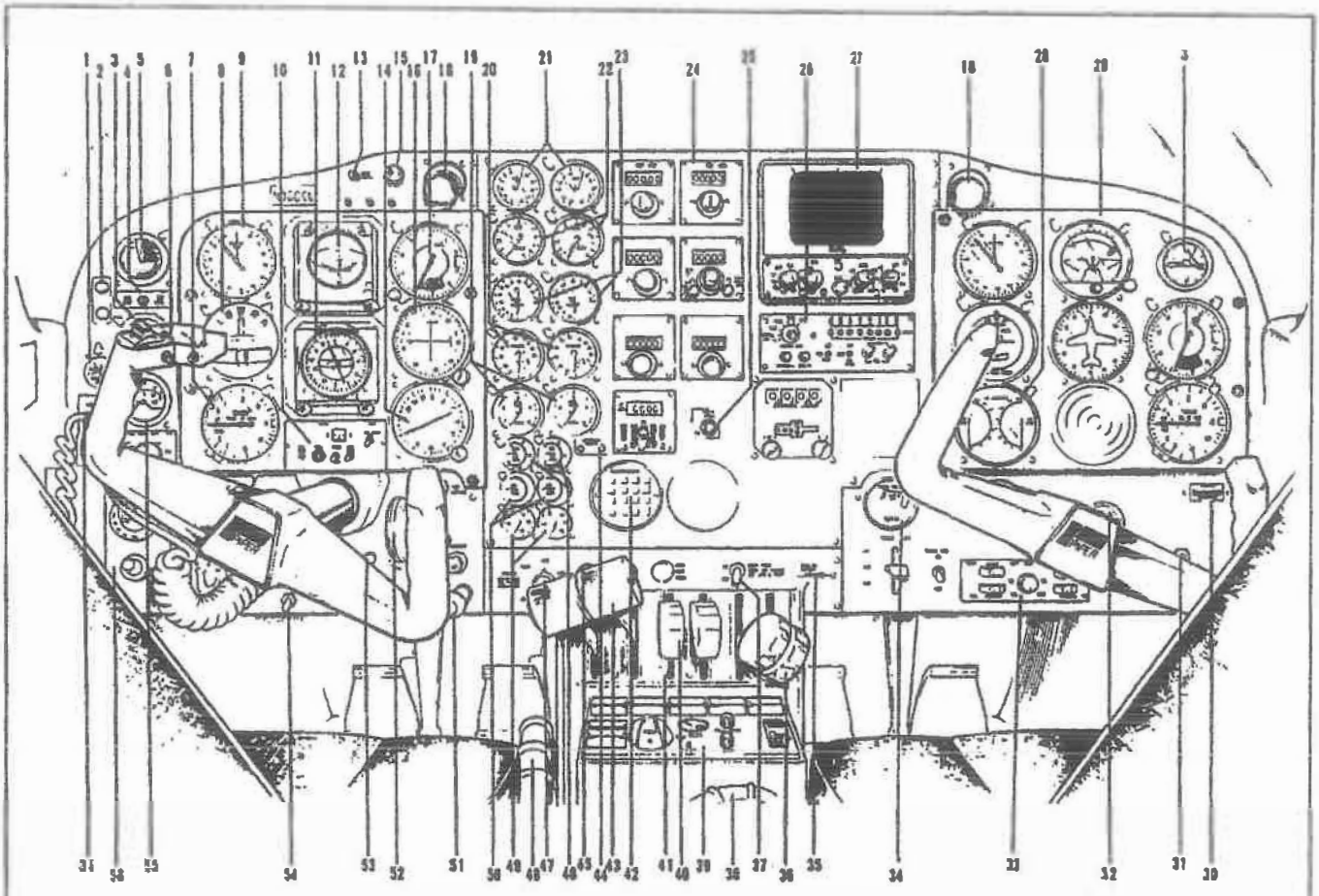
The Master Caution Horn will not sound on the SAS light actuation if previous maintenance activity has installed a Mod Status "A" Annunciator Controller Box. Check maintenance records for verification.

Other installations on the instrument panel include various indicator lights and gauges to show the position of the landing gear and wing flaps and the condition of the pneumatic system, instrument vacuum or pressure, oxygen system pressure, outside air temperature, beta range, etc. Advance stall warning is provided in serial numbers 31T-7720001 through 31T-7720069 by a stall warning light on the upper left instrument panel and by the simultaneous sounding of a stall warning horn. In serial numbers 31T-7820001 through 31T-7920094, stall warning is provided by the horn only.

Additional instrumentation includes an eight-day clock, a compass mounted on the windshield divider, and an engine hour recorder which is mounted either on the lower right of the instrument panel or on the cockpit overhead panel.

The cockpit overhead panel includes light switches, windshield and pitot heat switches, surface deicer and engine ice protection switches, oil cooler door controls, fuel pump, ignition and starter switches, and the battery master switch. Ammeters and an electrical monitoring gauge are located in the center of the overhead panel.

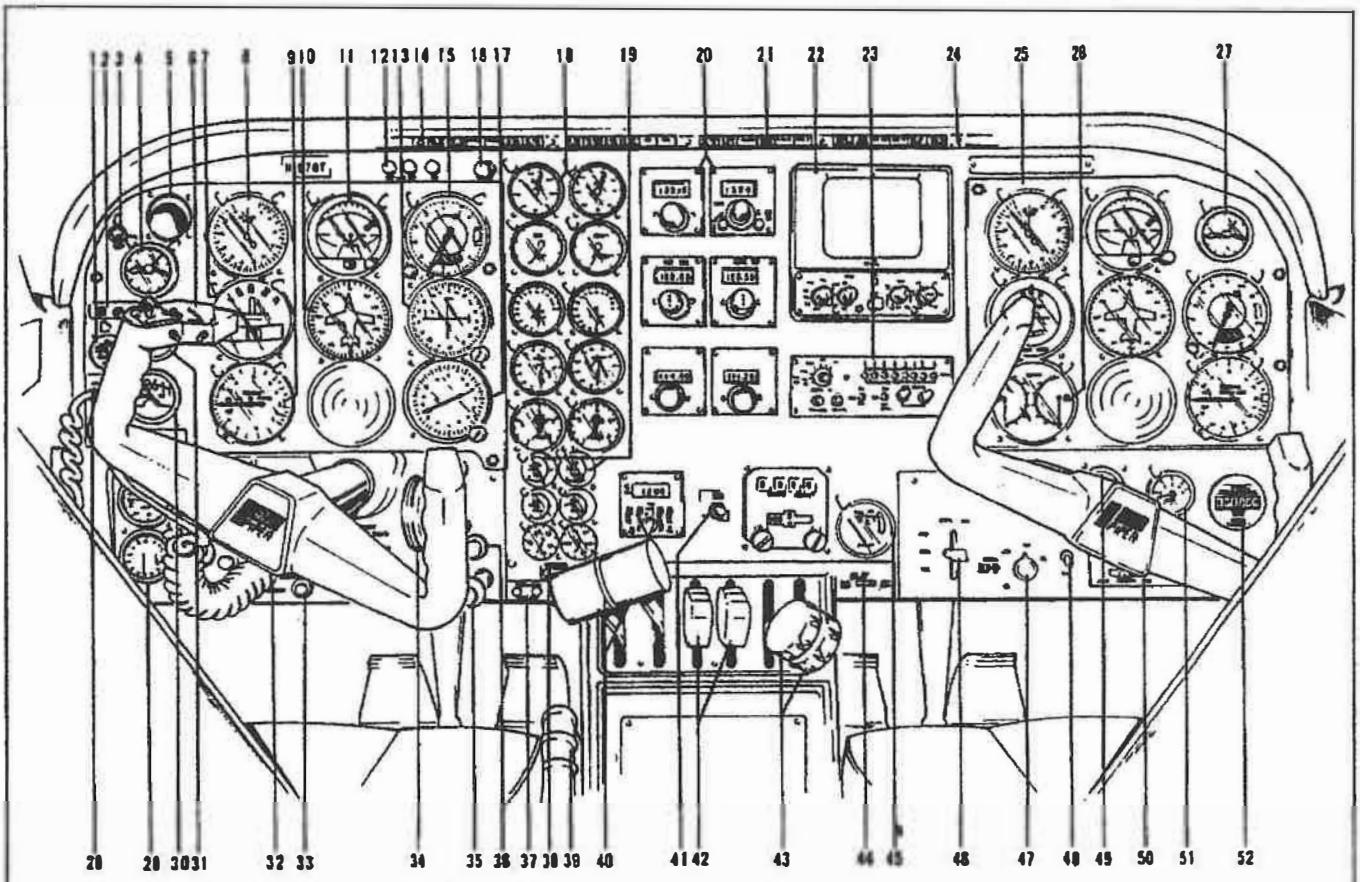
Instrument panel lighting is controlled by two rheostat switches located overhead and to the center of the cockpit.



1. PNEUMATIC PRESSURE GAUGE
2. SAS WARNING LIGHTS
3. CLOCK
4. SAS TEST SWITCH
5. STALL MARGIN INDICATOR
6. FLIGHT DIRECTOR/AUTOPILOT AND MIKE SWITCHES
7. RATE OF CLIMB INDICATOR
8. TURN AND BANK INDICATOR
9. TRUE AIRSPEED INDICATOR
10. FUNCTION PANEL
11. DIRECTOR HORIZON
12. HORIZONTAL SITUATION DISPLAY
13. STALL WARNING
14. ADF INDICATOR
15. MASTER WARNING LIGHT/RESET
16. NAV 2 INDICATOR
17. ALTIMETER
18. VENT
19. FUEL FLOW GAUGES
20. GAS GENERATOR RPM
21. ENGINE TORQUE
22. INTERSTAGE TURBINE TEMPERATURE
23. PROPELLER RPM
24. RADIO INSTALLATIONS
25. RADIO LIGHT DIMMER
26. AUDIO SELECTOR PANEL
27. RADAR
28. DUAL FUEL QUANTITY GAUGE
29. OPTIONAL COPILOT FLIGHT INSTRUMENTS
30. ENGINE HOUR METER
31. MICROPHONE AND EARPHONE JACKS
32. OXYGEN SUPPLY GAUGE
33. CABIN COMFORT PANEL
34. FLAP CONTROL AND POSITION INDICATOR
35. STATIC PRESSURE SELECTOR VALVE
36. CONDITION LEVERS
37. PROPELLER SYNCHRONIZER SWITCH
38. RUDDER TRIM WHEEL
39. AUTOPILOT CONTROLS
40. PROPELLER LEVERS
41. CONTROL PEDESTAL
42. ANNUNCIATOR DISPLAY
43. POWER LEVERS
44. STARTER ENERGIZED LIGHTS
45. BETA LIGHTS
46. FUEL PRESSURE GAUGES
47. WINDSHIELD WIPER CONTROL
48. ELEVATOR TRIM WHEEL
49. OIL TEMPERATURE GAUGES
50. OIL PRESSURE GAUGES
51. OXYGEN SYSTEM CONTROL
52. GEAR SELECTOR
53. HAND BRAKE LEVER
54. ENGINE GROUND TEST SWITCHES
55. OUTSIDE AIR TEMPERATURE GAUGE
56. CABIN PRESSURIZATION CONTROLS

TYPICAL DUAL INSTRUMENT PANEL (SERIAL NUMBERS 31T-7720001 THROUGH 7720069)

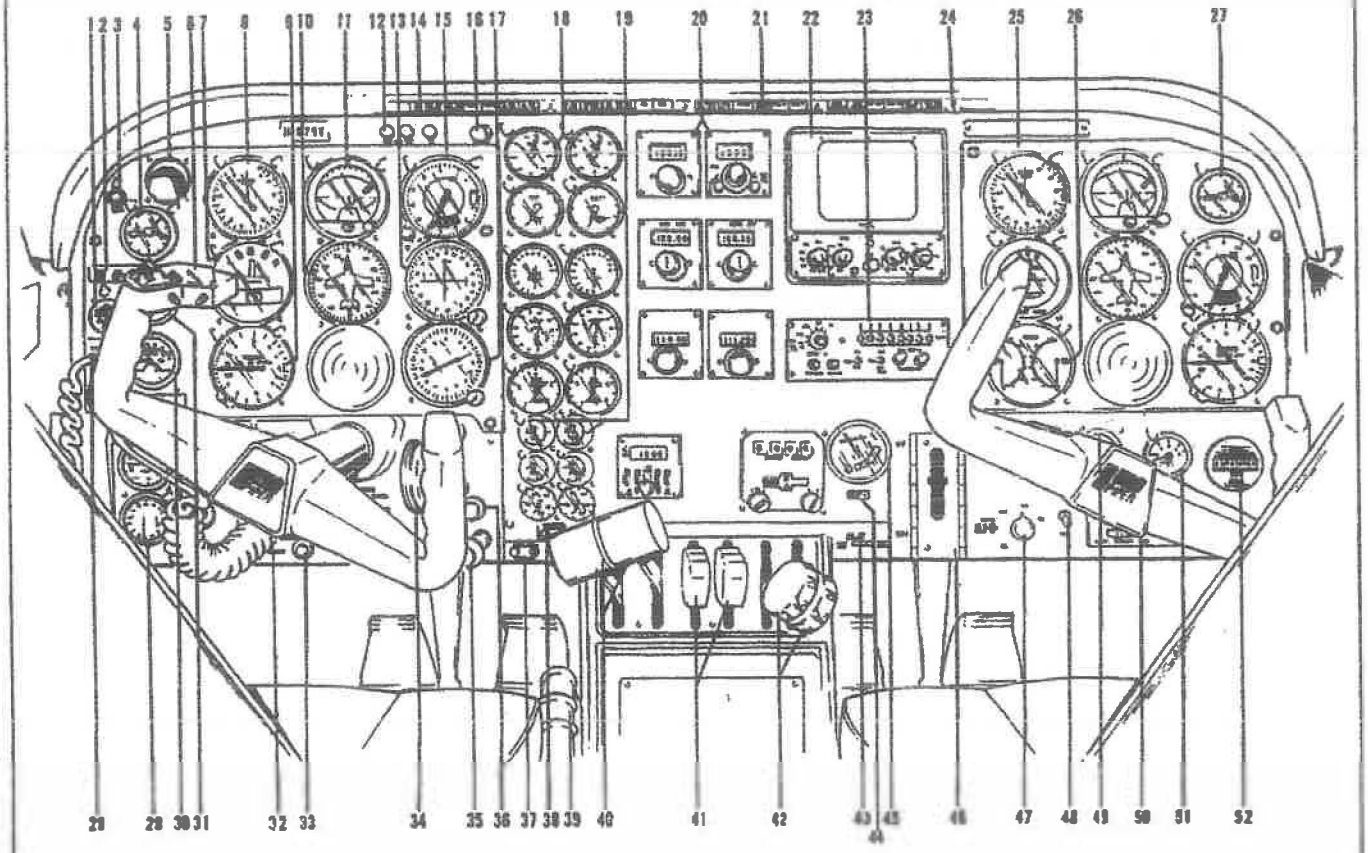
Figure 7-23



1. PNEUMATIC PRESSURE GAUGE
2. SAS TEST SWITCH
3. INSTRUMENT VACUUM GAUGE
4. CLOCK
5. VENT
6. AUTOPILOT, F/D AND MIKE SWITCHES
7. TURN AND BANK INDICATOR
8. AIRSPEED INDICATOR
9. RATE OF CLIMB INDICATOR
10. DIRECTIONAL GYRO
11. ATTITUDE GYRO
12. MARKER BEACONS
13. NAV 2
14. ANNUNCIATOR PRESS-TO-TEST
15. ALTIMETER
16. MASTER CAUTION/RESET
17. ADF
18. ENGINE GAUGES
19. ENGINE GAUGES
20. AVIONICS INSTALLATIONS
21. ANNUNCIATOR DISPLAY
22. RADAR
23. AUDIO SELECTOR PANEL
24. ANNUNCIATOR DISPLAY DIMMER
25. COPILOT FLIGHT INSTRUMENTS
26. DUAL FUEL QUANTITY GAUGE
27. CLOCK
28. MIKE AND EARPHONE JACKS
29. PRESSURIZATION CONTROLS
30. STALL MARGIN INDICATOR
31. OUTSIDE AIR TEMP. GAUGE
32. PARKING BRAKE HANDLE
33. HTG TEST SWITCHES
34. GEAR POSITION SELECTOR
35. OXYGEN SYSTEM CONTROL
36. GEAR INDICATOR LIGHTS
37. BETA LIGHTS
38. STARTER ENERGIZED
39. ELEVATOR TRIM WHEEL
40. POWER LEVERS
41. RADIO LIGHT DIMMER
42. PROPELLER LEVERS
43. CONDITION LEVERS
44. ALTERNATE STATIC SELECTOR
45. FLAP POSITION INDICATOR
46. FLAP POSITION SELECTOR
47. WINDSHIELD WIPER CONTROL
48. HEATER FUEL SWITCH
49. VENT
50. CABIN COMFORT PANEL
51. OXYGEN SUPPLY GAUGE
52. FUEL TOTALIZER

TYPICAL DUAL INSTRUMENT PANEL (SERIAL NUMBERS 31T-7820001 THROUGH 31T-7820066 AND 31T-7820068 THROUGH 31T-7820092)

Figure 7-24



1. PNEUMATIC PRESSURE GAUGE
2. SAS TEST SWITCH
3. GYRO PRESSURE GAUGE
4. CLOCK
5. VENT
6. AUTOPILOT, F/D AND MIKE SWITCHES
7. TURN AND BANK INDICATOR
8. AIRSPEED INDICATOR
9. RATE OF CLIMB INDICATOR
10. DIRECTIONAL GYRO
11. ATTITUDE GYRO
12. MARKER BEACONS
13. NAV 2
14. ANNUNCIATOR PRESS-TO-TEST
15. ALTIMETER
16. MASTER CAUTION/RESET
17. ADF
18. ENGINE GAUGES
19. ENGINE GAUGES
20. AVIONICS INSTALLATIONS
21. ANNUNCIATOR DISPLAY
22. RADAR
23. AUDIO SELECTOR PANEL
24. ANNUNCIATOR DISPLAY DIMMER
25. COPILOT FLIGHT INSTRUMENTS
26. DUAL FUEL QUANTITY GAUGE
27. CLOCK
28. MIKE AND EARPHONE JACKS
29. PRESSURIZATION CONTROLS
30. OUTSIDE AIR TEMP. GAUGE
31. STALL MARGIN INDICATOR
32. PARKING BRAKE HANDLE
33. HTG TEST SWITCHES
34. GEAR POSITION SELECTOR
35. OXYGEN SYSTEM CONTROL
36. GEAR INDICATOR LIGHTS
37. BETA LIGHTS
38. STARTER ENERGIZED
39. ELEVATOR TRIM WHEEL
40. POWER LEVERS
41. PROPELLER LEVERS
42. CONDITION LEVERS
43. ALTERNATE STATIC SELECTOR
44. FLAP TEST SWITCH
45. FLAP POSITION INDICATOR
46. FLAP POSITION SELECTOR
47. WINDSHIELD WIPER CONTROL
48. HEATER FUEL SWITCH
49. VENT
50. CABIN COMFORT PANEL
51. OXYGEN SUPPLY GAUGE
52. FUEL TOTALIZER

TYPICAL DUAL INSTRUMENT PANEL (SERIAL NUMBERS 31T-7820067, 31T-7920001 THROUGH 31T-7920094)

Figure 7-24a

7.28 ANNUNCIATOR DISPLAY SYSTEM

The instrument panel features an annunciator display system which provides aural/visual indication of the condition of certain systems essential to safe operation of the airplane. The annunciator system consists basically of an annunciator controller, sensors on the monitored systems, an annunciator display, a combination master caution light/reset button directly in front of the pilot, a warning horn and a press-to-test switch.

SERIAL NUMBERS 31T-7720001 THROUGH 7720069

On airplanes with serial numbers 31T-7720001 through 7720069, the annunciator display is mounted to the lower left of the radio navigational equipment. The monitored systems on these airplanes are cabin pressure, fuel and oil pressure, oil temperature, engine fire warning, engine fire extinguisher operational status, cabin, baggage and nose cone security, battery temperature and generator operation. In these earlier Cheyenne models, indicator lights are provided for engine deice operation, oil cooler door position and SAS malfunction; however, these lights are independent of the annunciator system and are mounted either on the cockpit overhead panel, or, in the case of the SAS warning, on the upper left instrument panel.

If a system monitored by the annunciator enters a condition which should be brought to the attention of the pilot, warning is given by both the warning horn and the master caution light. Simultaneously, the annunciator display identifies the specific condition by name. Pressing the master caution light/reset button turns off the master caution light and the warning horn; however, the individual warning light in the display will remain illuminated as long as the condition exists. If a second monitored system enters a pertinent condition, the warning procedure is repeated, and a second individual warning light on the display illuminates, the first remaining lit. This sequence is repeatable for all monitored circuits.

A press-to-test switch is installed on the display instrument. If the annunciator system is functioning properly, pressing the test switch will activate the master caution light, the warning horn, and all the lights on the annunciator display.

SERIAL NUMBERS 31T-7820001 THROUGH 31T-7920094

In airplanes with serial numbers 31T-7820001 through 31T-7920094, the annunciator display extends across the top center of the instrument panel. The monitored system on these later Cheyenne models are engine deice operation, oil cooler door position, engine fire, fuel pressure, oil pressure and temperature, SAS malfunction, flap condition, engine fire extinguisher operational status, avionics inverter power loss, generator operation, battery temperature, annunciator power, cabin pressure, cabin altitude, and cabin, nose cone and baggage door security.

NOTE

The Master Caution Horn will not sound on the SAS light actuation if previous maintenance activity has installed a Mod Status "A" Annunciator Controller Box. Check maintenance records for verification.

The engine deice and oil cooler door lights are single bulb indicators which illuminate steady green to show when an engine deice system is on or when an oil cooler door is open. These indicator channels do not flash and do not activate the master caution light or warning horn.

NOTE

The Master Caution Horn will not sound on the SAS light actuation if previous maintenance activity has installed a Mod Status "A" Annunciator Controller Box. Check maintenance records for verification.

With the exceptions of the above-mentioned indicator channels, all display lights are red, dual-bulb indicators. When a monitored system enters a pertinent condition, the associated display light will flash simultaneously with the flashing of the master caution light and the sounding of the annunciator warning horn. When the master caution light/reset button is pressed, the master caution light and the horn are turned off; however, as long as the condition exists, the display light will remain lit without flashing. Should a second monitored system enter a pertinent condition, the warning procedure is repeated with the second display light flashing and the first remaining lit steadily. This sequence is repeatable for all monitored circuits. If a malfunction triggers the annunciator and then the malfunction is corrected, the display for that system will automatically extinguish and reset.

A dimmer switch to the right of the annunciator panel raises or lowers the intensity of the display lights. The master caution light does not dim. During the press-to-test procedure, the display lights will test either bright or dim, depending upon the position of the dimmer switch. A slight time delay will occur between the selection of the bright mode and the actual brightening of the display.

A press-to-test switch to the left of the annunciator display panel activates the master caution light, the warning horn and all display lights. If the annunciator system is functioning properly, when the test switch is pressed the four green indicator lights should illuminate instantly, followed in one second by the sounding of the warning horn and the flashing of the master caution light and all red display lights. If any of the display lights are already lit at the time the test switch is activated, they will remain lit during the test but will not flash.

To test the flap annunciator light, press the test switch adjacent to the flap position indicator.

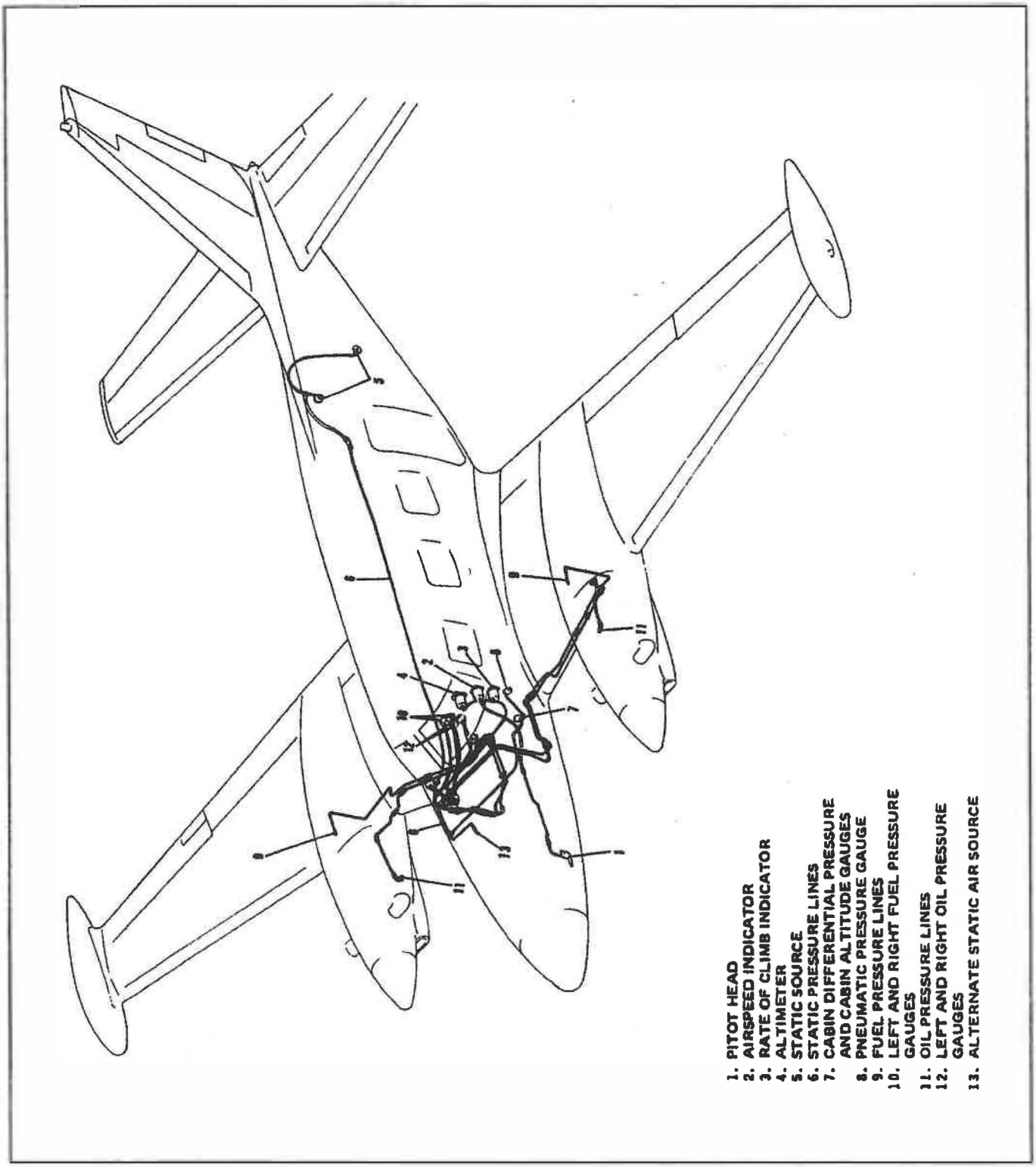
Illumination of the "ANN POWER" display light indicates a failure within the annunciator system. For probable causes of annunciator system malfunctions and for corrective procedures to follow in the event of such malfunctions, refer to Annunciator Failure procedures in Section 3, Emergency Procedures.

7.29 PITOT STATIC SYSTEM

The pitot static system supplies dynamic and static air pressure for the operation of the airspeed indicator. Static air is also supplied to the vertical velocity indicator and altimeter.

A heated pitot head is located under the nose of the aircraft just forward of the gear doors. A second heated pitot system is added when dual instruments are installed.

Static source pads are located on both sides of the rear fuselage forward of the horizontal tail. They connect to a single line leading to the instruments. The dual pickups are provided to reduce side slip effects on the airspeed indicator, altimeter and vertical velocity indicator.



INSTRUMENT AIR AND FLUID LINES

Figure 7-25

An alternate static source valve is located on the instrument panel to the right of the control pedestal. For normal operation, the lever remains to the left. For alternate air, move the lever to the right.

When the alternate static source is selected, the pilot's instruments are vented to the unpressurized nose section. This means that the altimeter and airspeed indicator will indicate higher readings than normal. (See correction chart in Section 5 - Performance.) The vertical velocity indicator will show a momentary climb.

The switches for the pitot heat are located in the right overhead switch panel. The left pitot heat switch also controls the heating of the SAS vane. Pitot covers are provided with each pitot head and should be installed when the aircraft is parked to prevent bugs and rain from entering the pitot head. A partially or completely blocked pitot system will give erratic or zero reading on the airspeed indicator.

NOTE

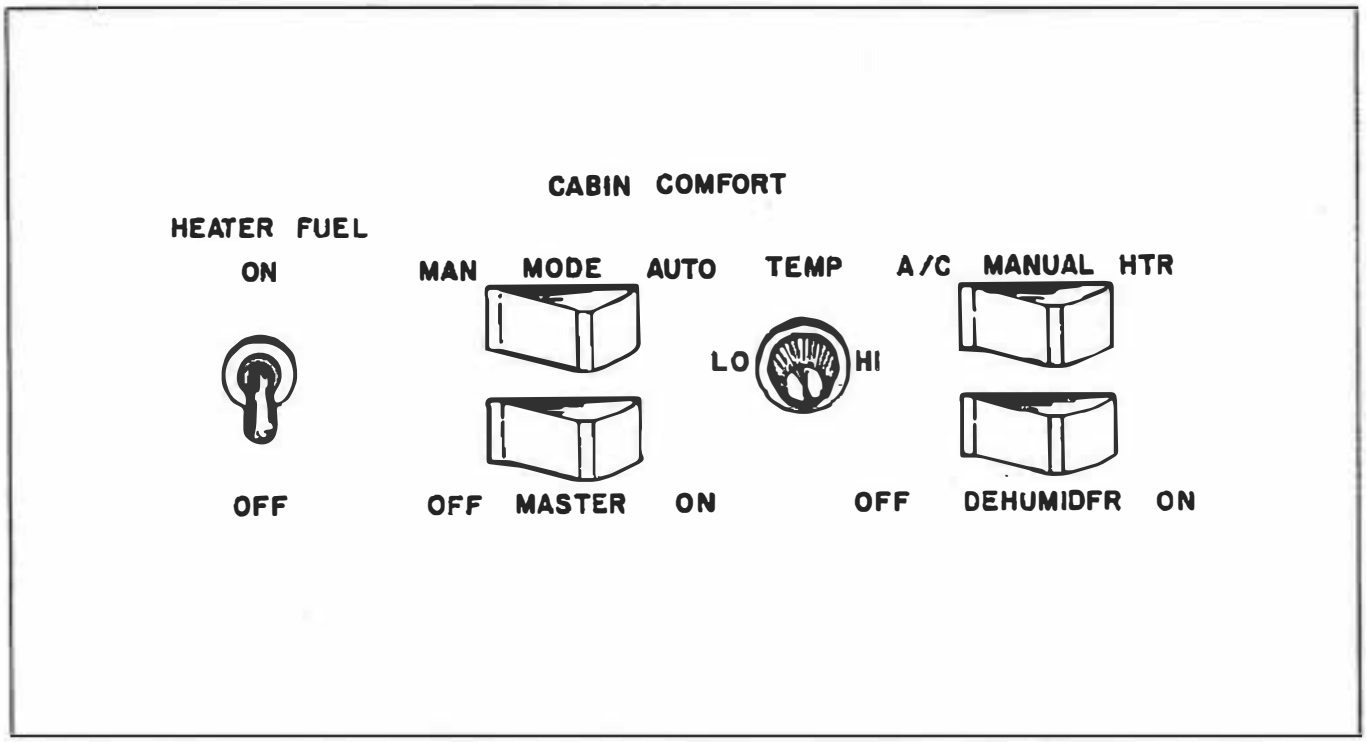
Before every flight, check to make sure the pitot cover has been removed and that static holes are unobstructed.

7.31 RADIO EQUIPMENT

Various radio installations are available. Audio selector switches, transmitter selector, frequency and volume controls, an ON-OFF switch, and other controls related to radio operation are located in the center section of the instrument panel, where they are accessible to both the pilot and the copilot. Jacks for earphones and microphones for the pilot and the copilot are on the far left and the far right of the instrument panel.

A guarded switch marked "ALT AVIONIC PWR" is located on the avionics circuit breaker panel. This switch is provided as an emergency back-up system in the event of a power failure in the avionics bus. If failure would occur in one bus, power can be restored from the other bus through the avionics bus tie. If after careful management of power consumption the total load on both avionics buses exceeds 50 amps, the pilot can actuate the guarded switch to supply additional power to the No. 1 avionics bus. This switch allows up to 50 amps to be drawn directly from the essential bus. Refer to the Power Distribution Diagram (Figure 7-15). If failure would occur to both avionics buses, power can still be routed to the No. 1 bus.

A ground clearance energy saver system is available to provide direct power to Comm #1 without turning on the master switch. An internally lit pushbutton switch, located on the instrument panel, provides annunciation for engagement of the system. When the button is engaged direct aircraft battery power is applied to Comm #1 and audio amplifier (speaker). The system is reset to the OFF position by activating the aircraft master switch.



CABIN COMFORT CONTROL PANEL

Figure 7-27

7.33 ENVIRONMENTAL CONTROL SYSTEM

A cabin comfort control panel, located at the lower right corner of the instrument panel, contains all the controls needed to operate the heating, cooling, and dehumidification system. A MASTER switch on the panel controls the heater, air conditioner, and cabin recirculating air blower. A MODE switch is normally used in the automatic position, and the operator need only select the proper temperature level with the control marked "TEMP." (When adjusting cabin temperature make small, gradual adjustments and allow time for the stabilization of temperature.) The MODE switch also has a manual position for standby use in case of a malfunction of the automatic mode. The switch marked "MANUAL" controls the heater or air conditioner when the mode switch is in the manual position.

The DEHUMIDIFIER switch provides a means to decrease humidity when the mode switch is in the automatic position. The toggle switch marked "HEATER FUEL" controls the flow of fuel to the heater fuel pump. It must be turned on for heater operation.

Control of cabin temperature is through the cycling of the heater or the air conditioner. Both units are controlled by an electronic controller which receives its signal from an adjustable thermostat. When the thermostat calls for heat, the controller turns on the heater system. The heater will operate at full capacity until the thermostat reaches the selected temperature. The thermostat has a temperature dead band between the heating and cooling cycles to prevent activation of the heater by the air conditioning cooling or of the air conditioner by the heater.

Under normal conditions, the cabin thermostat will automatically control heater and air conditioner operation. When the dehumidifier is on, the heater and the conditioner operate together, with the air conditioner operating continuously and the heater cycling to maintain the desired temperature level. This is helpful in preventing cabin condensation during letdowns from high cold soak altitude to warm humid conditions near airport level and to prevent condensation during ground operation under cool rainy conditions.

7.35 HEATING, VENTILATING AND DEFROSTING SYSTEM

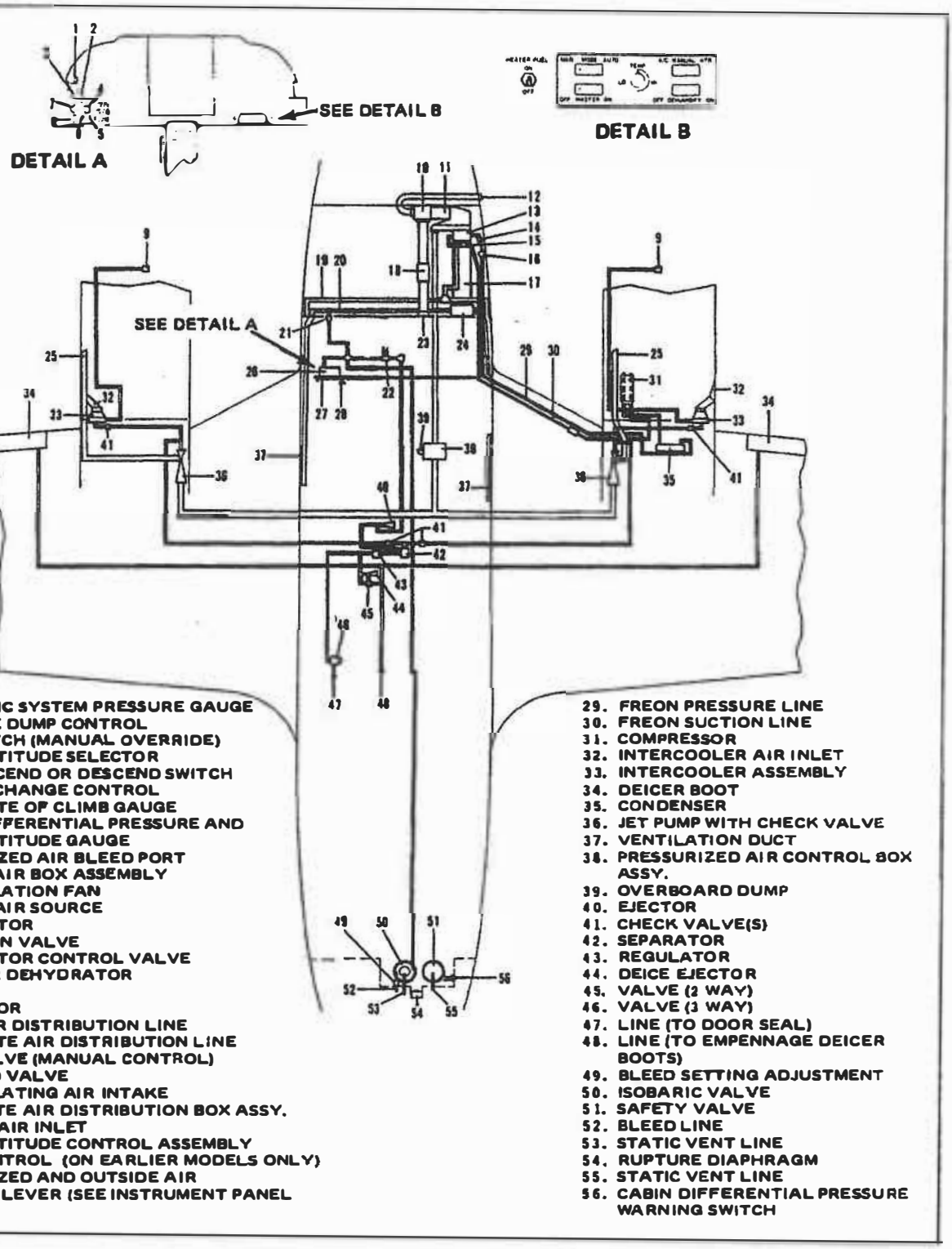
The flow of air for heating, ventilating, and defrosting is taken through the main pressurization air line and an outside air duct in the lower right side of the nose section. When the cabin is pressurized, the outside air duct is closed and air is taken from the cabin by the use of a recirculation blower and main pressurization air line. Air from the heater is directed to outlets along both sides of the cabin. Air from the heater can also be routed to the windshield defroster outlets along both sides of the windshield center post. Air for ventilating is routed through ducts along both sides of the cabin and enters from individually controlled eyeball outlets next to each passenger seat and in front of the pilot and copilot. The recirculation blower operates whenever the cabin comfort master switch is "ON." All controls for the heater are mounted on the lower right instrument panel.

7.37 HEATER OPERATION

The 35,000 B.T.U. Janitrol combustion heater can be operated either independently or in conjunction with the air conditioner, depending upon the mode selected on the cabin control comfort panel. A master switch turns the system on or off. To the left of the control panel is a HEATER FUEL switch which must be on for heater operation. During normal operation, the MODE switch is in the automatic ("AUTO") position, and an electronic controller turns the heater on or off automatically to keep the cabin at a temperature selected on the adjustable TEMP knob. When the MODE switch is in the manual ("MAN") position, the heater may be turned on or off, as desired. For manual operation, the switch labeled "MANUAL" should be placed in the heater ("HTR") position and the heater turned on or off by use of the HEATER FUEL switch.

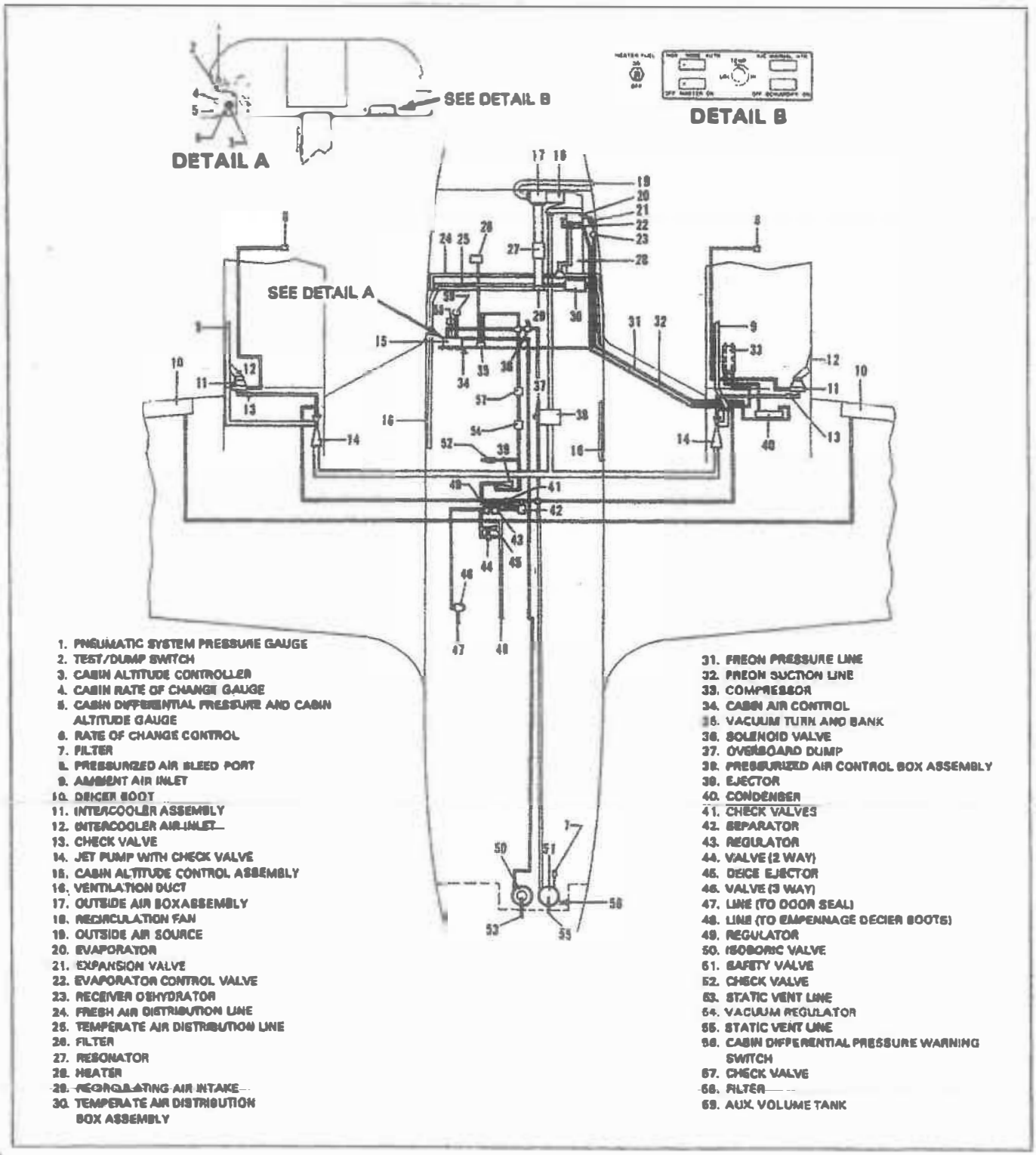
7.39 CABIN AIR CONDITIONING SYSTEM

The 23,000 B.T.U. air conditioning system can be operated either independently or in conjunction with the heater, depending upon the mode selected on the cabin comfort control panel. A master switch turns the system on or off. During normal operation, when the MODE switch is in the automatic ("AUTO") position, a thermostat, adjustable by the TEMP knob, signals an electronic controller which turns on the air conditioner until the cabin reaches the selected temperature. When the MODE switch is in the manual ("MAN") position, the air conditioner may be turned on or off, as desired, by use of the switch labeled "MANUAL." The air conditioner is on when the MANUAL switch is in the air conditioner ("A/C") position, and off when the switch is in the heater ("HTR") position. For manual operation of the air conditioner, the HEATER FUEL switch must be off.



1. PNEUMATIC SYSTEM PRESSURE GAUGE
2. PRESSURE DUMP CONTROL
3. TEST SWITCH (MANUAL OVERRIDE)
4. CABIN ALTITUDE SELECTOR
5. CABIN ASCEND OR DESCEND SWITCH
6. RATE OF CHANGE CONTROL
7. CABIN RATE OF CLIMB GAUGE
8. CABIN DIFFERENTIAL PRESSURE AND CABIN ALTITUDE GAUGE
9. PRESSURIZED AIR BLEED PORT
10. OUTSIDE AIR BOX ASSEMBLY
11. RECIRCULATION FAN
12. OUTSIDE AIR SOURCE
13. EVAPORATOR
14. EXPANSION VALVE
15. EVAPORATOR CONTROL VALVE
16. RECEIVER DEHYDRATOR
17. HEATER
18. RESONATOR
19. FRESH AIR DISTRIBUTION LINE
20. TEMPERATE AIR DISTRIBUTION LINE
21. DUMP VALVE (MANUAL CONTROL)
22. SOLENOID VALVE
23. RECIRCULATING AIR INTAKE
24. TEMPERATE AIR DISTRIBUTION BOX ASSY.
25. AMBIENT AIR INLET
26. CABIN ALTITUDE CONTROL ASSEMBLY
27. DUMP CONTROL (ON EARLIER MODELS ONLY)
28. PRESSURIZED AND OUTSIDE AIR CONTROL LEVER (SEE INSTRUMENT PANEL DETAIL)
29. FREON PRESSURE LINE
30. FREON SUCTION LINE
31. COMPRESSOR
32. INTERCOOLER AIR INLET
33. INTERCOOLER ASSEMBLY
34. DEICER BOOT
35. CONDENSER
36. JET PUMP WITH CHECK VALVE
37. VENTILATION DUCT
38. PRESSURIZED AIR CONTROL BOX ASSY.
39. OVERBOARD DUMP
40. EJECTOR
41. CHECK VALVE(S)
42. SEPARATOR
43. REGULATOR
44. DEICE EJECTOR
45. VALVE (2 WAY)
46. VALVE (3 WAY)
47. LINE (TO DOOR SEAL)
48. LINE (TO EMPENNAGE DEICER BOOTS)
49. BLEED SETTING ADJUSTMENT
50. ISOBARIC VALVE
51. SAFETY VALVE
52. BLEED LINE
53. STATIC VENT LINE
54. RUPTURE DIAPHRAGM
55. STATIC VENT LINE
56. CABIN DIFFERENTIAL PRESSURE WARNING SWITCH

HEATING, VENTILATING, AIR CONDITIONING AND PRESURIZATION SYSTEM SCHEMATIC (SERIAL NUMBERS 31T-7720001 THROUGH 7820066 AND 31T-7820068 THROUGH 31T-7820092)
Figure 7-29



HEATING, VENTILATING, AIR CONDITIONING AND PRESSURIZATION SYSTEM SCHEMATIC (SERIAL NUMBERS 31T-7820067, 31T-7920001 THROUGH 31T-7920094)
Figure 7-30

7.41 CABIN PRESSURIZATION

Pressurization air for the PA-31T is obtained by use of high pressure engine compressor bleed air. The high pressure air is routed through an intercooler, then into a jet pump which mixes bleed air with outside air. This decreases the amount of high pressure air required from the engine and also lowers the temperature of the bleed air. The air then proceeds to the main pressure line under the cabin floor and passes through the pressurized air control box assembly which controls the flow of air that is to be routed either to the cabin or overboard.

The pressurization control lever, to the left of the pilot's control wheel shaft, has three positions: "PRESSURIZED AIR," "RECIRCULATED AIR," and "OUTSIDE AIR." When the control is in the pressurized air position, the air is directed through the air conditioning evaporator to the heater and heater ducts, and through the cool air ducts along both sides of the cabin to individually controlled air outlets. When the control is in the outside air position, the air is not needed for pressurization. Air is then routed below the cabin floor and overboard. During ground operations, to prevent fumes from other aircraft entering the cabin, the control may be placed in the recirculated air position. In this position, no outside air enters the system. Restrict continuous operation in the recirculated air position to 15 minutes.

All the controls needed to operate the cabin pressurization system are grouped together on the lower left side of the instrument panel.

AIRCRAFT WITH SERIAL NUMBERS 31T-7720001 THROUGH 31T-7820066 AND 31T-7820068 THROUGH 31T-7820092

For pressurized flight below 13,000 feet, the cabin altitude selector ring should be set at 500 feet above the airport altitude and the pressurization control lever placed in the "PRESSURIZED AIR" position. The "DUMP" valve, if installed, must be pushed in. Cabin pressurization will then be controlled automatically. For flight above 13,000 feet, or should a change in cabin altitude be desired for any reason, altitude changes should be set on the outer dial of the cabin altitude selector ring, and the "ASCEND-DESCEND" toggle switch be set accordingly. This automatically brings the cabin altitude selector to a new setting. Should the rate of ascent or descent require adjustment, the "RATE OF CHANGE" control knob directly below the cabin altitude selector may be used to increase or decrease the rate of change. Lights indicate whether the unit is on the "ascent" or "descent" mode of operation. Once the desired cabin altitude is reached, the toggle switch should be returned to the "OFF' position.

To the immediate left of the cabin altitude selector and rate of change controls are instruments to simplify setting the system and to monitor system operation. The cabin altitude instrument indicates the cabin altitude in feet, and the cabin rate of change instrument indicates the rate at which cabin altitude is changing in feet per minute. A differential pressure gauge, which is incorporated in the face of the cabin altitude instrument, indicates the differential pressure between the cabin and the outside atmosphere.

A warning light on the annunciator display warns the pilot should the cabin altitude go above 10,500 feet or should the cabin differential pressure go above 5.7 psi. The cabin altitude warning light on aircraft serial numbers 31T-7820044 through 31T-7820092 will activate when the cabin altitude reaches 11,500 to 12,000 feet. Cabin pressure is automatically regulated to a maximum of 5.5 psi. Should the automatic regulator malfunction, a system of safety devices releases pressure. If both the automatic regulator and the safety valves fail, cabin pressure may be unloaded by slowly and partially raising the access cover of the emergency gear extender. (Some earlier models include a cabin pressure DUMP valve which, when pulled, release cabin pressure.) A landing gear pressurization safety switch on the left main landing gear prevents the cabin from being pressurized while the airplane is on the ground. A test switch on the instrument panel may be used to override the landing gear pressurization safety switch when testing the system on the ground.

For complete instructions on the operation of the cabin pressurization system, refer to Section 4 - Normal Procedures.

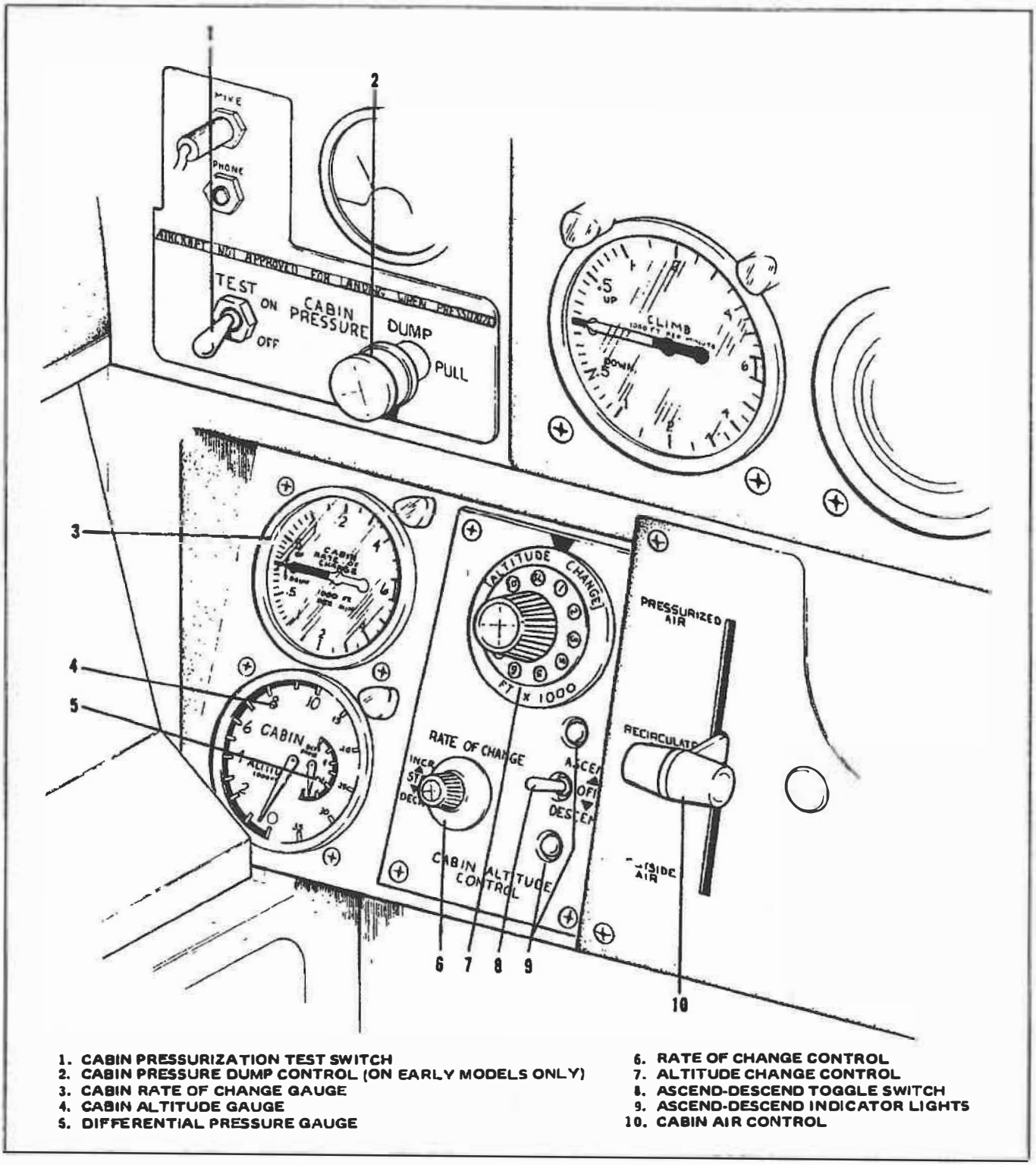
AIRCRAFT WITH SERIAL NUMBERS 31T-7820067, 31T-7920001 THROUGH 31T-7920094

For pressurized flight below 12,000 feet, the cabin altitude controller should be set at 500 feet above the airport altitude and the pressurization control lever placed in the "PRESSURIZED AIR" position. Cabin pressurization will then be controlled automatically. For flight above 12,000 feet, or should a change in cabin altitude be desired for any reason, altitude changes should be set on the cabin altitude controller. This automatically brings the cabin altitude to a new setting. Should the rate of ascent or descent require adjustment, the "RATE OF CHANGE" control knob below the cabin altitude controller may be used to increase or decrease the rate of change.

To the immediate left of the cabin altitude cntroller' and the rate of change control are instruments to simplify setting the system and to monitor system operation. The cabin altitude instrument indicates the cabin altitude in feet, and the cabin rate of change instrument indicates the rate at which cabin altitude is changing in feet per minute. A differential pressure gauge, which is incorporated in the face of the cabin altitude instrument, indicates the differential pressure between the cabin and the outside atmosphere.

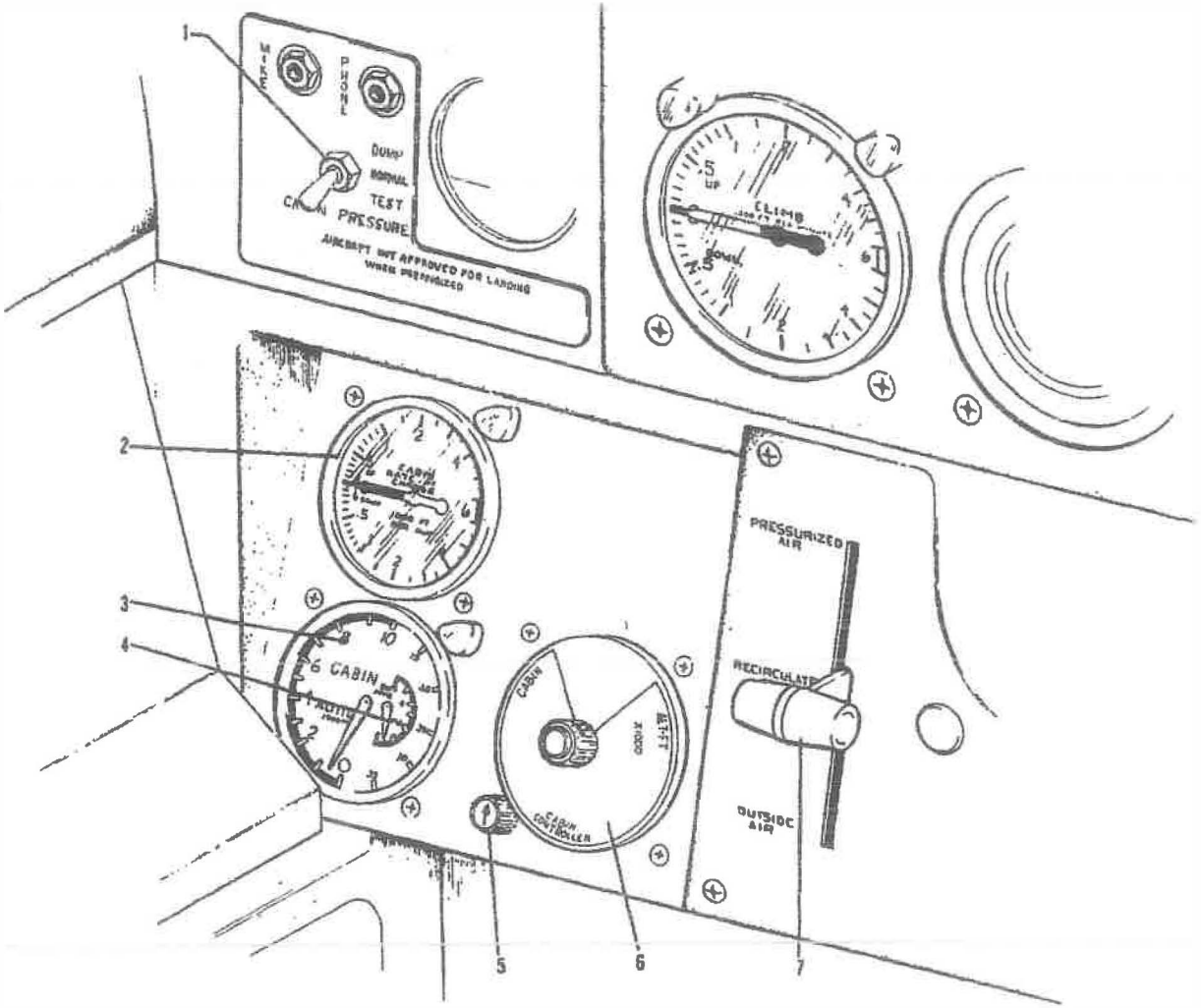
A warning light on the annunciator display warns the pilot should the cabin altitude go above 11,500 to 12,000 feet or should the cabin differential pressure go above 5.7 psi. Cabin pressure is automatically regulated to a maximum of 5.5 psi. Should the automatic regulator malfunction, a system of safety devices releases pressure. If both the automatic regulator and the safety valves fail, cabin pressure may be unloaded by slowly and partially raising the access cover of the emergency gear extender or by rapid decompression with the use of the dump switch. This switch is designed to prevent inadvertent dump and must be pulled out before actuation. A landing gear pressurization safety switch on the left main landing gear prevents the cabin from being pressurized while the airplane is on the ground. A test switch on the instrument panel may be used to override the landing gear pressurization safety switch when testing the system on the ground.

For complete instructions on the operation of the cabin pressurization system, refer to Section 4 - Normal Procedures.



1. CABIN PRESSURIZATION TEST SWITCH
2. CABIN PRESSURE DUMP CONTROL (ON EARLY MODELS ONLY)
3. CABIN RATE OF CHANGE GAUGE
4. CABIN ALTITUDE GAUGE
5. DIFFERENTIAL PRESSURE GAUGE
6. RATE OF CHANGE CONTROL
7. ALTITUDE CHANGE CONTROL
8. ASCEND-DESCEND TOGGLE SWITCH
9. ASCEND-DESCEND INDICATOR LIGHTS
10. CABIN AIR CONTROL

CABIN AND PRESSURIZATION CONTROLS (SERIAL NUMBERS 31T-7720001 THROUGH 31T-7820066 AND 31T-7820068 THROUGH 31T-7820092)
Figure 7-31



1. CABIN PRESSURIZATION TEST/DUMP SWITCH
2. CABIN RATE OF CHANGE GAUGE
3. CABIN ALTITUDE GAUGE
4. DIFFERENTIAL PRESSURE GAUGE
5. RATE OF CHANGE CONTROL
6. CABIN ALTITUDE CONTROLLER
7. AIR CONTROL LEVER

CABIN PRESSURIZATION CONTROLS (SERIAL NUMBERS 31T-7820067, 31T-7920001 THROUGH 31T-7920094)
Figure 7-32

7.43 OXYGEN SYSTEM

The oxygen system approved for the PA-31T provides emergency supplementary oxygen for the crew and passengers in the event of pressurization failure.

Eight oxygen plug-in receptacles with automatic on-off valves are incorporated into the cabin. An oxygen supply gauge is mounted on the lower right instrument panel and the flow control knob is located under the left lower instrument panel. An altitude pressure regulator is mounted directly to the oxygen cylinder.

The oxygen cylinder is mounted aft of the forward baggage compartment and, when fully charged, contains oxygen at a pressure of 1800 pounds per square inch at 70°F.

Before taking off for high altitude flying, ascertain that the oxygen supply is adequate for the proposed flight and that the passengers are briefed. The oxygen supply pressure gauge mounted in the right instrument panel indicates the pressure in the oxygen cylinder.

If oxygen should be required, pull the control knob "ON," allowing oxygen to flow from the cylinder through the connecting tubing and into the receptacles.

To use oxygen, connect a constant flow mask fitting into a receptacle and don the mask. The pilot's and copilot's masks are stowed under the pilot's seat and the copilot's seat, and the passengers' masks are stowed in the center overhead storage compartment adjacent to each pair of seats.

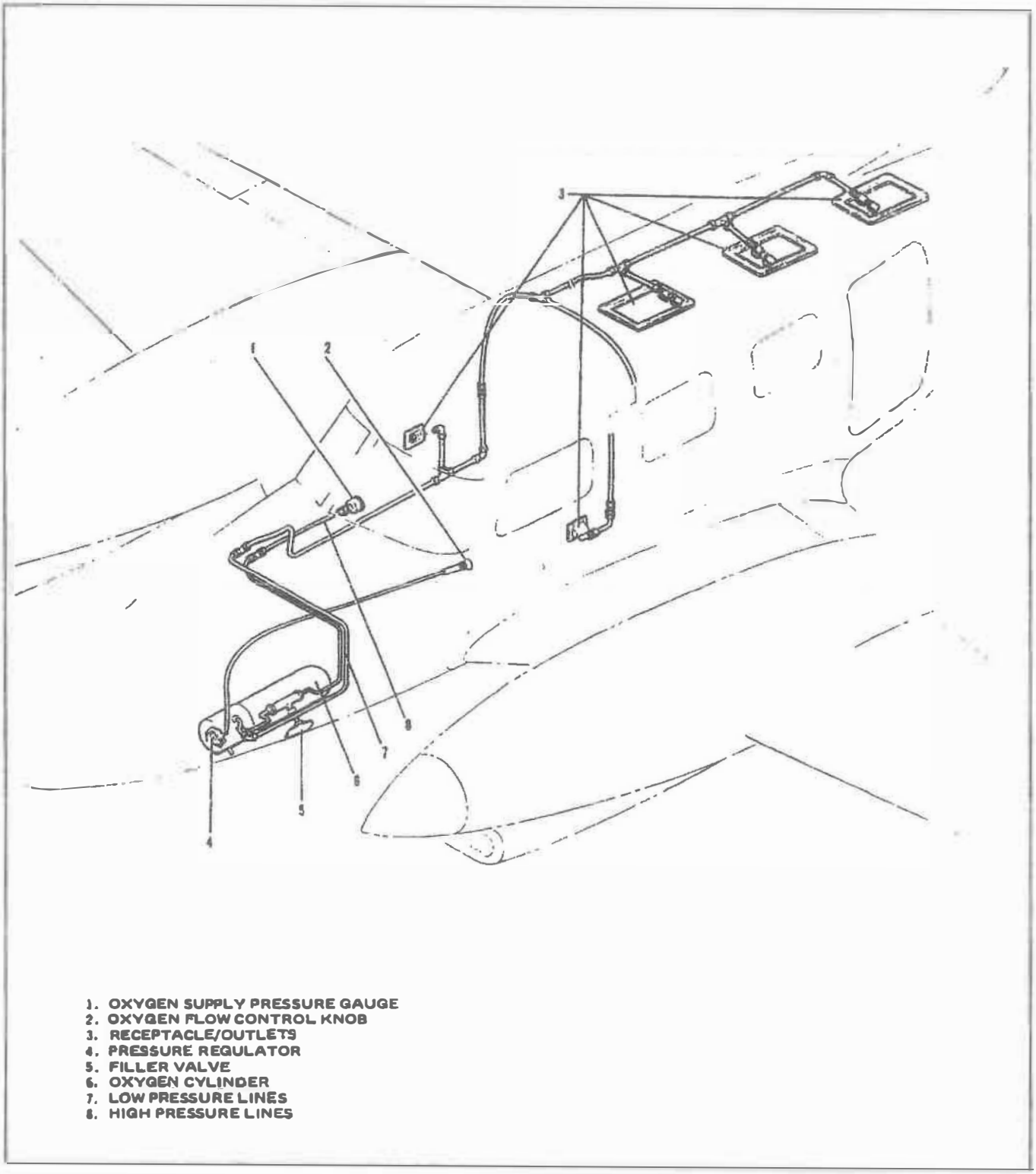
Always remove the fitting from the receptacle and stow the mask when not in use. Oxygen will flow through the mask whenever the fitting is in the receptacle, and the control knob is "ON." Masks may be damaged if not properly stowed.

All the masks (identified with a red band on the supply hose) supply 120 liters of oxygen per hour or a 5,000 foot level supply of oxygen to 20,000 feet. Aircraft with serial numbers 31T-7820067, 31T-7920001 through 31T-7920094 are equipped with masks that supply 180 liters of oxygen per hour and are identified with a green band on the supply hose. See Section 3 - Emergency Procedures - for oxygen use requirements.

CAUTION

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

Keep oil, grease, hydraulic fluid, paint, or other inflammable material away from oxygen equipment. After use, disposable type oxygen masks should be replaced, and permanent type masks should be cleaned.



1. OXYGEN SUPPLY PRESSURE GAUGE
2. OXYGEN FLOW CONTROL KNOB
3. RECEPTACLE/OUTLETS
4. PRESSURE REGULATOR
5. FILLER VALVE
6. OXYGEN CYLINDER
7. LOW PRESSURE LINES
8. HIGH PRESSURE LINES

OXYGEN SYSTEM

Figure 7-33

7.45 CABIN FEATURES

The normal seating arrangement is two crew seats and four reclining, adjustable executive-type passenger seats, each equipped with an adjustable headrest and two armrests. The outboard armrest is fixed and the aisle armrest is of a swing-away design for ease of entry and exit. An ash tray, a reading light, and an adjustable individual ventilation control are also standard for each passenger seat. For increased passenger capacity, one or two additional full-size seats may be installed to expand the cabin to seven or eight place seating. The standard seats are track mounted to allow movement fore and aft and are reversible for a foursome arrangement. The crew seats are adjustable three ways: fore and aft, up and down, and reclinable. The lever nearest the floor controls fore and aft movement; the center handle controls up and down movement, and the smaller top handle controls angle of recline.

The passenger seats adjust forward and aft and recline (except when the seats are facing aft).

Safety belts are installed on all seats. Shoulder harnesses with self-adjusting inertia reels are installed on the pilot and copilot seats. The inertia reels allow the shoulder harness to extend or retract during normal body movement; however, the strap locks securely in place under sharp forward force. To check the function of the inertia reel, tug sharply on the strap. The reel should lock under this test and prevent the strap from extending.

A storm window is installed in the pilot's side window.

A map clip is located on the control wheel, and a pocket for papers and registrations is attached to the left side panel forward of the pilot's seat. For the passengers' convenience, utility pockets are attached to each seat back. The cabin is equipped with "NO SMOKING" and "FASTEN SEAT BELT" lights controllable from the cockpit. Additional features include cabin and cockpit cigar lighters, individual oxygen masks, curtains, and clothes hanger support bars with hangers.

7.47 BAGGAGE AREAS

There are two baggage compartments. The forward compartment provides 20 cubic feet of storage space and has a 300 pound capacity. It is accessible from the left side of the nose section through a 26 x 21 inch door. The rear compartment has a volume of 22 cubic feet and a capacity of 200 pounds. It is loaded and unloaded through the cabin door and is accessible from the cabin.

The nose compartment is equipped with a courtesy light for night loading. Since this light illuminates automatically when the baggage compartment door is opened, regardless of the position of the battery master switch, it is recommended that the door not be left open for extended periods as this may lead to battery depletion.

NOTE

It is the pilot's responsibility to be sure that the airplane is properly loaded and that the aircraft C.G. falls within the allowable C.G. range. (See Section 6 - Weight and Balance.)

The baggage tie down and cargo net should be used for the safe and secure stowage of baggage.

7.49 ELECTRIC HEATED WINDSHIELD

The electric heated windshield, used to prevent and/or remove icing and fogging, is controlled with the "WINDSHIELD HEAT" switch on the overhead panel. To check the operation of the heated windshield before takeoff, the control switch should be activated with the engines running. If the windshield heat is operating properly, the windshield will be warm to the touch. The temperature of the windshield is regulated automatically.

Ground operation of the heated windshield should be kept to a minimum to prevent overheating which can result in distortion and bubbling in the windshield.

The electric heated windshield is installed on the left side as standard equipment and is available as an option on the right side.

7.51 ELECTRIC WINDSHIELD WIPER

An electrically operated windshield wiper is installed on the pilot's windshield. The wiper is controlled by the "WINDSHIELD WIPER" control knob on the instrument panel. The control knob has four positions: "PARK," "OFF," "LOW," and "HIGH." To activate the windshield wiper, simply set the knob at the desired speed position.

CAUTION

Do not operate the windshield wipers at airplane speeds above 153 KIAS or on a dry windshield.

When windshield wiper operation is no longer required, the control knob should be turned to "OFF," then to "PARK." The "PARK" position returns the blades to an unobtrusive vertical position. The knob automatically returns to "OFF" when released from the "PARK" position.

An optional windshield wiper installation is available for the right windshield.

7.53 FINISH

All aluminum sheet components of the airplane are finished inside and out. Both sides of all pieces are alodine treated and sprayed with zinc chromate primer. Exterior surfaces are painted with durable polyurethane in a variety of colors and color combinations.

7.55 NUMBER PLATES

The manufacturer's identification plate is attached to the underside of the fuselage just below and at the forward edge of the cabin door. A plate containing only the serial number is attached to the underside of the fuselage just left of the tail skid. The serial number should always be used when referring to the airplane in service or warranty matters.

7.57 PROPELLER SYNCHRONIZERS*

The synchronizer system consists basically of an electronic control box and a speed setting actuator, connected to the prop governor by a flexible drive shaft and rod end bearing assembly. Magnetic pick-ups in each prop governor send A.C. signals back to the control box. If the pick-up signal from the master engine (without actuator) differs from the signal from the slave engine (with actuator), the control box will send a signal to the actuator and match the speed of the slave engine to that of the master engine. In this installation, the right engine is the master engine.

These speed adjustments take place over a predetermined limited range. This limited range feature prevents the slaving engine's losing more than a fixed amount of speed in case the master engine is feathered with the synchronizer on. Normal governor speed setting controls and procedures are unchanged. The operating range of the actuator is approximately ± 35 RPM.

The propeller synchronizer "ON-OFF" switch is on the lower center of the instrument panel, just above the control levers. Propeller levers should be set close together before the propeller synchronizer system is turned "ON." When changing propeller speed, the system should be turned "OFF;" once RPM is set, the system should be turned back "ON." When an engine is to be feathered and during takeoffs and landings, the system should be turned "OFF."

7.58 PROPELLER SYNCHROPHASER*

WOODWARD TYPE I

The Woodward Type I Synchrophaser consists of a control box mounted in the cockpit, an actuator mounted in the slave engine nacelle, an adjustable rod end trimmer connecting the slave engine governor and actuator, speed sensing magnetic pickups located near three phase targets that rotate with each propeller shaft. The system operates on electronic impulses, generated by the disc target passing each magnetic pickup, being fed into the control box. Any difference in these pulse rates will cause the control box to run the actuator motor and, through the flexible shaft, trim the engine governor speed setting to exactly match the master engine's RPM and preset phase relationship. Normal governor operation is unchanged, but the synchrophaser will continuously monitor engine RPM and propeller phase angle and reset the slave engine governor as required.

The RPM of the slave engine will follow changes in the RPM of the master engine over a predetermined limited range. This limited range feature prevents the slave engine from losing more than a fixed amount of RPM in case the master engine is feathered with the synchrophaser "ON." In this installation, the right engine is the master engine.

The propeller synchrophaser "ON-OFF' switch is located on the lower center of the instrument panel, just above the control levers. Propeller levers should be set close together before the propeller synchrophaser is turned "ON." Once the synchrophaser is operating any adjustments, such as from climb to cruise, should be made by moving both engine RPM controls simultaneously in small steps to the new RPM setting. This will keep the two governor settings close enough to stay within the limited range adjustment of the synchrophaser. If at any other time, the synchrophaser is "ON," but is unable to adjust the slave engine RPM to match the master engine, the actuator has reached the end of its travel. Turn the synchrophaser switch "OFF" (allowing the actuator to run to the center of its range) and synchronize the propellers manually before turning the system back "ON."

*Optional equipment

With the airplane in a cruise configuration and the synchrophaser "ON," a functional test of the system can be made to check proper limited range settings and operation. Start the test by slowly moving only the master engine (RIGHT) RPM control lever in small steps to an increased RPM setting until the propellers are no longer synchronized. Repeat procedure to a decreased RPM setting. The RPM range over which the slave engine will remain synchronized with the master engine is the limited range. With the system "ON," move the master engine propeller governor control lever to a point which is close to the end of this limited range. Now turn the system "OFF," an unsynchronized condition will develope as the actuator moves the trimmer to its mid-position. When the system is turned "ON" again, synchronization will resume. If the propellers do not synchronize, the actuator has reached the end of its travel and the propellers must be synchronized manually.

WOODWARD TYPE II

Another propeller synchrophaser available on this aircraft is the Woodward Type II Synchrophaser. It consists of a control box mounted in the cockpit, a coil incorporated in each primary governor, a magnetic pickup and a disc containing one target also located in each primary governor. The system operates on electronic impulses, generated by the disc target passing each magnetic pickup, being fed into the control box. Any difference in the pulse rates will cause the control box to change the governor speed setting by varying the coil voltage until the engine RPM's exactly match. Normal governor operation is unchanged, but the synchrophaser will continuously monitor and bias the governor speed setting to match engine RPM's.

The synchrophaser automatically matches the RPM's of the two engines and allows the pilot to select any desired phase relationship between the propellers. The RPM of one engine will follow changes in the RPM of the other engine within a predetermined limited range. This limited range feature prevents either engine from losing more than a fixed amount of RPM in case the other engine is feathered while the synchrophaser is "ON" In no case will the RPM follow beyond that selected by the prop control lever.

The propeller synchrophaser "ON-OFF" switch and the phase adjuster control are combined on a single knob protruding from the instrument panel just above the control levers. After takeoff manually synchronize the propellers and then turn the synchrophaser "ON." When making propeller speed changes, such as from climb to cruise, switch the synchrophaser "OFF" move the propeller levers to the desired setting and manually synchronize, then turn the synchrophaser back "ON." Whenever an engine is to be feathered or during takeoff or landing, the synchrophaser must be turned "OFF."

7.59 EMERGENCY LOCATOR TRANSMITTER*

The Emergency Locator Transmitter (ELT), when installed, is enclosed under the removable dorsal fin forward of the vertical tail attachment to the fuselage. The unit meets the requirements of FAR 91.52. The transmitter operates on a self-contained battery.

A battery replacement date is marked on the transmitter label. To comply with FAA regulations, the battery must be replaced on or before this date. The battery must also be replaced if the transmitter had 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.

When installed in the airplane, the ELT transmits through the antenna mounted on the fuselage. The unit is also equipped with an integral portable antenna to allow the locator to be removed from the airplane in an emergency and used as a portable signal transmitter. Should it become necessary to remove the ELT from the airplane, be sure that the switch on the unit is in the "OFF" position before the transmitter is disconnected from the fuselage antenna. After the portable antenna is attached the unit may be turned "ON" as desired.

The locator should be checked during the preflight ground check to make sure that it has not been accidentally activated. Check by turning a radio receiver to 121.5 MHz. If there is an oscillating sound, the locator may have been activated and should be turned off immediately. Rearm the unit and then recheck.

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.

GARRETT 627810-1 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 should be selected whenever the unit is 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 dicontinue 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 lower left instrument panel allows the transmitter to be controlled from inside the cabin. The pilot's remote switch is placarded "ON (RESET)," "ARM." The "ARM" position should be selected for all normal flight operations. If activation occurs with the remote switch in the "ARM" position, the transmitter must be reset by selecting the "ON (RESET)" position for one second and returning the switch to "ARM."

CCC CIR 11 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 should be selected whenever the unit is 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 lower left instrument panel allows the transmitter to be controlled from inside the cabin. The pilot's remote switch is placarded "ON," "ARM" (Normal Flight Position), "RESET." If the pilot's remote switch has been placed in the "ON" position for any reason, the momentary "RESET" position must be selected for 3 seconds before allowing it to return to the "ARM" position. If for any reason the impact switch becomes inadvertently activated, it may be reset by selecting the momentary "RESET" position for 3 seconds before allowing it to return to the "ARM" position.

NARCO ELT 10 OPERATION

On the unit is a switch placarded "ON," "OFF" and "ARM." The "ARM" position allows the unit to be set to the automatic mode so that it will transmit only after activation by 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 should be selected whenever the unit is 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. The "OFF" position should be selected while changing the battery or to discontinue transmission after the unit has been activated.

A pilot's remote switch, located on the overhead panel allows the transmitter to be controlled from inside the cabin. The pilot's remote switch is placarded "ON," "ARM." The "ARM" position should be selected for all normal flight operations. If activation occurs with the remote switch in the "ARM" position, the transmitter must be reset. A button labeled "RESET" is located above the selector switch. To rearm the unit after it has been turned off or after it has been activated, the "RESET" button should be pressed in after the selector switch has been placed in the "ARM" position. This will end transmission and rearm the unit.

7.61 RADAR*

A weather radar system can be installed in this airplane. The basic components of this installation are an antenna, a transmitter/receiver, and a cockpit indicator. The function of the weather radar system is to detect weather conditions along the flight path and to visually display a continuous weather outline on the cockpit indicator. Through interpretation of the advance warning given on the display, the pilot can make an early decision on the most desirable weather avoidance course.

In addition to its primary purpose, weather mapping, the system can be used for navigation. A ground mapping feature allows the pilot to identify coastlines, water masses, islands, high ground, etc. This provides the pilot with a guidance feature which may be useful in adverse weather conditions or over areas where ground-based navigational aids are limited.

For detailed information on the weather radar system and for procedures to follow in operating and adjusting the system to its optimum efficiency, refer to the appropriate operating and service manuals provided by the radar system manufacturer.

WARNING

Heating and radiation effects of radar can cause serious damage to the eyes and tender organs of the body. Personnel should not be allowed within fifteen feet of the area being scanned by the antenna while the system is transmitting. Do not operate the radar during refueling or in the vicinity of trucks or containers accommodating explosives or flammables. Flashbulbs can be exploded by radar energy. Before operating the radar in any mode other than STANDBY, direct the nose of the airplane so that the forward 120 degree sector is free of any metal objects such as other aircraft or hangars for a distance of at least 100 yards, and tilt the antenna upward 15 degrees. Do not operate the radar while the airplane is in a hangar or other enclosure.

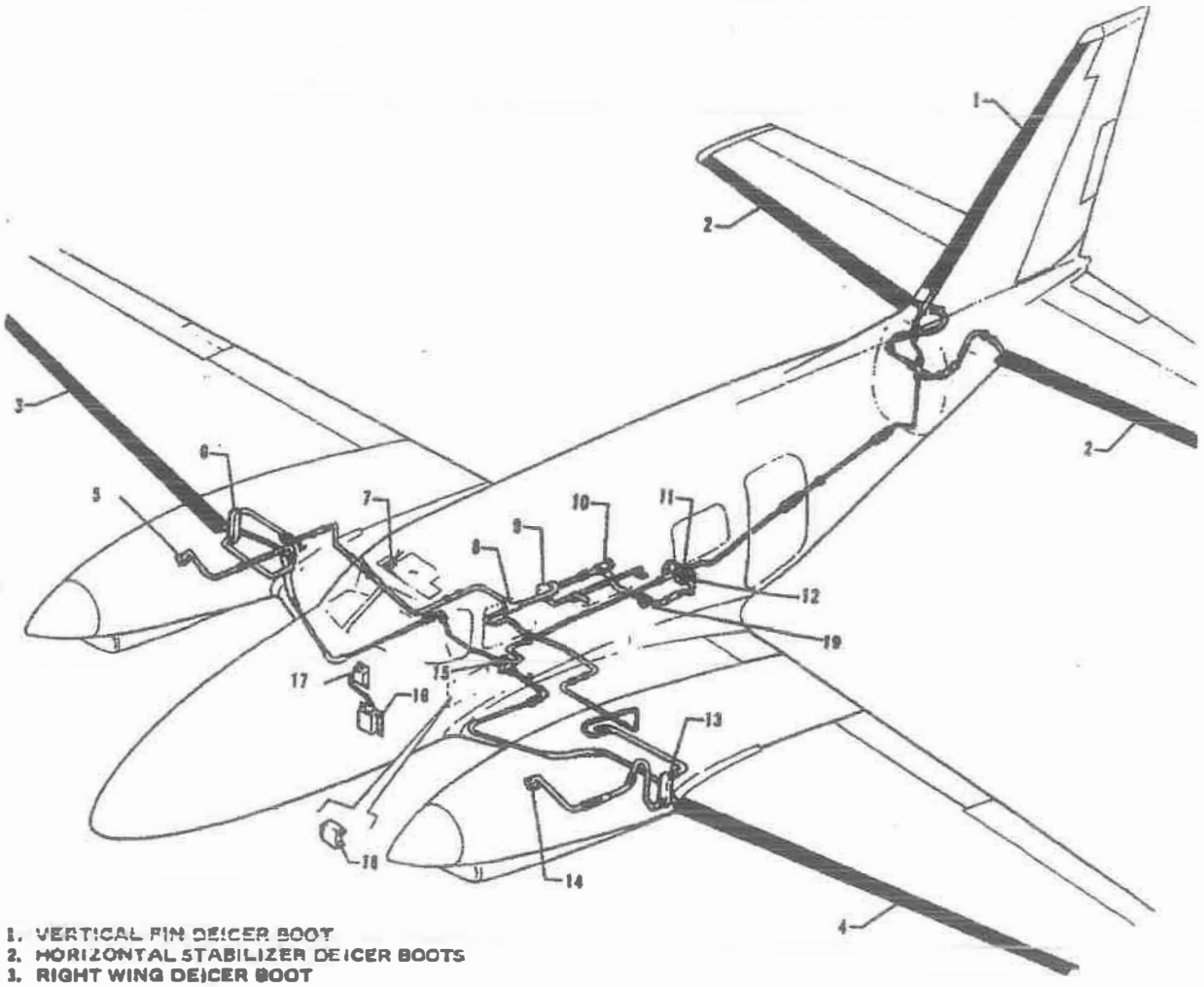
NOTE

When operating weather avoidance radar systems inside of moderate to heavy precipitation, it is advisable to set the range scale of the radar to its lowest scale.

7.63 RADAR ALTIMETER*

The PA-31T can be equipped with an optional radar altimeter. This installation employs radar signals to detect the altitude of the airplane above the terrain. For detailed operating and servicing instructions, refer to the manuals provided by the manufacturer of the radar altimeter system.

*Optional Equipment



1. VERTICAL FIN DEICER BOOT
2. HORIZONTAL STABILIZER DEICER BOOTS
3. RIGHT WING DEICER BOOT
4. LEFT WING DEICER BOOT
5. RIGHT ENGINE BLEED AIR PORT
6. RIGHT INTERCOOLER ASSEMBLY
7. SURFACE DEICER SWITCH
8. CHECK VALVE
9. ACCUMULATOR ASSEMBLY
10. PRESSURE REGULATOR
11. DEICER EJECTOR ASSEMBLY
12. 2-WAY COAXIAL SOLENOID VALVE
13. LEFT INTERCOOLER ASSEMBLY
14. LEFT ENGINE BLEED AIR PORT
15. PRESSURE SWITCH
16. DEICER TIMER
17. DEICER RELAY
18. CIRCUIT BREAKER
19. PRESSURE RELIEF VALVE

PNEUMATIC DEICING SYSTEM

Figure 7-35

7.65 PNEUMATIC WING AND TAIL DEICING*

Pneumatic deicer boots on the wing and tail leading surfaces inflate simultaneously. When the system is off, constant suction is applied to the deicer boots. This insures smooth, streamlined leading edges during normal operation.

Deicers are inflated by a deicer system control switch on the overhead switch panel. When this momentary switch is activated, the pneumatic pressure control valves are activated for six seconds. The boot solenoid valves are energized and release pressurized air directly into the boots, inflating all surface deicers on the airplane. The deicer pressure, nominally 18 psi, is regulated by the pneumatic regulator. When the cycle is completed, the deicer solenoid valves permit the pressurized air to return from the deicer boots, through the valve, and overboard. System vacuum is then applied to the deicers to hold them close to the surface skin. Deicer pressure can be monitored during deicer operation through the pneumatic pressure gauge located on the instrument panel. Normally, the gauge should register in the green, but it will flicker slightly during pneumatic deicer operation.

An ice inspection light can be installed on the outboard side of the left engine nacelle to allow the pilot to check icing conditions during night flight. The light is controlled by a switch on the overhead switch panel.

7.67 FIRE EXTINGUISHER - ENGINE*

This system consists of two spherical containers, one in each engine nacelle, that store a fire extinguishing agent supercharged with gaseous nitrogen. A pressure gauge mounted on the side of each container indicates internal pressure. To prevent the container from bursting, a fitting and integral valve releases the contents when the internal temperature of the charged sphere exceeds 215°F.

An electrically operated cartridge (firing squib), screwed into the cylinder housing assembly, provides the means of releasing the extinguishing agent. When an engine fire is indicated by the warning light on the annunciator display, the squib in the fire extinguisher in that engine may be manually activated by a switch on the pilot's side panel. An explosive charge shatters the seal on the container, releasing the extinguishing agent through tubes into the hot section of the engine and the engine accessory section.

The squib circuit is monitored through the annunciator display system. If the squib is not armed and ready to fire, the annunciator warns the pilot that the system is inoperative.

7.69 PORTABLE CABIN FIRE EXTINGUISHER*

A two and three-quarter pound portable fire extinguisher can be mounted on the wing spar carry-through cover directly behind the pilot's seat.

The extinguisher is of the dry powder type suitable for liquid or electrical fires. It is operated by aiming the nozzle at the base of the fire and squeezing the trigger grip. Releasing the trigger automatically stops further discharge of the extinguishing powder.

*Optional equipment

7.71 REFRESHMENT CABINET AND BEVERAGE DISPENSER*

Refreshment units may be installed either in the forward cabin area just aft of the crew seats or in the aft of the seating area just forward of the cabin baggage compartment. These units are mounted on vertical dividers which extend the height of the cabin.

The forward unit includes storage drawers, an ice chest, a cup dispenser, and an electrically heated beverage dispensing unit.

A variety of refreshment units are available for installation in the aft cabin area, either alone or in combination with toilet and vanity installations. The aft refreshment units may include such features as thermos pitchers for hot or cold non-carbonated beverages, a work counter, an ice chest, a condiment drawer, beverage decanters and a half-gallon electrically heated beverage dispensing unit. Some aft cabinet installations are equipped with 110 volt, 5 amp A.C. power outlets for electric razors.

7.73 FOLDING TABLES*

Folding tables can be installed on both sides of the cabin between the second and third rows of seats. To use the tables, the first passenger seat on each side must be installed facing aft, conference style. The drop-leaf table pulls from its wall rack and folds down into position. Ash trays and glass holders and a container for small objects are an integral part of the installation. An optional wall-mounted light may be added.

7.75 STORAGE CABINETS*

Additional storage space may be added when the third and fourth seats are reversed and one or two track-mounted storage cabinets are installed between the spar cover and seat bottoms.

7.77 TOILET INSTALLATION*

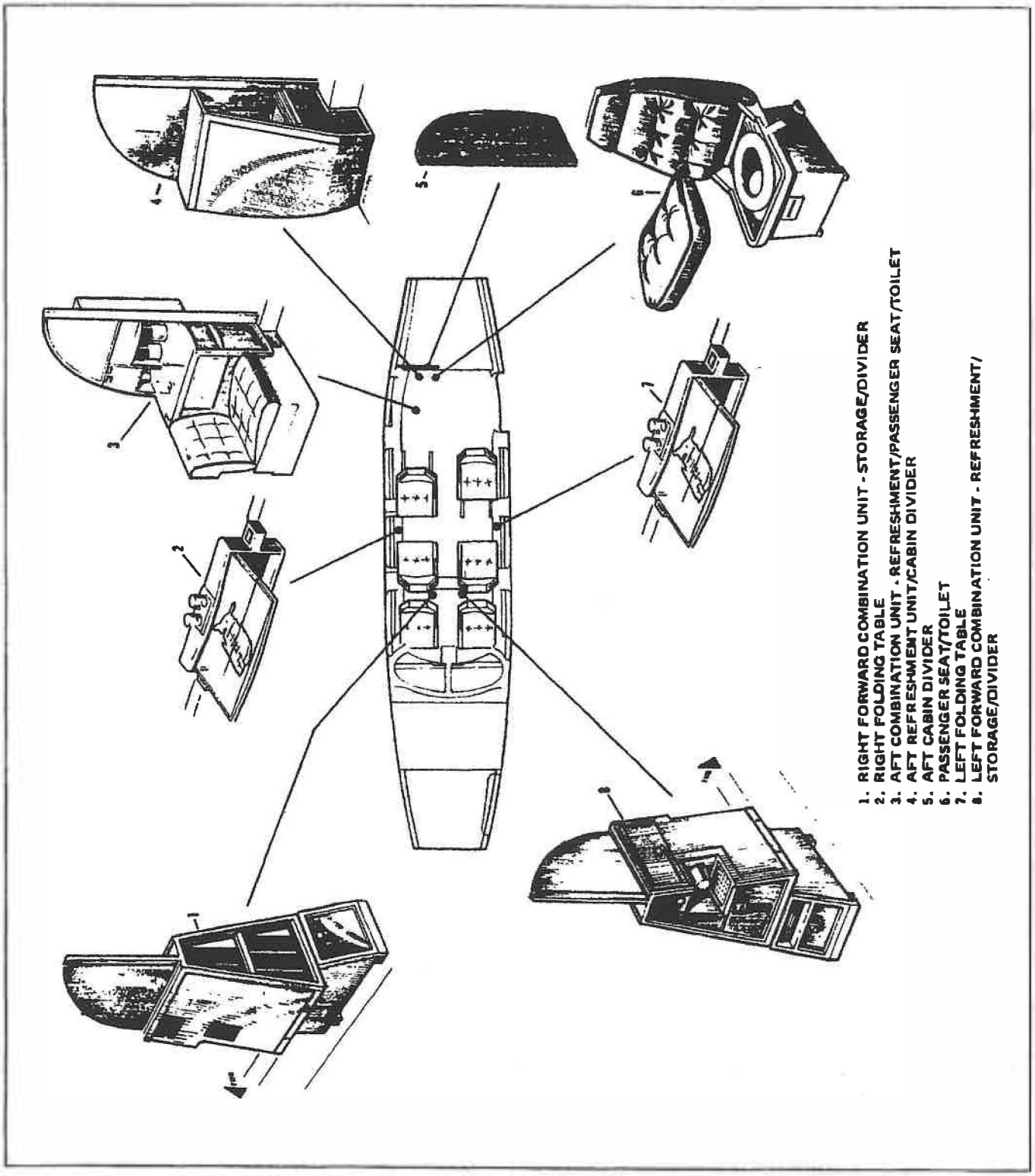
A self-contained toilet can be installed ahead of the cabinet on the right side of the rear cabin area, opposite the door. When closed, the installation serves as an additional passenger seat facing the aisle. A privacy curtain can be drawn across the aisle to isolate the toilet from the passenger section. When the seat concealing the toilet is raised, a tissue dispenser is exposed. To raise the seat, lift on the left front corner of the seat cushion bottom.

Disposable plastic bags are available from Piper dealers and a fresh one should be placed in the toilet receptacle before each use. After use, remove the plastic bag, close it with a wire tie, and place it in the covered pail provided for the purpose. The used plastic bags should be disposed of according to field facilities.

NOTE

Do not flush plastic bag in a toilet.

*Optional equipment



OPTIONAL CABIN APPOINTMENTS

Figure 7-37

7.79 EXTERNAL MICROPHONE AND EARPHONE JACKS*

With certain avionics packages, external microphone and earphone jacks are installed on the underside of the nose section. This permits ground personnel to communicate with the pilot when the engines are running or the cabin is sealed. A spring-loaded cover prevents moisture from entering the jacks.

7.81 RAMP HAILER*

The ramp hailer is controlled with a transmitter selector switch position marked "EXT" on the audio amplifier control panel. The external speaker located beneath the nose baggage compartment allows the pilot to speak to ground personnel.

7.83 EMERGENCY AVIONICS AND ATTITUDE GYRO POWER SUPPLY*

An optional emergency electrical power supply installation is available for the Cheyenne. This installation includes a 28 volt nickle-cadmium battery which will provide a short-term emergency electrical source to power Nav 2, Comm 2 and Glide Slope 2 as well as to drive a two-inch back-up attitude gyro which is part of the installation.

This installation is to be used only in an emergency situation and only after all emergency procedures for electrical failure outlined in Section 3 have been completed and no power from either generator or from the airplane's battery is available to the attitude gyro and/or the avionics bus.

The switch for the emergency power supply system is located on the copilot's instrument panel. When the emergency mode is selected, Nav 2, Comm 2 and Glide Slope 2 are removed from the primary electrical system and, together with the two-inch back-up attitude gyro, are transferred to the emergency battery.

The emergency power supply battery has a 3.8 amp hour life when fully charged. The back up attitude gyro draws .73 amps. Limited operation (equipment turned OFF when not in actual use) of the Nav 2, Comm 2, and Glide Slope 2 is required to extend the life of the emergency battery. The pilot must become familiar with the current consumption of these avionics installations to allow budgeting of emergency electrical power to insure arrival at a landing site. Current consumption information is available in the manuals provided by the manufacturer of the avionics equipment.

For a complete description of the system, its operation and maintenance, refer to the appropriate operating and service manuals supplied by the system manufacturer.

NOTE

Under IFR conditions, an approach and landing should be made at the nearest suitable airport no more than 45 minutes after activation of the Emergency Power Switch. The 45 minute limitation assumes a fully charged emergency battery.

*Optional equipment

7.85 RECOGNITION LIGHTS*

A ground recognition beacon located at the top of the vertical fin and tail recognition lights located on the horizontal stabilizer are available. When installed, these lights will aid ATC personnel during operations when visual identification is necessary. Both installations are controlled by separate switches on the overhead panel.

*Optional Equipment

SECTION 8

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SECTION 8

AIRPLANE HANDLING, SERVICING AND MAINTENANCE

8.1 GENERAL

This section provides guidelines relating to the handling, servicing, and maintenance of the Cheyenne. For complete maintenance instructions, refer to the PA-31T Service Manual.

WARNING

Inspection, maintenance and parts requirements for all non-PIPER approved STC installations are not included in this handbook. When a non-PIPER approved STC installation is incorporated on the airplane, those portions of the airplane affected by the installation must be inspected in accordance with the inspection program published by the owner of the STC. Since non-PIPER approved STC installations may change systems interface, operating characteristics and component loads or stresses on adjacent structures, PIPER provided inspection criteria may not be valid for airplanes with non-PIPER approved STC installations.

WARNING

Modifications must be approved in writing by PIPER prior to installation. Any and all other installations, whatsoever, of any kind will void this warranty in it's entirety.

WARNING

Use only genuine PIPER parts or PIPER approved parts obtained from PIPER approved sources, in connection with the maintenance and repair of PIPER airplanes.

Genuine PIPER parts are produced and inspected under rigorous procedures to insure airworthiness and suitability for use in PIPER airplane applications. Parts purchased from sources other than PIPER, even though identical in appearance, may not have had the required tests and inspections performed, may be different in fabrication techniques and materials, and may be dangerous when installed in an airplane.

Additionally, reworked or salvaged parts or those parts obtained from non-PIPER approved sources, may have service histories which are unknown or cannot be authenticated, may have been subjected to unacceptable stresses or temperatures or may have other hidden damage not discernible through routine visual or nondestructive testing. This may render the part, component or structural assembly, even though originally manufactured by PIPER, unsuitable and unsafe for airplane use.

PIPER expressly disclaims any responsibility for malfunctions, failures, damage or injury caused by use of non-PIPER approved parts.

8.1 GENERAL (CONTINUED)

Every owner should stay in close contact with an authorized Piper Cheyenne Service Center or Piper's Customer Service Department to obtain the latest information pertaining to his airplane, and to avail himself of Piper Aircraft's support systems.

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

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 Cheyenne Service Centers worldwide. Depending on the nature of the release, material and labor allowances may apply. This information is provided to all authorized Cheyenne Service Centers.

Service Letters deal with product improvements and servicing techniques pertaining to the airplane. They are sent to Piper Cheyenne 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 insure proper response.

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8.3 AIRPLANE INSPECTION PERIODS

WARNING

All inspection intervals, replacement time limits, overhaul time limits, the method of inspection, life limits, cycle limits, etc., recommended by PIPER are solely based on the use of new, remanufactured or overhauled PIPER approved parts. If parts are designed, manufactured, remanufactured, overhauled and/or approved by entities other than PIPER, then the data in PIPER'S maintenance/service manuals and parts catalogs are no longer applicable and the purchaser is warned not to rely on such data for non-PIPER parts. All inspection intervals, replacement time limits, overhaul time limits, the method of inspection, life limits, cycle limits, etc., for such non-PIPER parts must be obtained from the manufacturer and/or seller of such non-PIPER parts.

Piper Aircraft Corporation has developed inspection items and required inspection intervals for the PA-31T, Cheyenne (see PA-31T Service and Inspection Manuals). The PA-31T Inspection Manual contains appropriate forms, and all inspection procedures should be complied with by a properly trained, knowledgeable, and qualified mechanic at a Piper Cheyenne Service Center or a reputable repair shop. Piper Aircraft Corporation cannot accept responsibility for the continued airworthiness of any aircraft not maintained to these standards, and/or not brought into compliance with applicable Service Bulletins issued by Piper Aircraft Corporation, instructions issued by the engine, propeller, or accessory manufacturers, or Airworthiness Directives issued by the FAA.

A programmed inspection, approved by the Federal Aviation Administration (FAA), is also available to the owner. This involves routine and detailed inspections to allow maximum utilization of the airplane. Maintenance inspection costs are reduced, and the maximum standard of continued airworthiness is maintained. Complete details are available from Piper Aircraft Corporation.

In addition, but in conjunction with the above, the FAA requires periodic inspections on all aircraft to keep the Airworthiness Certificate in effect. The owner is responsible for assuring compliance with these inspection requirements and for maintaining proper documentation in logbooks and/or maintenance records.

A spectrographic analysis of the engine oil is available from Pratt & Whitney Canada or a Pratt & Whitney approved facility. 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-1362B.
  (2) Aircraft Registration Certificate Form FAA-500A.
  (3) Aircraft Radio Station License Form FCC-404A, 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 towed by use of power equipment that will not damage or excessively strain the nose gear steering assembly.

CAUTION

When towing with power equipment, do not turn the nose gear beyond its 40 degrees turning radius in either direction, as this may result in damage to the nose gear and steering mechanism. Do not push or pull on the propellers or control surfaces when moving the airplane.

CAUTION

Do not tow the airplane when the controls are secured.

(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 and taxiing 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 procedures should be followed:

(1) Taxi with the propeller in the low pitch, high RPM setting.
(2) When taxiing on uneven ground, avoid holes and ruts.
(3) Observe wing clearances when taxiing near buildings or other stationary objects. If possible, station an observer outside to guide the airplane.
(4) Do not operate the engines 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.
(5) After taxiing forward a few feet, apply the brakes to determine their effectiveness.
(6) While taxiing, make slight turns to ascertain the effectiveness of the steering.
(7) Propeller thrust may be modulated from full forward to full reverse by selection of the reversing range. A lock-out feature allows reverse pitch to function only during ground operations.
(8) When the airplane is stopped on the taxiway or runway and brake freeze-up occurs, actuate the brakes several times using maximum pressure. To reduce the possibility of brake freeze-up during taxi operation in severe weather conditions, one or two taxi slow-downs (from 25 to 5 knots) may be made using light brake pressure, which will assist moisture evaporation within the brake.

(c) Parking

When parking the airplane, be sure that it is sufficiently protected against 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) When parking the airplane, head it into the wind if possible.

(2) Set the parking brake by applying pressure to the toe brakes at the top of the rudder pedals while pulling out on the parking brake handle just below the left control column. To release the parking brake, apply toe pressure to the pedals and push in on the parking brake handle.

CAUTION

Care should be exercised when setting brakes that are overheated, or during cold weather when accumulated moisture may freeze brake shoes and discs together.

When excessive moisture/freezing temperature conditions exist, parked aircraft should have their brakes in the OFF condition and wheel chocks properly positioned. If brake freeze-up is suspected, actuate the brakes several times using maximum pressure.

(3) Aileron and stabilator controls should be secured with the front seat belts. Wheels should be blocked if chocks are available.

(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) Place chocks both fore and aft of the main wheels.

(5) Secure tie-down ropes to the wing tie-down rings and 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.

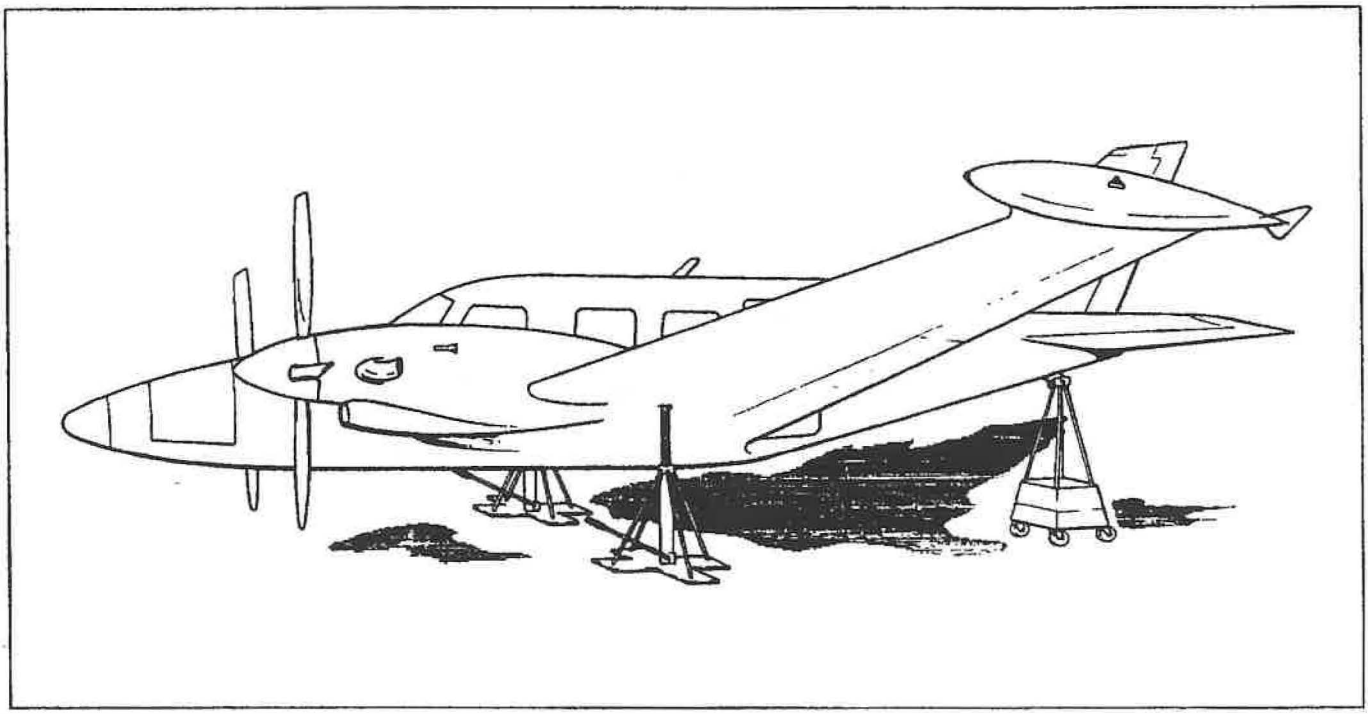
NOTE

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

(6) Overnight or in blowing snow or dust, install dust covers on engine air inlet and exhaust ports. Attach propeller restrainers to prevent windmilling.

(7) Install pitot head covers and the SAS vane cover. Be sure to remove the pitot head covers and SAS vane cover before flight.

(8) Cabin and baggage doors should be locked when the airplane is unattended.



JACKING ARRANGEMENT

Figure 8-1

(e) Jacking

The airplane is equipped with a jacking pad on each main spar just outboard of the engine nacelle. When the airplane is raised on jacks, the tail skid serves as a support position. To jack the airplane, proceed as follows:

(1) Place the jacks under the jack pads.

(2) Attach the tail support to the tail skid. Place a minimum of 500 pounds of ballast on the support to hold the tail down.

CAUTION

Be sure to apply sufficient tail support ballast; otherwise the airplane may tip forward and damage the nose section.

(3) Raise the jacks until all three wheels clear the floor.

CAUTION

Should it be necessary to raise the nose gear while the main gear remain on the ground, use seat belts to hold the control wheel aft, raising the elevators to neutral or higher. If the elevators are down, the tabs will contact the ground before the skid and could be damaged.

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8.11 BRAKE SERVICE

The brake system is filled with MIL-H-5606 (petroleum base, red) hydraulic fluid. This should be checked at every 50 hour inspection and replenished when necessary.

Do not use vegetable base brake fluids (blue) when refilling the system. The brake fluid reservoir is filled by opening the access door on the upper right portion of the nose section, exposing the brake reservoir, and removing the filler cap. Then add fluid to the reservoir to the required level.

If it is necessary to bleed the brake system to get air out of the lines, fluid should be added under pressure at the bleeder attachment on the brake unit.

No adjustment of brake clearances is necessary. If, after extended service, braking action requires too much movement of the toe pedal or the brakes are spongy, check the Service Manual for corrective action.

8.13 HYDRAULIC SYSTEM SERVICE

The fluid level of the hydraulic reservoir should be checked every 50 hours by placing the airplane in a level position and viewing the fluid level through the sight glass located in the forward surface of the reservoir dome. Access to the reservoir is through the forward baggage compartment door. The reservoir is mounted directly aft of the radio shelf.

If fluid is not visible, filtered hydraulic fluid MIL-H-5606 should be added. Fluid may be added by utilizing the filler line located at the upper forward corner of the access panel on the right side of the nose section. See Service Manual for filling instructions.

8.15 LANDING GEAR SERVICE

The operation of the landing gear oleos is standard for the air-oil type. Hydraulic fluid passing through an orifice serves as the major shock absorber, while air compressed statically acts as a taxiing spring. The piston tube has a total travel of 8.50 inches on the nose and 9 inches on the main. About 3.25 inches of tube should be exposed under normal static loads.

All of the oleos are inflated through readily accessible valves on the top of the unit. All major attachments and actuating bearings are equipped with grease fittings for lubrication of the bearing surfaces, and should be lubricated periodically. (Refer to the Lubrication Chart in the Service Manual.)

In the event the oleo strut slowly loses pressure and extension, the most probable source of trouble is the air valve attachment to the leg or the core of the air valve. These parts should be checked first to determine whether or not air leaks are occurring. If hydraulic fluid is evident on the exposed chrome plated oleo strut, the O-rings on the piston tube bearing units may need to be replaced.

To add air to the oleo struts, a strut pump is attached at the air valve and the oleo pumped up until 3.25 inches of piston tube is exposed with normal static weight on the gears. To add oil, first place the airplane on jacks; then release all the air through the valves, allowing the oleo to extend fully. Next, remove the air valve and fill the unit through this opening. Compress the oleo again to within 1/4 inch of full compression, allowing excess oil to overflow and working out trapped air. Then reinsert the valve core and pump up the strut.

The steering cable from the rudder pedals to the nose wheel steering torque shaft arm is adjusted at the rudder pedals or at the torque shaft rollers by turning in or out the threaded rod end bearings. Adjustment is normally accomplished at the forward end of the rods. Adjustment should be made in such a way that the nose wheel is in line with the fore and aft axis of the airplane when the rudder pedals and rudder are centered.

Alignment of the nose wheel can be checked by pushing the airplane back and forth with the rudder centered to determine that the airplane follows a perfectly straight line.

In adjusting the steering arm stops, care should be taken to see that the nose wheel reaches its full 14° travel just after the rudder hits its stops. This guarantees that the rudder will be allowed to move through its full travel.

The turning arc of the nose wheel is 40 degrees in either direction and is factory adjusted at stops on the bottom of the forging. The turning radius is approximately 31.67 feet.

Adjustable rod end bearings on each hydraulic cylinder actuate the landing gear struts. These rod ends should be set so that the cylinders move the landing gear retracting links just far enough to engage the spring-loaded downlocks and make contact at the stops. Too much extension of the adjusting screws will overload the links, and too little extension will prevent the links from traveling to the required past-center position.

8.17 TIRE SERVICE

For maximum service from the tires, keep them inflated to the proper pressures of 88 psi for the nose wheel and 80 psi for the main wheels. When inflating the tires, visually inspect them for cracks and breaks. If necessary, reverse the tires on the wheels or interchange them for even wear. All tires and wheels are balanced before original installation, and the relationship of tire, wheel, and tube should be maintained upon reinstallation. If new components are installed, it may be necessary to rebalance the wheels with the tires mounted. Out-of-balance wheels can cause extreme vibration during takeoff and landing.

For the optional 17.23 x 6.31 nose wheel tire, proper inflation is 80 psi.

NOTE

Proper inflation of the 17.23 x 6.31 nose wheel tire is more critical due to a lesser propeller to ground clearance for a fully deflected tire than with a fully deflected 18 x 4.4 standard equipment nose wheel tire. This difference is due principally to the smaller wheel diameter with the optional tire.

8.19 PROPELLER SERVICE

Since propellers will pick up loose pieces of rock or debris from the ramp and runway, the blades should be checked periodically for damage. Minor nicks in the leading edge of blades should be filed out and all edges rounded, since cracks sometimes start from such defects. Use fine emery cloth for finishing the depressions. Refer to FAA Advisory Circular 43.13-1 for blade repair recommendations and repair limitations. The daily inspection should include examination of blades and spinner for visible damage or cracks and inspection for grease or oil leakage. To prevent corrosion, the propeller surfaces should be cleaned and waxed periodically with hard automotive paste wax.

8.21 OIL REQUIREMENTS

The oil capacity of the United Aircraft PT6A-28 engine is 2.3 gallons. The engine oil should be changed and the oil filter cleaned at intervals recommended in UACL Service Bulletin Number 1.

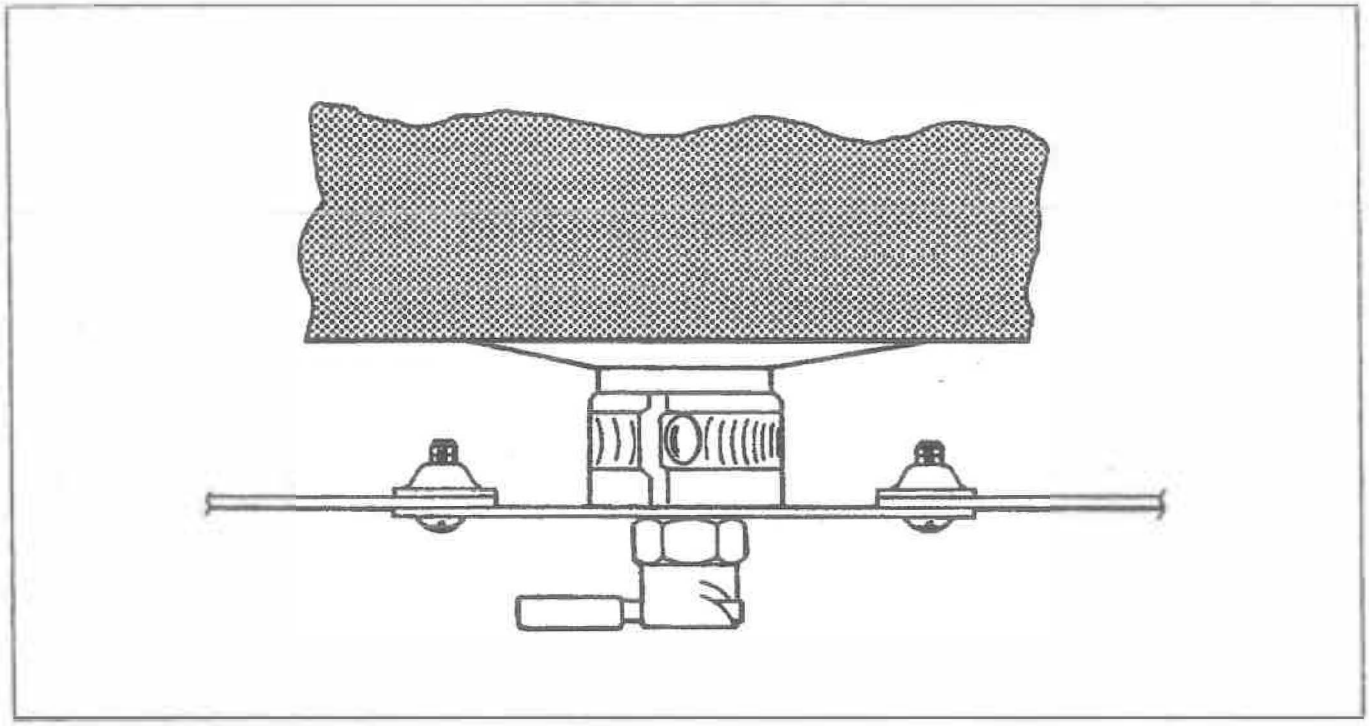
The oil level should be checked within one hour of engine shutdown as follows:

(a) Unlock filler cap and withdraw attached dipstick from filler neck located at 11 o'clock position on the accessory gear box.

CAUTION

Do not mix different brands or specifications of oil. Should different brands of oil become mixed, drain and flush oil system and refill with fresh oil (refer to UACL Maintenance Manual P/N 3013242).

(b) Check contents against marking on dipstick which corresponds to U.S. quarts and service to required level. Normal oil level is one quart below maximum level. Approved oils for this engine are listed in UACL Service Bulletin Number 1.



MAIN FUEL CELL DRAINS
Figure 8-3

8.23 FUEL SYSTEM

(a) Fuel Requirements

Aviation grade fuels conforming to PWA 522 or CPW 46 should be used. These fuels include Jet A, Jet A-1, Jet B. JP4 and JP5. If fuel PWA 522 or CPW 46 is not available, aviation gasoline MIL-G-5572, all grades, may be used for a maximum of 150 hours between overhauls.

The operation of the aircraft is approved with or without an anti-icing additive in the fuel. When an anti-icing additive is used it must meet the specification MIL-1-27686, must be uniformly blended with the fuel while refueling, must not exceed .15% by volume of the refueled quantity, and to ensure its effectiveness should be blended at not less than .10% by volume. One and one half liquid ozs. per ten gallon of fuel would fall within this range. A blender supplied by the additive manufacturer should be used. Except for the information contained in this section, the manufacturer's mixing or blending instructions should be carefully followed.

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.

This additive should not be used as a replacement for preflight draining of the fuel system drains.

(b) Filling Fuel Cells

The fuel cells of each wing are filled through filler necks located on top of each nacelle and on top of each tip tank.

(1) Observe all required safety precautions for handling aviation fuels.
(2) Fill fuel cells through nacelle filler neck until full, secure nacelle filler neck cap and continue filling system through tip tank (DO NOT OPEN NACELLE FILLER CAP WITH MORE THAN 2 INCHES OF FUEL IN TIP TANK).

(c) Draining Moisture From Fuel System

To facilitate draining the fuel system filter bowls, lines and fuel cells of moisture and foreign matter, drains are incorporated in the bottom of each filter bowl and in low points in the system.

(1) To drain either filter bowl, open the access door located on the left upper side of the engine cowling. Open the drain valve for a few seconds by pushing down on the drain lever. Allow enough fuel to flow to remove sediment.
(2) To drain the fuel system, push up on the arms of each of the four drains under the wings and allow to flow for a few seconds.
(3) To drain the tip tanks, push up on the drain tubes within the access doors on the undersides of the tip tanks.

WARNING

When draining any amount of fuel, be sure that no fire hazard exists before starting engines. Do not allow fuel to come in contact with the tires.

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8.25 BATTERY SERVICE

The battery used in the PA-31T is a rechargeable, vented, sintered plate, nickel-cadmium battery. There are 20 nylon encased cells housed in a stainless steel battery box. The electrolyte is composed of a 30 percent solution of potassium hydroxide in distilled water. During operation, no appreciable chemical change occurs in the electrolyte; therefore, testing the specific gravity of the electrolyte can not determine the state of charge. For servicing and cleaning instructions, refer to the PA-31T Service Manual.

WARNING

Servicing the nickel-cadmium battery in the PA-31T requires special training, tools, and equipment. Improper handling of the battery can result in serious bodily injury or in damage to the airplane. The electrolyte used in this battery is potassium hydroxide (KOH), which is a caustic chemical agent. Serious burns will result if this electrolyte comes in contact with the skin. If spilled on skin or clothing, neutralize the electrolyte with vinegar or a mild boric acid solution, or, if these are not available, wash thoroughly with water. Should the electrolyte come in contact with the eyes, flush thoroughly with running water and secure immediate medical attention. Shorted batteries can deliver high currents and a spark can cause a cell to explode. Metal articles, such as jewelry on the hands, can fuse to intercell straps causing serious injury. Bodily injury and equipment damage may result if acid or tools contaiminated with acid are used in servicing nickel-cadmium batteries. Water or electrolyte spilled into the battery container may cause corrosion and battery failure. Personnel qualified to service, clean, test, remove or install the battery should refer to the PA-31T Service Manual for instructions.

8.27 OXYGEN SYSTEM SERVICE

The filler valve for the oxygen cylinder is serviced by opening the access panel on the lower left nose section just aft of the forward baggage compartment door. To charge the oxygen system, remove the protective cap from the filler valve and attach the fitting from an oxygen cart.

WARNING

Inspect the filler connection for cleanliness before attaching it to the filler valve. Be sure hands, tools and clothing are very clean and free from grease and oil since these contaminants will ignite when in contact with pure oxygen under pressure.

Open the cylinder valve on supply tank and fill the system slowly by adjusting the recharge rate with the pressure regulating valve on the cart. When the pressure gauge on the cylinder reads 1800 to 1850 psi at 70°F, close the pressure regulating valve and replace the protective cap on the filler valve.

If oxygen masks are of the disposable type, they should be discarded and replaced after use. If oxygen masks are of the permanent type, they can be cleaned by the following procedure:

(a) Remove the microphone from the mask.
(b) Remove the sponge rubber discs from the mask. Do not use soap to clean sponge rubber parts, as this may deteriorate the rubber and give off unpleasant odors. Clean sponge rubber parts in clear water and squeeze dry.
(c) Wash the rest of the mask in a very mild soap and water solution.
(d) Rinse mask thoroughly to remove all traces of soap.
(e) Allow components to dry thoroughly before reassembling. Do not allow sides of the breathing bag to stick together while drying.
(f) The mask can be sterilized with a 70 percent ethyl alcohol solution.

8.29 ENVIRONMENTAL CONTROL SYSTEM

This is a combination of various systems used to control the atmospheric environment of the pressurized cabin area. No service or maintenance other than an operational check of each system should be done unless the PA-31T Service Manual is consulted for further information on the following systems: heating, air conditioning and ventilating.

8.31 PRESSURIZATION SYSTEM

The system should be given an operational check before each flight. Should the operational check show any malfunction of the pressurization system, the PA-31T Service Manual must be consulted for service instructions and any maintenance or adjustments required to make the system operational.

8.33 NUMBER PLATES

The manufacturer's name plate is located on the fuselage underside even with the forward edge of the cabin door. A second plate containing only the serial number is located to the left of the tail skid. The serial number should always be used in referring to the airplane in service or warranty matters.

8.35 LUBRICATION

For lubricating instructions, a chart showing lubrication points and types of lubricants to be used, and lubrication methods, refer to the PA-31T Service Manual.

8.37 CLEANING

(a) Cleaning Engine Compartment

Operating conditions and environments dictate the frequency and methods to be observed in cleaning the airplane's engines. Salt air and airborne pollution, for example, leave corrosive deposits which must be washed from the engine before they are allowed to accumulate.

For engine cleaning procedures, refer to and comply with the UACL PT6A-28 Maintenance Manual, Part No. 3013242, Part 2, Section 3.

(b) Cleaning Landing Gear

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

(1) Place a pan under the gear to catch waste.
(2) Spray or brush the gear with solvent or a mixture of solvent and degreaser. To remove especially heavy dirt and grease deposits, it may be necessary to brush areas that were sprayed.
(3) Allow the solvent to remain on the gear from five to ten minutes. Then rinse the gear with additional solvent and allow it to dry.
(4) Remove the protective cover and the catch pan.
(5) Lubricate the gear in accordance with the Lubrication Chart in the PA-31T Service Manual.

CAUTION

Do not brush the micro switches.

(c) Cleaning Exterior Surfaces

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

(1) Flush away loose dirt with water.
(2) Apply clean 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 stains, use a soft cloth dampened with naphtha.
(5) Rinse all surfaces thoroughly.
(6) Any good automotive wax may be used to protect and preserve painted surfaces. Soft cleaning cloths or a chamois should be used to prevent scratches when cleaning or polishing. A heavier coat of wax on leading surfaces will reduce the abrasion problems in these areas. Refer to item (h) for surface deicer cleaning procedures.

(d) Cleaning Windshield and Windows

CAUTION

Use only mild soap and water when cleaning the heated windshield. Use of ANY other cleaning agent or material may cause distortion or damage to windshield coatings.

(1) Remove dirt, mud, and other loose particles from exterior surfaces with clean water.
(2) Wash interior and exterior window surfaces with mild soap and warm water. 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 dampened with kerosene.
(4) Rinse windows thoroughly and dry with soft lint-free cloth.

CAUTION

Do not use gasoline, alcohol, benzene, carbon tetrachloride, thinner, acetone, other strong solvents, or window cleaning sprays. Do not use plastic cleaner on heated glass windshields.

(5) A severe scratch or mar in plastic can be removed by rubbing out the scratch with jeweler's rouge.
(6) When windows are clean, apply a thin coat of hand polishing wax. Rub lightly with a soft cloth. Do not apply wax on heated windshield.

(e) Cleaning Interior

(1) Headliners and other vinyl interior surfaces may be cleaned with a damp cloth and mild soap and water solution.

(2) Window curtains may be dry cleaned but it is not recommended that they be laundered.

(3) Leather may be cleaned with a mild hand soap and water solution or with saddle soap. Follow the precautions which apply to the cleaning of any fine leather product. Avoid saturation and never use detergents or harsh cleaning solutions on leather.

(4) Wood surfaces may be cleaned with any good household liquid or spray cleaner/polish manufactured for this purpose.

(5) All upholstery fabrics are "Scotchgard" treated and may be cleaned as follows:

Spilled oily and watery liquids will generally bead up on the fabric and can be blotted away leaving little or no stain. Blot spills up as quickly as possible with an absorbent cloth, tissue or sponge. If the material is a solid or semi-solid, such as butter, remove the excess by gentle scraping with a table knife. Often, blotting will remove all traces of stain but if the staining agent is not completely removed by blotting, the following techniques are suggested:

a. Water-based stains such as ketchup, milk, ice cream, coffee:

Wipe the stain with a cloth wet with water containing a detergent or ammonia (4 fl. oz. or 118 ml. ammonia to a gallon of water). Repeat if necessary.

b. Oil based stains such as salad dressing, butter or mayonnaise may be removed by either of the following procedures:

1. Apply "Texize K-2R Spot Remover" by spraying or rubbing into the fabric, and let dry. Vacuum off the residual powder. Repeat if necessary.

or

2. Wet a cloth with a solvent type spot cleaner such as "Energine" or "Renuzit" and wipe or gently rub the stained area. Turn cloth and rewet with solvent often. Repeat until stain disappears.

Fabrics treated with "Scotchgard" Fabric Protector with Extra Soil Defense offer remarkable soil resistance. This means that dirt will sit on the fabric surface and can be readily vacuumed off. Frequent vacuuming of loose dirt will prevent its being worked into the fabric.

Fabrics which have accumulated significant overall soil must be vacuumed thoroughly. A foam cleaner recommended by the manufacturer should then be applied. The following cleaners have been found to be suitable: "Fiber Fresh Concentrate," "Bissell Foam Upholstery Cleaner," "Glamorene," and "Ivory Flakes" or any other similar product. Carefully follow the manufacturer's instructions.

NOTE

It is best to test the cleaner on an inconspicuous portion of the fabric to test for discoloration. Also, avoid soaking or harsh rubbing.

To remove residual detergent left on the fabric, wipe the entire fabric surface with a cloth dampened with water. The cloth should be rinsed in clean water several times. This procedure will ensure that the treatment will continue to function.

CAUTION

Solvent cleaners require adequate ventilation.

(f) Cleaning Carpets

Use a small whisk broom or vacuum cleaner to remove dirt. For soiled spots, use a noninflammable dry cleaning fluid. Floor carpets may be removed and cleaned like any household carpet.

(g) Cleaning Toilet

(1) To dispose of the sanitary bag, pull the top of the bag from the pail and close with a wire tie. Remove it from the airplane in the covered-pail and dispose of according to field facilities. Do not attempt to flush the bag in a toilet.
(2) To dean and deodorize the airplane's toilet, mix a solution of disinfectant type cleaner. Using a soft bustled brush, rag and solution, wash the toilet pail and seat. The toilet may be removed for cleaning by disconnecting the two fasteners at the inside forward end of the unit. Slide it back and lift from the floor.
(3) When offensive odor remains, use a stronger solution and reclean.
(4) Rinse with fresh water and dry.
(5) To install a new sanitary bag, place it over the top edge of the pail and push it into the bottom of the pail.

(h) Cleaning Surface Deicing Equipment

The deicers should be cleaned when the aircraft is washed using a mild soap and water solution.

In cold weather, wash the boots with the airplane inside a warm hangar if possible. If the cleaning is to be done outdoors, heat the soap and water solution before taking it out to the airplane. If difficulty is encountered with the water freezing on boots, direct a blast of warm air along the region being cleaned, using a portable type ground heater.

As an alternate cleaning solvent, use benzol or nonleaded gasoline. Moisten the cleaning cloth in the solvent, scrub lightly, and then, with a clean, dry cloth, wipe dry so that the cleaner does not have time to soak into the rubber. Petroleum products such as these are injurious to rubber, and therefore should be used sparingly if at all.

With the deicer boots properly cleaned, a coating of Agemaster No. 1 should be applied as described in the Cheyenne Service Manual. This treatment helps protect the boot rubber from ozone attack, aging, and weathering.

After the Agemaster coating is dry, a coating of B. F. Goodrich Icex may be applied to the boots if icing conditions are anticipated. For specific instructions, refer to the Cheyenne Service Manual.

SECTION 9

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SECTION 9

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SECTION 9

SUPPLEMENTS

9.1 GENERAL

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

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

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SUPPLEMENT 1

BENDIX M-4D FLIGHT DIRECTOR AUTOPILOT

SECTION 1 - GENERAL

This supplement contains information necessary for the efficient operation of the airplane when the optional Bendix M-4D Flight Director Autopilot is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook based on Bendix STC No. SA578SO and must remain in this handbook at all times when the optional Bendix M-4D Flight Director Autopilot is installed.

SECTION 2 - LIMITATIONS

(a) Autopilot and YAW Damper OFF during takeoff and landing.
(b) Do not engage autopilot if airplane is out of trim.
(c) Maximum airspeed for autopilot operation up to 12,000 feet is 242 KIAS.
(See Vmo Chart in Section 2 of this handbook for speeds above 12,000 feet.)
(d) During flight director/autopilot operation, the pilot must be in his seat with the safety belt fastened.
(e) Do not manually override autopilot to produce or prevent pitch attitude changes or to increase bank angle.
(f) Adjust rudder and aileron trim tabs to compensate for asymmetric power in the event of a failed engine.
(g) Maximum flap extension is 15° during autopilot operation
(h) Minimum approach speed for autopilot operation is 104 KIAS. (109 KIAS if SAS inoperative.)
(i) Serial numbers 31T-7720001 through 31T-7820066 and 31T-7820068 through 31T-7820092:
As the autopilot may mask high control forces necessary to counter asymmetric ("split") flap extension, actuate the flaps only while the airplane is under manual control - not while the autopilot is engaged

SECTION 3 - EMERGENCY PROCEDURES

AUTOPILOT

(a) In the event a malfunction in the autopilot performance is detected, the pilot must immediately disengage the autopilot by momentarily pressing the FC/REL button on the control wheel or by manually overriding the A/T.

(b) Maximum altitude loss during malfunction tests in the following configuration:

(1) Climb, Cruise, Descent	500 feet
(2) ILS Approach (Twin Engine)	120 feet
(3) ILS Approach (Single Engine)	75 feet

PITCH TRIM

(a) If for any reason the trim warning system activates or trim does not function properly, pull the Autopilot/Trim circuit breaker and have system repaired prior to operation.

SECTION 4 - NORMAL PROCEDURES

PREFLIGHT CHECKOUT PROCEDURES

(a) FD/AP MASTER SWITCH - Turn the FD/AP master switch ON.

The flight director incorporates a Director Horizon. In addition to supplying attitude information to the computer, the director horizon displays command bars which receive information from the computer in the same manner as the autopilot servos. By maneuvering the aircraft to satisfy the command bars, the pilot is acting in the same manner as the autopilot servos.

(b) FLIGHT DIRECTOR SWITCH - Rotate the F/D ON/OFF switch (located on the lower left corner of Director Horizon) clockwise to the ON position. (Command bars should appear.)

(c) PITCH COMMAND - Adjust pitch command as required to align the attitude command bars with the wing tips of the symbolic aircraft.

(d) BEFORE TAKEOFF - Engage the autopilot, apply a force to the controls (one axis at a time) to determine if the autopilot may be overpowered.

(1) Test Button - Depress test button on flight controller to check integrity of all mode annunciator lamps. This does not affect any autopilot mode.

(2) Press HDG, NAV, APPR, REV AND ALT buttons one at a time and check operation of respective lights on Flight Controller.

NOTE

Automatic pitch trim will operate during this check and should be reset prior to takeoff.

(e) RELEASE SWITCH - Disengage the autopilot by pressing the FC/REL button, located on the left side of the pilot's control wheel.

(f) MANUAL ELECTRIC TRIM - The following checks should be conducted prior to each flight.
(1) Press the A/P disengage button incorporated in the trim switch, located on the pilot's control wheel. Trim should not run, but trim warning light and horn should actuate.
(2) Move the trim rocker switch in each direction (without pressing the A/P disengage button). Trim should not run, but trim warning light and horn should actuate.
(3) Press the A/P disengage button and move the trim rocker switch in each direction. Trim should run in direction selected and trim warning system should not actuate.
(4) Release trim switch and check trim wheel for freedom of movement.
(5) Check aircraft pitch trim prior to takeoff.

IN FLIGHT PROCEDURES

(a) FD/AP Master Switch ON.

(b) Turn Command Knob on Flight Controller in center detent position.

(c) Center pitch trim indicator. Autopilot pitch synchronization is provided for pitch angles up to approximately plus or minus 20° of level flight. The pitch trim indicator, when centered, indicates to the pilot that the autopilot has synchronized to the aircraft pitch attitude.

(d) RELEASE SWITCHES - Momentarily pressing the FC/REL button (located on left side of pilot's control wheel) disengages the autopilot. Momentarily pressing the disengage button incorporated in the pitch trim switch (located on left side of pilot's control wheel) disengages the roll and pitch axis only leaving the YAW axis engaged.

(e) ENGAGEMENT - Manually adjust aircraft trim prior to engaging autopilot. Place aircraft in wings level attitude. Press AP button, AP button and YAW button ON annunciators will light.

NOTE

The yaw axis only can be engaged by pressing the YAW button on the flight controller. This provides a yaw damper system and is disengaged by pressing the FC/REL button.

(f) ROLL TRIM KNOB - Adjust the roll trim knob as required to produce a wings level attitude. This adjustment is made with the Turn Command Knob in its center detent position and all lateral modes disengaged.

NOTE

Be sure the aircraft aileron and rudder trim are properly adjusted before adjusting the autopilot roll trim. Slight adjustments of rudder trim can be made with the autopilot engaged to center the ball.

(g) PITCH CONTROL - To climb, rotate the Pitch Command Disc to UP. To descend, rotate the Pitch Command Disc to DN. The rate of pitch angle change is proportional to the amount of rotation of the Pitch Command Disc.

NOTE

Pressing and holding the PITCH SYNC button (located on left side of pilot's control wheel) disengages the pitch axis and allows the pilot to manually adjust the aircraft pitch attitude. When the switch is released, the pitch axis is re-engaged and the autopilot will maintain the new attitude.

(h) AUTOMATIC ELECTRIC TRIM is provided whenever the autopilot is engaged. To manually operate the elevator trim tab, the autopilot must be disengaged. Pressing the FC/REL button disengages the autopilot.

(i) MANUAL ELECTRIC TRIM - The Manual Electric Trim System is powered through a dual-purpose trim autopilot switch assembly. To operate the trim system, simultaneously press the A/P disengage button (incorporated in the trim switch) and move the trim switch in the desired direction UP or DN. Trim should run in direction selected. When sufficient trim has been accomplished, release trim switch and trim will stop.

NOTE

If for any reason, trim warning system actuates or trim does not function properly, pull the trim/autopilot circuit breaker and have system serviced prior to operation.

(j) TURN CONTROL - The Turn Command Knob on the flight controller has two positions each side of center detent. The first position commands a bank angle of approximately 12°, while the second position commands a bank angle of approximately 25°. To turn left, rotate the Turn Command Knob to the left. To turn right, rotate the Turn Command Knob to the right.
(1) To make turns using the heading mode, see Autopilot Features item (a).

(k) ALTITUDE HOLD - The ALT button may be depressed at any time. Aircraft pressure altitude will be held when the autopilot altitude hold is engaged. Momentarily rotating the pitch knob in either direction or engagement of the Glide Slope or pressing the PITCH SYNC button disengages the altitude hold function.

NOTE

The altitude controller attemps to maintain the aircraft at the selected altitude by changing the pitch attitude of the aircraft. The human pilot must then maintain power settings to assure a safe airspeed.

FLIGHT DIRECTOR

To operate the flight director, turn the FD/AP master switch ON and rotate the FD ON/OFF switch on the Director Horizon clockwise to the ON position. All operations are identical to the autopilot except the AP button on the flight controller is not pressed for flight director only. Press HDG on the controller and the command bars will command the direction and attitude to satisfy the heading command. Likewise, NAV, APPR and REV all work in the same manner as explained in the following paragraphs.

NOTE

To preclude possible damage to the altitude controller, the flight director must not be left in the altitude hold mode while making climbs and descents with autopilot disengaged.

AUTOPILOT FEATURES

(a) HEADING SELECTOR

The heading knob on the Horizontal Situation Display (HSD) may be used to select a heading prior to pushing the (HDG) heading button. When the heading button is pressed, the aircraft will turn to the selected heading in the direction which is less than 180°, and at a bank angle of approximately 22°, and HDG button ON annunciator will light.

(b) NAVIGATION SELECTOR

When the NAV button is depressed, the autopilot will intercept and track any selected VOR radial. There are two methods of intercepting a VOR radial.

(1) Variable Intercept Angle - With this method, the pilot may preselect any intercept angle desired.

a. After identifying desired omni station, select desired course by rotating the CRS knob on the HSD until the Course Selector Pointer aligns with the desired omni course.

b. Position the Heading Selector Pointer (heading bug) to select the desired intercept angle by rotating the HDG knob on the HSD. The number of degrees between the Course Selector Pointer and the Heading Selector Pointer is the intercept angle. For obvious reasons, the pilot should not select an intercept angle less than 20° or more than 90°.

c. Simultaneously press HDG and NAV buttons on the controller. The HDG button and NAV button ON annunciators will light. The aircraft will turn toward the heading selected until the lateral deviation needle moves approximately one dot away from full deflection. At this time the HDG button ON annunciator will extinguish and the aircraft will assume an automatic 45° intercept angle.

(2) Fixed Intercept Angle

a. After identifying the desired omni station, select desired omni course on the HSD by rotating the CRS knob until the Course Selector Pointer aligns with the desired omni course.

b. Press the NAV button. NAV button ON annunciator will light. Aircraft will turn left or right, depending upon the relation of the aircraft heading to that of the selected omni bearing. If the omni bearing selected is less than 120° from the aircraft heading when the NAV mode is selected, the aircraft will turn toward the selected omni course. At angles of 120° or greater, the aircraft will turn away from the selected omni course and continue to turn through the larger angle until a proper intercept course is established. In either case, the aircraft will assume an intercept course which will be approximately 45° to the selected omni course.

(c) APPROACH SELECTOR - When the APPR button is depressed, the autopilot will intercept and track the selected ILS localizer or VOR radial. There are two methods of intercepting the localizer.

(1) Variable Intercept Angle - This method is recommended when being vectored toward the localizer or radial, by approach control, with the HDG and APPR modes engaged.

a. Align the Course Selector Pointer to the published inbound course by rotating the CRS knob on the HSD.

b. Position the Heading Selector Pointer (heading bug) and select the desired intercept angle by rotating the HDG knob on the HSD.

c. Simultaneously press HDG and APPR buttons on the controller. HDG button and APPR button ON annunciators will light. Aircraft will turn toward the heading selected until the Lateral Deviation Needle moves approximately one dot away from full deflection. At this time the HDG button ON annunciator will extinguish and the aircraft will assume an automatic 45° intercept angle.

(2) Fixed Intercept Angle

a. Align the Course Selector Pointer to the published inbound course by rotating the CRS knob on the HSD.

b. Press the APPR button on the controller. APPR button ON annunciator will light and aircraft will turn left or right depending on the relation of the aircraft heading to that of the localizer inbound heading. Aircraft will automatically assume an intercept course of approximately 45° to the localizer or radial. For reasons explained in Section Autopilot Features - item (b) (2), do not select APPR mode until the aircraft heading is less than 120° from the localizer inbound heading.

(d) GLIDE SLOPE

(1) Glide slope is automatically armed and the GS ARM annunciator on the controller will light when the following conditions are met:

a. Navigation receiver is turned to a localizer frequency.

b. The APPR button on controller is depressed.

c. Aircraft is below glide slope beam at least 20 seconds prior to glide slope interception.

When the glide slope pointer centers, the GS ARM annunciator will extinguish and the GS ON annunciator will light. The aircraft will then capture the glide slope and begin a rate of descent commensurate with the glide slope angle. Power must be adjusted as required to maintain airspeed.

(2) Glide slope may be disengaged by pressing the ALT button, moving the Pitch Command Disc, pressing the GA button or the Pitch Sync button.

(3) Glide slope may be manually engaged by pressing the GS button on the controller when the glide slope needle centers.

NOTE

Manual glide slope may be activated when in any mode, except go-around or REV.

(e) AREA NAVIGATION SYSTEM - On aircraft equipped with area NAV equipment, during A/P flight the system is coupled to the RNAV computer. The RNV annunciators indicate when the RNAV system is operating and lock out automatic glide slope function when either RNV annunciator is illuminated.

(f) BACK COURSE - For a Back Course Localizer approach, select the front course localizer inbound heading. Press REV button on the controller. APPR button and REV button ON annunciators will light indicating to the pilot that he is in both the Approach and Reverse modes.

(g) Serial numbers 31T-7720001 through 31T-7820066 and 31T-7820068 through 31T-7820092:
GO-AROUND - The Go-Around button in the left throttle lever knob may be pressed any time the autopilot is in the APPR mode and the pilot decides not to continue the approach to landing. Pressing the GA button will cause the aircraft to automatically assume a preset attitude of approximately 9° (pilot must adjust power settings to maintain airspeed). Disengage the autopilot, retract gear and flaps, retrim the aircraft and re-engage the autopilot.

Aircraft will continue to track the localizer or radial. GA annunciator on Director Horizon will light. If a missed approach heading is selected and HDG button pressed, aircraft will turn to selected heading, while remaining in the go-around mode. Movement of the Pitch Command Disc or pressing the PITCH SYNC or the ALT button will disengage the go-around mode.

If an approach is carried to completion, upon reaching ILS minimums the FC/ REL button must be momentarily depressed prior to landing. This disconnects the autopilot and returns the aircraft to manual control for completion of the landing.

Serial numbers 31T-7820067, 31T-7920001 through 31T-7920094:
GO-AROUND - The Go-Around button in the left throttle lever knob may be pressed any time the autopilot is in the APPR mode and the pilot decides not to continue the approach to landing. Pressing the GA button will cause the aircraft to automatically assume a preset attitude of approximately 9° (pilot must adjust power settings to maintain airspeed). Do not retract flaps until autopilot is trimmed out in climb.

Aircraft will continue to track the localizer or radial. GA annunciator on Director Horizon will light. If a missed approach heading is selected and HDG button pressed, aircraft will turn to selected heading, while remaining in the go-around mode. Movement of the Pitch Command Disc or pressing the PITCH SYNC or the ALT button will disengage the go-around mode.

If an approach is carried to completion, upon reaching ILS minimums the FC/REL button must be momentarily depressed prior to landing. This disconnects the autopilot and returns the aircraft to manual control for completion of the landing.

SECTION 5 - PERFORMANCE

Installation of the Bendix M-4D Flight Director Autopilot does not affect the basic Performance information presented in Section 5 of this handbook.

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SUPPLEMENT 2

SPERRY SPZ-200/STARS IVC AUTOMATIC FLIGHT CONTROL SYSTEM

SECTION 1 - GENERAL

This supplement supplies information necessary for the efficient operation of the airplane when the optional Sperry SPZ-200/Stars IVC Automatic Flight Control 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 based on Piper TC No. A8EA and must remain in this handbook at all times when the optional Sperry SPZ-200 is installed.

SECTION 2 - LIMITATIONS

(a) Autopilot and Yaw Damper OFF during takeoff and landing.
(b) During autopilot operation, pilot must be seated at the controls with seat belt fastened.
(c) Do not manually override autopilot to produce or prevent pitch attitude changes or to increase bank angle.
(d) Maximum airspeed for autopilot operation up to 12,000 feet is 242 KIAS.
(See Vmo Chart in Section 2 of this handbook for speeds above 12,000 feet.)
(e) The autopilot is approved for category 1 approach.
(f) Do not use autopilot or electric trim if electric trim system does not function properly.
(g) Maximum flap extension is 15° during autopilot operation.
(h) Serial numbers 31T-7720001 through 31T-7820066 and 31T-7820068 through 31T-7820092:
As the autopilot may mask high control forces necessary to counter asymmetric ("split") flap extension, actuate the flaps only while the airplane is under manual control - not while the autopilot is engaged.

PLACARDS

On autopilot controller, adjacent to the test button:

TEST PRIOR TO EA FLT.

SECTION 3 - EMERGENCY PROCEDURES

(a) ELECTRIC ELEVATOR TRIM

The Electric Elevator Trim may be disengaged by one of the following:

(1) Depressing and holding the pilot's or copilot's A/P TRIM DISC button.

(2) Opening the autopilot DC circuit breaker.

NOTE

Holding the manual elevator trim wheel will stop the trim.

(b) YAW DAMPER DISENGAGEMENT

The Yaw Damper may be disengaged by performing one of the following:
(Disengagement is accompanied by the Y/D Engage Light extinguishing.)

(1) Depressing pilot's or copilot's A/P TRIM DISC button.

(2) Depressing the autopilot TEST button on the autopilot engage controller.

(c) AUTOPILOT DISENGAGEMENT

The Autopilot may be disengaged by performing one of the following:

(1) Depressing pilot's or copilot's A/P TRIM DISC button.

(2) Depressing the autopilot TEST button on the autopilot engage controller.

(3) Operating manual electric trim switches when the TCS (Touch Control Steering) button is not depressed.

(4) Selecting Go-Around mode on the FDCC (Flight Director Computer Controller) or depressing the Go-Around button on the throttle.

(d) OVERPOWER OF AUTOPILOT

(1) The autopilot may be overpowered by forces on the control wheel or rudder pedals whenever necessary during an emergency. This will not damage the autopilot. The autopilot should be disengaged as soon as practical since an overpower force in the pitch axis will drive the automatic trim to oppose the overpower force.

(2) The maximum overpower forces are:

Aileron	-	10 lbs.
Elevator	-	10 lbs.
Rudder	-	50 lbs.

(e) ENGINE-OUT PROCEDURES

(1) For any single-engine emergency occurring at other than automatic ILS coupled approaches, disconnect the autopilot, handle the emergency, trim aircraft rudder, and then engage the autopilot. When trimming the rudder with autopilot engaged, there will be a slight lag from trim input until the airplane reacts to trim.

(2) For engine failure during ILS approach, disconnect the autopilot, handle the emergency, trim rudder manually to center ball, regain ILS manually, and then engage autopilot.

(f) MAXIMUM ALTITUDE LOSS DUE TO AUTOPILOT MALFUNCTION

(1)	Climb	-	150 feet
(2)	Cruise	-	200 feet
(3)	Descent	-	300 feet
(4)	ILS Approach	-	75 feet
(5)	TLS Approach (engine out)	-	75 feet

SECTION 4 - NORMAL PROCEDURES

PREFLIGHT PROCEDURES

(a) AVIONICS MASTER SWITCH - ON
(b) TURN KNOB - CENTER DETENT
(c) AUTOPILOT ENGAGE BUTTON - DEPRESS. Autopilot and yaw damper should engage and autopilot engage and Yaw Damper buttons should illuminate.
(d) FLIGHT CONTROLS - CHECK. Apply a force to the controls (one axis at a time) to determine if the autopilot may be overpowered. Autopilot should remain engaged. If disengagement occurs, do not operate autopilot.
(e) AUTOPILOT TEST. This test should be conducted as a preflight test on every flight on which the autopilot is to be used.
    (1) Autopilot Test Button DEPRESS. Autopilot should disengage. A/P ENGAGE AND Y/D ENGAGE buttons shall extinguish. A/P disconnect light will illuminate.

WARNING

If autopilot does not disengage when the test button is depressed, it indicates autopilot torque monitors are not functioning properly. Do not use autopilot in flight until corrective action has been taken.

(f) MANUAL ELECTRIC TRIM - CHECK

The manual electric trim system is powered through a dual-purpose trim switch assembly. To operate the trim system, simultaneously press and rock the trim switch in the proper direction, depending on trim desired. To disconnect the autopilot (roll and pitch axis only) momentarily depress the portion of the switch marked trim. Autopilot will disengage.

    (1) Preflight
        a. Independently operate the trim switch and the rocker switch in each direction. Trim should not run.
        b. Simultaneously operate the trim switch and the UP or DN rocker switch. Trim should run in direction selected.
        c. Manual Trim Wheel Freedom of Movement - CHECK.
    (2) If for any reason, trim does not function properly, turn off the "autopilot" D.C. circuit breaker and have system serviced prior to operation.

(g) HORIZON ATT TEST SWITCH - DEPRESS. The attitude sphere will show a 20 degree right bank and a 10 degree pitch-up attitude, and the ATT warning flag will appear. When switch is released warning flap will disappear and sphere will return to normal.

IN FLIGHT PROCEDURES

(a) YAW DAMPER ENGAGE - The yaw damper is engaged by depressing the Y/D ENGAGE button on the autopilot controller, which illuminates the button. The yaw damper provides yaw stabilization through rudder control.

(b) AUTOPILOT ENGAGE - Verify turn knob is centered and depress the A/P ENGAGE button. The button illuminates. With the Flight Director Computer Controller (FDCC) in Standby (SBY), pitch attitude is held and roll attitude is brought to zero. When the roll attitude is less than 6 degrees, heading hold is energized. The yaw damper is automatically engaged with autopilot engagement.

(c) HEADING HOLD - With the TURN Knob in detent, roll attitude less than 6 degrees, and the roll axis not coupled, the aircraft heading is maintained.

(d) TURN KNOB (Optional with Autopilot Manual Controller) - Rotation of the Turn Knob out of detent results in a roll command. The roll angle is proportional to and in the direction of knob rotation.

(e) PITCH WHEEL (Optional with Autopilot Manual Controller) - Rotation of the Pitch Wheel results in a change of pitch attitude proportional to the rotation of the wheel and in the direction of wheel movement.

(f) TOUCH CONTROL STEERING - When the Touch Control Steering (TCS) switch on the control wheel is depressed, the roll and pitch attitude of the aircraft can be changed by pilot inputs through the control wheel or electric trim. When the switch is released, pitch attitude is held. If the aircraft is at a roll attitude between 6 and 36 degrees, the roll attitude is maintained; if the roll attitude is greater than 36 degrees, the roll attitude will be reduced to 36 degrees; if roll attitude is less than 6 degrees, the aircraft heading is held. TCS may only be used with the TURN Knob in detent.

NOTES

When TCS switch is depressed the elevator and aileron axes are disengaged, the A/P ENGAGE light is extinguished, and the pilot manually flies the controls. When the TCS switch is released the autopilot re-engages, lighting the A/P ENGAGE light.

The TCS feature allows the pilot to modify the commanded flight path from the FDCC. When coupled to the airspeed or altitude mode, TCS can be selected and the airspeed or altitude manually changed through pitch attitude or power change. Upon release of the switch, the new airspeed or altitude is held. If the autopilot is coupled to the Glide Path, using TCS uncouples the pitch axis. If the autopilot is coupled to a FDCC roll mode and a roll attitude greater than 6 degrees is not exceeded, the autopilot remains coupled to the roll mode when the switch is released. If a roll attitude of 6 degrees is exceeded, the roll attitude is held, and the roll mode is uncoupled when the switch is released. The roll axis may be recoupled by depressing the ROLL COUPLE button on the autopilot control.

(g) AUTOPILOT COUPLING AND FLIGHT DIRECTOR MODES - The autopilot uses the FDCC as a common computer for both the flight director and autopilot. When the autopilot receives commands from the FDCC, the ROLL COUPLE and/or PITCH COUPLE lights on the autopilot controller will be illuminated.

The following modes from the FDCC may be coupled to the autopilot:

HDG	-	Heading select
V/L	-	VOR or LOC beam tracking
REV	-	LOC reverse course
GS	-	Glide path control
ALT	-	Altitude hold
IAS	-	Airspeed hold

NOTES

The autopilot is disconnected when the GO-AROUND mode is selected. When SBY (Standby) is selected the autopilot cannot be coupled to FDCC.

When the autopilot is engaged and a coupled mode has previously been selected on the FDCC, the autopilot automatically couples to the mode selected. If the autopilot is engaged when the FDCC is not in a lateral mode, subsequent selection of HDG, V/L or REV couples the autopilot to the mode selected, and the ROLL COUPLE switch will illuminate. The pitch axis can be coupled after the autopilot is engaged by selecting ALT, IAS or GS. When coupled, the PITCH COUPLE switch will illuminate. When the autopilot is coupled to the altitude hold or airspeed hold modes, the respective air data reference is momentarily synchronized to the value present at the time of coupling.

(1) The roll axis can be uncoupled by accomplishing any of the following: (uncoupling is accompanied by an extinguished light on the roll couple button).
   a. Rotating the TURN Knob out of detent (optional with Manual Controller).
   b. Depressing the ROLL COUPLE switch.
   c. Selecting SBY.
   d. Rolling above 6 degrees bank angle with TCS.

(2) The roll axis is recoupled by accomplishing any of the following: (accompanied by an illuminated roll couple button).
   a. Depressing the ROLL COUPLE switch with a lateral mode selected on the FDCC.
   b. Selecting a lateral mode when in SBY.

(3) If the pitch axis is coupled it can be uncoupled by accomplishing any of the following:
   a. Depressing the PITCH COUPLE switch.
   b. Rotating the PITCH Wheel. (With Optional Manual Controller)
   c. Selecting SBY.
   d. Using TCS when in GS mode.

(4) The pitch axis is recoupled by accomplishing either of the following: (accompanied by an illuminated pitch couple button).
   a. Depressing the PITCH COUPLE switch with a vertical mode selected on the FDCC.
   b. Selecting a vertical mode when in SBY.

(h) VOR/LOCALIZER MODE - In this mode, VOR or Localizer operation is selected by pressing the button and illuminating the button when the radio is turned to a VOR or LOC frequency. The desired radial or inbound course is selected on the HSI course selector by turning the course knob. When the V/L mode is selected with the aircraft outside the edge of the beam, the HDG mode is automatically selected and the HDG button is also illuminated. The heading selector on the HSI is used to set the intercept angle to the beam. When the capture point is reached, the HDG mode drops out and extinguishes its light. The vertical flight director bar commands the proper aircraft responses to track the VOR radial or LOC beam. The outbound radial may be changed when station passage is reached.

(i) REVERSE MODE - This mode is selected by pressing the REV button and illuminating the button. It provides lateral commands on the vertical flight director bar to fly back course localizer approaches or outbound on the front course. The inbound front course is selected on the HSI using the course knob. Operation is as described in the V/L mode.

(j) APPROACH ARM MODE - Selecting the Approach Arm Mode illuminates the buttons and engages the V/L mode, illuminating its button, if the aircraft is inside the edge of the localizer beam. If the aircraft is outside the localizer beam, the HDG mode is engaged and the button illuminated, and the V/L mode is armed (button remains extinguished). The heading selector on the HSI is used to set the intercept angle to the localizer. When the edge of the localizer beam is reached, the HDG mode drops out, extinguishing the button, and the V/L mode is engaged, illuminating its button. The glide slope beam cannot be captured until after the localizer beam is captured. The glide slope should normally be captured from below the glide slope. Capture of the glide slope is indicated by illumination of the glide slope button and the extinguishing of the Approach Arm button. If the ALT or IAS modes were selected prior to selecting APP ARM, these modes are retained until glide slope capture.

(k) GLIDE SLOPE MODE - This mode, besides annunciating normal glide slope capture, provides manual capture of the glide slope from above or below the beam, when the button is pushed. This mode should be selected when the GS needle is centered.

(l) GLIDE SLOPE EXTEND MODE - This annunciator will illuminate when the GS mode is operational and the aircraft has intercepted the middle marker. The GS EXT mode cannot be selected. In this system, the annunciator only indicates a decrease in sensitivity of the gain settings of the FDCC.

(m) GO-AROUND MODE - When Go-Around mode is selected, the autopilot and yaw damper will disengage. Pilot should establish the Go-Around climb attitude and roll attitude by satisfying command bars on the ADI. (Command Bars on ADI are set for approx. 8°.) As soon as climb is initiated, clean up aircraft and establish best rate of climb speed, for the aircraft configuration. Autopilot may be re-engaged if desired and go-around mode will drop out when ALT, IAS or SBY mode is selected.

(n) SOFT RIDE MODE - Selection of the SOFT RIDE mode on the autopilot engage controller reduces autopilot gain in both roll and pitch axes, making the system less sensitive. This mode may be used for turbulence penetration.

(o) DISENGAGING THE YAW DAMPER - The yaw damper is normally disengaged by actuation of the A/P TRIM DISC button on the control wheel.

(p) DISENGAGING THE AUTOPILOT

(1) The autopilot is normally disengaged by any of the following:

a. Actuation of the A/P TRIM DISC button on the control wheel.

b. Operation of the manual electric trim switch will disengage the roll and pitch axes of the autopilot except when the TCS button is depressed.

c. Selecting the Go-Around mode on the FDCC or depressing the Go-Around button on the throttle.

(2) When the autopilot is disengaged, the A/P DISC Annunciator will illuminate, and the autopilot engage button will extinguish. Depressing the A/P DISC Annunciator will extinguish the light.

(q) Serial numbers 31T-7720001 through 31T-7820066 and 31T-7820068 through 31T-7820092:
COUPLED APPROACHES - ILS or VOR coupled approaches may be made at the recommended approach speeds The autopilot must be disengaged during flap operation. The autopilot and yaw damper must be disengaged before landing.

Serial numbers 31T-7820067, 31T-7920001 through 31T-7920094:
COUPLED APPROACHES - ILS or VOR coupled approaches may be made at the recommended approach speeds. The autopilot and yaw damper must be disengaged before landing.

(r) FLIGHT DIRECTOR SYSTEM

(1) The flight director system incorporates a director horizon in lieu of the conventional artificial horizon. In addition to supplying attitude information to the autopilot, the flight director system displays the same command information from the computer that is used to operate the autopilot servos. By maneuvering the aircraft to satisfy the commands, the pilot is acting in the same manner as the autopilot servos.

(2) To operate the flight director, turn on the avionics master switch. All operations are identical to autopilot except the A/P ENGAGE button on the controller is not depressed for flight director only. Depress HDG and the command bar will command the direction and attitude to satisfy the heading command. Likewise, the V/L, ALT, IAS, GS, and GA all work in the same manner as explained for Normal Operations.

(s) MANUAL ELECTRIC TRIM

(1) IN-FLIGHT OPERATING PROCEDURES - Simultaneously operate the trim switch and the UP or DN rocker switch forward or aft for desired trim.

SECTION 5 - PERFORMANCE

Installation of the Sperry SPZ-200/STARS IVC does not effect the basic Performance information presented in Section 5 of this handbook.

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SUPPLEMENT 3

SPERRY SPZ-200/STARS IVC AUTOMATIC FLIGHT CONTROL SYSTEM WITH TORQUE SWITCHING (WTS)

SECTION 1 - GENERAL

This supplement supplies information necessary for the efficient operation of the airplane when the optional Sperry SPZ-200/Stars IVC Automatic Flight Control System (WTS) is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook based on Piper TC No. A8EA and must remain in this handbook at all times when the optional Sperry SPZ-200 is installed.

The SPZ-200 autopilot, with elevator torque switching, was designed for the Piper Cheyenne. It operates with its companion STARS flight director system to form an integrated automatic flight control system. They provide flight instruments and autopilot/flight director controls for navigation during cruise as well as for terminal area guidance.

When engaged and coupled to the flight director, the SPZ-200 will control the aircraft using the commands generated by the flight director computer/controller.

When engaged and uncoupled from the flight director, manual pitch and roll commands may be inserted using the Touch Control Steering (TCS) or the optional pitch and turn knob.

When the autopilot is coupled to the flight director, the instruments act as a means to monitor the performance of the autopilot. When the autopilot is not coupled to the flight director, the same modes of operation are available for flight director only. The pilot maneuvers the aircraft to satisfy the FD commands, as the autopilot does when it is engaged.

An altitude torque switching sensor reduces the elevator servo torque effort above 15,000 ft. ± 1000 ft. An annunciator light is illuminated at all times when the servo torque is in the high mode.

SECTION 2 - LIMITATIONS

(a) Autopilot and Yaw Damper OFF during takeoff and landing.
(b) During autopilot operation, pilot must be seated at the controls with seat belt fastened.
(c) Do not manually override autopilot to produce or prevent pitch attitude changes or to increase bank angle.
(d) Maximum airspeed for autopilot operation up to 12,000 feet is 242 KIAS.
(See Vmo Chart in Section 2 of this handbook for speeds above 12,000 feet.)
(e) The autopilot is approved for category I approach.
(f) Do not use autopilot or electric trim if electric trim system does not function properly.
(g) Maximum flap extension is 15° during autopilot operation.
(h) Serial numbers 31T-7720001 through 31T-7820066 and 31T-7820068 through 31T-7820092:
As the autopilot may mask high control forces necessary to counter asymmetric ("split") flap extension, actuate the flaps only while the airplane is under manual control - not while the autopilot is engaged.

(h) Do not use autopilot above 16,000 ft., if high torque annunciator is illuminated.
(i) AUTOPILOT OPERATING LIMITS

Yaw Damper	Roll angle up to 45° left or right bank
Autopilot Engage	Roll angle up to 45° left or right bank Pitch angle up to ± 20°
TCS	Roll angle up to 40° left or right bank Pitch angle up to ± 25°
Turn Knob Bank Limit	Roll angle up to 32° left or right bank
Pitch Knob Pitch Limit	Pitch angles up to ± 25°
Bank Limit	IIDG Mode 27° left or right bank VOR Mode 22° left or right bank LOC Mode 27° left or right bank Programing down to 13° left or right bank at ON-COURSE
Pitch Limits	GS Mode 25° up, 12° down (maximum) All other modes ± 25°
LOC Capture VOR Capture	Less than 140 MV of beam signal Less than 70 MV of beam signal
Glide Slope Capture	Above glide slope beam - any value Below glide slope beam - 22 MV of beam signal
VOR Cross Wind Capability	Up to 45° of crab angle

PLACARDS

(a) On autopilot controller, adjacent to the test button:

TEST PRIOR TO EA FLT.

(b) Located on instrument panel adjacent to the high torque annunciator:

A/P
HIGH TORQUE.

SECTION 3 - EMERGENCY PROCEDURES

(a) ELECTRIC ELEVATOR TRIM

The Electric Elevator Trim may be disengaged by one of the following:

(1) Depressing and holding the pilot's or copilot's A/P TRIM DISC button.

(2) Opening the autopilot DC circuit breaker.

NOTE

Holding the manual elevator trim wheel will stop the trim.

(b) YAW DAMPER DISENGAGEMENT

The Yaw Damper may be disengaged by performing one of the following:
(Disengagement is accompanied by the Y/D Engage Light extinguishing.)

(1) Depressing pilot's or copilot's A/P TRIM DISC button.

(2) Depressing the autopilot TEST button on the autopilot engage controller.

(c) AUTOPILOT DISENGAGEMENT

The Autopilot may be disengaged by performing one of the following:

(1) Depressing pilot's or copilot's A/P TRIM DISC button.

(2) Depressing the autopilot TEST button on the autopilot engage controller.

(3) Operating manual electric trim switches when the TCS (Touch Control Steering) button is not depressed.

(4) Depressing the Go-Around button on the throttle.

(d) OVERPOWER OF AUTOPILOT

(1) The autopilot may be overpowered by forces on the control wheel or rudder pedals whenever necessary during an emergency. This will not damage the autopilot. The autopilot should be disengaged as soon as practical since an overpower force in the pitch axis will drive the automatic trim to oppose the overpower force.

(2) The maximum overpower forces are:

Aileron	-	10 lbs.
Elevator	-	18 lbs.
Rudder	-	50 lbs.

(e) ENGINE-OUT PROCEDURES

(1) For any single-engine emergency occurring at other than automatic ILS coupled approaches, disconnect the autopilot, handle the emergency, trim aircraft rudder, and then engage the autopilot. When trimming the rudder with autopilot engaged, there will be a slight lag from trim input until the airplane reacts to trim.

(2) For engine failure during ILS approach, disconnect the autopilot, handle the emergency, trim rudder manually to center ball, regain ILS manually, and then engage autopilot.

(f) MAXIMUM ALTITUDE LOSS DUE TO AUTOPILOT MALFUNCTION

(1)	Climb	-	200 ft.
(2)	Cruise	-	500 ft.
(3)	Descent	-	450 ft.
(4)	ILS Approach	-	80 ft.
(5)	ILS Approach (engine out)	-	80 ft.

SECTION 4 - NORMAL PROCEDURES

PREFLIGHT PROCEDURES

(a) AVIONICS MASTER SWITCH - ON
(b) TURN KNOB - CENTER DETENT
(c) AUTOPILOT ENGAGE BUTTON - DEPRESS. Autopilot and yaw damper should engage and autopilot engage and Yaw Damper buttons should illuminate.
(d) FLIGHT CONTROLS - CHECK. Apply a force to the controls (one axis at a time) to determine if the autopilot may be overpowered. Autopilot should remain engaged. If disengagement occurs, do not operate autopilot.
(e) AUTOPILOT TEST. This test should be conducted as a preflight test on every flight on which the autopilot is to be used.
    (1) Autopilot Test Button DEPRESS. Autopilot should disengage. A/P ENGAGE AND Y/D ENGAGE buttons shall extinguish. A/P disconnect light will illuminate.

WARNING

If autopilot does not disengage when the test button is depressed, it indicates autopilot torque monitors are not functioning properly. Do not use autopilot in flight until corrective action has been taken.

(f) TORQUE LEVEL-CHECK. With the autopilot engaged, the HIGH TORQUE annunciator should be illuminated. If the annunciator is not illuminated, do not use the autopilot until corrective action has been taken.

(g) MANUAL ELECTRIC TRIM - CHECK

The manual electric trim system is powered through a dual-purpose trim switch assembly. To operate the trim system, simultaneously press and rock the trim switch in the proper direction, depending on trim desired. To disconnect the autopilot (roll and pitch axis only) momentarily depress the portion of the switch marked trim. Autopilot will disengage.

    (1) Preflight
        a. Independently operate the trim switch and the rocker switch in each direction. Trim should not run.
        b. Simultaneously operate the trim switch and the UP or DN rocker switch. Trim should run in direction selected.
        c. Manual Trim Wheel Freedom of Movement - CHECK.
    (2) If for any reason, trim does not function properly, turn off the "autopilot" D.C. circuit breaker and have system serviced prior to operation.

(h) HORIZON ATT TEST SWITCH - DEPRESS. The attitude sphere will show a 20 degree right bank and a 10 degree pitch-up attitude, and the ATT warning flag will appear. When switch is released warning flap will disappear and sphere will return to normal.

IN FLIGHT PROCEDURES

(a) YAW DAMPER ENGAGE - The yaw damper is engaged by depressing the Y/D ENGAGE button on the autopilot controller, which illuminates the button. The yaw damper provides yaw stabilization through rudder control.

(b) AUTOPILOT ENGAGE - Verify turn knob is centered and depress the A/P ENGAGE button. The button illuminates. With the Flight Director Computer Controller (FDCC) in Standby (SBY), pitch attitude is held and roll attitude is brought to zero. When the roll attitude is less than 6 degrees, heading hold is energized. The yaw damper is automatically engaged with autopilot engagement.

(c) HEADING HOLD - With the TURN Knob in detent, roll attitude less than 6 degrees, and the roll axis not coupled, the aircraft heading is maintained.

(d) TURN KNOB (Optional with Autopilot Manual Controller) - Rotation of the Turn Knob out of detent results in a roll command. The roll angle is proportional to and in the direction of knob rotation.

(e) PITCH WHEEL (Optional with Autopilot Manual Controller) - Rotation of the Pitch Wheel results in a change of pitch attitude proportional to the rotation of the wheel and in the direction of wheel movement.

(f) TOUCH CONTROL STEERING - When the Touch Control Steering (TCS) switch on the control wheel is depressed, the roll and pitch attitude of the aircraft can be changed by pilot inputs through the control wheel or electric trim. When the switch is released, pitch attitude is held. If the aircraft is at a roll attitude between 6 and 40 degrees, the roll attitude is maintained; if the roll attitude is greater than 40 degrees, the roll attitude will be reduced to 40 degrees; if roll attitude is less than 6 degrees, the aircraft heading is held. TCS may only be used with the TURN Knob in detent.

NOTES

When TCS switch is depressed the elevator and aileron axes are disengaged, the A/P ENGAGE light is extinguished, and the pilot manually flies the controls. When the TCS switch is released the autopilot re-engages, lighting the A/P ENGAGE light.

The TCS feature allows the pilot to modify the commanded flight path from the FDCC. When coupled to the airspeed or altitude mode, TCS can be selected and the airspeed or altitude manually changed through pitch attitude or power change. Upon release of the switch, the new airspeed or altitude is held. If the autopilot is coupled to the Glide Path, using TCS uncouples the pitch axis. If the autopilot is coupled to a FDCC roll mode and a roll attitude greater than 6 degrees is not exceeded, the autopilot remains coupled to the roll mode when the switch is released. If a roll attitude of 6 degrees is exceeded, the roll attitude is held, and the roll mode is uncoupled when the switch is released. The roll axis may be recoupled by depressing the ROLL COUPLE button on the autopilot control.

(g) AUTOPILOT COUPLING AND FLIGHT DIRECTOR MODES - The autopilot uses the FDCC as a common computer for both the flight director and autopilot. When the autopilot receives commands from the FDCC, the ROLL COUPLE and/or PITCH COUPLE lights on the autopilot controller will be illuminated.

The following modes from the FDCC may be coupled to the autopilot:

HDG	-	Heading select
V/L	-	VOR or LOC beam tracking
REV	-	LOC reverse course
GS	-	Glide path control
ALT	-	Altitude hold
IAS	-	Airspeed hold

NOTES

The autopilot is disconnected when the GO-AROUND mode is selected. When SBY (Standby) is selected the autopilot cannot be coupled to FDCC.

When the autopilot is engaged and a coupled mode has previously been selected on the FDCC, the autopilot automatically couples to the mode selected. If the autopilot is engaged when the FDCC is not in a lateral mode, subsequent selection of HDG, V/L or REV couples the autopilot to the mode selected, and the ROLL COUPLE switch will illuminate. The pitch axis can be coupled after the autopilot is engaged by selecting ALT, IAS or GS. When coupled, the PITCH COUPLE switch will illuminate. When the autopilot is coupled to the altitude hold or airspeed hold modes, the respective air data reference is momentarily synchronized to the value present at the time of coupling.

(1) The roll axis can be uncoupled by accomplishing any of the following: (uncoupling is accompanied by an extinguished light on the roll couple button).
   a. Rotating the TURN Knob out of detent (optional with Manual Controller).
   b. Depressing the ROLL COUPLE switch.
   c. Selecting SBY.
   d. Rolling above 6 degrees bank angle with TCS.

(2) The roll axis is recoupled by accomplishing any of the following: (accompanied by an illuminated roll couple button).
   a. Depressing the ROLL COUPLE switch with a lateral mode selected on the FDCC.
   b. Selecting a lateral mode when in SBY.

(3) If the pitch axis is coupled it can be uncoupled by accomplishing any of the following:
   a. Depressing the PITCH COUPLE switch.
   b. Rotating the PITCH Wheel. (With Optional Manual Controller)
   c. Selecting SBY.
   d. Using TCS when in GS mode.

(4) The pitch axis is recoupled by accomplishing either of the following: (accompanied by an illuminated pitch couple button).
   a. Depressing the PITCH COUPLE switch with a vertical mode selected on the FDCC.
   b. Selecting a vertical mode when in SBY.

(h) VOR/LOCALIZER MODE - In this mode, VOR or Localizer operation is selected by pressing the button and illuminating the button when the radio is turned to a VOR or LOC frequency. The desired radial or inbound course is selected on the HSI course selector by turning the course knob. When the V/L mode is selected with the aircraft outside the edge of the beam, the HDG mode is automatically selected and the HDG button is also illuminated. The heading selector on the HSI is used to set the intercept angle to the beam. When the capture point is reached, the HDG mode drops out and extinguishes its light. The vertical flight director bar commands the proper aircraft responses to track the VOR radial or LOC beam. The outbound radial may be changed when station passage is reached.

(i) REVERSE MODE - This mode is selected by pressing the REV button and illuminating the button. It provides lateral commands on the vertical flight director bar to fly back course localizer approaches or outbound on the front course. The inbound front course is selected on the HSI using the course knob. Operation is as described in the V/L mode.

(j) APPROACH ARM MODE - Selecting the Approach Arm Mode illuminates the button and engages the V/L mode, illuminating its button, if the aircraft is inside the edge of the localizer beam. If the aircraft is outside the localizer beam, the HDG mode is engaged and the button illuminated, and the V/L mode is armed (button remains extinguished). The heading selector on the HSI is used to set the intercept angle to the localizer. When the edge of the localizer beam is reached, the HDG mode drops out, extinguishing the button, and the V/L mode is engaged, illuminating its button. The glide slope beam cannot be captured until after the localizer beam is captured. The glide slope should normally be captured from below the glide slope. Capture of the glide slope is indicated by illumination of the glide slope button and the extinguishing of the Approach Arm button. If the ALT or IAS modes were selected prior to selecting APP ARM, these modes are retained until glide slope capture.

(k) GLIDE SLOPE MODE - This mode, besides annunciating normal glide slope capture, provides manual capture of the glide slope from above or below the beam, when the button is pushed. This mode should be selected when the GS needle is centered.

(l) GLIDE SLOPE EXTEND MODE - This annunciator will illuminate when the GS mode is operational and the aircraft has intercepted the middle marker. The GS EXT mode cannot be selected. In this system, the annunciator only indicates a decrease in sensitivity of the gain settings of the FDCC.

(m) GO-AROUND MODE - When Go-Around mode is selected, the autopilot and yaw damper will disengage. Pilot should establish the Go-Around climb attitude and roll attitude by satisfying command bars on the ADI. (Command Bars on ADI are set for approx. 8°.) As soon as climb is initiated, clean up aircraft and establish best rate of climb speed, for the aircraft configuration. Autopilot may be re-engaged if desired and go-around mode will drop out when ALT, IAS or SBY mode is selected.

(n) SOFT RIDE MODE - Selection of the SOFT RIDE mode on the autopilot engage controller reduces autopilot gain in both roll and pitch axes, making the system less sensitive. This mode may be used for turbulence penetration.

(o) DISENGAGING THE YAW DAMPER - The yaw damper is normally disengaged by actuation of the A/P TRIM DISC button on the control wheel.

(p) DISENGAGING THE AUTOPILOT

(1) The autopilot is normally disengaged by any of the following:

a. Actuation of the A/P TRIM DISC button on the control wheel.

b. Operation of the manual electric trim switch will disengage the roll and pitch axes of the autopilot except when the TCS button is depressed.

c. Selecting the Go-Around mode on the FDCC or depressing the Go-Around button on the throttle.

(2) When the autopilot is disengaged, the A/P DISC Annunciator will illuminate, and the autopilot engage button will extinguish. Depressing the A/P DISC Annunciator will extinguish the light.

(q) Serial numbers 31T-7720001 through 31T-7820066 and 31T-7820068 through 31T-7820092:
COUPLED APPROACHES - ILS or VOR coupled approaches may be made at the recommended approach speeds. The autopilot must be disengaged during flap operation. The autopilot and yaw damper must be disengaged before landing.

Serial numbers 31T-7820067, 31T-7920001 through 31T-7920094:
COUPLED APPROACHES - ILS or VOR coupled approaches may be made at the recommended approach speeds. The autopilot and yaw damper must be disengaged before landing.

(r) FLIGHT DIRECTOR SYSTEM

(1) The flight director system incorporates a director horizon in lieu of the conventional artificial horizon. In addition to supplying attitude information to the autopilot, the flight director system displays the same command information from the computer that is used to operate the autopilot servos. By maneuvering the aircraft to satisfy the commands, the pilot is acting in the same manner as the autopilot servos.

(2) To operate the flight director, turn on the avionics master switch. All operations are identical to autopilot except the A/P ENGAGE button on the controller is not depressed for flight director only. Depress HDG and the command bar will command the direction and attitude to satisfy the heading command. Likewise, the V/L, ALT, IAS, GS, and GA all work in the same manner as explained for Normal Operations.

(s) MANUAL ELECTRIC TRIM

(1) IN-FLIGHT OPERATING PROCEDURES - Simultaneously operate the trim switch and the UP or DN rocker switch forward or aft for desired trim.

SECTION 5 - PERFORMANCE

Installation of the Sperry SPZ-200/STARS IVC does not effect the basic Performance information presented in Section 5 of this handbook.

SUPPLEMENT 4

KFC 300 AUTOMATIC FLIGHT CONTROL SYSTEM (WITH FLIGHT DIRECTOR INSTALLATION)

SECTION 1 - GENERAL

This manual is to acquaint the pilot with the operation of the KFC 300 Automatic Flight Control System as installed in the PA-31T, Cheyenne. The aircraft must be operated within the limitations herein specified.

This supplement has been "FAA Approved" as a permanent part of this handbook based on King STC No. SA1188CE, and must remain in this handbook at all times when the optional King KFC 300 Automatic Flight Control System is installed.

The KFC 300 is certified in this airplane with two axis control pitch and roll and a third axis yaw damper for turn coordination and rate stabilization. The system may be operated as a flight director alone, with the pilot steering the airplane to the flight director command presentation, or the autopilot/yaw damper can be engaged to steer the airplane to the flight director command presentation.

The airplane is equipped with an electric pitch trim system which is also used to accomplish automatic trimming to unload the autopilot elevator servo so that autopilot disengagement does not result in transient airplane motion. An autotrim/manual electric pitch trim monitor is provided in the autopilot. Autotrim and/or manual electric pitch trim faults are visually annunciated on the control panel and accompanied by an audible warning.

This airplane is equipped with a manual electric pitch trim system designed to withstand any type in-flight single malfunction provided that the system is fully functional during the preflight operational check.

ABBREVIATIONS

ADC	Air Data Computer
ALT	Altitude
ALTIM	Altimeter
AP	Autopilot
APPR	Approach
ARM	Activation of an Automatic Capturing Mode
CB	Circuit Breaker
CPLD	Coupled (Indication that capture of an automatic mode has been achieved.)
CWS (SYNC)	Control Wheel Steering or Synchronization
DG	Directional Gyro
DISC	Disconnect
FCI	Flight Command Indicator or Flight Director
FCS	Flight Control System
FD	Flight Director
FLT/DIR	Flight Director
GA	Go Around
HDG	Heading
HDG SEL	Heading Select
IAS	Indicated Air Speed
NAV	Navigation
PA	Pitch Attitude
PNI	Pictorial Navigation Indicator
REV LOC	Reverse Localizer
RNAV	Lateral Navigation Computer
SPD PRF	Speed Profile
VG	Vertical Gyro
VNAV	Vertical Navigation Computer
VTA	Vertical Track Angle
YD	Yaw Damper

SECTION 2 - LIMITATIONS

(a) During Autopilot operation, one pilot must be seated at the controls with seat belt fastened.
(b) Maximum speed for autopilot operation is 242 KIAS, up to 12,000 feet (see Vmo chart for speeds above 12,000 feet in flight manual).
(c) Autopilot and Yaw Damper must be OFF during takeoff or landing.
(d) The pitch trim fault monitor system must be preflight tested operational prior to flight.
(e) The vertical nav portion of the King KVN 395 VNAV System must not be used for IFR approaches or with waypoint distances greater than 90NM.
(f) Maximum flap extension is 15° during autopilot operation
(g) The maximum altitude for operation of the autopilot is 29,000 feet.
(h) Serial numbers 31T-7720001 through 31T-7820066 and 31T-7820068 through 31T-7820092:
As the autopilot may mask high control forces necessary to counter asymmetric ("split") flap extension, actuate the flaps only while the airplane is under manual control - not while the autopilot is engaged.
(i) Placards:
Location - In full view of the pilot

CONDUCT AFCS PREFLIGHT CHECK PRIOR TO FLIGHT
IN ACCORDANCE WITH FLIGHT MANUAL.

SECTION 3 - EMERGENCY PROCEDURES

(a) AUTOPILOT DISENGAGEMENT

The autopilot can be disengaged by any of the following methods:

(1) Press the A/P disconnect/trim interrupt switch on the pilot's or copilot's control wheel to the first detent.
(2) The electric trim system may be interrupted by depressing the A/P disconnect/trim interrupt switch on the pilot's or copilot's control wheel to the second detent.
(3) Move the ON-OFF handle to the OFF position.
(4) Engage the Go-Around mode. (Yaw Damper will remain on.)
(5) Pull the Flight Director/autopilot circuit breakers out (OFF).
(6) Turn off the aircraft battery switch.
(7) Any interruption or failure of power.
(8) Operate manual electric Him switch UP or DN. (Yaw Damper will remain engaged.)

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.

(b) AUTOMATIC AUTOPILOT DISENGAGEMENT

The following conditions will cause the autopilot to disengage automatically:

(1) Vertical gyro failure indication.
(2) Flight control system power or circuit failure.

(c) SERVO DISENGAGEMENT

The following will cause a servo to disengage:

(1) Rapidly overpowering any servo will cause disengagement of only that servo through operation of the servo monitor. The servo may be re-engaged by turning off the autopilot and waiting for the monitor light to extinguish before reengaging the autopilot.
(2) A hardover failure in any of the primary servos will result in only that servo being automatically disengaged.

(d) MAXIMUM ALTITUDE LOST DURING MALFUNCTION TESTS WERE

(1) Cruise	600 feet
(2) Approach	60 feet
(3) Approach single engine	60 feet

(e) ENGINE FAILURE (Coupled)
(1) Disengage AP and YD.
(2) Follow basic Airplane Flight Manual single engine procedures.
(3) Airplane rudder and aileron axes must be manually trimmed prior to engaging autopilot for single engine operations.

CAUTION

IF RUDDER AND AILERON TRIM CANNOT BE MAINTAINED WHEN POWER IS CHANGED DURING A SINGLE ENGINE COUPLED APPROACH OR GO AROUND, DISENGAGE AUTOPILOT AND CONTINUE APPROACH/GO AROUND MANUALLY.

SECTION 4 - NORMAL PROCEDURES

(a) PILOT'S/COPILOT'S CONTROL WHEEL SWITCH FUNCTIONS

AP DISC 1ST/TRIM INTERRUPT 2ND - This is a two-position switch which will disengage the AP and Yaw Damp in the first position (1st) and interrupt the electric trim system in the second position (2nd). To resume AP and Yaw Damp control, the AP lever on the Mode Controller must be re-engaged. In the event of electric trim or autotrim failure, the switch can be held completely depressed (two clicks), which removes all power from the trim system to allow the pilot time to turn off the AVIONICS MASTER switch and pull the (PITCH TRIM) circuit breaker.

CWS (SYNC) - This switch when depressed and held will allow the pilot to manually fly the A/C in pitch and roll without disengaging the AP. When the switch is released the AP will resume control (within the pitch and roll attitude limits). The CWS switch will resync the FD in PAH, ALT, IAS, or SPD PRF mode and will transfer the Go Around mode to PAH.

TRIM UP/DOWN - Manual electric pitch trim is activated by a dual action type switch that requires both halves be moved simultaneously for actuating up or down trim commands. Operation of the manual electric pitch trim switch will disengage the AP lever switch on the Mode Controller while the YAW DAMP remains engaged.

GA (GO AROUND) - The GA switch is located on the throttle and the operation of the switch will indicate a fixed angle of climb of 11° on the FDI. Selection of the GA Mode when in the APPR or NAV CPLD Mode will disengage the mode and revert to the FD Mode (wings level) for lateral steering. The AP, if engaged, will disengage. The AP, however, can be engaged or re-engaged with GA mode selected and will follow the pitch command to climb at the fixed angle.

NOTE

THE FLIGHT CONTROL SYSTEM INCORPORATES ITS OWN ANNUNCIATOR PANEL WHICH IS LOCATED ON THE INSTRUMENT PANEL. THE MODES AND INDICATIONS GIVEN ON THE ANNUNCIATOR PANEL ARE PLACARDED ON THE FACE OF THE LENSES AND ILLUMINATE WHEN THE RESPECTIVE CONDITIONS ARE INDICATED. THE SWITCHES ON THE MODE SELECTOR ARE THE PUSH-ON, PUSH-OFF TYPE. WHEN ENGAGED, THE CORRESPONDING FD/AP ANNUNCIATOR LIGHT ILLUMINATES. THE V-BARS ON THE FLIGHT DIRECTOR INDICATOR WILL DISAPPEAR TO THE TOP OF THE INSTRUMENT WHEN NO FLIGHT DIRECTOR MODES ARE ENGAGED. THE V-BARS MUST BE IN VIEW BEFORE THE AUTOPILOT CAN BE ENGAGED. WHEN THE AUTOPILOT IS NOT ENGAGED, THE SYSTEM MAY BE USED AS A MANUAL FLIGHT DIRECTOR SYSTEM.

(b) PREFLIGHT CHECK (Must be performed prior to each flight).

Neither the autopilot nor the flight director may be turned on if the attitude flag or computer flag is visible on the flight command indicator. Allow approximately three (3) minutes after application of power for the vertical and directional gyros to come up to speed.

(1) Check that all circuit breakers for the flight control system are in.
(2) Turn the Battery and Radio Master switch on and engage the flight director to bring the command bars into view.
(3) Engage the autopilot and yaw damper. (The autopilot will not engage when the flight director is inoperative.)
(4) Press and hold the preflight test button located on the lower left corner of the flight command indicator. This will activate a self test cycle provided to preflight the autopilot and flight director system. Note the following sequence for the test cycle:
    a. All autopilot flight director, trim warning, and mode lights should illuminate and remain lighted until the test has been completed. The trim warning will be accompanied with aural alert also during test.
    b. A simulated climbing right turn of 10° pitch up and 10° right roll will appear on the attitude display.
    c. The command bars will remain centered with the airplane reference symbol until the flight director, autopilot computer, and servos check valid.
    d. All three servo actuator monitors will trip.
    e. The autopilot and yaw damper will disengage to demonstrate proper computer monitor operation.
    f. The command bars will come into exact alignment with the original horizon display after the flight director computer, autopilot computer, and servos check valid.

(5) Release the preflight test button and check to see that warning and mode lights extinguish. A warning light illuminated after the test button is released indicates malfunction for that mode.

(6) Engage the autopilot and yaw damper. Check that the system can be overpowered in all three axes.

(7) Pitch Trim Preflight Test.

a. With the AP disengaged, run the following manual electric pitch trim checks.
   1. Verify that the PITCH TRIM circuit breaker is in.
   2. Actuate the left-side switch to the fore and aft positions. The trim solenoid should engage, but the trim should not run.
      Actuate the right-side switch to the fore and aft positions. The trim solenoid should not engage and the trim should not run.
   3. Run the trim from stop to stop. The time required is 61 ± 6 seconds.
   4. Grasping the manual trim wheel, run the trim both up and down and check the overpower capability. (Check that the trim indicator moves with the wheel.)
   5. Press the AP DISC/TRIM INTERRUPT switch completely down (2nd detent) and hold. The manual electric pitch trim will not operate either up or down.

b. AFCS Trim Test Fault #2 - Trimming action up or down with no trim command.
   1. With the autopilot disengaged, select and hold the AFCS Trim Test switch in the Fault #2 position.
   2. Activate the manual electric trim up via the trim switch on the pilot's control yoke.
   3. Immediately after the trim starts to run up, the trim fail light and horn will activate.
   4. Repeat the test for down fault.

c. AFCS Trim Test Fault #1 - Test for trim command-up and down with no trimming action.
   1. With the autopilot engaged, select and hold the AFCS trim test switch in the Fault #1 position..
   2. Using the Vertical Trim switch on the mode selector, insert an up command into the system.
   3. The trim fail light and horn will activate after a time delay of approximately 17 seconds.
   4. Repeat the test for a down vertical trim command.

d. Test for Trim Command up and down with correct trimming action.
   1. Engage the FD. Then engage the AP, depress the CWS switch, center the flight controls and then release the CWS switch. Apply force to the controls to determine if the AP can be overpowered.
   2. Check the operation of the pilot's control wheel switch functions.
   3. Engage the FD and AP and put in a pitch (UP) command using the vertical trim switch on the Mode Controller. Hold the control column to keep it from moving and observe the autotrim run in the nose-up direction after approximately three (3) seconds delay. Use the vertical trim switch and put in a pitch (DN) command. Hold the control column and observe the autotrim run in the nose-down direction after approximately three (3) seconds.
   4. Engage the HDG mode and the AP. Set the HDG bug to command a right turn. The control wheel will rotate clockwise. Set the HDG bug to command a left turn. The control wheel will rotate counterclockwise.
   5. Disengage the AP and check the aircraft manual pitch trim prior to takeoff.

(c) INFLIGHT OPERATION

(1) Engage Procedure:

a. Engage the FLT DIR mode on the mode controller. A command to hold the existing pitch attitude and heading will be displayed on the flight command indicator command bars as they are brought into view.

CAUTION

IF THE PILOT HAS BEEN OPERATING THE SYSTEM ON ANY FLIGHT DIRECTOR MODE WITHOUT SATISFYING THE COMMAND BARS THE SYSTEM SHOULD BE SYNCHRONIZED TO THE PRESENT AIRPLANE POSITION BY MOMENTARILY DEPRESSING THE CWS SWITCH PRIOR TO ENGAGING THE AUTOPILOT.

b. Engage the Autopilot. The autopilot action is always in response to, and consistent with, flight director commands and when engaged by the solenoid-held toggle switch on the mode controller, the autopilot will respond to any operating mode through a soft engage circuit, which allows engagement into an unsatisfied flight director command without an abrupt control transient.

c. Depressing the Control Wheel Steering switch, located on the pilot's control wheel, allows the pilot to momentarily revert to manual control in pitch and roll (yaw damper stays engaged), while retaining his previous mode "program", and conveniently resuming that profile upon disengagement. When in Go Around, operation of the Control Wheel Steering switch disengages the Go Around Mode.

d. The autopilot, together with yaw damper, provides three-axis rate stabilization, automatic turn coordination, and automatic elevator trim as well as automatic response to all flight director modes.

(2) Heading Control Operation

The flight control system is electrically connected to the directional gyro for heading hold information whenever the system is in basic flight director mode. Heading hold is automatically disengaged when an incompatible lateral mode is engaged. Pressing the HDG SEL mode button automatically causes the aircraft to execute a pre-selected heading change as set in on the Pictorial Navigation Indicator with the HDG select knob or slew control.

Heading changes using HDG SEL mode will bank the aircraft 1.5 degrees for every degree of heading change selected up to a maximum bank angle of 25 degrees. When in the heading select mode, depressing the Control Wheel Steering (SYNC) button located on the yoke of the pilot's control wheel, will cause the command bars to sync while the button is depressed, but when released the previously programmed heading information to the command bars will be resumed.

(3) Vertical Control Operation

a. Vertical Trim:
Operation of the vertical trim switch (on mode controller), provides a convenient means of adjusting the reference parameter of all the vertical modes except glideslope and vertical navigation. This permits the pilot to change his vertical reference without disengaging and re-engaging modes.

b. Altitude Hold:
The altitude hold mode may be engaged by pressing the ALT hold switch on the mode controller. The aircraft will maintain the pressure altitude existing at the time the switch is depressed. Altitude hold may be engaged at any rate of climb or descent. Altitude hold is automatically disengaged when any other vertical mode is selected. The vertical trim switch may be used to trim the referenced altitude up or down at approximately 500 fpm.

c. Altitude Select: (Optional)
This mode allows the pilot to select, arm, and upon approaching the preset altitude, obtain an automatic visual pitch command to capture and hold the preselected altitude. Prior to selecting the function, the pilot must set the desired altitude (by means of rotary control knobs) into the selected altitude readout of the Vertical Navigation Computer. The ALT ARM button on the Vertical Navigation Computer may be depressed any time during climb or descent to arm the altitude capture circuitry and the ALT ARM annunciator will illuminate. As the aircraft approaches the selected altitude, the ALT ARM annunciator will extinguish, and as the aircraft passes through the selected altitude, the altitude hold mode will automatically engage and the ALT HOLD annunciator light will illuminate.

d. Indicated Airspeed Hold:
Engaging the indicated airspeed hold mode will introduce a computed, visually-displayed pitch command to maintain the reference airspeed. The mode is utilized by manually maneuvering the aircraft, and setting engine power, to attain the desired speed in climb, descent, or level flight and then depressing the IAS button. The reference airspeed may be adjusted at a rate of 1.0 knot per second by operation of the vertical trim switch on the mode controller.

e. Speed Profile:
Engaging the speed profile mode will introduce a visually displayed pitch command on the Flight Command Indicator which varies the indicated climb or descent speed as a function of altitude. During climb, airspeed is decreased at the rate of approximately 1.3 knots per 1,000 feet. The proper initial airspeed must be set by the pilot and correct power setting maintained before depressing the SPD PRF button. After engagement, airspeed reference may be trimmed using the vertical trim switch.

f. Vertical Navigation: (Optional)
The vertical navigation computer provides a computed flight path angle prior to VNAV engagement, which is displayed on the VNAV Deviation Indicator. After engagement, the vertical navigation computer provides a VNAV steering command to the flight control system to maintain the selected vertical track angle in climb or descent. The VNAV may be used to provide vertical guidance commands while using any of the lateral modes to provide lateral steering.

g. Altitude Alerting: (Optional)
Altitude alerting is also included in the Vertical Navigation Computer. Altitude selection also sets the alerter warning bands. The outer bank is set nominally 1,000 feet above and below the selected altitude and the inner band 500 feet above and below the selected altitude. Flight through the limits provides visual and aural warning by illumination of both alert lights and 2 sec. tone.
The altitude alerting function is also operational throughout use of the vertical navigation mode and will provide warning of aircraft penetration of the 1,000 and 500 feet levels above and below the selected altitude. An MDA toggle switch on the Vertical Navigation Computer allows the pilot to activate the MDA annunciator for warning when the minimum descent altitude is reached.

h. Go-Around:
Engagement of the go-around button located on the left engine throttle lever will introduce a wings level 11° nose-up display on the Flight Command Indicator command bars. Operation of go-around cancels all other vertical modes and also disengages the autopilot, if the autopilot has been engaged. The go-around mode may be used as a take-off pitch reference, if desired, by engaging go-around mode on the runaway. Operation of the control wheel steering switch on the pilot's control column disengages the Go-Around Mode.

NOTE

THE GO-AROUND MODE IS PREDICATED ON TWO ENGINE PERFORMANCE. FOR SINGLE ENGINE GO-AROUND, MONITOR IAS AND USE PAH MODE.

(4) Flying Radio Facilities

a. Vor Procedures:

1. Tune the VOR receiver to the appropriate frequency. (RNAV mode selector in VOR-DME.)
2. Set the desired course to or from the station on the pilot's PNI.
3. Set the desired intercept heading. (Heading hold or HDG SEL may be used.)

NOTE

THE INTERCEPT ANGLE, RELATIVE TO THE VOR RADIAL, MAY BE ANY ANGLE OF 90° OR LESS.

4. Arm the navigation mode by depressing the NAV switch on the mode controller. The NAV ARM light on the flight director annunciator panel illuminates indicating that the system is armed to capture the selected radial. At the point of capture, the NAV ARM light on the annunciator extinguishes and the NAV CPLD annunciator light illuminates, indicating the system has captured the selected course.
5. The selected track may be changed while in the tracking mode by selecting a new course on the pilot's course indicator. If a new course on the pilot's course indicator is selected a preprogrammed intercept angle of 45° is automatically engaged without having to return to the heading mode. When over the navigational facility, the course selection should be made at the to/from change, for best results.

b. Area Navigation Enroute: (Optional)

NOTE

THE RNAV DISTANCE TO WAYPOINT INFORMATION IS DISPLAYED ON THE APPROPRIATE INSTRUMENT(S) THAT DISPLAY DME DISTANCE, WHEN AN AREA NAVIGATION MODE IS SELECTED.

1. Tune the VOR and DME receivers supplying information to the Area Navigation Computer to the radio facility (VORTAC) being used. The signal must be valid.
2. Set the area navigation bearing, and distance, to establish the desired waypoint.
3. Set the area navigation mode switch to RNAV position.
4. Set the desired course on the pilot's course indicator.
5. Set the desired intercept heading (heading hold or HDG SEL may be used).

NOTE

THE INTERCEPT ANGLE WITH RESPECT TO THE RNAV RADIAL SELECTED MAY BE ANY ANGLE UP TO 90°.

6. Arm the navigation mode by depressing the NAV switch on the mode controller. The NAV ARM light on the flight director Annunciator Panel illuminates indicating that the system is armed to capture the selected radial. At the point of capture, the NAV ARM light on the annunciator will extinguish and the NAV CPLD annunciator light illuminates, indicating the system has captured the selected course.

c. Vertical Navigation (VNAV): (Optional)

Vertical navigation provides a computed pitch command displayed on the Flight Command Indicator to capture and maintain a vertical track angle in ascent or descent, to an RNAV waypoint less than 90NM distant. The following prerequisites are required for VNAV Valid:

1. The RNAV computer mode switch must be placed in an RNAV position.
2. The desired course "TO" the selected waypoint must be set in on the PNI.
3. The RNAV must be valid (NAV flag retracted in PNI). Having RNAV valid insures both VOR and DME valids.
4. The flight path angle to ascent or descent to the selected RNAV waypoint must not be greater than 5.5.
5. The servoed Altimeter used in conjunction with the VNAV must be valid.

Normal "ENROUTE" operation of the Vertical Navigation Computer (VNAV):

1. Preset the desired RNAV waypoint on the RNAV computer and select the course "TO" the waypoint. (RNAV ENROUTE mode must be selected and valid.)
2. Set the desired altitude in the altitude select window.
3. Set the altitude of the VORTAC facility being used, using the VTAC ALT adjustment tab.

4. If Altitude acquisition is desired prior to reaching the selected waypoint, program the mileage offset (0 to 30 miles) using the DIST BIAS miles knob. (Bias is the distance short of the selected waypoint.)

CAUTION

DO NOT ADJUST THE PILOT'S ALTIMETER SETTING OR DIST BIAS AFTER VNAV IS COUPLED. A LARGE CHANGE IN EITHER OF THESE PARAMETERS WILL CAUSE AN ABRUPT PITCH ATTITUDE CHANGE. IF CHANGES IN THESE SETTINGS ARE REQUIRED, DISENGAGE VNAV, RESET, AND RECOUPLE AS DESIRED.

If the VNAV is valid the Vertical Track angle will be indicated on the right display scale of the Flight Command Indicator in degrees of angle, to maximum of ± 5°. As the aircraft flies toward the waypoint at a constant altitude, the displayed Vertical Track angle will slowly increase. When the Vertical Track angle has reached a value desired by the pilot, the pilot must manually engage the VNAV CPLD mode by depressing the VNAV CPLD switch on the VNAV computer.

The Vertical Track angle display upon engagement becomes a deviation display above or below the selected flight path. The maximum scale deflection in the VNAV CPLD Mode is ± 250 feet (50 feet per increment). Selection of the VNAV CPLD Mode automatically activates ALT ARM to capture the selected altitude.

The VNAV CPLD Mode may be used in conjunction with the NAV CPLD Mode to automatically make good an RNAV waypoint or may be coupled with the HDG SEL Mode where the pilot makes the HDG SEL course changes necessary to make good the RNAV waypoint.

NOTE

WHEN VNAV CPLD MODE IS USED WITH ANY FLIGHT CONTROL SYSTEM LATERAL MODE OTHER THAN NAV CPLD THE PILOT MUST MAKE THE NECESSARY COURSE CORRECTION TO MAKE GOOD THE RNAV WAYPOINT OR THE VNAV COMPUTER CANNOT INSURE MAKING GOOD THE VERTICAL WAYPOINT. THE HDG SEL MODE MAY BE USED TO MAKE RADAR VECTORS AND SHORT TERM HDG CHANGES WITHOUT ADVERSELY AFFECTING VNAV PERFORMANCE. FLYING AN RNAV OFFSET ALONG TRACK OF GREATER THAN TWO (2) NAUTICAL MILES IS NOT RECOMMENDED AS THIS MAY PREVENT THE SYSTEM FROM MAKING GOOD THE WAYPOINT. HDG SEL TURNS GREATER THAN 90° WHEN VNAV CPLD IS NOT RECOMMENDED. IF TURNS BEYOND 90° ARE COMMANDED THE AIRPLANE WILL START CLIMBING (IF INITIALLY ON A DESCENT) OR DESCENDING (IF INITIALLY ON A CLIMB) IN ORDER TO MAKE GOOD THE SELECTED VERTICAL TRACK.

d. Approach

VOR

VOR approaches may be made by coupling VOR in the approach mode. This gives proper responses for a close in non-precision approach.

ILS FRONT COURSE

1. Tune the NAV receiver to the correct ILS frequency, set the course selector to the inbound front course heading, set the heading bug to the desired intercept angle (90° or less) and set the decision height on the radio altimeter if installed.

NOTE

WITH BOTH VOR RECEIVERS TUNED TO THE SAME ILS FACILITY, IF THE NUMBER 2 NAV DEVIATES GREATER THAN 35 MILLIVOLTS ON EITHER LOC OR GS THE APPROPRIATE ANNUNCIATOR WILL FLASH INDICATING THE MONITOR LIMITS HAVE BEEN EXCEEDED. IT IS COMMON FOR THE LOC AND GS MODES TO MOMENTARILY FLASH WHEN THE RESPECTIVE MODE IS FIRST CAPTURED SINCE THE CAPTURE POINT IS GENERALLY OUTSIDE THE MONITOR LIMITS.

LOCALIZER AND GLIDESLOPE ARE CAPTURED AUTOMATICALLY ON FRONT COURSE. THE LOCALIZER MUST BE CAPTURED BEFORE GLIDESLOPE CAPTURE IS ENABLED.

CAUTION

MARKER BEACON TEST ACTIVATION AFTER GLIDESLOPE CAPTURE DECREASES THE GLIDESLOPE GAINS WHEN THE MARKER BEACON IS BEING USED TO CONTROL THE GLIDESLOPE GAIN.

2. Engage HDG mode and arm the APPR mode. The APPR ARM annunciator will illuminate, indicating the system is armed to capture the localizer beam. As the aircraft nears the beam, the APPR CPLD annunciator will illuminate and the system will intercept the localizer. At the point of glide path intercept, the GS CPLD annunciator will illuminate and all other vertical modes will be disengaged, indicating the system is locked on to the glideslope.
3. The Decision Height light on the Flight Command Indicator will illuminate when the aircraft reaches the decision height previously selected by the pilot on the radio altimeter.
4. To assume manual control of the aircraft for landing, depress the autopilot disengage switch on the pilot's control wheel.
5. Go-Around mode may be selected by pressing the GA button any time the pilot needs to execute a missed approach. The autopilot will be disengaged and the Flight Command Indicator will command an 11° nose-up wings level attitude.

e. ILS Back Course

1. Tune the NAV receiver to the correct ILS frequency, set the course selector to the LOC front course, set the heading bug on the PNI to establish the desired intercept angle (90° or less) and set decision height on the radio altimeter if installed.

NOTE

WITH BOTH VOR RECEIVERS TUNED TO THE SAME ILS FACILITY, IF THE NUMBER 2 NAV DEVIATES GREATER THAN 35 MILLIVOLTS, THE LOC ANNUNCIATOR WILL FLASH INDICATING THE MONITOR LIMITS HAVE BEEN EXCEEDED. IT IS COMMON FOR THE LOC MODE TO MOMENTARILY FLASH WHEN THE MODE IS FIRST CAPTURED SINCE THE CAPTURE POINT IS GENERALLY OUTSIDE THE MONITOR LIMITS.

LOCALIZER IS CAPTURED AUTOMATICALLY ON BACK COURSE, GLIDESLOPE IS LOCKED OUT.

IF THE AIRCRAFT HEADING IS WITHIN 90° OF THE LOC BACK COURSE, THE COMPUTER AUTOMATICALLY DETECTS AND ANNUNCIATES REV LOC.

2. Engage HDG mode and arm the APPR mode. The APPR ARM annunciator will illuminate, indicating the system is armed to capture the localizer beam. As the aircraft nears the beam, the APPR CPLD annunciator will illuminate and the system will intercept the localizer.
3. Indicated Airspeed hold or pitch attitude hold may be used to establish a descent while on Rev LOC.
4. Go Around operation is the same as for front course operation.

f. RNAV Approach: (Optional)

1. Tune the VOR receiver and DME to the appropriate VORTAC frequency.
2. Set RNAV bearing and distance as given on the navigation charts for RNAV approaches. Set RNAV mode switch to RNAV APPR position when within ten miles of the selected waypoint.
3. Set the VNAV to give minimum descent altitude and bias as desired. Set the MDA switch to the MDA WARN position.
4. Set the required front course in on the Pictorial Navigation Indicator and set up an intercept angle to intercept the inbound radial. Arm the APPR mode on the Autopilot Mode Controller.
5. After RNAV approach is coupled, observe the vertical navigation deviation on the Flight Command Indicator and depress the VNAV CPLD button when desired descent angle is displayed.
6. When the MDA annunciator on the Flight Command Indicator illuminates, level off and continue the approach.

(5) Disengaging the Autopilot

a. Monitor the controls prior to disengagement. Under normal operating conditions the automatic pitch trim will have the aircraft properly trimmed in the pitch axis at the pitch attitude existing when the system is disengaged.

b. Disengage the system by pressing the A/P Disconnect/Trim Interrupt switch on the control wheel to the first detent or return the autopilot engage handle to OFF. The flight director may be turned off which will also disengage the autopilot.

SECTION 5 - PERFORMANCE

Installation of the King KFC 300 Flight Control System does not affect the basic performance information presented by Section 5 of this handbook

PILOT'S OPERATING HANDBOOK SUPPLEMENT

FOR THE

AUXILIARY HEAT SYSTEM

SECTION 1 - GENERAL

This supplement must be attached to the Pilot's Operating Handbook when the Auxiliary Heat System is installed per Piper Dwg. 81354 and Piper Service Kit No. 764 058. The information contained herein supplements or supersedes the basic Pilot's Operating Handbook only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook.

This supplement has been "FAA Approved" based on compliance with CAR 3.682(b); 3.690; 3.693; 3.694 and 3.695.

FAA APPROVED Paul E Everly

PAUL E. EVERLY
D.O.A. NO. EA-I
PIPER AIRCRAFT CORPORATION
LOCK HAVEN, PENNSYLVANIA

SECTION 2 - LIMITATIONS

(a) Do not exceed the maximum allowable generator electrical loading (see Section 2.7(e) in the basic handbook).

(b) In the event the circulation fan is inoperative, the thermostat switches in the unit will actuate and trip the control circuit breaker.

CAUTION

Do not reset this breaker if it trips after three minutes of operation.

(c) A minimum of four fresh air vents must be open when operating the system.

(d) It is recommended that the use of this system be limited to an occasional supplement to the combustion unit or as a temporary substitute for an inoperative combustion unit.

(e) The use of the unit is restricted during icing operations due to the increase in electrical loading under these conditions.

(f) Placards:
At the system selector switch:

DO NOT EXCEED
MAX. ALLOWED
GENERATOR LOADING

Above magnetic compass:

COMPASS ERRATIC WITH
AUXILIARY HEAT ON

SECTION 3 - EMERGENCY PROCEDURES

(a) In case airflow is not felt at a vent outlet upon turning on the unit, immediately deactivate the system.

(b) In the event the activation of the unit exceeds the maximum allowable electrical loading (see Section 2.7(e) in the basic handbook), the pilot should immediately deactivate the unit.

NOTE

The unit is deactivated by turning the control selector to the OFF position or by pulling the Aux. Heat control circuit breaker.

SECTION 4 - NORMAL PROCEDURES

(a) Turn on the system by moving the control selector switch, located on the right side of the instrument panel, to the ON position. This activates the heating unit and the recirculating fan. The control selector has two positions: OFF and ON.

(b) Be sure at least four fresh air vents are open.

(c) Verify the action of the recirculating fan by checking for airflow at an open vent.

(d) The auxiliary heat system should reach operating temperature within three minutes.

NOTE

The auxiliary assembly will shut off in the event the unit exceeds 450° F.

(e) The maximum temperature at the copilot fresh air outlet should not exceed ambient plus 145° F. The unit is capable of delivering 8500 BTU's per hour with the recirculating fan delivering 300 CFM through the ventilating air ducts.

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

SECTION 5 - PERFORMANCE

Installation of the Auxiliary Heat System does not affect the basic performance information presented in Section 5 of the basic handbook.

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Piper Aircraft Corporation
3000 Medulla Road
Lakeland, Florida 33803

FAA APPROVED "PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL" SUPPLEMENT FOR BOBWEIGHT INSTALLATION KIT NO. 765 158

MODEL PA-31T

REG. NO. ~~N-123DE~~ N4NH

SER. NO. 31T-7820056

This Supplement must be attached to the "Pilot's Operating Handbook and FAA Approved Airplane Flight Manual" PAC Report 2048, dated October 21, 1976, when Bobweight Kit 765 158 is installed on PA-31T airplanes with serial numbers 31T-7720001 through 31T-7920094, in accordance with PAC Drawing 02556. The information contained herein supplements or supercedes the information of the basic handbook only in those areas listed herein. For limitations, procedures and performance information not contained in this Supplement, consult the basic "Pilot's Operating Handbook and FAA Approved Airplane Flight Manual."

FAA Approved: D. H. Trompler

D. H. Trompler
D.O.A. No. SO-2
Piper Aircraft Corporation
Lakeland, Florida

Date: 11-26-1985 (inserted in manual)

Piper Aircraft Corporation
3000 Medulla Road
Lakeland, Florida 33803

SECTION 1 - GENERAL

This supplement supplies information necessary for the safe operation of the airplane when equipped with Bobweight installation Kit No. 765 158.

SECTION 2 - LIMITATION

2.15 CENTER OF GRAVITY LIMITS (LANDING GEAR EXTENDED)

Weight Pounds	Forward Limit Inches Aft of Datum	Rearward Limit Inches Aft of Datum
7170 or less	126.0	138.0
8500	129.6	138.0
9000 (Max. Flight and Landing)	131.9	138.0
9050 (Max. Ramp)	132.1	138.0

SECTION 3 - EMERGENCY PROCEDURES

No change.

SECTION 4 - NORMAL PROCEDURES

No change.

SECTION 5 - PERFORMANCE

No change.

FAA Approved March 15, 1985

SECTION 6 - WEIGHT AND BALANCE

See Figures 1 and 2.

SECTION 7 - DESCRIPTION AND OPERATION

7.19 FLIGHT CONTROL SYSTEM

A bobweight, suspended from a cantilever arm attached to the elevator control torque tube, is provided to improve longitudinal stability.

SECTION 8 - AIRPLANE HANDLING, SERVICING AND MAINTENANCE

No change.

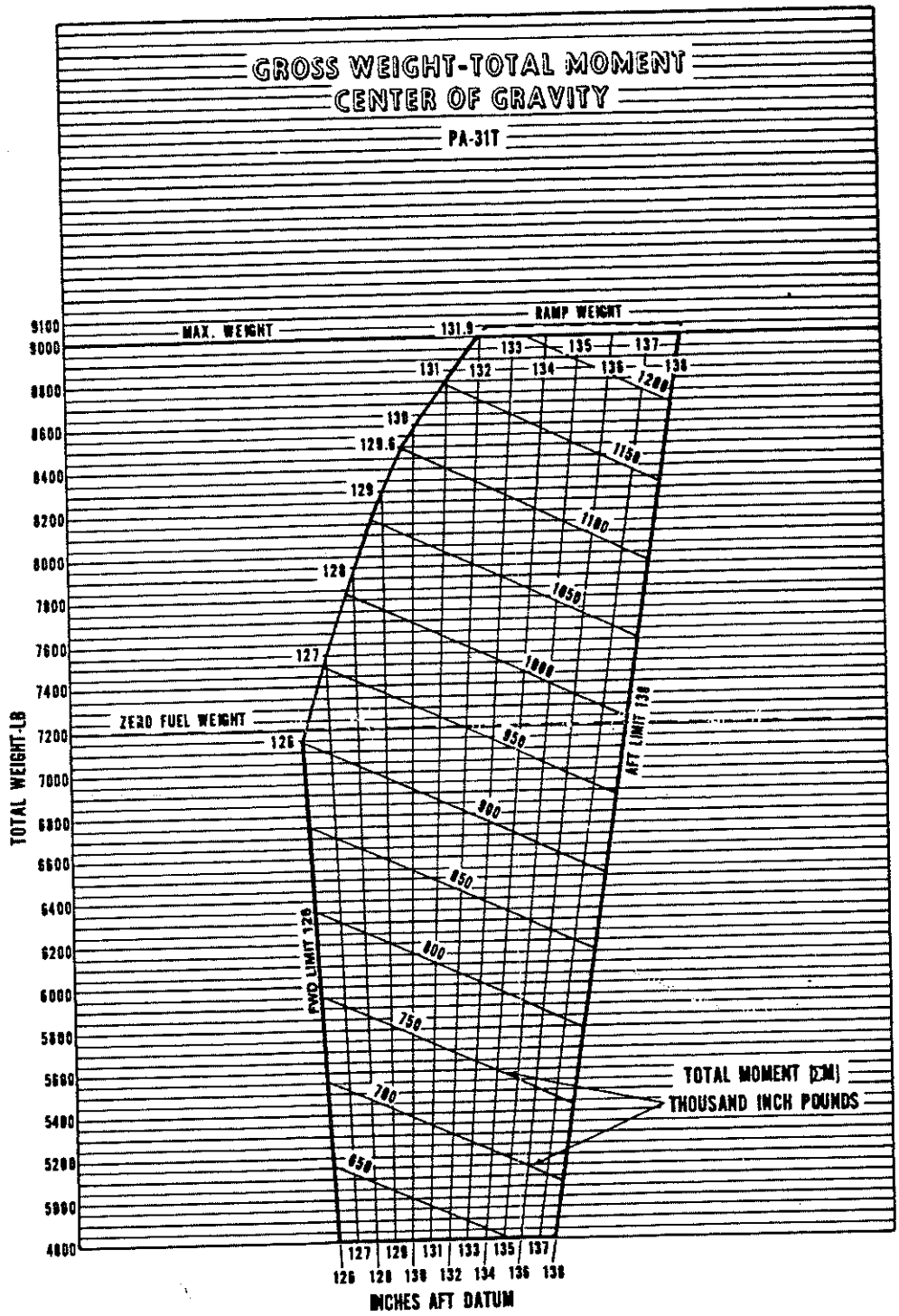
SECTION 9 - SUPPLEMENTS

No change.

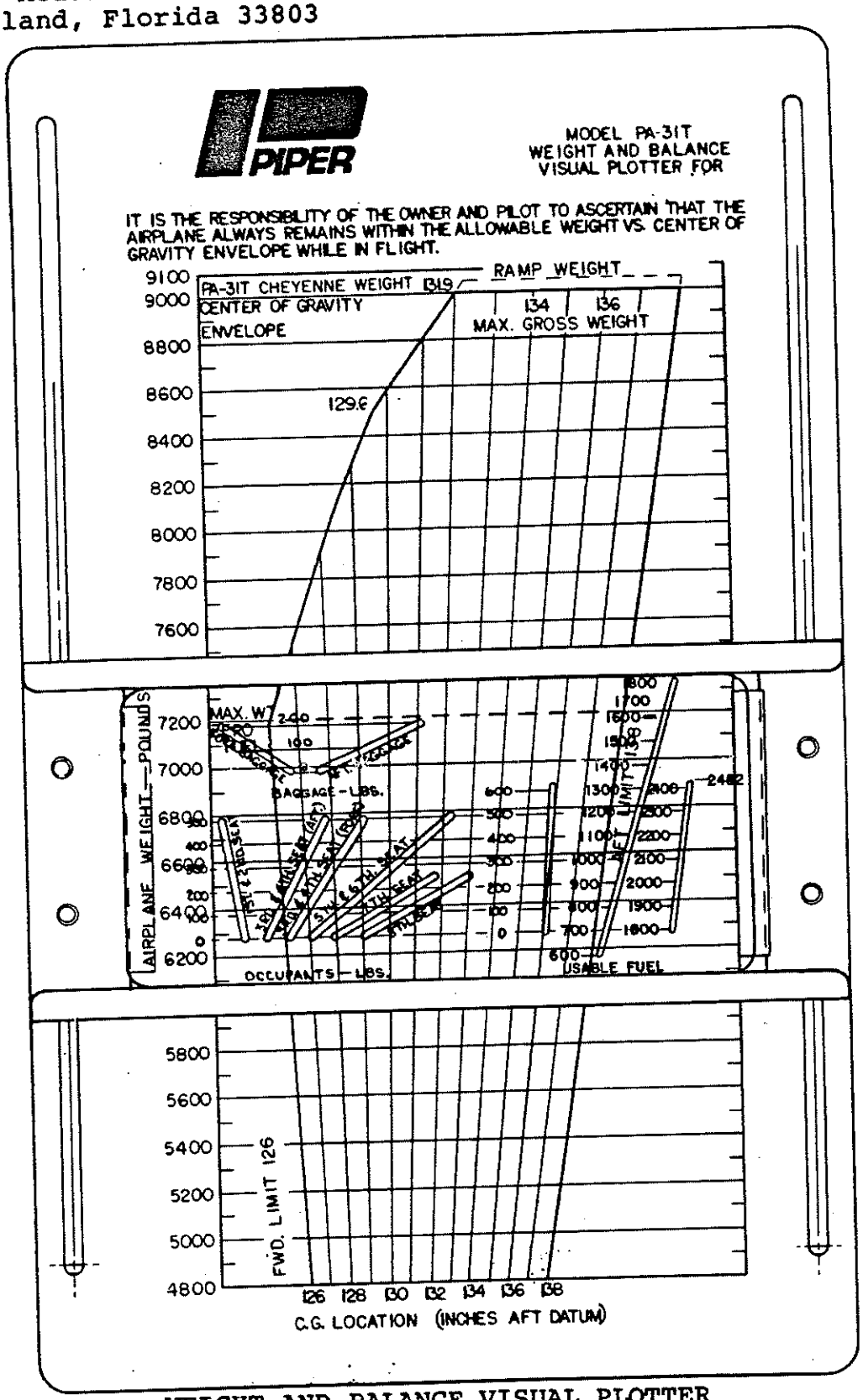
SECTION 10 - SAFETY TIPS

No change.

Piper Aircraft Corporation
3000 Medulla Road
Lakeland, Florida 33803



C.G. LIMITS GRAPH
Figure 1



WEIGHT AND BALANCE VISUAL PLOTTER
Figure 2

PREPARED BY SMS CHECKED BY TMK APPROVED BY	**McCAULEY ACCESSORY DIVISION** CESSNA AIRCRAFT COMPANY REPORT TR 757	N5IRD

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

FOR THE

PIPER CHEYENNE PA-31T
S/N 31T-7720001 and UP

and

PIPER CHEYENNE PA-31T1
S/N 31T-7804001 to 31T-8104101, inclusive
(aircraft with tip tank option only)

Reg. No. N5IRD

Ser. No. 31T-7820056

STC No. SA1593GL

GENERAL

The information in this supplement is FAA approved material and must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the McCauley 4HFR34C766/94LNA-2 propeller model is installed in accordance with McCauley STC approved data. The information contained herein supplements or supersedes the basic flight manual only in those areas listed. 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: Marlon Anderson
for Royace L. Prather, Manager
Systems and Flight Test Branch
Chicago Aircraft Certification Office

DATE: May 1, 1991
REVISION DATE: MAR 27 1995

PREPARED BY	McCAULEY ACCESSORY DIVISION CESSNA AIRCRAFT COMPANY	
CHECKED BY		
APPROVED BY	REPORT TR 757	

FAA AIRPLANE

FLIGHT MANUAL SUPPLEMENT

for

PIPER CHEYENNE PA-31T
S/Ns 31T-7720001 and UP

and

PIPER CHEYENNE PA-31T1
S/N 31T-7804001 to 31T-8104101, inclusive
(aircraft with tip tank option only)

McCauley Four Bladed Propeller System

SUPPLEMENT No. _____

This Supplement approved for Brazilian registered aircraft in accordance with RBHA 21 - Subpart E must be included in the PA-31T FAA Approved Flight Manual when the McCauley Four Bladed Propeller System (Model 4HFR34C766/94LNA-2) has been installed in the aircraft, in accordance with the "Certificado de Homologacào Suplementar de Tipo N " issued by CTA. This supplement is approved by FAA on behalf of CTA.

FAA Approved: _____

Date: August 18, 1995
Revised: MAR 27 1996

Aircraft Registration:

Aircraft Serial Number:

This aircraft must be operated in accordance with the limitations and instructions of the Flight Manual with the additional information approved in this Supplement.

PREPARED BY [illegible]
CHECKED BY [illegible]
APPROVED BY [illegible]

McCAULEY ACCESSORY DIVISION
CESSNA AIRCRAFT COMPANY

REPORT TR 757

LOG OF REVISIONS

Revision Number	Revised Pages	Description of Revision	Date	FAA Approval *
A	All	See ECN 8111	3/26/91	[illegible]
A	5,6,7,8 & 9	See ECN 8132	4/03/91	
A	6	See ECN 8227	5/17/91	SEP 26 1991
B	1	Added second title page for Brazilian CTA approval; See ECN 10417	AUG 18 1995	C.B. Bonner
C	1	Added Piper Model PA-31T1 to both title pages, See ECN 10624	MAR 27 1996	[illegible]

* Approved by Manager, Chicago Aircraft Certification Office

NOTE: All changes are indicated by black vertical line along the left margin.

McCAULEY ACCESSORY DIVISION
CESSNA AIRCRAFT COMPANY
FAA APPROVED STC # SA1593GL

SECTION 1 GENERAL

1.5 PROPELLERS

(a) Number of Propellers 3
(b) Propeller Manufacturer .....McCauley Accessory Division
(c) Blade Model 94LNA-2
(d) Number of Blades 4
(e) Hub Model 4HFR34C766
(f) Propeller Diameter (In.) 92
(g) Propeller Type .....Hydraulically Operated, Constant Speed, Full Feathering, Reversible

SECTION 2 LIMITATIONS

2.7 POWER PLANT LIMITATIONS

(d) Operating Condition .....Idle (1)
Maximum Observed ITT ($^{\circ}$C) 660 (2)
Minimum Np RPM 1100 (3)
(1) Reverse limited to ground operation only.
(2) Advance power control lever as required to maintain temperature within this limit.
(3) Not applicable during landing with reverse.
(i) Propeller Manufacturer .....McCauley Accessory Division
(j) Propeller Hub Model 4HFR34C766
(k) Propeller Blade Model 94LNA-2
(l) Propeller Diameter (In.)
Minimum 91
Maximum 92
(m) Propeller Blade Angles at Propeller Station 30 at Flight Idle Pick-up .....19.1°

SECTION 3 EMERGENCY PROCEDURES

3.3 EMERGENCY CHECKLIST
ABNORMAL DEICE AMMETER READINGS

PROPELLER DEICE

Zero Amps:
C/B, Switch .....Checked
C/B, Switch (If OFF) .....Reset
C/B, Switch (If ON With Zero Amps) .....OFF

Less Than 18 Amps:
Icing Conditions .....Avoided
Use of System .....Emergencies Only
Time of Operation .....Minimum

ENGINE INLET LIP DEICE

Zero Amps:
C/B .....Checked
C/B (If OFF) .....Reset
C/B (If ON With Zero Amps) .....OFF

* Less Than 22 Amps for More Than 68 Seconds:
Icing Conditions .....Avoided
Use of System .....Emergencies Only
Time of Operation .....Minimum

* NOTE
Normal Operation of the Inlet Deice Ammeter Will Show 22-26 Amps for Half a Cycle (68 Sec.) Then Change to Approximately 13 Amps for the Second Half of the Cycle (68 Sec.)

3.23 ELECTRICAL MALFUNCTIONS
ABNORMAL DEICE AMMETER READINGS

The ammeter for the propeller deice should read 18-24 amps when the system is ON. If the propeller deice ammeter reads zero, check the circuit breaker and switch. If a breaker has opened, reset it. If the switch is on and the ammeter still reads zero, turn the system OFF and avoid icing conditions.

When the engine inlet lip deice system is ON and the ammeter switch left in one position, the inlet deice ammeter should read 22-26 amps for half a cycle (68 sec.) then read approximately 13 amps for the second half of the cycle (68 sec.). When the ammeter switch is changed to the second position, the inverse cycle will occur. If the inlet deice ammeter reads zero when the switches are ON, check the circuit breaker(s). If a breaker has opened, reset it. If the switches are ON and the circuit breaker is set and the ammeter still reads zero, turn the system OFF and avoid icing conditions.

If the propeller deice ammeter reading is less than 18 amps or the inlet deice ammeter reading is less than 22 amps for more than 68 seconds, avoid icing conditions, as the continued operation of the system cannot be assured. In an emergency, the system may be activated, but time of operation must be kept to a minimum.

SECTION 4 NORMAL PROCEDURES

4.5 NORMAL PROCEDURES CHECKLIST

TAXIING

NOTE

Ground idle thrust with four blade propellers is higher than with three blade propellers. To reduce brake wear associated with excess thrust during taxi, move the power levers into the BETA operating range. Forward thrust is reduced in this operating range, even though propeller RPM indicates an increase.

FLIGHT IN ICING CONDITIONS

Engine Ice Protection Switch
(In Visible Moisture Below +5°C) .....ON
Propeller Deice Switch .....ON
Pitot Heat .....ON
Windshield Heat .....ON
Surface Deice .....As Required
Oil Temp. .....Monitored
Oil Cooler Doors (If Temp. High) .....Open

4.27 FLIGHT IN ICING CONDITIONS

For ice protection system operating procedures, refer to Paragraph 4.43.

If visible moisture is encountered at temperatures below +5°C or if icing conditions are encountered or anticipated, turn ON the engine ice protection and propeller deice switches. Turn ON pitot heat, and turn the windshield heat ON-LOW. If the low position is inadequate or in anticipation of severe icing conditions, turn the windshield heat ON-HIGH.

Actuation of engine ice protection, a drop in torque is normal. Power can be regained by advancing the power levers while monitoring ITT to avoid exceeding limits.

Press the surface deice switch to cycle the pneumatic deicers as required. Monitor oil temperatures, and open oil cooler doors if necessary to maintain oil temperatures within limits.

4.43 ICE PROTECTION SYSTEM

(a) Engine and Propeller Anti-Icing System

During Run-up (1800 RPM Np):

(1) Left and Right Engine Ice Protection Switches - ON.
(2) Check "ICE DEFLECTOR DOWN" Light.
(3) Observe Torque Drop.
(4) Monitor Inlet Deicer Ammeter for Sequenced Operation of the Electrically Heated Engine Air Inlet Boots:
   a. Inlet Deice Ammeter Switch Set to LEFT
   b. Ground Test Button - PRESS AND HOLD (3 Min.)
   c. Check Ammeter for IN-THE-GREEN, Then Wait for Change to 13 Amps, Then Release Button

NOTE
Normal Operation of the Inlet Deice Ammeter Will Show 22-26 Amps for Half a Cycle (68 Sec.) Then Change to Approximately 13 Amps for the Second Half of the Cycle (68 Sec.)

(5) Left and Right Engine Ice Protection Switches - OFF.
(6) Observe Regain of Original Torque.

CAUTION
Engine Inlet Lip Deicers Can Be Damaged If Heated Without the Cooling Effect of Propeller Slipstream. Do Not Press Ground Test Button at Lower Than 1800 RPM Np.

(7) Prop Deice Switch - ON (3 Min.).
(8) Monitor Prop Deice Ammeter for Sequenced Operation of the Electrically Heated Prop Deice Boots. Check Ammeter for IN-THE-GREEN Indication (18-24 Amps).

In Flight (+5°C or Below in Visible Moisture or When Ice Conditions are Anticipated):

(1) Engine Ice Protection Switches - Both ON.
   Prop Deice Switch - ON.
   Systems May be Operated Continuously in Flight and Will Function Automatically Until the Switches are Turned Off.
(2) Observe Torque Drop.
(3) Check Both the Prop Deice and Inlet Deice (Left Then Right) Ammeters Occasionally for Normal Operation.
(4) Relieve Propeller Imbalance Due to Ice Accumulation by Increasing RPM Briefly. Repeat as Required.

SECTION 5 PERFORMANCE

No Change

SECTION 6 WEIGHT AND BALANCE

No Change

SECTION 7 DESCRIPTION AND OPERATION

7.7 ICE PROTECTION

Three different ice protection systems exist on this aircraft: ice deflector and control, engine inlet lip deice and propeller deice. The complete engine ice protection system consists of electrically heated boots on the lip of the engine air intake duct and an ice deflector vane located inside the air intake duct coupled to a bypass door on the outside of the engine nacelle. The propeller deice is a separate system and consists of electrically heated boots on each propeller blade.

The engine ice deflector and control, and engine inlet lip deice functions are controlled by two control switches on the overhead switch panel, one for each engine. Each switch operates two relays; a motor control relay and a power control relay, and it also reverses the field for the motor that controls the ice deflector vane and bypass door.

The motor control relay delivers power to the motor that operates the mechanism that extends and retracts the ice deflection vane and bypass door. Coupled to this mechanism are two limit switches whose functions are to automatically turn off the motor control relay when the deflector vane and bypass door have reached an extreme position, either up or down depending on which has been selected.

The sequence of operation is as follows: The selector switch is moved from the OFF position to ON; the deflector vane and bypass door extend into the airstream, and when the switch is returned to OFF, the doors retract into the normal position. (Note: A torque loss will be noted when deflector vane and bypass door extend.) The down or extended limit switch also activates an indicator light in the cockpit telling the operator that the deflector door is in proper position for ice protection.

The power control relay delivers power to the electrically heated boots of the engine inlet lip deice system. The boot on the air intake lip is divided into three separate sections: the parting strip or the area most forward on the lip, and two shedding areas.

When the left hand side (LHS) engine ice protection switch activates the power relay, it delivers power directly to the LHS parting strip only. When the right hand side (RHS) engine ice protection switch activates the power relay, it delivers power directly to the RHS parting strip and to the inlet deice timer relay. This relay in turn delivers power to both the RHS and LHS inlet deicers in a timer sequence of 34 seconds each, i.e., RHS shedding area I is on for 34 seconds, RHS shedding area II is on for 34 seconds, LHS shedding area I is on for 34 seconds and finally LHS shedding area II is on for 34 seconds. This sequence is repeated until the system is turned off. The ground for the power relay is

wired through a landing gear squat switch so that the engine air intake lip deicers cannot be activated on the ground. However, to check the system, override is provided by means of a ground test switch located on the left side panel below the deice ammeter.

The electrically heated boots of the propeller deice system are controlled by a circuit breaker switch located on an auxiliary panel with the propeller deice ammeter. When the switch is activated, it delivers power directly to the prop deice timer. This timer in turn, delivers power to the prop deice boots in a timer sequence of 90 seconds each as follows: prop blades #1 and #3 of both RHS and LHS propellers are on for 90 seconds, then prop blades #2 and #4 of both RHS and LHS propellers are on for 90 seconds. This sequence is repeated until the switch is turned off.

An ammeter is provided to monitor the operation of the boots on the air intake lip. The ground leads of the inlet deice boots are run to ground through a different shunt on each engine, with the shunt leads returning to a switch (located on the left side panel). This allows the operator to monitor the RHS and LHS air intake boots separately. Leaving the ammeter switch in one position (i.e. LEFT), normal operation will produce a green arc of 22-26 amps for half a cycle then move to approximately 13 amps for the second half of the cycle. For half a cycle (68 sec.), both the parting strip and one of the shedding strips are active, but during the second half of the cycle, only the parting strip is on. Another ammeter is provided to monitor the operation of the propeller boots only. This ammeter will indicate 18-24 amps with minor fluctuations approximately every 90 seconds during normal operation.

7.9 PROPELLERS

The propellers are McCauley four blade, 92 inch diameter, constant speed, reversing and full feathering. Propeller speed is kept constant by a governor, which controls the pressure of engine oil to the hub. When the oil pressure generated and controlled by the governor is increased, the blades are moved to the low pitch (increased rpm) hydraulic stop. When the oil pressure is decreased, feathering springs and centrifugal counterweights allow the blades to move into the high pitch (decreased rpm) position.

Beta and reverse blade angles are also controlled by engine oil pressure to the propeller hub. Selection of the reverse range provides a complete modulation of thrust from full forward to full reverse. Reverse operation of the propellers is obtained by bringing the power levers rearward to the gate stop, lifting and going through the gate into the reverse range. When reverse range is selected, a switch on the power lever opens, removing positive voltage from the solenoid and allowing the propeller to go into reverse. Reverse pitch is locked out in flight by landing gear squat switches on the nose gear and right main gear. These switches maintain positive voltage directly to the solenoid, bypassing the power lever. A test switch is provided to allow testing this lock out feature on the ground.

Backup governors and overspeed protection, the in-flight reverse lock out feature, a secondary low pitch stop and the ground test switch are incorporated in the propeller controls to insure against malfunction.

SECTION 8 AIRPLANE HANDLING, SERVICING AND MAINTENANCE

No Change

SECTION 9 SUPPLEMENTS

No Change

SECTION 10 SAFETY TIPS

No Change

Garmin International, Inc.
1200 E. 151st Street
Olathe, Kansas 66062 U.S.A.

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for the
Garmin GNS 500W, 500WT, 530W, 530AW, 530WT, or 530AWT
GPS/SBAS Navigation System
as installed in

PIPER PA31T
Make and Model Airplane

Registration Number: N781CK Serial Number: 31T-7820056

This document serves as an Airplane Flight Manual Supplement or as a Supplemental Airplane Flight Manual when the aircraft is equipped with the Garmin GNS 500W, 500WT, 530W, 530AW, 530WT, or 530AWT GPS/SBAS Navigation System. This document must be carried in the airplane at all times when the Garmin GNS unit is installed in accordance with STC SA01933LA-D. This document must be incorporated into the FAA Approved Airplane Flight Manual or provided as an FAA Approved Supplemental Airplane Flight Manual.

The information contained herein supplements the information in the FAA Approved Airplane Flight Manual. For limitations, procedures, loading and performance information not contained in this document, refer to the FAA Approved Airplane Flight Manual, markings, or placards.

FAA Approved By: Erik Frisk

Erik Frisk
ODA STC Unit Administrator
Garmin International, Inc.
ODA-240087-CE

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	Page			
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Section 1. GENERAL

1.1 Garmin 5XXW Series GPS/WAAS Nav Com

The Garmin GNS Series GPS/WAAS Navigator is a panel-mounted product that contains a GPS/WAAS receiver for GPS approved primary navigation under TSO-C146a, (plus optional VHF Com and VHF Nav radios) in an integrated unit with a moving map and color display. The 5XXW Series unit features a graphical display which may also be used to depict traffic, weather, or terrain data. Optional TAWS annunciation and audio is available in some installations.

The navigation functions are operated by dedicated keys and graphical menus which are controlled by the buttons and the dual concentric rotary knob along the bottom and right side of the display.

Optional VHF Com and VHF Nav radio functions are controlled via dedicated buttons and knobs on the left side of the display and adjacent to frequencies they are controlling.

Figure 1 - 530W Series Control and Display Layout

1.2 GPS/SBAS TSO-C146a Class 3 Operation

The GNS complies with AC 20-138A and has airworthiness approval for navigation using GPS and SBAS (within the coverage of a Satellite Based Augmentation System complying with ICAO Annex 10) for IFR en route, terminal area, and non-precision approach operations (including those approaches titled “GPS”, “or GPS”, and “RNAV (GPS)” approaches). The Garmin GNSS navigation system is composed of the GNS navigator and antenna, and is approved for approach procedures with vertical guidance including “LPV” and “LNAV/VNAV” and without vertical guidance including “LP” and “LNAV,” within the U.S. National Airspace System.

The Garmin GNSS navigation system complies with the equipment requirements of AC 90-105 and meets the equipment performance and functional requirements to conduct RNP terminal departure and arrival procedures and RNP approach procedures without RF (radius to fix) legs. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval from the FAA.

The Garmin GNSS navigation system complies with the equipment requirements of AC 90-100A for RNAV 2 and RNAV 1 operations. In accordance with AC 90-100A, Part 91 operators (except subpart K) following the aircraft and training guidance in AC 90-100A are authorized to fly RNAV 2 and RNAV 1 procedures. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval from the FAA.

Applicable to dual installations consisting of two Garmin GNSS units: The Garmin GNSS navigation system has been found to comply with the requirements for GPS Class II oceanic and remote navigation (RNP-10) without time limitations in accordance with AC 20-138A and FAA Order 8400.12A. The Garmin GNSS navigation system can be used without reliance on other long-range navigation systems. This does not constitute an operational approval.

The Garmin GNSS navigation system has been found to comply with the navigation requirements for GPS Class II oceanic and remote navigation (RNP-4) in accordance with AC 20-138A and FAA Order 8400.33. The Garmin GNSS navigation system can be used without reliance on other long-range navigation systems. Additional equipment may be required to obtain operational approval to utilize RNP-4 performance. This does not constitute an operational approval.

The Garmin GNSS navigation system complies with the accuracy, integrity, and continuity of function, and contains the minimum system functions required for P-RNAV operations in accordance with JAA Administrative & Guidance Material Section One: General Part 3: Temporary Guidance Leaflets, Leaflet No 10 (JAA TGL-10 Rev 1). The GNSS navigation system has one or more TSO-C146a Class 3 approved Garmin GNS Navigation Systems. The Garmin GNSS navigation system complies with the accuracy, integrity, and continuity of function, and contains the minimum system functions required for B-RNAV operations in accordance with EASA AMC 20-4. The Garmin GNSS navigation system complies with the equipment requirements for P-RNAV and B-RNAV/RNAV-5 operations in accordance with AC 90-96A CHG 1. This does not constitute an operational approval.

Garmin International holds an FAA Type 2 Letter of Acceptance (LOA) in accordance with AC 20-153 for database integrity, quality, and database management practices for the navigation database. Flight crew and operators can view the LOA status at FlyGarmin.com then select “Type 2 LOA Status.”

Navigation information is referenced to the WGS-84 reference system.

Note that for some types of aircraft operation and for operation in non-U.S. airspace, separate operational approval(s) may be required in addition to equipment installation and airworthiness approval.

Section 2. LIMITATIONS

2.1 Pilot's Guide

The Quick Reference Guide, part number and revision listed below (or later applicable revisions), must be immediately available for the flight crew whenever navigation is predicated on the use of the 5XXW Series unit.

- 500W Series Quick Reference Guide P/N 190-00357-01 Rev H

The Pilot's Guide Addendum, part number and revision listed below (or later applicable revision), must be immediately available for the flight crew whenever one or more of the following units are installed and utilized with the 5XXW Series unit:

GDL 69/69A XM Satellite Data link
GDL 88 ADS-B Transceiver
GTX 330/330D TIS
Garmin TAWS (GPS 500WT & GNS 530WT)
GTS 8XX Series TAS
Flight Stream 210

- 400W/500W Series Optional Displays P/N 190-00356-30 Rev L

The Pilot's Guide Addendum, part number and revision listed below (or later applicable revision), must be immediately available for the flight crew whenever one or more of the following units are installed and utilized with the 5XXW Series unit:

Stormscope® Lightning Detection System
Skywatch® Traffic Advisory System
Bendix/King® Traffic Advisory System
Avidyne/Ryan TCAD Traffic System

- 400W/500W Series Display Interfaces P/N 190-00356-31 Rev D

2.2 Kinds of Operation

This AFM supplement does not grant approval for IFR operations to aircraft limited to VFR operations. Additional aircraft systems may be required for IFR operational approval. Systems limited to VFR shall be placarded in close proximity to the 5XXW Series unit: "**GPS LIMITED TO VFR USE ONLY**".

2.3 System Software

This AFMS/AFM is applicable to the software versions shown in Table 1.

The Main and GPS software versions are displayed on the start-up page immediately after power-on.

Software Item	**Approved Software Version** *(or later FAA approved versions for this STC)*	
	SW version	As displayed on unit
Main SW Version	5.40	5.40
GPS SW Version	5.0	5.0
Flight Stream 210	2.80	2.80 (Displayed on GNS)

Table 1 – Required Equipment

2.4 Navigation database

GPS/SBAS based IFR enroute, oceanic, and terminal navigation is prohibited unless the flight crew verifies and uses a valid, compatible, and current navigation database or verifies each waypoint for accuracy by reference to current approved data.

"GPS", "or GPS", and "RNAV (GPS)" instrument approaches using the Garmin navigation system are prohibited unless the flight crew verifies and uses the current navigation database. GPS based instrument approaches must be flown in accordance with an approved instrument approach procedure that is loaded from the navigation database.

Discrepancies that invalidate a procedure should be reported to Garmin International. The affected procedure is prohibited from being flown using data from the navigation database until a new navigation database is installed in the aircraft and verified that the discrepancy has been corrected. Navigation database discrepancies can be reported at FlyGarmin.com by selecting "Aviation Data Error Report." Flight crew and operators can view navigation database alerts at FlyGarmin.com then select "NavData Alerts."

If the navigation database cycle will change during flight, the flight crew must ensure the accuracy of navigation data, including suitability of navigation facilities used to define the routes and procedures for flight. If an amended chart affecting navigation data is published for the procedure, the database must not be used to conduct the procedure.

2.5 Flight Planning

For flight planning purposes, in areas where SBAS coverage is not available, the flight crew must check RAIM availability.

- Within the United States, RAIM availability can be determined using the Garmin WFDE Prediction program, Garmin part number 006-A0154-04 software version 3.00 or later approved version with Garmin approved antennas or the FAA's enroute and terminal RAIM prediction website: www.raimprediction.net, or by contacting a Flight Service Station.
- Within Europe, RAIM availability can be determined using the Garmin WFDE Prediction program or Europe's AUGER GPS RAIM Prediction Tool at http://augur.ecacnav.com/augur/app/home.
- For other areas, use the Garmin WFDE Prediction program.

This RAIM availability requirement is not necessary if SBAS coverage is confirmed to be available along the entire route of flight. The route planning and WFDE prediction program may be downloaded from the Garmin website on the internet. For information on using the WFDE Prediction Program, refer to Garmin WAAS FDE Prediction Program, part number 190-00643-01, 'WFDE Prediction Program Instructions'.

For flight planning purposes, for operations within the U.S. National Airspace System on RNP and RNAV procedures when SBAS signals are not available, the availability of GPS RAIM shall be confirmed for the intended route of flight. In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended route of flight, the flight shall be delayed, canceled, or rerouted on a track where RAIM requirements can be met. The flight may also be re-planned using non-GPS based navigational capabilities.

For flight planning purposes for operations within European B-RNAV/RNAV-5 and P-RNAV airspace, if more than one satellite is scheduled to be out of service, then the availability of GPS RAIM shall be confirmed for the intended flight (route and time). In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended flight, the flight shall be delayed, canceled, or rerouted on a track where RAIM requirements can be met.

Applicable to dual installations consisting of two Garmin GNSS units:

For flight planning purposes, for operations where the route requires Class II navigation the aircraft's operator or flight crew must use the Garmin WFDE Prediction program to demonstrate that there are no outages on the specified route that would prevent the Garmin GNSS navigation system to provide GPS Class II navigation in oceanic and remote areas of operation that requires RNP-10 or RNP-4 capability. If the Garmin WFDE Prediction program indicates fault exclusion (FDE) will be unavailable for more than 34 minutes in accordance with FAA Order 8400.12A for RNP-10 requirements, or 25 minutes in accordance with FAA Order 8400.33 for RNP-4 requirements, then the operation must be rescheduled when FDE is available.

Both Garmin GPS navigation receivers must be operating and providing GPS navigation guidance for operations requiring RNP-4 performance.

North Atlantic (NAT) Minimum Navigational Performance Specifications (MNPS) Airspace operations per AC 91-49 and AC 120-33 require both GPS/SBAS receivers to be operating and receiving usable signals except for routes requiring only one Long Range Navigation sensor. Each display computes an independent navigation solution based on its internal GPS receiver.

Whenever possible, RNP and RNAV routes including Standard Instrument Departures (SIDs), and Standard Terminal Arrival (STAR), routes should be loaded into the flight plan from the database in their entirety, rather than loading route waypoints from the database into the flight plan individually. Selecting and inserting individual named fixes from the database is permitted, provided all fixes along the published route to be flown are inserted. Manual entry of waypoints using latitude/longitude or place/bearing is prohibited.

It is not acceptable to flight plan a required alternate airport based on RNAV(GPS) LP/LPV or LNAV/VNAV approach minimums. The required alternate airport must be flight planned using an LNAV approach minimums or available ground-based approach aid.

Navigation information is referenced to the WGS-84 reference system, and should only be used where the Aeronautical Information Publication (including electronic data and aeronautical charts) conform to WGS-84 or equivalent.

NOTE

If flight plan information is imported from a portable electronic device utilizing the Flight Stream 210 Bluetooth® system, all waypoints and flight plan sequences must be verified by the crew.

2.6 Approaches

- Instrument approaches using GPS guidance may only be conducted when the GNS is operating in the approach mode. (LNAV, LNAV+V, L/VNAV, LPV, LP, or LP +V)

NOTE

Advisory vertical guidance deviation is provided when the GNS annunciates LNAV+V or LP +V. The controlling minimums remain LNAV or LP even when advisory vertical guidance is provided. Advisory vertical guidance information displayed on the VDI in this mode is only an aid to help flight crews comply with altitude restrictions. When using advisory vertical guidance, the flight crew must use the primary barometric altimeter to ensure compliance with all

altitude restrictions in accordance with the LNAV or LP approach procedure.

- When conducting instrument approaches referenced to true North, the NAV Angle on the AUX-Units/Position page must be set to **True**.
- The navigation equipment required to join and fly an instrument approach procedure is indicated by the title of the procedure and notes on the IAP chart. Navigating the final approach segment (that segment from the final approach fix to the missed approach point) of an ILS, LOC, LOC-BC, LDA, SDF, MLS, TACAN approach, or any other type of approach not approved for GPS, is not authorized with GPS navigation guidance. GPS guidance can only be used for approach procedures with GPS or RNAV in the procedure title or for VOR and NDB approaches provided the underlying VOR or NDB is operational and the signal is monitored for final approach segment alignment. When using the Garmin LOC/GS receivers to fly the final approach segment, LOC/GS navigation data must be selected and presented on the CDI of the pilot flying.
- Not all published Instrument Approach Procedures (IAP) are in the navigation database. Flight crews planning to fly an RNAV instrument approach must ensure that the navigation database contains the planned RNAV Instrument Approach Procedure and that approach procedure must be loaded from the navigation database into the GNS system flight plan by its name. Users are prohibited from flying any approach path that contains manually entered waypoints.
- IFR approaches are prohibited whenever any physical or visual obstruction (such as a throw-over yoke) restricts pilot view or access to the GNS and/or the CDI.

2.7 Autopilot Coupling

IFR installations of a Garmin 5XXW Series unit allow the operator to fly all phases of flight based on the navigation information presented to the pilot; however, not all modes may be coupled to the autopilot. All autopilots may be coupled in Oceanic (OCN), Enroute (ENR), and Terminal (TERM) modes; however, the FAA requires that vertical coupling of an autopilot for approaches be demonstrated to meet their intended function and provide safe and proper operation to published minimums. This installation is limited to:

☐ Lateral coupling only for GPS approaches. Coupling to the vertical path for GPS approaches is not authorized.

2.8 Terrain Proximity Function (All Units)

Terrain and obstacle information appears on the map and terrain display pages as red and yellow tiles or towers, and is depicted for advisory use only. Aircraft maneuvers and navigation must not be predicated upon the use of the terrain display. Terrain and obstacle information is advisory only and is not equivalent to warnings provided by TAWS.

The terrain display is intended to serve as a situational awareness tool only. By itself, it may not provide either the accuracy or the fidelity on which to base decisions and plan maneuvers to avoid terrain or obstacles.

2.9 TAWS Function (Equipped Units)

Flight crews are authorized to deviate from their current ATC clearance to the extent necessary to comply with TAWS warnings. Navigation must not be predicated upon the use of TAWS.

If an external TAWS annunciator panel is installed in the aircraft, this annunciator panel must be fully functional in order to use the TAWS system.

2.10 VNAV – Vertical Navigation Calculation Page

VNAV information accessible by pressing the "VNAV" button may be utilized for advisory information only. Use of VNAV information for Instrument Approach Procedures does not guarantee Step-Down Fix altitude protection, or arrival at approach minimums in a normal position to land.

2.11 Weather Display (Optional)

This limitation applies to data linked weather products from SiriusXM via a GDL 69/69A or FIS-B via a GDL 88.

Do not use data link weather information for maneuvering in, near, or around areas of hazardous weather. Information provided by data link weather products may not accurately depict current weather conditions.

Do not use the indicated data link weather product age to determine the age of the weather information shown by the data link weather product. Due to time delays inherent in gathering and processing weather data for data link transmission, the weather information shown by the data link weather product may be significantly older than the indicated weather product age.

Do not rely solely upon data link services to provide Temporary Flight Restriction (TFR) or Notice to Airmen (NOTAM) information. Not all TFRs and NOTAMS can be depicted on the GNS.

2.12 Traffic Display (Optional)

Traffic may be displayed on the GNS when connected to an approved optional TCAS I, TAS, TIS, or ADS-B traffic device. These systems are capable of providing traffic monitoring and alerting to the flight crew. Traffic shown on the display may or may not have traffic alerting available. The display of traffic is an aid to visual acquisition and may not be utilized for aircraft maneuvering.

2.13 GTN Crossfill

When GTN Crossfill is in use, OBS mode shall be initiated only on the GTN. OBS mode on the GNS when GTN Crossfill is enabled is prohibited.

When GTN Crossfill is in use, the crew must verify each flight plan leg prior to using the GNS to navigate. See section 7.2 for additional information.

2.14 Flight Stream 210 (Optional)

The Flight Stream 210 provides the ability for the crew to import flight plans from a portable electronic device to the GNS. The crew must verify all flight plan and waypoint information imported from a portable electronic device prior to use on the GNS. See section 7.3 for additional information.

2.15 Portable Electronic Devices

This STC does not relieve the operator from complying with the requirements of 91.21 or any other operational regulation regarding portable electronic devices.

Section 3. EMERGENCY PROCEDURES

3.1 Emergency Procedures

3.1.1 TAWS WARNING

Red annunciator and aural "PULL UP":
Autopilot ..... **DISCONNECT**
Aircraft Controls ..... **INITIATE MAXIMUM POWER CLIMB**
Airspeed ..... **BEST ANGLE OF CLIMB SPEED**

After Warning Ceases:
Altitude ..... **CLIMB AND MAINTAIN SAFE ALTITUDE**
Advise ATC of Altitude Deviation, if appropriate.

NOTE

Only vertical maneuvers are recommended, unless either operating in visual meteorological conditions (VMC), or the flight crew determines, based on all available information, that turning in addition to the vertical escape maneuver is the safest course of action, or both.

3.2 Abnormal Procedures

3.2.1 LOSS OF GPS/SBAS NAVIGATION DATA

When the GPS/SBAS receiver is inoperative or GPS navigation information is not available or invalid, the GNS will enter one of two modes: Dead Reckoning mode (DR) or Loss Of Integrity mode (LOI). The mode is indicated on the GNS by an amber "DR" or "INTEG".

If the Loss Of Integrity annunciation is displayed, revert to an alternate means of navigation appropriate to the route and phase of flight.

If the Dead Reckoning annunciation is displayed, the map will continue to be displayed with an amber ownship icon. Course guidance will be removed on the CDI. Aircraft position will be based upon the last valid GPS position, then estimated by Dead Reckoning methods. Changes in true airspeed, altitude, heading, or winds aloft can affect the estimated position substantially. Dead Reckoning is only available in Enroute and Oceanic modes. Terminal and Approach modes do not support Dead Reckoning.

If Alternate Navigation Sources (ILS, LOC, VOR, DME, ADF) Are Available:

Navigation..... **USE ALTERNATE SOURCES**

If No Alternate Navigation Sources Are Available:

DEAD RECKONING (DR) MODE:

Navigation..... **USE GNS**

NOTE

All information normally derived from GPS will become less accurate over time.

LOSS OF INTEGRITY (LOI) MODE:

Navigation..... **FLY TOWARDS KNOWN VISUAL CONDITIONS**

NOTE

All information derived from GPS will be removed.

NOTE

The airplane symbol is removed from all maps. The map will remain centered at the last known position. "No GPS Position" will be annunciated in the center of the map.

3.2.2 GPS APPROACH DOWNGRADE

During a GPS LPV, LNAV/VNAV, LP +V, or LNAV+V approach, if GPS accuracy requirements cannot be met by the GPS receiver prior to the Final Approach Fix, the GNS will downgrade the approach. The downgrade will remove vertical deviation indication from the VDI and change the approach annunciation accordingly from LPV, L/VNAV, LP +V, or LNAV+V to LNAV. The approach may be continued using the LNAV only minimums. After the Final Approach Fix has been passed, the approach will be aborted using the indications described below.

During a GPS approach in which GPS accuracy requirements cannot be met by the GPS receiver for any GPS approach type, the GNS will flag all CDI guidance and display a system message "ABORT APPROACH - Loss of Navigation". Immediately upon viewing the message, the unit will revert to Terminal navigation mode alarm limits. If the position integrity is within these limits lateral guidance will be restored and the GPS may be used to execute the missed approach, otherwise alternate means of navigation must be utilized.

3.2.3 LOSS OF COM RADIO TUNING FUNCTIONS

If alternate COM is available:
Communications ..... **USE ALTERNATE COM**

If no alternate COM is available:
COM RMT XFR key (if installed).....**PRESS AND HOLD FOR 2 SECONDS**

NOTE

This procedure will tune the active COM radio the emergency frequency 121.5, regardless of what frequency is displayed on the GNS. Certain failures of the tuning system will automatically tune 121.5 without flight crew action.

3.2.4 TAWS CAUTION (Terrain or Obstacle Ahead, Sink Rate, Don't Sink)

When a TAWS CAUTION occurs, take corrective action until the alert ceases. Stop descending or initiate either a climb or a turn, or both as necessary, based on analysis of all available instruments and information.

3.2.5 TAWS INHIBIT

The TAWS Forward Looking Terrain Avoidance (FLTA) and Premature Descent Alerts (PDA) functions may be inhibited to prevent alerting, if desired. Refer to GNS 400W/500W Optional Displays Addendum for additional information.

To Inhibit TAWS:
Go to TERRAIN Page
Menu Button ..... PRESS
"Inhibit Terrain?" ..... SELECT
Enter Button ..... PRESS

3.2.6 TER N/A and TER FAIL

If the amber **TER N/A** or **TER FAIL** status annunciator is displayed, the system will no longer provide TAWS alerting or display relative terrain and obstacle elevations. The crew must maintain compliance with procedures that ensure minimum terrain and obstacle separation.

Section 4. NORMAL PROCEDURES

Refer to the 5XXW Series unit Quick Reference Guide defined in paragraph 2.1 on page 8 of this document for normal operating procedures. This includes all GPS operations, VHF COM and NAV, and Multi-Function Display information. For information on TIS traffic, data linked weather, or TAWS see the Pilot's Guide addendum for optional displays. For information on active traffic device or Stormscope operation and displays see the Pilot's Guide addendum for display interfaces.

The 5XXW Series unit requires a reasonable degree of familiarity to prevent operations without becoming too engrossed at the expense of basic instrument flying in IMC and basic see-and-avoid in VMC. Pilot workload will be higher for pilots with limited familiarity in using the unit in an IFR environment, particularly without the autopilot engaged. Garmin provides training tools with the Pilot's Guide and PC based simulator. Pilots should take full advantage of these training tools to enhance system familiarization.

4.1 Unit Power On

Database ..... **REVIEW EFFECTIVE DATES**
Self Test ..... **VERIFY OUTPUTS TO NAV INDICATORS**
Self Test - TAWS Remote Annunciator (If Installed):
- PULL UP ..... **ILLUMINATED**
- TERR ..... **ILLUMINATED**
- TERR N/A ..... **ILLUMINATED**
- TERR INHB ..... **ILLUMINATED**

Self Test - GPS Remote Annunciator (If Installed):
- VLOC ..... **ILLUMINATED**
- GPS ..... **ILLUMINATED**
- INTG ..... **ILLUMINATED**
- TERM ..... **ILLUMINATED**
- WPT ..... **ILLUMINATED**
- APR ..... **ILLUMINATED**
- MSG ..... **ILLUMINATED**
- SUSP ..... **ILLUMINATED**

4.2 Before Takeoff

System Messages and Annunciators ..... **CONSIDERED**

4.3 HSI and EHSI Operation

If an HSI is used to display navigation data from the GNS the pilot should rotate the course pointer as prompted on the GNS.

If an EHSI is used to display navigation data from the GNS the course pointer may autoslew to the correct course when using GPS navigation. When using VLOC navigation the course pointer will not autoslew and must be rotated to the correct course by the pilot. For detailed information about the functionality of the EHSI system, refer to the FAA approved Flight Manual or Flight Manual Supplement for that system.

CAUTION

The pilot must verify the active course and waypoint for each flight plan leg. The pilot must verify proper course selection each time the CDI source is changed from GPS to VLOC.

4.4 Autopilot Operation

The GNS may be coupled to an optional autopilot, if installed in the aircraft, when operating as prescribed in the LIMITATIONS section of this manual.

Autopilots coupled to the GNS system in an analog (NAV) mode will follow GPS or VHF navigation guidance as they would with existing VOR receivers.

Autopilots that support GPSS or GPS Roll Steering in addition to the analog course guidance will lead course changes, fly arcing procedures, procedure turns, and holding patterns if coupled in GPSS mode.

For autopilot operating instructions, refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

4.5 Coupling the Autopilot during approaches

CAUTION

When the CDI source is changed on the GNS, autopilot mode may change. Confirm autopilot mode selection after CDI source change on the GNS. Refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

☐ This installation prompts the flight crew and requires the pilot to enable the approach outputs just prior to engaging the autopilot in APR mode.

To couple an approach:
Once established on the final approach course with the final approach fix as the active waypoint, the GNS will issue a flashing message indication with the following message "APR Guidance Available, Use PROC before A/P APR".

PROC Button ..... **PRESS**
"Enable A/P APR Outputs?" ..... **SELECT**
ENT Button ..... **PRESS**

If coupled, Autopilot will revert to ROL mode at this time.

Autopilot ..... **ENGAGE APPROACH MODE**

☐ This installation supports coupling to the autopilot in approach mode once vertical guidance is available.

To couple an approach:
Once established on the final approach course with the final approach fix as the active waypoint, the GNS will enable vertical guidance.

Vertical Guidance ..... **CONFIRM AVAILABLE**
Autopilot ..... **ENGAGE APPROACH MODE**

☐ The autopilot does not support any vertical capture or tracking in this installation.

Analog only autopilots should use APR mode for coupling to LNAV approaches. Autopilots which support digital roll steering commands (GPSS) may utilize NAV mode and take advantage of the digital tracking during LNAV only approaches.

4.6 Traffic Mode Selection (Optional)

If the GNS is interfaced to a traffic device, the GNS can be used to control the mode of the traffic system. This is accomplished by pressing the cursor knob while on the dedicated traffic page to enter/exit the traffic device menu. It is important to note that while the traffic device menu is active, the current state of the traffic system is *not* displayed. The state of the traffic device is only displayed once the traffic device menu is exited.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

See current weight and balance data.

Section 7. SYSTEM DESCRIPTIONS

7.1 Pilot's Guide

See Garmin 5XXW Series unit Pilot's Guide for a complete description of the 5XXW Series unit.

7.2 Manual GTN Crossfill

Manual GTN Crossfill is a feature that will keep the GNS system in sync with a flight plan that is being used on the GTN system. The GTN *will not* automatically keep its flight plan in sync with changes made on the GNS system. Manual crossfill feature is "one way" – from the GTN to the GNS.

The GTN systems support a variety of procedure leg types that the GNS systems do not support. As such, it is normal and expected that the flight plan leg that is displayed on the GNS system will not always match the flight plan leg on the GTN system. Departure, arrival and approach procedures contain leg types that the GNS does not support. The GNS typically "skips" over these leg types and provides no guidance. Guidance may be available on the GTN but not on the GNS in these cases. The GNS will sequence the procedure as it normally would if Crossfill were not active. Once a leg type is reached that is supported on both the GTN and GNS systems, the systems will automatically sync to the same leg.

If the GNS is interfaced with a GTN and the GTN Crossfill feature is enabled on the GNS, then auto-switching from GPS to VLOC guidance on the CDI for ILS/LOC approaches will be disabled on the GNS.

If the flight plan on an interfaced GTN is altered while in a hold, the GNS will reinitiate guidance to the holding waypoint and sequence into the hold upon crossing the waypoint.

If the Missed Approach is activated on the GTN prior to reaching the Missed Approach Point, the GTN will automatically resume leg sequencing upon reaching the Missed Approach Point. The GNS will remain suspended upon reaching the Missed Approach Point and leg sequencing must be manually resumed.

7.3 Flight Stream 210

The Flight Stream 210 provides wireless communication of specific flight plan information and GPS sensor data to a PED (Personal Electronic Device) from the GNS.

For details on the operation and features of the Flight Stream 210, please refer to the GNS 400W/500W Series Optional Displays, P/N 190-00356-30 Rev J.

For additional details about the Garmin supported devices and apps for use with the Flight Stream 210, please visit:
http://garmin.com/connext/supported_devices

Garmin International, Inc.
1200 E. 151st Street
Olathe, Kansas 66062 U.S.A.

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL

for the
Garmin GNS 400W, 420W, 420AW, 430W, or 430AW
GPS/SBAS Navigation System
as installed in

PIPER PA31T
Make and Model Airplane

Registration Number: N781CK Serial Number: 31T-7820056

This document serves as an Airplane Flight Manual Supplement or as a Supplemental Airplane Flight Manual when the aircraft is equipped with the Garmin GNS 400W, 420W, 420AW, 430W, or 430AW GPS/SBAS Navigation System. This document must be carried in the airplane at all times when the Garmin GNS unit is installed in accordance with STC SA01933LA-D. This document must be incorporated into the FAA Approved Airplane Flight Manual or provided as an FAA Approved Supplemental Airplane Flight Manual.

The information contained herein supplements the information in the FAA Approved Airplane Flight Manual. For limitations, procedures, loading and performance information not contained in this document, refer to the FAA Approved Airplane Flight Manual, markings, or placards.

FAA Approved By: Erik Frisk

Erik Frisk
ODA STC Unit Administrator
Garmin International, Inc.
ODA-240087-CE

Date: 6-MAR-2020

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	Page			
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Section 1. GENERAL

1.1 Garmin 4XXW Series GPS/WAAS Nav Com

The Garmin GNS Series GPS/WAAS Navigator is a panel-mounted product that contains a GPS/WAAS receiver for GPS approved primary navigation under TSO-C146a, (plus optional VHF Com and VHF Nav radios) in an integrated unit with a moving map and color display. The 4XXW Series unit features a graphical display which may also be used to depict traffic, weather, or terrain data.

The navigation functions are operated by dedicated keys and graphical menus which are controlled by the buttons and the dual concentric rotary knob along the bottom and right side of the display.

Optional VHF Com and VHF Nav radio functions are controlled via dedicated buttons and knobs on the left side of the display and adjacent to frequencies they are controlling.

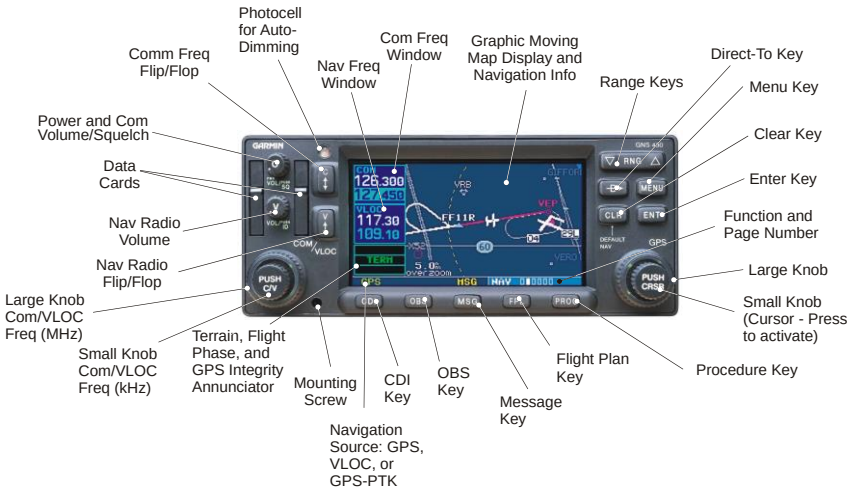

Figure 1 - 430W Series Control and Display Layout

1.2 GPS/SBAS TSO-C146a Class 3 Operation

The GNS complies with AC 20-138A and has airworthiness approval for navigation using GPS and SBAS (within the coverage of a Satellite Based Augmentation System complying with ICAO Annex 10) for IFR en route, terminal area, and non-precision approach operations (including those approaches titled “GPS”, “or GPS”, and “RNAV (GPS)” approaches). The Garmin GNSS navigation system is composed of the GNS navigator and antenna, and is approved for approach procedures with vertical guidance including “LPV” and “LNAV/VNAV” and without vertical guidance including “LP” and “LNAV,” within the U.S. National Airspace System.

The Garmin GNSS navigation system complies with the equipment requirements of AC 90-105 and meets the equipment performance and functional requirements to conduct RNP terminal departure and arrival procedures and RNP approach procedures without RF (radius to fix) legs. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval from the FAA.

The Garmin GNSS navigation system complies with the equipment requirements of AC 90-100A for RNAV 2 and RNAV 1 operations. In accordance with AC 90-100A, Part 91 operators (except subpart K) following the aircraft and training guidance in AC 90-100A are authorized to fly RNAV 2 and RNAV 1 procedures. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval from the FAA.

Applicable to dual installations consisting of two Garmin GNSS units: The Garmin GNSS navigation system has been found to comply with the requirements for GPS Class II oceanic and remote navigation (RNP-10) without time limitations in accordance with AC 20-138A and FAA Order 8400.12A. The Garmin GNSS navigation system can be used without reliance on other long-range navigation systems. This does not constitute an operational approval.

The Garmin GNSS navigation system has been found to comply with the navigation requirements for GPS Class II oceanic and remote navigation (RNP-4) in accordance with AC 20-138A and FAA Order 8400.33. The Garmin GNSS navigation system can be used without reliance on other long-range navigation systems. Additional equipment may be required to obtain operational approval to utilize RNP-4 performance. This does not constitute an operational approval.

The Garmin GNSS navigation system complies with the accuracy, integrity, and continuity of function, and contains the minimum system functions required for P-RNAV operations in accordance with JAA Administrative & Guidance Material Section One: General Part 3: Temporary Guidance Leaflets, Leaflet No 10 (JAA TGL-10 Rev 1). The GNSS navigation system has one or more TSO-C146a Class 3 approved Garmin GNS Navigation Systems. The Garmin GNSS navigation system complies with the accuracy, integrity, and continuity of function, and contains the minimum system functions required for B-RNAV operations in accordance with EASA AMC 20-4. The Garmin GNSS navigation system complies with the equipment requirements for P-RNAV and B-RNAV/RNAV-5 operations in accordance with AC 90-96A CHG 1. This does not constitute an operational approval.

Garmin International holds an FAA Type 2 Letter of Acceptance (LOA) in accordance with AC 20-153 for database integrity, quality, and database management practices for the navigation database. Flight crew and operators can view the LOA status at FlyGarmin.com then select “Type 2 LOA Status.”

Navigation information is referenced to the WGS-84 reference system.

Note that for some types of aircraft operation and for operation in non-U.S. airspace, separate operational approval(s) may be required in addition to equipment installation and airworthiness approval.

Section 2. LIMITATIONS

2.1 Pilot's Guide

The Quick Reference Guide, part number and revision listed below (or later applicable revisions), must be immediately available for the flight crew whenever navigation is predicated on the use of the 4XXW Series unit.

- 400W Series Quick Reference Guide P/N 190-00356-01 Rev J

The Pilot's Guide Addendum, part number and revision listed below (or later applicable revision), must be immediately available for the flight crew whenever one or more of the following units are installed and utilized with the 4XXW Series unit:

GDL 69/69A XM Satellite Data link
GDL 88 ADS-B Transceiver
GTX 330/330D TIS
GTS 8XX Series TAS
Flight Stream 210

- 400W/500W Series Optional Displays P/N 190-00356-30 Rev L

The Pilot's Guide Addendum, part number and revision listed below (or later applicable revision), must be immediately available for the flight crew whenever one or more of the following units are installed and utilized with the 4XXW Series unit:

Stormscope® Lightning Detection System
Skywatch® Traffic Advisory System
Bendix/King® Traffic Advisory System
Avidyne/Ryan TCAD Traffic System

- 400W/500W Series Display Interfaces P/N 190-00356-31 Rev D

2.2 Kinds of Operation

This AFM supplement does not grant approval for IFR operations to aircraft limited to VFR operations. Additional aircraft systems may be required for IFR operational approval. Systems limited to VFR shall be placarded in close proximity to the 4XXW Series unit: "**GPS LIMITED TO VFR USE ONLY**".

2.3 System Software

This AFMS/AFM is applicable to the software versions shown in Table 1.

The Main and GPS software versions are displayed on the start-up page immediately after power-on.

Software Item	**Approved Software Version** *(or later FAA approved versions for this STC)*	
	SW version	As displayed on unit
Main SW Version	5.40	5.40
GPS SW Version	5.0	5.0
Flight Stream 210	2.80	2.80 (Displayed on GNS)

Table 1 – Required Equipment

2.4 Navigation database

GPS/SBAS based IFR enroute, oceanic, and terminal navigation is prohibited unless the flight crew verifies and uses a valid, compatible, and current navigation database or verifies each waypoint for accuracy by reference to current approved data.

"GPS", "or GPS", and "RNAV (GPS)" instrument approaches using the Garmin navigation system are prohibited unless the flight crew verifies and uses the current navigation database. GPS based instrument approaches must be flown in accordance with an approved instrument approach procedure that is loaded from the navigation database.

Discrepancies that invalidate a procedure should be reported to Garmin International. The affected procedure is prohibited from being flown using data from the navigation database until a new navigation database is installed in the aircraft and verified that the discrepancy has been corrected. Navigation database discrepancies can be reported at FlyGarmin.com by selecting "Aviation Data Error Report." Flight crew and operators can view navigation database alerts at FlyGarmin.com then select "NavData Alerts."

If the navigation database cycle will change during flight, the flight crew must ensure the accuracy of navigation data, including suitability of navigation facilities used to define the routes and procedures for flight. If an amended chart affecting navigation data is published for the procedure, the database must not be used to conduct the procedure.

2.5 Flight Planning

For flight planning purposes, in areas where SBAS coverage is not available, the flight crew must check RAIM availability.

- Within the United States, RAIM availability can be determined using the Garmin WFDE Prediction program, Garmin part number 006-A0154-04 software version 3.00 or later approved version with Garmin approved antennas or the FAA's enroute and terminal RAIM prediction website: www.raimprediction.net, or by contacting a Flight Service Station.
- Within Europe, RAIM availability can be determined using the Garmin WFDE Prediction program or Europe's AUGER GPS RAIM Prediction Tool at http://augur.ecacnav.com/augur/app/home.
- For other areas, use the Garmin WFDE Prediction program.

This RAIM availability requirement is not necessary if SBAS coverage is confirmed to be available along the entire route of flight. The route planning and WFDE prediction program may be downloaded from the Garmin website on the internet. For information on using the WFDE Prediction Program, refer to Garmin WAAS FDE Prediction Program, part number 190-00643-01, 'WFDE Prediction Program Instructions'.

For flight planning purposes, for operations within the U.S. National Airspace System on RNP and RNAV procedures when SBAS signals are not available, the availability of GPS RAIM shall be confirmed for the intended route of flight. In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended route of flight, the flight shall be delayed, canceled, or rerouted on a track where RAIM requirements can be met. The flight may also be re-planned using non-GPS based navigational capabilities.

For flight planning purposes for operations within European B-RNAV/RNAV-5 and P-RNAV airspace, if more than one satellite is scheduled to be out of service, then the availability of GPS RAIM shall be confirmed for the intended flight (route and time). In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended flight, the flight shall be delayed, canceled, or rerouted on a track where RAIM requirements can be met.

Applicable to dual installations consisting of two Garmin GNSS units:

For flight planning purposes, for operations where the route requires Class II navigation the aircraft's operator or flight crew must use the Garmin WFDE Prediction program to demonstrate that there are no outages on the specified route that would prevent the Garmin GNSS navigation system to provide GPS Class II navigation in oceanic and remote areas of operation that requires RNP-10 or RNP-4 capability. If the Garmin WFDE Prediction program indicates fault exclusion (FDE) will be unavailable for more than 34 minutes in accordance with FAA Order 8400.12A for RNP-10 requirements, or 25 minutes in accordance with FAA Order 8400.33 for RNP-4 requirements, then the operation must be rescheduled when FDE is available.

Both Garmin GPS navigation receivers must be operating and providing GPS navigation guidance for operations requiring RNP-4 performance.

North Atlantic (NAT) Minimum Navigational Performance Specifications (MNPS) Airspace operations per AC 91-49 and AC 120-33 require both GPS/SBAS receivers to be operating and receiving usable signals except for routes requiring only one Long Range Navigation sensor. Each display computes an independent navigation solution based on its internal GPS receiver.

Whenever possible, RNP and RNAV routes including Standard Instrument Departures (SIDs), and Standard Terminal Arrival (STAR), routes should be loaded into the flight plan from the database in their entirety, rather than loading route waypoints from the database into the flight plan individually. Selecting and inserting individual named fixes from the database is permitted, provided all fixes along the published route to be flown are inserted. Manual entry of waypoints using latitude/longitude or place/bearing is prohibited.

NOTE

If flight plan information is imported from a portable electronic device utilizing the Flight Stream 210, all waypoints and flight plan information must be verified by the crew.

It is not acceptable to flight plan a required alternate airport based on RNAV(GPS) LP/LPV or LNAV/VNAV approach minimums. The required alternate airport must be flight planned using an LNAV approach minimums or available ground-based approach aid.

Navigation information is referenced to the WGS-84 reference system, and should only be used where the Aeronautical Information Publication (including electronic data and aeronautical charts) conform to WGS-84 or equivalent.

2.6 Approaches

- Instrument approaches using GPS guidance may only be conducted when the GNS is operating in the approach mode. (LNAV, LNAV+V, L/VNAV, LPV, LP, or LP +V)

NOTE

Advisory vertical guidance deviation is provided when the GNS annunciates LNAV+V or LP +V. The controlling minimums remain LNAV or LP even when advisory vertical guidance is provided. Advisory vertical guidance information displayed on the VDI in this mode is only an aid to help flight crews comply with altitude restrictions. When using advisory vertical guidance, the flight crew must use the primary barometric altimeter to ensure compliance with all altitude restrictions in

accordance with the LNAV or LP approach procedure.

- When conducting instrument approaches referenced to true North, the NAV Angle on the AUX-Units/Position page must be set to **True**.
- The navigation equipment required to join and fly an instrument approach procedure is indicated by the title of the procedure and notes on the IAP chart. Navigating the final approach segment (that segment from the final approach fix to the missed approach point) of an ILS, LOC, LOC-BC, LDA, SDF, MLS, TACAN approach, or any other type of approach not approved for GPS, is not authorized with GPS navigation guidance. GPS guidance can only be used for approach procedures with GPS or RNAV in the procedure title or for VOR and NDB approaches provided the underlying VOR or NDB is operational and the signal is monitored for final approach segment alignment. When using the Garmin LOC/GS receivers to fly the final approach segment, LOC/GS navigation data must be selected and presented on the CDI of the pilot flying.
- Not all published Instrument Approach Procedures (IAP) are in the navigation database. Flight crews planning to fly an RNAV instrument approach must ensure that the navigation database contains the planned RNAV Instrument Approach Procedure and that approach procedure must be loaded from the navigation database into the GNS system flight plan by its name. Users are prohibited from flying any approach path that contains manually entered waypoints.
- IFR approaches are prohibited whenever any physical or visual obstruction (such as a throw-over yoke) restricts pilot view or access to the GNS and/or the CDI.

2.7 Autopilot Coupling

IFR installations of a Garmin 4XXW Series unit allow the operator to fly all phases of flight based on the navigation information presented to the pilot; however, not all modes may be coupled to the autopilot. All autopilots may be coupled in Oceanic (OCN), Enroute (ENR), and Terminal (TERM) modes; however, the FAA requires that vertical coupling of an autopilot for approaches be demonstrated to meet their intended function and provide safe and proper operation to published minimums. This installation is limited to:

☐ Lateral coupling only for GPS approaches. Coupling to the vertical path for GPS approaches is not authorized.

2.8 Terrain Proximity Function

Terrain and obstacle information appears on the map and terrain display pages as red and yellow tiles or towers, and is depicted for advisory use only. Aircraft maneuvers and navigation must not be predicated upon the use of the terrain display. Terrain and obstacle information is advisory only and is not equivalent to warnings provided by TAWS.

The terrain display is intended to serve as a situational awareness tool only. By itself, it may not provide either the accuracy or the fidelity on which to base decisions and plan maneuvers to avoid terrain or obstacles.

2.9 VNAV – Vertical Navigation Calculation Page

VNAV information accessible by pressing the "VNAV" button may be utilized for advisory information only. Use of VNAV information for Instrument Approach Procedures does not guarantee Step-Down Fix altitude protection, or arrival at approach minimums in a normal position to land.

2.10 Weather Display (Optional)

This limitation applies to data linked weather products from SiriusXM via a GDL 69/69A or FIS-B via a GDL 88.

Do not use data link weather information for maneuvering in, near, or around areas of hazardous weather. Information provided by data link weather products may not accurately depict current weather conditions.

Do not use the indicated data link weather product age to determine the age of the weather information shown by the data link weather product. Due to time delays inherent in gathering and processing weather data for data link transmission, the weather information shown by the data link weather product may be significantly older than the indicated weather product age.

Do not rely solely upon data link services to provide Temporary Flight Restriction (TFR) or Notice to Airmen (NOTAM) information. Not all TFRs and NOTAMS can be depicted on the GNS.

2.11 Traffic Display (Optional)

Traffic may be displayed on the GNS when connected to an approved optional TCAS I, TAS, TIS, or ADS-B traffic device. These systems are capable of providing traffic monitoring and alerting to the flight crew. Traffic shown on the display may or may not have traffic alerting available. The display of traffic is an aid to visual acquisition and may not be utilized for aircraft maneuvering.

2.12 GTN Crossfill

When GTN Crossfill is in use, OBS mode shall be initiated only on the GTN. OBS mode on the GNS when GTN Crossfill is enabled is prohibited.

When GTN Crossfill is in use, the crew must verify each flight plan leg prior to using the GNS to navigate. See section 7.2 for additional information.

2.13 Flight Stream 210 (Optional)

The Flight Stream 210 provides the ability for the crew to import flight plans from a portable electronic device to the GNS. The crew must verify all flight plan and waypoint information imported from a portable electronic device prior to use on the GNS. See section 7.3 for additional information.

2.14 Portable Electronic Devices

This STC does not relieve the operator from complying with the requirements of 91.21 or any other operational regulation regarding portable electronic devices.

Section 3. EMERGENCY PROCEDURES

3.1 Emergency Procedures

No change.

3.2 Abnormal Procedures

3.2.1 LOSS OF GPS/SBAS NAVIGATION DATA

When the GPS/SBAS receiver is inoperative or GPS navigation information is not available or invalid, the GNS will enter one of two modes: Dead Reckoning mode (DR) or Loss Of Integrity mode (LOI). The mode is indicated on the GNS by an amber "DR" or "INTEG".

If the Loss Of Integrity annunciation is displayed, revert to an alternate means of navigation appropriate to the route and phase of flight.

If the Dead Reckoning annunciation is displayed, the map will continue to be displayed with an amber ownship icon. Course guidance will be removed on the CDI. Aircraft position will be based upon the last valid GPS position, then estimated by Dead Reckoning methods. Changes in true airspeed, altitude, heading, or winds aloft can affect the estimated position substantially. Dead Reckoning is only available in Enroute and Oceanic modes. Terminal and Approach modes do not support Dead Reckoning.

If Alternate Navigation Sources (ILS, LOC, VOR, DME, ADF) Are Available:

Navigation ..... **USE ALTERNATE SOURCES**

If No Alternate Navigation Sources Are Available:

DEAD RECKONING (DR) MODE:

Navigation .....**USE GNS**

NOTE

All information normally derived from GPS will become less accurate over time.

LOSS OF INTEGRITY (LOI) MODE:

Navigation..... **FLY TOWARDS KNOWN VISUAL CONDITIONS**

NOTE

All information derived from GPS will be removed.

NOTE

The airplane symbol is removed from all maps. The map will remain centered at the last known position. "No GPS Position" will be annunciated in the center of the map.

3.2.2 GPS APPROACH DOWNGRADE

During a GPS LPV, LNAV/VNAV, LP +V, or LNAV+V approach, if GPS accuracy requirements cannot be met by the GPS receiver prior to the Final Approach Fix, the GNS will downgrade the approach. The downgrade will remove vertical deviation indication from the VDI and change the approach annunciation accordingly from LPV, L/VNAV, LP +V, or LNAV+V to LNAV. The approach may be continued using the LNAV only minimums. After the Final Approach Fix has been passed, the approach will be aborted using the indications described below.

During a GPS approach in which GPS accuracy requirements cannot be met by the GPS receiver for any GPS approach type, the GNS will flag all CDI guidance and display a system message "ABORT APPROACH - Loss of Navigation". Immediately upon viewing the message, the unit will revert to Terminal navigation mode alarm limits. If the position integrity is within these limits lateral guidance will be restored and the GPS may be used to execute the missed approach, otherwise alternate means of navigation must be utilized.

3.2.3 LOSS OF COM RADIO TUNING FUNCTIONS

If alternate COM is available:

Communications ..... **USE ALTERNATE COM**

If no alternate COM is available:

COM RMT XFR key (if installed).....**PRESS AND HOLD FOR 2 SECONDS**

NOTE

This procedure will tune the active COM radio the emergency frequency 121.5, regardless of what frequency is displayed on the GNS. Certain failures of the tuning system will automatically tune 121.5 without flight crew action.

Section 4. NORMAL PROCEDURES

Refer to the 4XXW Series unit Quick Reference Guide defined in paragraph 2.1 on page 8 of this document for normal operating procedures. This includes all GPS operations, VHF COM and NAV, and Multi-Function Display information. For information on TIS traffic or data linked weather, see the Pilot's Guide addendum for optional displays. For information on active traffic device or Stormscope operation and displays see the Pilot's Guide addendum for display interfaces.

The 4XXW Series unit requires a reasonable degree of familiarity to prevent operations without becoming too engrossed at the expense of basic instrument flying in IMC and basic see-and-avoid in VMC. Pilot workload will be higher for pilots with limited familiarity in using the unit in an IFR environment, particularly without the autopilot engaged. Garmin provides training tools with the Pilot's Guide and PC based simulator. Pilots should take full advantage of these training tools to enhance system familiarization.

4.1 Unit Power On

Database..... **REVIEW EFFECTIVE DATES**
Self Test..... **VERIFY OUTPUTS TO NAV INDICATORS**
Self Test - GPS Remote Annunciator (If Installed):
- VLOC ..... **ILLUMINATED**
- GPS..... **ILLUMINATED**
- INTG ..... **ILLUMINATED**
- TERM..... **ILLUMINATED**
- WPT..... **ILLUMINATED**
- APR ..... **ILLUMINATED**
- MSG ..... **ILLUMINATED**
- SUSP ..... **ILLUMINATED**

4.2 Before Takeoff

System Messages and Annunciators..... **CONSIDERED**

4.3 HSI and EHSI Operation

If an HSI is used to display navigation data from the GNS the pilot should rotate the course pointer as prompted on the GNS.

If an EHSI is used to display navigation data from the GNS the course pointer may autoslew to the correct course when using GPS navigation. When using VLOC navigation the course pointer will not autoslew and must be rotated to the correct course by the pilot. For detailed information about the functionality of the EHSI system, refer to the FAA approved Flight Manual or Flight Manual Supplement for that system.

CAUTION

The pilot must verify the active course and waypoint for each flight plan leg. The pilot must verify proper course selection each time the CDI source is changed from GPS to VLOC.

4.4 Autopilot Operation

The GNS may be coupled to an optional autopilot, if installed in the aircraft, when operating as prescribed in the LIMITATIONS section of this manual.

Autopilots coupled to the GNS system in an analog (NAV) mode will follow GPS or VHF navigation guidance as they would with existing VOR receivers.

Autopilots that support GPSS or GPS Roll Steering in addition to the analog course guidance will lead course changes, fly arcing procedures, procedure turns, and holding patterns if coupled in GPSS mode.

For autopilot operating instructions, refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

4.5 Coupling the Autopilot during approaches

CAUTION

When the CDI source is changed on the GNS, autopilot mode may change. Confirm autopilot mode selection after CDI source change on the GNS. Refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

☐ This installation prompts the flight crew and requires the pilot to enable the approach outputs just prior to engaging the autopilot in APR mode.

To couple an approach:
Once established on the final approach course with the final approach fix as the active waypoint, the GNS will issue a flashing message indication with the following message "APR Guidance Available, Use PROC before A/P APR".

PROC Button..... **PRESS**
"Enable A/P APR Outputs?"..... **SELECT**
ENT Button ..... **PRESS**

If coupled, Autopilot will revert to ROL mode at this time.

Autopilot..... **ENGAGE APPROACH MODE**

☐ This installation supports coupling to the autopilot in approach mode once vertical guidance is available.

To couple an approach:
Once established on the final approach course with the final approach fix as the active waypoint, the GNS will enable vertical guidance.

Vertical Guidance..... **CONFIRM AVAILABLE**
Autopilot..... **ENGAGE APPROACH MODE**

☐ The autopilot does not support any vertical capture or tracking in this installation.

Analog only autopilots should use APR mode for coupling to LNAV approaches. Autopilots which support digital roll steering commands (GPSS) may utilize NAV mode and take advantage of the digital tracking during LNAV only approaches.

4.6 Traffic Mode Selection (Optional)

If the GNS is interfaced to a traffic device, the GNS can be used to control the mode of the traffic system. This is accomplished by pressing the cursor knob while on the dedicated traffic page to enter/exit the traffic device menu. It is important to note that while the traffic device menu is active, the current state of the traffic system is *not* displayed. The state of the traffic device is only displayed once the traffic device menu is exited.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

See current weight and balance data.

Section 7. SYSTEM DESCRIPTIONS

7.1 Pilot's Guide

See Garmin 4XXW Series unit Pilot's Guide for a complete description of the 4XXW Series unit.

7.2 Manual GTN Crossfill

Manual GTN Crossfill is a feature that will keep the GNS system in sync with a flight plan that is being used on the GTN system. The GTN *will not* automatically keep its flight plan in sync with changes made on the GNS system. Manual crossfill feature is "one way" – from the GTN to the GNS.

The GTN systems support a variety of procedure leg types that the GNS systems do not support. As such, it is normal and expected that the flight plan leg that is displayed on the GNS system will not always match the flight plan leg on the GTN system. Departure, arrival and approach procedures contain leg types that the GNS does not support. The GNS typically "skips" over these leg types and provides no guidance. Guidance may be available on the GTN but not on the GNS in these cases. The GNS will sequence the procedure as it normally would if Crossfill were not active. Once a leg type is reached that is supported on both the GTN and GNS systems, the systems will automatically sync to the same leg.

If the GNS is interfaced with a GTN and the GTN Crossfill feature is enabled on the GNS, then auto-switching from GPS to VLOC guidance on the CDI for ILS/LOC approaches will be disabled on the GNS..

If the flight plan on an interfaced GTN is altered while in a hold, the GNS will reinitiate guidance to the holding waypoint and sequence into the hold upon crossing the waypoint.

If the Missed Approach is activated on the GTN prior to reaching the Missed Approach Point, the GTN will automatically resume leg sequencing upon reaching the Missed Approach Point. The GNS will remain suspended upon reaching the Missed Approach Point and leg sequencing must be manually resumed.

7.3 Flight Stream 210

The Flight Stream 210 provides wireless communication of specific flight plan information and GPS sensor data to a PED (Personal Electronic Device) from the GNS.

For details on the operation and features of the Flight Stream 210, please refer to the GNS 400W/500W Series Optional Displays, P/N 190-00356-30 Rev J.

For additional details about the Garmin supported devices and apps for use with the Flight Stream 210, please visit:
http://garmin.com/connext/supported_devices

ADS-B Technologies, LLC
900 Merrill Field Drive
Anchorage, Alaska 99501, U.S.A

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

or

SUPPLEMENTAL FLIGHT MANUAL

For The

L-3 Aviation Products
Lynx Multilink Surveillance System
Model NGT-9000
L-3 Part Number 9029000-20000

This Airplane Flight Manual Supplement or Supplemental Flight Manual must be carried on board the aircraft when the NGT-9000 Multilink Surveillance System is installed in accordance with the AML Supplemental Type Certificate SA02444AK.

The information contained herein supplements the FAA approved Airplane Flight Manual or the type design data only in those areas listed herein. For limitations, procedures and performance information not contained in this document, refer to the FAA approved Airplane Flight Manual, manual material, markings, placards, or other information that was required by the applicable regulations under which the aircraft was type certificated.

Make and Model Airplane: PIPER PA-31T

Airplane Serial Number: 31T-7820056

Airplane Registration Number: N781CK

FAA Approved:

August A. Asay
Manager, Anchorage Aircraft Certification Office
Federal Aviation Administration
Anchorage, Alaska

Date: JUN 19 2015

FAA APPROVED
AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL FLIGHT MANUAL
For The

L-3 Aviation Products
Lynx Multilink Surveillance System
Models NGT-9000
L-3 Part Number 9029000-20000

RECORD OF REVISIONS

Revision	Date of Revision	Description
Original	3/31/2015	Original Issue
1	6/19/2015	Typographical error corrections Corrections to Table 3-1 in section 3.2.1

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SECTION 1. GENERAL

1.1 Functional Description

The Lynx MultiLink Surveillance System (also referred to in this manual as the Lynx NGT-9000) is a Mode S Level 2 dens Class 1 Transponder with an integrated GPS receiver providing Automatic Dependent Surveillance-Broadcast (ADS-B) output using a 1090ES (Extended Squitter). The unit also receives ADS-B data via 1090ES and UAT (978 MHz Universal Access Transceiver). Figure 1-1 is a depiction of the NGT-9000.

The unit replies to Mode A, Mode C and Mode S interrogations receiving interrogations at 1030 MHz and transmitting responses at 1090 MHz. The unit is equipped with IDENT capability that activates the Special Identification (SPI) pulse for 18 seconds.

Ground stations can interrogate Mode S Transponders individually using a 24-bit ICAO Mode S address, which is unique to the particular aircraft. In addition, ground stations may interrogate the unit for its transponder data capability and the aircraft's Flight ID.

The ADS-B provides own aircraft data with Enhanced Visual Acquisition (EVAcq) traffic information that improves situational awareness and flight safety by providing aircraft position, velocity, and heading information that is automatically transmitted to other aircraft and ground stations providing immediate surveillance of air-to-air traffic.

The 1090ES and UAT ADS-B datalink have the following capabilities:

- 1030MHz/1090 MHz In - Receive ADS-R and TIS-B
- 1090ES Out - Transmit ADS-B
- UAT In - Receives ADS-B, ADS-R and TIS-B, FIS-B, NOTAMS, and TFR's

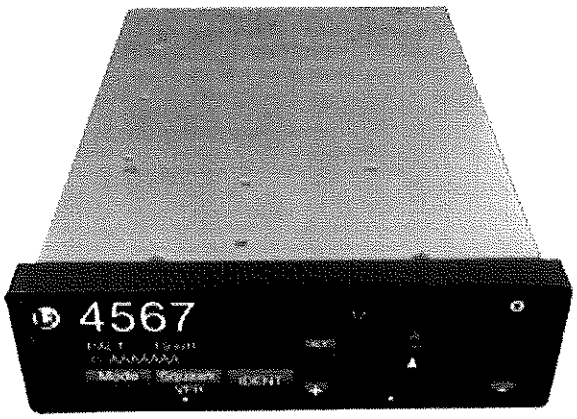

Figure 1-1: Lynx NGT-9000

1.2 NGT-9000+ Traffic Awareness Overview [Optional]

The NGT-9000+ ("9000 Plus") supports optional active Traffic Awareness System (TAS).

The TAS option is an active system that operates as an aircraft-to-aircraft interrogation device. The unit interrogates transponders in the surrounding airspace similar to ground based radar. When replies to these active interrogations are received, the responding aircraft's range, altitude, and closure rates are computed to plot traffic location and predict collision threats. The unit alerts the flight crew to nearby transponder equipped aircraft and assists the pilot in the visual acquisition of aircraft that may represent a danger. Traffic information, out to a selected range, is graphically displayed on the unit or alternate display.

- The system display shows the relative position of traffic using text, shapes (i.e., Traffic Advisory = solid circle; Other Traffic = open diamond) and colors.
- The effective active-mode surveillance range is 35 nm and the system is capable of tracking 35 Intruders simultaneously with the target bearing relative to the nose of own aircraft.
- The tracking of targets is in a cylindrical volume centered on own aircraft that has, at a minimum, a radius of 35 nm and extends 10,000 ft above and 10,000 ft below own aircraft.
- The system uses a voice audio output that announces Traffic Advisory and relative altitude.

1.3 NGT-9000D Antenna Diversity Overview [Optional]

The NGT-9000D has the same hardware and firmware/software as the basic NGT-9000, but is capable of supporting dual L-band antennas (one bottom and one top) to enhance system performance and prevent fuselage blanking of a single bottom antenna in tight turns into a ground station or UAT target. The upper L-band antenna may be a single blade antenna.

1.4 Capabilities

The NGT-9000 transceiver can be software configured as either an NGT-9000, 9000+, or 9000D. It can also be installed with, or without peripheral ARINC-429 or RS-422 panel mounted traffic and weather displays.

1.5 L-Band UAT Antenna

The L-Band antenna is used by the Lynx NGT-9000 to transmit and receive 1090 MHz ADS-B and receive 978MHz ADS-B (UAT). At least one L-band antenna must be located on the bottom of the aircraft.

1.6 GPS Antenna and the MSS Internal GPS Receiver

The GPS utilizes signals from Global Positioning System (GPS) satellite constellation and Satellite-Based Augmentation Systems (SBAS). The MSS has an internal GPS function that provides position, velocity, time and integrity (NIC, NAC, etc.) information to the ADS-B functions. It is located on the top of the aircraft.

NOTE

The NGT-9000's built-in GPS does not provide ownship position for external moving map displays

1.7 Configuring the NGT-9000

The unit's configuration is preserved within the Data Configuration Module (DCM), which is permanently attached to the aircraft and communicates with the NGT-9000 via a serial connection. The configuration options are set up during installation and cannot be changed except by a licensed installer.

> **NOTE**
>
> The NGT-9000's configuration parameters can only be changed by a licensed installer

1.8 Personal Electronic Devices

The Lynx NGT-9000 supports the use of personal electronic devices (e.g., iPad) via a Wi-Fi connection. The PED must use approved applications that support the ADS-B broadcast services (i.e., ADS-B In, TIS-B, ADS-R, and FIS-B). Check with an L-3 approved avionics dealer or contact L-3 Avionics Systems for a current list of approved applications.

1.9 Weather Displays

NEXRAD, METARS, TAFS, PIREPS, NOTAMS and temperatures and winds aloft are displayed on the NGT-9000 provided that the aircraft is within the service volume of a ground station. Additionally, the same information can be displayed on approved weather displays can interface with the NGT-9000 to provide FIS-B weather information using the ADS-B IN link. Screen information and controls may be different for each of the approved displays.

Refer to your Installed Display operations manual for details on operation and a description of how the weather is depicted. Check with an L-3 approved avionics dealer or contact L-3 Avionics Systems for a current list of approved weather displays.

1.10 Traffic Displays

The NGT-9000 will provide, at a minimum, UAT, TIS-B and ADS-R traffic on the unit's built-in display and can repeat this traffic information on any approved ARINC-429 or RS-422 display. The NGT-9000+ can also display active Traffic Awareness System (TAS) targets on the unit's built-in display and can repeat this traffic information on any approved ARINC-429 or RS-422 display. Figure 1-1 Illustrates a typical traffic display

Refer to the displays operations manual for details on operation and a description of how the information is depicted. Check with an L-3 approves avionics dealer or contact L-3 Avionics Systems for a current list of approved traffic displays.

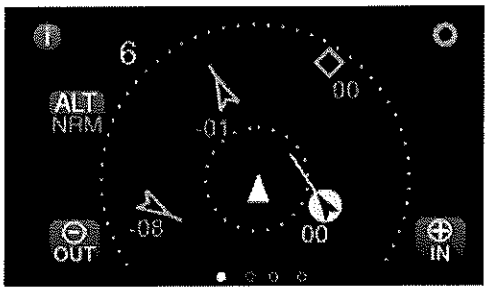

Figure 1-2: Typical NGT-9000 Traffic Screen

1.11 Interaction of Major Components

Figure 1-3 shows how the major components of the NGT-9000 connect to other aircraft systems.

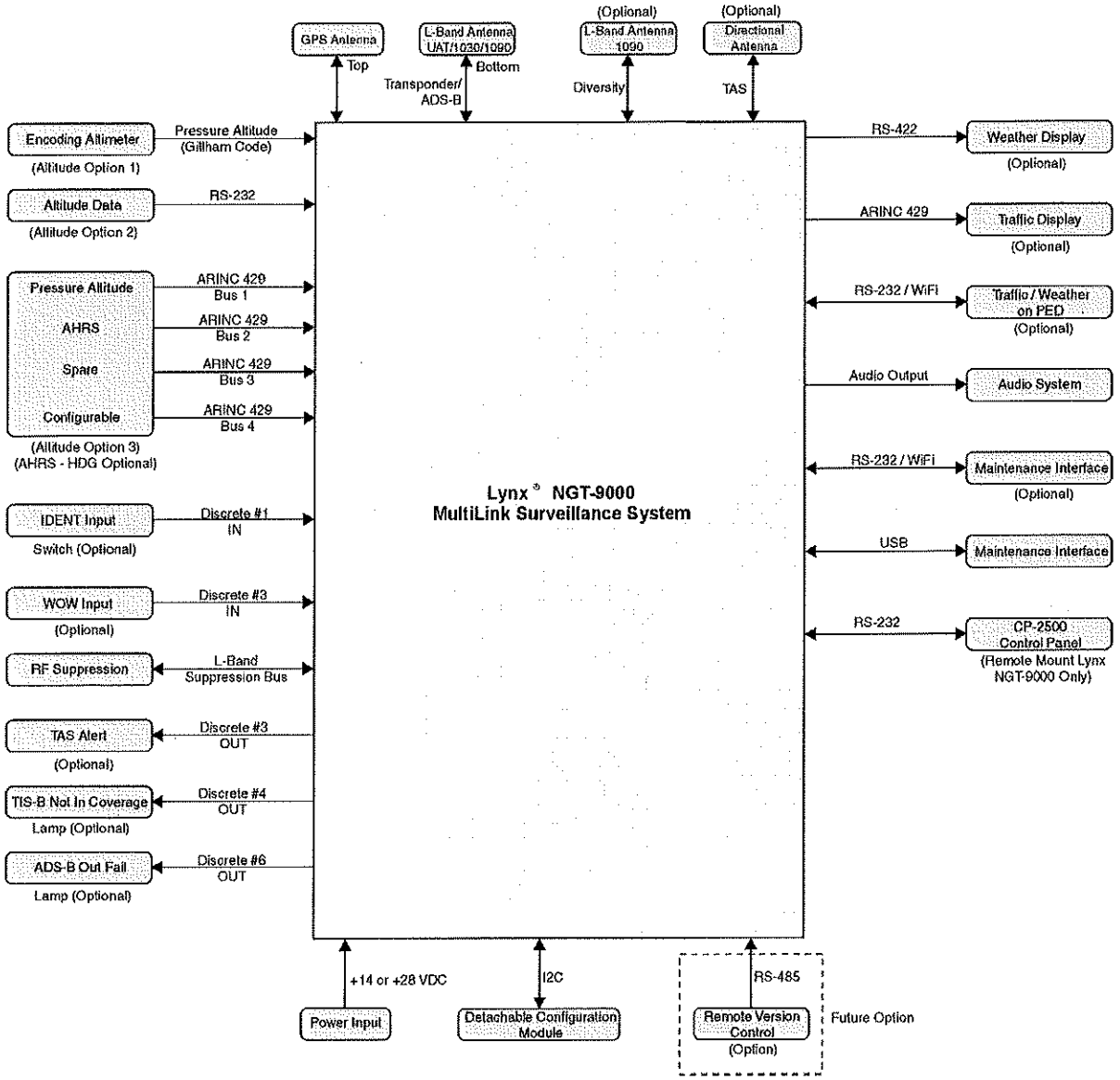

Figure 1-3: NGT-9000 Connections and Functions

1.12 Installation Configuration for This Aircraft

Figure 1-4 should be completed by a licensed installer.

This aircraft has been configured as a: ☑ NGT-9000 ☐ NGT-9000D ☐ NGT-9000+

Altitude Encoder: ☐ Serially Interfaced to MSS
☑ Interfaced via Gillham (gray code)

Interfaced Traffic Display: ☐ RS-422: _____ ☐ ARINC-429: _____

Interfaced WX Display: ☐ RS-422: _____

Heading Source: ☐ YES _____ ☑ NO

Weight On Wheels (WOW) Switch Installed: ☐ YES ☑ NO

Wi-Fi Enabled: ☑ YES _____ ☐ NO

Figure 1-4: Installation Configuration Data

SECTION 2. LIMITATIONS

2.1 Minimum Documentation

The L-3 Pilot's Guide for Models NGT-9000, NGT-9000D and NGT-9000+, Part Number 0040-17000-01 (Rev D, or later revision) must be carried on board the aircraft at all times.

2.2 Minimum Equipment

The NGT-9000 must have the following system interfaces in Table 2-1 fully functional in order to be compliant with the requirements for 14 CFR 91.225 and 91.227 ADS-B OUT operations:

Table 2-1: Required Equipment

Interfaced Equipment		Number Required	Number Installed
NGT-9000, NGT-9000D, or NGT-9000+ With operable SBAS position source		1	1
External ADS-B Annunciator: *"ASD-B FAIL"*		0	1 lamp
NGT-9000+ Equipped with TAS	Pilot's Audio (For Traffic Alerts)	1	1

2.3 ADS-B OUT Compliance

The NGT-9000 only complies with 14 CFR 91.227 when all its required functions are operational as indicated by external annunciators not being illuminated and/or interfaced display ADS-B messages not being present.

2.4 Anonymous Mode

Anonymous Mode must only be operated while operating under VFR and while squawking a VFR code. Anonymous Mode must be turned off when requested by Air Traffic Control.

2.5 IDENT Function

The system must be capable of squawking IDENT when requested by Air Traffic Control.

2.6 ALT Function

While operating within airspace requiring an ADS-B OUT compliant transmitter, Pressure Altitude Broadcast Inhibit (PABI), or "No ALT" shall only be enabled when requested by Air Traffic Control.

2.7 Traffic Awareness

Traffic Awareness and Traffic Alerting are intended as an aid to visual acquisition of conflicting traffic and may not be used as the sole basis for aircraft maneuvering.

NOTE

Information shown on the display is provided to the pilot as an aid to visually acquiring traffic. Pilots should maneuver their aircraft based only on ATC guidance or positive visual acquisition of the conflicting traffic. Maneuver should be consistent with ATC instructions. ATC should be contacted for resolution of the traffic conflict.

2.8 Applicable System Software

This AFMS/SFM is applicable to the software versions shown in Table 2-2.

Table 2-2: Software Version

Software	Part No.	Version
NGT-9000 Ops s/w	9020010-002	Rev 1.1
68DC Navigational Database North America (68.bin)	8010-22310-0201	Most current cycle*
72DC Cultural Features Database North American Extended (72.bin)	8010-12004-0001	Most current cycle*

* *There is no requirement to update this database because it is used only for informational purposes.*

SECTION 3. EMERGENCY PROCEDURES

3.1 Emergency Procedures

None.

3.2 Abnormal Procedures

3.2.1 Abnormal Indications

Table 3-1: Troubleshooting for the Panel Mount NGT-9000

Indications	Cause/Corrective Actions
The unit has manual brightness adjustment only.	Loss of light sensor data. 1. Try clearing the failure by tapping the Restart button. 2. Check light sensor (upper left corner of bezel) for dirt or obstructions. 3. If the problem continues, replacement of the Lynx NGT-9000 may be required. Contact L- 3 Field Service before removal.
• Blank display. • If installed, ADS-B Fail lamp is OFF.	Loss of power or damaged unit. 1. Check breakers and main avionics switch. 2. Verify Battery (BAT) Master switch is on. 3. Replacement of unit may be required. Contact L-3 Field Service before removal.
When touching the screen the command function seems to be slightly off from the center of the screen symbol or area.	The screen calibration is out of toler- ance. 1. A Screen Calibration may need to be performed. See Maintenance Mode. 2. If problem continues contact L-3 Field Service before removal.
Internal fan is always active.	Loss of temperature sensor data. 1. Try clearing the failure by tapping the Restart button. 2. If the problem continues, replacement of the Lynx NGT-9000 may be required. Contact L- 3 Field Service before removal.
Unit does not operate in normal mode and starts in Bootloader or maintenance mode.	Internal hardware test failures cause the unit to automatically reset. This happens without cycling power to the unit. If the hardware failure being detected does not clear a system fail message is sent. 1. Cycle power to the unit to clear the failure. 2. Replacement of unit may be required. Contact L-3 Field Service before removal.
Message page contains messages that do not indi- cate a functional failure.	Although no immediate loss of func- tion is occurring, an undesired condi- tion is taking place. At the earliest convenience, perform the following action: 1. Try clearing the failure by tapping the Restart button. 2. If the problem continues, replacement of the Lynx NGT-9000 may be required. Contact L- 3 Field Service before removal.

Indications	Cause/Corrective Actions
• No data showing. • If installed, ADS-B Fail lamp is ON. • A compatible traffic display may have the message "NO DATA" showing.	A hardware failure has been detected within the NGT-9000. • At next power cycle if symptoms persist contact L-3 Field Service before removal of the unit or other equipment.
• Compatible displays may indicate "STANDBY" or "DATA-FAIL" and Wi-Fi information is not available. • If installed, ADS-B Fail lamp begins to flash and continues to flash until GPS is acquired.	GPS-Acquiring (On Ground – no previous position fix). 1. The GPS may need up to 4 minutes to provide a position after power is applied to the Lynx NGT- 9000. 2. The GPS signal may be weak. Move the aircraft into an area where the unit can acquire the GPS signal. Make sure nothing is covering or blocking the GPS antenna. 3. At next power cycle if symptoms persist contact L-3 Field Service before removal of the unit or other equipment.
• Compatible displays may indicate "STANDBY" or "DATA-FAIL" and Wi-Fi information is not available. • If installed, ADS-B Out Fail lamp flashes (1 second On/Off) for 2 minutes, and then remains ON indefinitely until a GPS position is acquired.	GPS is Acquiring (In Air – no previ- ous position fix). 1. The GPS may need up to 4 minutes to provide a position after power is applied to the unit. 2. The GPS signal may be weak. Move the aircraft into an area where the unit can acquire the GPS signal. 3. Cycle power to the unit. 4. Contact L-3 Field Service before removal of unit.
• Display indicator MAP FAIL (red text) showing on FIS-B application screen. • Compatible displays may indicate "STANDBY" or "DATA-FAIL" and Wi-Fi information is not available. • If installed, ADS-B Fail lamp flashes for 2 minutes. After 2 minutes the lamp stays ON.	GPS-Acquiring (On Ground or In Air– previous position fix). 1. The GPS signal may be weak. Move the aircraft into an area where the unit can reacquire the GPS signal. 2. At next power cycle if symptoms persist contact L-3 Field Service before removal of the unit or other equipment.
• No targets are shown on the traffic screen. • Ownship data is displayed. • A "Traffic Unavailable" or "Traffic Failed" indication is being displayed. • If installed, ADS-B Fail lamp is OFF.	The aircraft is not in an ADS-B (UAT / 1090ES) coverage area, or the tar- gets are not transmitting ADS-B data, or the ground station is not transmit- ting ADS-B data. 1. The symptoms are expected if the target or ground station are not transmitting ADS-B. 2. The target or ground station needs to be within line-of-site range. 3. At next power cycle if symptoms persist contact L-3 Field Service before removal of the unit or other equipment.

Indications	Cause/Corrective Actions
• No targets are shown on the traffic display. • Ownship data may or may not be displayed on the weather display. • The MSG window is showing and functions are showing as failed or degraded.	Possible hardware problem with the Lynx NGT-9000. • At next power cycle if symptoms persist contact L-3 Field Service before removal of the unit or other equipment.
• No data on the weather display. • If installed, ADS-B Fail lamp is OFF.	The FIS-B data is not being transmit- ted to the weather display. 1. No ground station is in range. 2. The ground station may not provide FIS-B service. 3. At next power cycle if symptoms persist within a known FIS-B service area, then contact L-3 Field Service before removal of the unit or other equipment.
The traffic symbols on the traffic display are non-direc- tional (diamond shape)	Non-directional traffic symbols on the traffic display is due to one of the following reasons: 1. The directional information that is being received by the MSS does not have directional data. The MSS continues to transmit non-directional data to the traffic display. 2. An alternate traffic display (if installed) does not support the DTIF data format necessary to show directional data provided by ADS-B.
Traffic display is working correctly, but aircraft are not showing up on the display.	Lack of data as described below: 1. The ADS-B In requires other aircraft to be equipped with ADS- B Out. 2. The TIS-B and ADS-R services are supported when in range of ground stations providing the service. 3. If receiving the TIS-B service, Mode C and Mode S transponder equipped aircraft that do not provide altitude information are not seen on the traffic display. If receiving the TIS-B service, but aircraft not equipped with a transponder, or equipped with a Mode A transponder are not part of the TIS-B data and will not be seen on the traffic display.
No TIS-B or FIS-B Coverage Indicator is showing, but the aircraft is in coverage area.	The Lynx NGT-9000 or a system component may have failed or de- graded. • At next power cycle if symptoms persist contact L-3 Field Service before removal of the unit or other equipment.

3.2.2 Loss Of Aircraft Electrical Power Generation (Loss of Generator)

Loss of electrical power generation .....REMOVE POWER FROM NGT-9000

If the NGT-9000 is shut down in order to shed load from the aircraft's electrical system, ADS-B OUT and ADS-B IN will no longer be available. If under ATC control, notify your Controller of loss of ADS-B OUT.

NOTE
This guidance is supplementary to any procedure provided in the AFM or POH for the aircraft in Loss of Power situations

3.2.3 Loss of GPS/SBAS Position Data

Loss of GPS/SBAS indicated by a SLOW blinking ADS-B FAIL light.....PULL NGT CIRCUIT BREAKER. WAIT 5 SECONDS AND RESET. IF FAST BLINKING ADS-B FAIL LIGHT CONTINUES, OR BECOMES STEADY, ASSUME AN ADS-B OUT FAILURE.

If under ATC control, notify your Controller of loss of ADS-B OUT.

3.2.4 Visual/Aural Traffic Alert

Traffic Alert .....VISUALLY ACQUIRE TRAFFIC

SECTION 4. NORMAL PROCEDURES

The procedures described below are specific only to the NGT-9000. Reference the Pilot Operating Handbooks and AFM Supplements for operating instructions specific to any installed displays or peripheral devices.

4.1 Normal Power ON

The NGT-9000 is self-starting and self-tests once avionics power has been applied to the system

NGT Power .....ON

SELF TEST .....PASS. Audio "Self Test Pass"

NOTE
GPS alignment may take 2 – 3 minutes depending on the aircraft location and distance the aircraft has been moved since the last alignment. An ADS-B OUT OF RANGE light is normal until the aircraft is airborne and within the service volume of an ADS-B Ground Station (GBT).

SECTION 5. PERFORMANCE

No change

SECTION 6. WEIGHT AND BALANCE

See current weight and balance data

SECTION 7. SYSTEM DESCRIPTIONS

7.1 Pilot's Guide

THE L-3 LYNX, Models NGT-900 -9000D and NGT-9000+ Pilot's Guide, Document Part Number 0040-17000-01, contains additional information regarding the system's description, function and control. The Pilot should become familiar with the contents of this Guide and keep it available for reference.

7.2 Traffic Sources

The NGT-9000 is capable of receiving ADS-B IN traffic advisories and displaying them on the Main Display, PED's such as the Apple iPad and on panel mounted RS-422 capable display such as the Garmin GMX 200. Refer to the appropriate installed display manual for information on target symbology and optional alerting functions.

7.3 Weather Sources

The NGT-9000 is capable of receiving ADS-B IN Flight Information System (FIS) weather and airspace information on the Main Display, PED's such as the Apple iPad and on panel mounted RS-422 capable display such as the Garmin GMX 200. METAR, TAF, SIGMET and PIREP data is normally displayed in text format, while NEXRAD weather radar images are available graphically. Refer to the appropriate installed display manual for information on the type of information available and display options.

7.4 Power

Power for the NGT-9000 is provided through a circuit breaker labeled "NGT".

7.5 External Switches, Lights and Controls

Although no external lights are required for the NGT-9000, the optional status lights listed in Table 7-1 may be installed at the Operator's option.

Table 7-1: Light and Switch Functions

Switch or Light	Function
ADS-B FAIL Light	Out – Normal operation
	Steady – ADS-B Failure
	Slow Flashing – GPS aligning

SECTION 10