



AIRPLANE MAINTENANCE MANUAL

CARD 1 OF 7

PA-34-220T

Seneca IV

(SN's 3447001 THRU 3447029)

SENECA

(SN's 3449001 AND UP)

THE NEW PIPER AIRCRAFT, INC.

Published by
Technical Publications

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Member
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Manufacturers Association

**THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
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AEROFICHE REVISION STATUS

Revisions to Maintenance Manual (P/N 761-888) issued July 12, 1995, are as follows:

<u>Revision</u>	<u>Publication Date</u>	<u>Aerofiche Card Effectivity</u>
ORG950712	November 7, 1996	1, 2, 3, 4 and 5
PR980415	April 15, 1998	1, 2, 3, 4 and 5
PR981115	November 15, 1998	1, 2, 3, 4 and 5
PR020531	May 31, 2002	1
CR050819	August 19, 2005	1, 2, 3, 4, 5, 6 and 7
PR051107	November 7, 2005	1, 2, 4 and 5
PR060428*	April 28, 2006	1, 2, 3, 4, 5, 6 and 7

*** PARTIAL REVISION OF MAINTENANCE MANUAL 761-888**

Revisions appear in Aerofiche Cards 1, 2, 3, 4, 5, 6, and 7. Accordingly, discard your existing Aerofiche Cards and replace them with the cards dated April 28, 2006.

Consult the Customer Service Information Aerofiche (P/N 1753-755) for current revision dates for this manual.

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INTRODUCTION

1. Instructions for Continued Airworthiness

WARNING: INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA) FOR ALL NON-PIPER APPROVED STC INSTALLATIONS ARE NOT INCLUDED IN THIS MANUAL. 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 ICA 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, THE PIPER PROVIDED ICA MAY NOT BE VALID FOR AIRPLANES SO MODIFIED.

The PIPER PA-34-220T Seneca IV / V Maintenance Manual constitutes the Instructions for Continued Airworthiness (ICA) as required by Federal Aviation Regulations (FAR) Part 23, Appendix G. Chapter 4 contains the Airworthiness Limitations section (4-00-00) and the Inspection Program is in Chapter 5 (5-20-00).

2. General

This publication is prepared in accordance with the General Aviation Manufacturers Association (GAMA) Specification No. 2, with respect to the arrangement and content of the System/Chapters within the designated Chapter/Section-numbering system.

WARNING: USE ONLY GENUINE PIPER AIRCRAFT PARTS OR PIPER AIRCRAFT APPROVED PARTS OBTAINED FROM PIPER APPROVED SOURCES, IN CONNECTION WITH THE MAINTENANCE AND REPAIR OF PIPER AIRPLANES.

This manual generally does not contain hardware callouts for installation. Hardware callouts are only indicated where a special application is required. To confirm the correct hardware used, refer to the PA-34-220T Parts Catalog, P/N 761-887, and FAR 43 for proper use.

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.

THE NEW PIPER AIRCRAFT, INC. expressly disclaims any responsibility for malfunctions, failures, damage or injury caused by use of non-PIPER approved parts.

NOTE: THE NEW PIPER AIRCRAFT, INC. expressly reserves the right to supersede, cancel and/or declare obsolete any part, part numbers, kits or publication that may be referenced in this manual without prior notice.

In any question concerning the care of your airplane, be sure to include the airplane serial number in any correspondence.

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3. Effectivity

This maintenance manual is effective for PA-34-220T Seneca IV airplanes, serial numbers 3447001 thru 3447029, and Seneca V airplanes, serial numbers 3449001 and up.

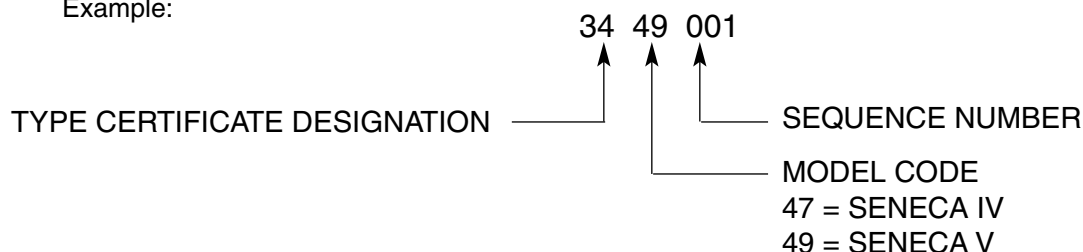
This encompasses the following model years:

NOTE: The following is provided as a general reference only.

<u>Model</u>	<u>Serial Numbers</u>	<u>Model Year</u>
Seneca IV	3447001 thru 3447012	1995
	3447013 thru 3447029	1996
Seneca V	3449001	Prototype
	3449002 thru 3449041	1997
	3449042 thru 3449096	1998
	3449097 thru 3449151	1999
	3449152 thru 3449195	2000
	3449196 thru 3449231	2001
	3449232,	2002
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	3449241 thru 3449268	
	3449269, 3449273, and	2003
	3449275 thru 3449300	
	3449301 thru 3449310	2004
	3449311 thru 3449322	2005
	3449323 and Up	2006

4. Serial Number Explanation

Example:



5. Assignment of Subject Material

This publication is divided into industry standard, three element, numeric subject groupings as follows:

- A. System/Chapter - The various groups are broken down into major systems such as Environmental Systems, Electrical Power, Landing Gear, etc. They are assigned a number, which becomes the first element of the standardized numbering system. Thus, the element "28" of the number 28-40-01 refers to the chapter "Fuel". Everything concerning the fuel system will be covered in this chapter.
- B. Sub-System/Section - The major systems/chapters of an airplane are broken down into subsystems. These sub-systems are identified by the second element of the standard numbering system. The element "40" of the number 28-40-01 concerns itself with the indicating section of the fuel system.

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- C. Unit/Subject - The individual units within a sub-system/section may be identified by the third element of the standard numbering system. The element "01" of the number 28-40-01 is a subject designator. This element is assigned at the option of the manufacturer and is normally zeroed out by PIPER.

Refer to paragraph 14, Chapter/Section Index Guide, for a complete breakdown and list. The material is arranged in ascending numerical sequence.

6. Pagination

The Chapter - Section (i.e. - 28-40-00) numbering system (explained above) forms the primary page numbering system for this manual. Within each Section, pages are numbered consecutively beginning with Page 1 (i.e. - 28-40-00, Page 1). Additionally, the aerofiche grid numbering system (explained below) is also used to indicate location within the manual.

7. Aerofiche Effectivity

- A. The General Aviation Manufacturers Association (GAMA) has developed specifications for microfiche reproduction of aircraft publications. The information compiled in this Aerofiche Maintenance Manual will be kept current by revisions distributed periodically. These revisions will supersede all previous revisions and will be complete Aerofiche card replacements and shall supersede Aerofiche cards of the same number in the set. The "Aerofiche Effectivity" page at the front of this manual lists the current revision for each card in this set.

- B. Conversion of Aerofiche alpha/numeric grid code numbers:

First number is the Aerofiche card number.

Letter is the horizontal row reference per card.

Second number is the vertical column reference per card.

Example: 2J16 = Aerofiche card number two, row J, column 16.

- C. To aid in locating information, the following is provided at the beginning of each aerofiche card:

- (1) A complete Introduction containing the Chapter/Section Index Guide for all fiche in this set.
- (2) A complete subject Index for all fiche in this set.

8. Identifying Revised Material

A revision to a page is defined as any change to the printed matter that existed previously. Revisions, additions and deletions are identified by a vertical line (i.e. - change bar) along the left-hand margin of the page opposite only that portion of the printed matter that was changed.

A change bar in the left-hand margin opposite the footer (i.e. - chapter/section/subject, page number and date), indicates that the text was unchanged but the material was relocated to a different page.

Example.

NOTE: Change bars are not used in the title pages, list of effective pages, or index.

9. Indexing

An alphabetically arranged subject Index follows this introduction to assist the user in locating desired information. In addition, each System/Chapter begins with an individual Table of Contents.

10. List of Effective Pages

Each System/Chapter has a List of Effective Pages preceding the Table of Contents to identify the effective revision date for each page in that chapter.

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11. Warnings, Cautions and Notes

These adjuncts to the text are used to highlight or emphasize important points when necessary. **Warnings** call attention to use of materials, processes, methods, procedures or limits which must be followed precisely to avoid injury or death to persons. **Cautions** call attention to methods and procedures which must be followed to avoid damage to equipment. **Notes** call attention to methods which make the job easier. Warnings and Cautions shall be located directly above and Notes directly beneath the text and be in line with the paragraphs to which they apply.

12. Accident/Incident Reporting

To improve our Service and Reliability system and aid in our compliance with FAR 21.3, knowledge of all incidents and/or accidents must be reported to Piper immediately. To expedite and assist in reporting all incidents and accidents, Piper Form 420-01 has been created. See Service Letter 1041 for latest revision. This procedure is to be used by all Dealers, Service Centers and Repair Facilities.

13. Supplementary Publications

The following publications/sources provide servicing, overhaul and parts information for the PA-34-220T Seneca IV / V airplanes and their various components. Use them to supplement this manual.

A. Piper Publications: (by Part Number)	Seneca IV	Seneca V
(1) Parts Catalog:	761-887	761-887
(2) Periodic Inspection Report:	230-1061	767-012
(3) Progressive Inspection Manual (50 Hour):	761-753	767-006

B. Vendor Publications:

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY.

(1) AIR CONDITIONING COMPRESSOR:

Vendor:	Sanden International (USA), Inc. 601 South Sanden Blvd. Wylie, TX 75098-4999 http://www.sanden.com	PH: - (972) 442-8400
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(2) AUTOFLIGHT:

Vendor(s):	Honeywell One Technology Center 23500 W. 105th St., M/D #45 Olathe, Kansas 66061-1950 http://www.bendixking.com/	(or)	S-TEC Corporation One S-TEC Way Mineral Wells, Tx 76067 PH: - (940) 325-9406 www.s-tec.com
Flight Control:	Bendix/King		
System Flight Line Installation Manual:	KFC 150 P/N 006-0287-00		

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(3) BATTERY:

Vendor:	GILL Batteries A Division of Teledyne Continental Motors http://www.gillbatteries.com	PH: - (800) 456-0070
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(4) BRAKES AND WHEELS:

Vendor:	Parker Hannifin Corp. Aircraft Wheel and Brake Division 1160 Center Road Avon, Ohio 44011 http://www.parker.com/cleveland/Universe/book.pdf	PH: - (800) 272-5464
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(5) ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS):

Vendor:	Meggitt Avionics, Inc. 10 Ammon Drive Manchester, NH 03103-7406 http://www.meggittavi.com/	PH: - (603) 669-0940 FAX: - (603) 669-0931
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Vendor:	Avidyne Corporation 55 Old Bedford Road Lincoln, MA 01773 http://www.avidyne.com/index.htm	PH - (800) 284-3963
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Instructions for Continued Airworthiness

Primary Flight Display and Magnetometer/OAT:	Document No. AVPFD-174
Multifunction Display:	Document No. AVMFD-167
Data Acquisition Unit:	Document No. AVSIU-011

(6) EMERGENCY LOCATOR TRANSMITTER:

Vendor:	Artex Aircraft Supplies 14405 Keil Road NE Aurora, Oregon 97002 http://www.artex.net/	PH: - (800) 547-8901
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(7) ENGINE:

Vendor:	Teledyne Continental Motors Attn: Aircraft Products Division Mobile, Alabama 36601	PH: - (800) 718-3411 FAX: - (251) 432-7352
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SENECA IV

Overhaul Manual =	CONTINENTAL - Form No. X-30030A
Parts Catalog =	CONTINENTAL - Form No. X-30031A
Operators Handbook =	CONTINENTAL - Form No. X-30553

SENECA V

Maintenance Manual =	CONTINENTAL - Form No. X-30645A
Overhaul Manual =	CONTINENTAL - Form No. X-30596A

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(8) FIRE EXTINGUISHER (PORTABLE):

Vendor:	H3R Inc. 43 Magnolia Ave # 4 San Francisco, California 94123-2911 http://www.h3r.com/index.htm	PH: - (800) 249-4289
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(9) FUEL CELLS:

Vendor:	Engineered Fabrics Corporation 669 Goodyear Street Rockmart, Georgia 30153-0548 http://www.kfefc.com/index.htm	PH: - (770) 684-7855 FAX: - (770) 684-7438
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(10) FUEL PUMP:

Vendor:	Weldon Pumps P.O. Box 46579 640 Golden Oak Parkway Oakwood Village, Ohio 44146 http://www.weldonpumps.com/index.html	PH: - (440) 232-2282 FAX: - (440) 232-0606
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(11) GEAR LOCKING ACTUATORS, HYDRAULIC PUMP, AND ALL HYDRAULIC COMPONENTS:

Vendor:	Parker Hannifin Corporation 6035 Parkland Boulevard Cleveland, OH 44124-4141 USA email: c-parker@parker.com	PH: - (800) C-PARKER (800) 272-7537 FAX: - (440) 266-7400
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(12) KEVLAR:

Vendor:	KEVLAR Special Products E.I. DuPont De Nemours & Co. Inc. Textile Fibers Department Centre Road Building Wilmington, Delaware 19898
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A Guide to Cutting and Machining Kevlar Aramid

(13) LIGHTS - NAVIGATION, STROBE, AND MAP LIGHTS:

Vendor:	Whelen Engineering Co. Inc. Route 145, Winthrop Rd. Chester, Connecticut 06412 http://www.whelen.com/	PH: - (860) 526-9504 FAX: - (860) 526-2009
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(14) MAGNETOS:

Vendor: TCM Aircraft Products PH: - (800) 718-3411
P. O. Box 90 FAX: - (251) 432-7352
Mobile, AL 36601
<http://www.tcmlink.com/>

Installation, Operation and Maintenance Teledyne Continental Motors (TCM)
Service Support Manual, P/N x42002

Instructions = S-20 / S-200 Series High Tension Magnetos

or,

Vendor: Slick Aircraft Products PH: - (904) 739-4000
Unison Industries FAX: - (904) 739-4006
Attn: Subscription Service
7575 Baymeadows Way
Jacksonville, FL 32256
http://www.unisonindustries.com/news/service_documents.html

Installation, Operation and Maintenance F1100 MASTER SERVICE MANUAL,
4300/6300 SERIES MAGNETO MAINTENANCE AND
Instructions: OVERHAUL MANUAL - L-1363

(15) NAVIGATION, COMMUNICATIONS, AND GPS (NAV/COM/GPS):

Vendor: Garmin International PH: - (913) 397-8200
1200 East 151ST Street
Olathe, KS 66062
<http://www.garmin.com>

(16) OXYGEN SYSTEM:

Vendor: Scott Aviation PH: - (716) 683-5100
2225 Erie Street
Lancaster, New York 14086
<http://www.scottaviation.com/>

(17) PROPELLER:

Vendor: Hartzell Propeller Inc. PH: - (937) 778-4379
One Propeller Place FAX: - (937) 778-4321
Piqua, OH 45356-2634
<http://www.hartzellprop.com/index2.htm>

Overhaul Instructions: Manual No. 117

or,

Vendor: McCauley Accessory Division
3535 McCauley Drive
P.O. Drawer 5053
Vandalia, Ohio 45377-5053

McCAULEY C500 SERIES SERVICE MANUAL - P/N 810915

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(18) STANDBY ATTITUDE INDICATOR:

Vendor Address: Mid-Continent Instruments Co., Inc. PH - (316) 630-0101
9400 E. 34 TH Street N. FAX - (316) 630-0723
Wichita, KS 67226
<http://www.mcico.com/index.html>

Installation Manual and
Operating Instructions: Manual No. 9015762

(19) STARTER:

Electro Systems, Inc.
(see "Voltage Regulator," below)

(20) VACUUM PUMP:

Vendor: Aero Accessories, Inc. PH: - (800) 822-3200
1240 Springwood Avenue
Gibsonville, NC 27249
<http://www.aeroaccessories.com/index.html>

(21) VACUUM REGULATOR:

Vendor: Parker Hannifin Corp. PH: - (800) 382-8422
Airborne Division
711 Taylor Street
Elyria, Ohio 44035
<http://www.parker.com/cleveland/Universe/book.pdf>

(22) VOLTAGE REGULATOR:

Vendor: Electro Systems, Inc. PH: - (888) 461-6077
Airport Complex
P. O. Box 273
Fort Deposit, Alabama 36032
<http://www.kellyaerospace.com/index.htm/>

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14. Chapter/Section Index Guide

NOTE: The following GAMA Specification No. 2 standard chapters are not included in this Maintenance Manual: 23, 36, 38, 49, 53, 54, 60, 72, 75, and 83. These chapters are omitted because the subject system is either: not installed in these airplanes; adequately covered in vendor or other manuals; or, for ease of use, has been combined with another chapter.

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CHAPTER

4

AIRWORTHINESS LIMITATIONS

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AIRWORTHINESS LIMITATIONS

NOTE: The Airworthiness Limitations section is FAA approved and specifies maintenance required under §§ 43.16 and 91.403 of the Federal Aviation Regulations unless an alternative program has been FAA approved.

1. Limitations

(PIR-TCDS A7SO, Rev. 16.)

NOTE: Refer to the LIMITATIONS section in the Pilot's Operating Handbook for a detailed delineation of the flight limitations of the airplane.

The following limitations related to the fatigue life of the airplane and its components have been established for the PA-34-220T Seneca IV / V airplane:

The bolt and stack-up that connect the upper drag link to the nose gear trunnion are required to be replaced every 500 hours time-in-service. The part numbers are as follows:

- A. P/N 400-274 (AN7-35) bolt or P/N 693-215 (NAS6207-50D) bolt;
- B. P/N 407-591 (AN960-716L) washer, as applicable;
- C. P/N 407-568 (AN 960-716) washer, as applicable;
- D. P/N 404-396 (AN 320-7) nut; and
- E. P/N 424-085 cotter pin.

2. Inspections

Refer to 5-20-00 for Piper's recommended Inspection Program.

3. Life Limited Parts Marking and Disposition

14 CFR Part 43.10, Disposition of Life-Limited Aircraft Parts requires that proper procedures are followed when removing life limited parts with time and/or cycles remaining on them as well as the disposition of life limited parts with no time and/or cycles left. Life limited parts defined by Type Certificate (TC) are listed in paragraph 1, above. Other parts which are replaced or rebuilt at specified intervals are listed in Chapter 5.

- A. Parts that are removed prior to accumulating their life limit, are to be marked with indelible ink or marker with the part number, serial number and accumulated life status as defined in 14 CFR Part 43.10 in a manner that does not affect part structural integrity, i.e. - no surface deformation such as vibration/etching allowed.
- B. Parts that have accumulated the life limit shall be disposed of in accordance with the applicable FARs. Piper recommends life limited parts with no time and/or cycles remaining be completely destroyed.

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CHAPTER

5

TIME LIMITS / MAINTENANCE CHECKS

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GENERAL

The New Piper Aircraft, Inc. (Piper) takes a continuing interest in having the owner get the most efficient use from his airplane, and keeping the airplane in the best mechanical condition. To that end, Piper publishes a recurring maintenance schedule which is supplemented with Service Bulletins, Service Letters and Service Spares Letters as required.

- A. The recurring maintenance schedules for the PA-34-220T Seneca IV / V are described in 5-20-00.
- B. Piper Service Bulletins are of special importance and Piper considers compliance mandatory. These are sent to the latest U.S. registered owners and Piper Service Centers.
- C. Service Letters deal with product improvements and service hints pertaining to the aircraft. They are sent to Piper Service Centers and sometimes directly to owners, so they can properly service the aircraft and keep it up to date with the latest changes. Owners should give careful attention to the service letter information.
- D. Service Spares Letters, which are sent only to Piper Service Centers, offer improved parts, kits and optional equipment which were not available originally and which may be of interest to the owner.

NOTE: Piper mails Service Bulletins, Service Letters, and P.O.H. Revisions to the registered owner's name and address as shown on the Aircraft Registration Certificate. If the aircraft is based and/or operated at a different location (or locations) and/or by a person (or persons) other than those recorded on the aircraft registration, then the registered owner(s) is responsible for forwarding these Bulletins and Letters to the operating location(s) or person(s).

Changes in aircraft registration may take a substantial amount of time to be recorded by the Federal Aviation Administration and received by Piper to change the mailing address. Owners and operators should make arrangements to keep abreast of service releases during this interim period through their Piper Service Center.

The Federal Aviation Administration (FAA) publishes Airworthiness Directives (AD's) that apply to specific aircraft. They are mandatory changes and are to be complied within a time limit set by the FAA. When an AD is issued, it is sent to the latest registered owner of the affected aircraft and also to subscribers of the service. The owner is solely responsible for being aware of and complying with airworthiness directives.

NOTE: A searchable database of AD's is available on the FAA website. See the "Airworthiness Directives" link at "www.faa.gov". Additionally, Avantext offers a free email notification service for new AD's as well as the last six weeks worth of AD's at "www.avantext.com".

An owner should periodically check with a Piper Service Center to find out the latest information to keep his aircraft up to date.

The New Piper Aircraft, Inc. has a subscription service for the Service Bulletins, Service Letters, and Service Spares Letters. This service is offered to interested persons such as owners, pilots, and mechanics at a nominal fee and may be obtained through Piper Service Centers. Owners residing outside of the United States are urged to subscribe to this service since Piper cannot otherwise obtain the addresses of foreign owners. Maintenance Manuals and Illustrated Parts Catalogs are also available through Piper Service Centers and Dealers world wide.

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TIME LIMITS

1. Refer to 4-00-00 for the FAA-approved airworthiness limitations section. It sets forth each mandatory replacement time, structural inspection interval, and related structural inspection procedure required for type certification.
2. Refer to 5-20-00 for Piper's recommended Inspection Programs. They include the frequency and extent of the inspections required for the continued airworthiness of these airplanes.
3. Inspections required by Flight Hour or Calendar Year, if due, are included as part of the Annual / 100 Hour Inspection and/or the Progressive Inspection Event cycles, and are listed individually in 5-30-00.

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SCHEDULED MAINTENANCE

This section provides instructions for conducting inspections. Repair or replacement instructions for those components found to be unserviceable during inspections will be found in the applicable airplane system chapter. (See Chapter/Section Index Guide, Introduction.)

WARNING: GROUND THE MAGNETO PRIMARY CIRCUIT (P LEAD), BEFORE PERFORMING ANY MAINTENANCE OPERATION ON THE ENGINE.

1. Description

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

The recurring maintenance schedule for the PA-34-220T Seneca IV / V is provided herein as an Annual / 100 Hour Inspection. A Progressive Inspection Program will be available from Piper Dealers in a separate manual form.

Piper inspection programs comply with the F.A.A. Federal Aviation Regulations Parts 43, 91 and 135. The owner/operator is primarily responsible for maintaining the airplane in an airworthy condition, including compliance with all applicable Airworthiness Directives and conformity with the requirements in FAR 91.409, 91.411 and 91.413.

The first overhaul or replacement of components should be performed at the given periods. The condition of various components can then be used as criteria for determining subsequent periods applicable to the individual airplane, depending on usage, providing the owner/operator has an established Part 91 Progressive Inspection Program (see 91.409(d)) or Part 135 Approved Aircraft Inspection Program (see 135.419).

The time periods given for inspections of various components are based on average usage and environmental conditions.

NOTE: The listed inspection, overhaul and replacement schedules do not guarantee that a particular item or component will reach the listed time without malfunction. Unique operating conditions encountered by individual airplanes cannot be controlled by the manufacturer.

2. Definitions

- A. Inspections - Must be performed only by Certified Mechanics who are qualified on these aircraft, using acceptable methods, techniques and practices to determine physical condition and detect defects.
 - (1) Routine Inspection - Consists of a visual examination or check of the aircraft and its components and systems without disassembly.
 - (2) Detailed Inspection - Consists of a thorough examination of the aircraft, appliance, component, or system; with disassembly as necessary to determine condition.
 - (3) Special Inspection - Involves those components, systems or structure which by their application or intended use require an inspection peculiar to, more extensive in scope or at a time period other than that which is normally accomplished during an event or annual inspection.
- B. Checks - Can be performed by pilots and/or mechanics who are qualified on this aircraft and consists of examinations in the form of comparisons with stated standards for the purpose of verifying condition, accuracy and tolerances.

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- C. Approved Inspection - Means a continuing airworthiness inspection of an airplane and its various component and systems at scheduled interval in accordance with procedures approved by the FAA under FAR Part 91.409(d) or Part 135.419.
- D. Tests - Operation of aircraft components, appliances or systems to evaluate functional performance.
- (1) Operational Test - A task to determine that an item is fulfilling its intended purpose. The task does not require quantitative tolerances. This is a fault finding task.
 - (2) Functional Test - A quantitative check to determine if one or more functions of an item performs within specified limits. This test may require the use of supplemental bench test equipment.
 - (3) In addition, each of the above tests must be performed by an FAA Certified Repair Station with appropriate ratings or by a Certified Mechanic who is qualified on this aircraft. The recording of the above function must be made in the permanent aircraft records by the authorized individual performing the test.
- E. Bench Test - Means removal of component from the aircraft to inspect for cleanliness, impending failure, need for lubrication, repair or replacement of parts and calibration to at least the manufacturers specifications using the manufacturers recommended test equipment or standards or the equivalent.
- Each bench test will be performed by a Piper Service Center, FAA Certified Repair Station with appropriate rating or by a certified mechanic. This test will be performed at the scheduled interval regardless of any bench test performed on a particular component while being repaired/overhauled before scheduled interval bench test. After the component is installed into the aircraft, an operational test of the component and its related system should be performed to ensure proper function. Serviceable parts that were issued to the component will be filed in the aircraft permanent records. The person performing the check must make appropriate entries in the aircraft's permanent maintenance record.
- F. Maintenance - The word maintenance as defined by FAR Part 1, means "inspection, overhaul, repair, preservation and the replacement of parts, but excludes preventive maintenance."
- G. On Condition Maintenance - A primary maintenance process having repetitive inspections or tests to determine the condition of units, systems, or portions of structure with regard to continued serviceability (corrective action is taken when required by item condition.)
- H. Time - as used in this manual.
- (1) Time-in-service for aircraft components, unless otherwise specified, is a cumulative total of flight hours or calendar time calculated from the time a new or overhauled component was first installed in any aircraft, and including:
 - (a) the aircraft time that elapses from the initial installation to the first removal, if any; and,
 - (b) the aircraft time that elapses from each subsequent installation to each subsequent removal, if any; or,
 - (c) the calendar time elapsed since the installation.
- NOTE:** Dates stamped on individual components at the time of manufacture are typically applied to determine shelf life - i.e. the maximum time allowed from manufacture/assembly/cure until actually installed in an aircraft and are not relevant.
- Do not, however; ignore markings applied to life-limited parts when removed with time and/or cycles remaining on them.
- (2) Aircraft time, flight hours, or aircraft hours are the "Hobbs Time" shown on, or calculated from, the installed "Hour Meter."

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3. Inspection Requirements

WARNING: INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA) FOR ALL NON-PIPER APPROVED STC INSTALLATIONS ARE NOT INCLUDED IN THIS MANUAL. 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 ICA 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, THE PIPER PROVIDED ICA MAY NOT BE VALID FOR AIRPLANES SO MODIFIED.

A. Annual / 100 Hour Inspection. (See paragraph 4.)

Owners/operators may maintain the airplane solely under FAR 91.409 (a) and (b) inspection requirements. The 100 hour inspection cycle is a complete inspection of the airplane and is identical in scope to an annual inspection. Inspections must be accomplished by persons authorized by the FAA.

B. Progressive Inspection.

The Progressive Inspection program is designed to permit the best utilization of the aircraft through the use of a planned inspection schedule. This schedule is prepared in a manual form, which will be available from Piper Dealers:

P/N 767-006, Progressive Inspection Manual (50 Hour).

Refer to Piper's Customer Service Information Aerofiche P/N 1753-755 for a checklist to ensure obtaining latest issue.

NOTE: The 50 Hour Progressive Inspection Manual (P/N 767-006) referenced above will not be a stand-alone document. It will constitute a snapshot of the Airworthiness Limitations and Inspection sections of the Instructions for Continued Airworthiness (ICA) and will be current only at the time of printing. Use it as follows:

- (1) Owners/operators desiring to establish a Part 91 Progressive Inspection Program (PIP) (see 91.409(d)) or a Part 135 Approved Aircraft Inspection Program (AAIP) (see 135.419) should use the appropriate Progressive Inspection Manual as a template for submission to their regional FAA office.
- (2) Service centers conducting Event Cycle inspections under a FAA-approved PIP or AAIP can use the appropriate Progressive Inspection Manual as a working check-off list/form, provided they verify its currency against the FAA-approved PIP or AAIP.

C. Overlimits Inspection.

If the airplane has been operated so that any of its components have exceeded their maximum operational limits, special inspections may be required by Piper and/or the component manufacturer. See 5-50-00 and applicable vendor publications.

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4. Annual / 100 Hour Inspection Procedure

A. Scheduled Maintenance (i.e. - paragraph 5.)

- (1) The required periodic inspection procedure is listed in paragraph 5. This inspection procedure is broken down into major groups which include Propeller, Engine, Cabin and Cockpit, Fuselage and Empennage, Wing, Landing Gear, Special Inspection, Operational Inspection and General. The first column in each group lists the inspection or procedure to be performed. The second column is divided into two sub-columns indicating the required inspection interval of 50 hours or 100 hours. Each inspection or operation is required at each of the inspection intervals indicated by a circle (O). When vendor publications specify times other than those designated in the the various columns, it will be indicated as:

As required by “applicable vendor publication”	or	See Note “X”
--	----	--------------

in the inspection interval columns, or listed as a special inspection in 5-30-00, or both.

- (2) Refer to the applicable chapter of this manual for instructions on how to gain access to remove any item that must be removed and is not completely accessible.
- (3) Inspection Report Forms.

To help in the performance of periodic inspections, Inspection Report forms are available through Piper Dealers:

P/N 767-012, Inspection Report, for the [Seneca IV \(S/N's 3447001 thru 3447029\)](#) and [Seneca V \(S/N's 3449001 and up\)](#).

NOTE: Service centers conducting Part 91 Annual / 100 Hour Inspections can use the Inspection Report Form (P/N 767-012), as a working check-off list, provided they verify its currency against an up-to-date copy of the ICA (i.e. - this Maintenance Manual, see 4-00-00 and 5-20-00).

- (4) In addition to inspection intervals required in scheduled maintenance (i.e. - paragraph 5), preflight inspection must also be performed.
- (5) References to maintenance manual applicable areas are per the “chapter - system/sub-system” assignment of subject material numbering system.

B. Special Inspections (see 5-30-00.)

C. Unscheduled Maintenance (see 5-50-00.)

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5. Scheduled Maintenance

Refer to Notes 1, 2, 3, and 4 before performing the following inspections.

NATURE OF INSPECTION	Inspection Interval (Hrs)			
	L	R	50	100
A. PROPELLER GROUP				
<u>WARNING:</u> USE EXTREME CAUTION WHEN ROTATING PROPELLER BY HAND; PROPELLER MAY KICK BACK. PRIOR TO ROTATING PROPELLER, ENSURE BOTH MAGNETO SWITCHES ARE OFF (GROUNDED). IF MAGNETOS ARE NOT GROUNDED, TURNING PROPELLER MAY START ENGINE.				
1. Inspect spinner and back plate for cracks	O	O	O	O
2. Inspect blades for nicks and cracks	O	O	O	O
3. Inspect for grease and oil leaks	O	O	O	O
4. Lubricate propeller (Hartzell) per Lubrication Chart, 12-20-00	O	O		O
5. Inspect spinner mounting brackets for cracks	O	O		O
6. Inspect propeller mounting bolts and safety (check torque if safety is broken)	O	O		O
7. Inspect hub parts for cracks and corrosion	O	O		O
8. Rotate blades of constant speed propeller and check for tightness in hub pilot tube	O	O		O
9. Inspect complete propeller and spinner assembly for security, chafing, cracks, deterioration, wear, and correct installation. (See Note 30.)	O	O		O
10. Check propeller (Hartzell) air pressure (at least once a month)	O	O	O	O
11. Inspect propeller deicers (if installed) for nicks, tears, or delamination from propeller	O	O	O	O
12. Inspect propeller deicer slip ring and brush block (if installed) for condition and security. Replace as required	O	O	O	O
13. Inspect propeller deice wiring and junction blocks (if installed) for security, cracks, chafing and damage	O	O	O	O
B. ENGINE GROUP				
<u>WARNING:</u> GROUND MAGNETO PRIMARY CIRCUIT BEFORE WORKING ON ENGINE.				
<u>NOTE:</u> Read Notes 5 and 6 prior to completing this group.				
1. Remove engine and nacelle cowlings	O	O	O	O
2. Clean and inspect cowling for cracks, distortion, and loose or missing fasteners	O	O	O	O
3. Compression check while engine is warm. (Refer to Teledyne Continental Motors Service Bulletin M84-15, latest revision.)	O	O		O
4. Drain oil sump while engine is warm	O	O	O	O
5. Change full flow (spin-on type) oil filter element (inspect element for foreign particles), check oil level after installing new filter	O	O	O	O

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5. Scheduled Maintenance (continued)

NATURE OF INSPECTION	Inspection Interval (Hrs)			
	L	R	50	100
B. ENGINE GROUP (CONTINUED)				
6. Inspect oil temperature sender unit for leaks and security	O	O		O
7. Inspect oil lines and fittings for leaks, security, chafing, dents, and cracks. (See Note 17.)	O	O	O	O
8. Clean and inspect oil radiator cooling fins	O	O		O
CAUTION: USE CAUTION NOT TO CONTAMINATE VACUUM PUMP WITH CLEANING FLUID.				
9. Clean engine	O	O	O	O
10. Inspect condition of spark plug. Clean and adjust gap as required. (See Note 7.)	O	O		O
11. Inspect ignition harness and insulators for high tension leakage and continuity. (See Notes 7 and 11.)	O	O	O	O
12. Check magneto points for proper clearance (maintain clearance as specified by manufacturer. - See Notes 11 and 56.)	O	O		O
13. Inspect magneto for oil seal leakage	O	O		O
14. Inspect breaker felts for proper lubrication. (Bendix magnetos only.)	O	O		O
15. Check magnetos to engine timing	O	O		O
16. Remove induction air filter and tap gently to remove dirt particles. Replace as required. (See Note 26.)	O	O	O	O
17. (Seneca V only) Remove and clean injector fuel inlet strainer. Replace strainer O-rings, if damaged. (See Note 15.)	O	O	O	O
18. (Seneca V only) Inspect fuel injector servo linkages for adjustment and security. (See Note 40.)	O	O	O	O
19. Clean injector nozzles as required. (Clean with acetone only.)	O	O	O	O
20. Inspect induction air box valve and inspect for excessive wear or cracks, replace defective parts	O	O		O
21. Inspect fuel injector attachments for loose hardware	O	O		O
22. Inspect intake seals for leaks and clamps for tightness. (See Note 39.)	O	O		O
23. Inspect all air inlet duct hoses (replace as required)	O	O		O
24. Inspect condition of flexible fuel lines. (See Note 17.)	O	O		O
25. Inspect fuel system for leaks	O	O		O
26. Inspect condition and operation of fuel pumps (engine driven and electric)	O	O		O
27. Inspect pneumatic pumps and lines. (See Note 28.)	O	O		O
28. Change vacuum regulator filter	O	O		O
29. Inspect throttle, alternate air, mixture, and propeller governor controls for security, travel, and operating condition. (See Note 40.)	O	O		O
30. Inspect exhaust stacks, connections, and gaskets (replace gaskets as required)	O	O	O	O
31. Inspect breather tubes for obstructions and security. (See Note 46.)	O	O		O
32. (Seneca V only) Inspect air/oil separator for adjustment, leakage, and security	O	O	O	O

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NATURE OF INSPECTION	Inspection Interval (Hrs)			
	L	R	50	100
B. ENGINE GROUP (CONTINUED)				
33. Inspect crankcase for cracks, leaks, and security of seam bolts	O	O		O
34. Inspect engine mounts for cracks and loose mountings	O	O		O
35. Inspect rubber engine mount bushings for deterioration (replace as required)	O	O		O
36. Inspect all engine baffles	O	O		O
37. Inspect firewall seals	O	O		O
38. Inspect condition of alternator and starter	O	O		O
39. Inspect all lines, air ducts, electrical leads, and engine attachments for security, proper routing, chafing, cracks, deterioration, and correct installation. (See Notes 25 and 39.)	O	O	O	O
40. Inspect condition/tension of compressor & alternator belts	O	O		O
41. Inspect security of compressor mounting	O	O		O
42. Inspect compressor clutch security and condition of wiring	O	O		O
43. Inspect compressor and freon lines for condition and security	O	O		O
44. Lubricate per Lubrication Chart,(12-20-00)	O	O		O
C. TURBOCHARGER GROUP				
1. Inspect all air inlet ducting and compressor discharge ducting for worn spots, loose clamps, or leaks	O	O	O	O
2. Inspect engine air inlet assembly for cracks, loose clamps, and screws. (See Note 21.).....	O	O	O	O
3. Inspect exhaust ducting and exhaust stacks for signs of leaks or cracks. Check all clamps for tightness	O	O	O	O
4. Inspect turbocharger rotor for excessive play, vane damage, carbon and dirt deposits	O	O		O
5. Inspect all turbo support brackets, struts for breakage, sagging or wear	O	O	O	O
6. Inspect all oil lines and fittings for wear, leakage, heat damage or fatigue	O	O	O	O
7. Inspect bypass valve for security and safety	O	O	O	O
8. Install engine cowling	O	O	O	O
9. Run up engines, check all instruments for smooth, steady response	O	O	O	O

**THE NEW PIPER AIRCRAFT, INC.
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MAINTENANCE MANUAL**

5. Scheduled Maintenance (continued)

NATURE OF INSPECTION	Inspection Interval (Hrs)	
	50	100
D. CABIN AND COCKPIT GROUP		
1. Inspect cabin entrance doors, cargo, and baggage doors for damage and operation. Check condition and security of locks, latches and hinges (See Note 45.)		O
2. Inspect upholstery for tears		O
3. Inspect seats, seat belts, shoulder harnesses, security brackets and bolts. (See Note 23 and Restraint System Inspection, 25-10-00.)		O
4. Inspect trim operation		O
5. Inspect operation and condition of rudder pedals		O
6. Inspect parking brake valve and toe brakes for operation and cylinder leaks		O
7. Inspect control wheels, column, pulleys, bobweight, and cables. (See Notes 14, 19, and 50.)		O
8. Inspect condition and security of electrical leads and installations. (See Note 25.)		O
9. Check landing, navigation, cabin and instrument lights		O
10. Inspect instruments, lines and attachments. (See Notes 29, 31, 35, 36, 41, 44, 48, and 59.)		O
11. Inspect gyro operated instruments and electric turn and bank. (Overhaul or replace as required.)		O
12. Replace filters on gyro horizon and directional gyro. (See Note 32.)		O
13. Inspect pitot-static system. Perform system test as required. (See Note 16.)		O
14. Inspect altimeter and transponder for installation/certification per latest revision of AC43.13-1 and tested/inspected per FAR's 91.411 and 91.413, respectively		O
15. Inspect and test ELT per FAR 91.207. (See Testing ELT, 25-60-00.)		O
16. Inspect operation of fuel selector valves. (See Note 22.)		O
17. Inspect operation of fuel drains		O
18. Inspect condition of heater controls and ducts.		O
19. Inspect condition and operation of air ducts		O
20. Inspect condition of air conditioning ducts		O
21. Remove and clean air conditioning evaporator filter		O
22. If installed, inspect portable fire extinguisher minimum weight as specified on nameplate		O
E. FUSELAGE AND EMPENNAGE GROUP		
1. Remove inspection plates and panels		O
2. Inspect battery, box and cables. Flush box as required and fill battery per instructions on box	O	O
3. Inspect cabin heater. (See Note 43, 54, and AD 2004-21-05.)		O
4. Inspect fuel regulator and shutoff valve for leakage. (See Fuel Regulator and Shutoff Valve, 100 Hour Inspection, 21-40-00.)		O
5. Inspect electrical and electronic installations for security. (See Note 20.)		O
6. Inspect skins, bulkheads, frames, stringers, and longerons for damage. (See Note 51.)		O
7. Inspect antenna mounts for electric wiring security and condition		O
8. Check hydraulic pump fluid level. (Fill as required.)	O	O
9. Inspect hydraulic pump lines for damage and leaks.....		O

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NATURE OF INSPECTION	Inspection Interval (Hrs)	
	50	100
E. FUSELAGE AND EMPENNAGE GROUP (CONTINUED)		
10. Check air conditioning system for refrigerant leaks. (See Note 12.).....		O
11. Check refrigerant level in sight gauge of receiver-dehydrator. (See Note 12 and 21-50-00.).....	O	O
12. Inspect fuel lines, valves and gauges for damage and operation		O
13. Inspect security of all lines		O
14. Inspect vertical fin and rudder surfaces for damage or irregularities (i.e. - skin cracks, distortion, dents, corrosion, and excessive paint build up); structural defects (i.e. - loose or missing rivets); misrigging or structural imbalance; hinge damage, excessive wear, freedom of movement and proper lubrication; and attachment points for missing or worn hardware. (See Note 47.)		O
15. Inspect vertical stabilizer forward spar attachment steel bracket for corrosion; clean and prime with Dinitrol AV8, if required		O
16. Inspect rudder hinges, horn and attachments for damage and operation		O
17. Inspect ELT battery for condition/date per FAR 91.207		O
18. Inspect ELT installation and antenna for condition and security. Replace antenna if bent or damaged		O
19. Inspect rudder, tab hinge bolts for excess wear and free play. Replace as required. (See Notes 8 and 14.)		O
20. Inspect rudder trim mechanism. (See Note 8.)		O
21. Inspect stabilator surface for damage or irregularities (i.e. - skin cracks, distortion, dents, corrosion, and excessive paint build up); structural defects (i.e. - loose or missing rivets); misrigging or structural imbalance; hinge damage, excessive wear, freedom of movement and proper lubrication; and attachment points for missing or worn hardware		O
22. Inspect stabilator, tab hinges, horn and attachments for damage and operation. (See Note 49.)		O
23. Inspect stabilator attachments		O
24. Inspect stabilator and tab hinges, bolts and bearings for excess wear. (Replace as required.)		O
25. Inspect condition and operation of stabilator trim mechanism. (See Notes 18, and 38.)		O
26. Inspect wing rear attach fittings for corrosion, general condition and security. (See Aft Wing Attach Fittings 100 Hour Inspection, 57-40-00.).....		O
27. Check all cable tensions. (Use tensiometer - See Note 9.)		O
28. Inspect aileron, rudder, stabilator, stabilator trim cables, terminals, turnbuckles, guides, fittings, and pulleys for safety, condition, and operation. (See Note 14.) ...		O
29. Inspect all control cables, air ducts, electrical leads, harnesses, and attaching parts for security, routing, chafing, deterioration, wear and correct installation. (See Note 14.) (Perform 100 Hour Inspection, 51-80-00.)		O
30. Lubricate per Lubrication Chart, (12-20-00)	O	O
31. Inspect strobe lights for security and operation		O
32. Inspect security of autopilot bridle cable clamps. (See Note 14.)		O
33. If installed, inspect deice system (i.e. - pneumatic valves and lines, electrical switches, wiring and components) for condition and security. (See Notes 33 and 37.)		O
34. Reinstall inspection plates and panels		O

**THE NEW PIPER AIRCRAFT, INC.
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MAINTENANCE MANUAL**

5. Scheduled Maintenance (continued)

NATURE OF INSPECTION	Inspection Interval (Hrs)	
	50	100
F. WING GROUP		
1. Remove inspection plates and fairings		O
2. Inspect wing surfaces and tips for damage, loose rivets, and condition of walkway		O
3. Inspect ailerons for surface damage or irregularities (i.e. - skin cracks, distortion, dents, corrosion, and excessive paint build up); structural defects (i.e. - loose or missing rivets); misrigging or structural imbalance; hinge damage, excessive wear, freedom of movement and proper lubrication; and attachment points for missing or worn hardware		O
4. Inspect aileron cables, terminals, turnbuckles, fittings, guides, pulleys, and bellcranks for safety, condition, and operation. (See Note 14.)		O
5. Inspect flaps for surface damage or irregularities (i.e. - skin cracks, distortion, dents, corrosion, and excessive paint build up); structural defects (i.e. - loose or missing rivets); misrigging or structural imbalance; hinge damage, excessive wear, freedom of movement and proper lubrication; and attachment points for missing or worn hardware		O
6. Inspect condition of bolts used with hinges (replace as required)		O
7. Lubricate per Lubrication Chart, 12-20-00	O	O
8. Inspect wing attachment bolts, nuts, and brackets for security and condition (See Notes 57 and 58.)		O
9. Retorque wing aft spar-to-fuselage attach bolt per 57-40-00, Figure 1, Sketch B (See Note 57.)		O
10. Inspect all control cables, electrical leads, air ducts, lines, and attaching parts for security, routing, chafing, deterioration, wear, and correct installation. (See Note 14.)		O
11. Inspect air conditioner condenser air scoop rigging	O	O
12. If installed, inspect deice system pneumatic valves and lines for condition and security. (See Note 34.)		O
13. Inspect fuel tanks and lines for leaks and water		O
14. Remove, drain, and clean fuel filter bowls and screens	O	O
15. Fuel tanks marked for minimum octane rating		O
16. Inspect fuel tank vents. (See Note 17.)		O
17. Reinstall inspection plates and fairings		O

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NATURE OF INSPECTION

**Inspection
Interval (Hrs)**
50 100

G. LANDING GEAR GROUP

NOTE: The following inspections incorporate the requirements of Piper Service Bulletin (PSB) No. 1123B. Any later revisions to PSB No. 1123 must be complied with separately. See also AD 93-24-14.

- | | | |
|--|---|---|
| 1. Check oleo struts for proper extension and evidence of fluid leakage and scoring. (See Landing Gear, 12-10-00.) | O | O |
| 2. Inspect wheel alignment, if required | | O |
| 3. Put airplane on jacks. (See 7-10-00.) | | O |
| 4. Inspect tires for cuts, uneven or excessive wear and slippage | | O |
| 5. Remove wheels, clean, check and repack bearings | | O |
| 6. Inspect wheels for cracks, corrosion and broken bolts | | O |
| 7. Check tire pressure. (See Tires, 12-10-00, and Chart 1, 6-00-00.) | O | O |
| 8. Inspect brake lining and disc. (See 32-40-00.) | | O |
| 9. Inspect brake backing plates | | O |
| 10. Inspect brake lines and retaining clamps | | O |
| 11. Inspect condition of nose gear centering spring and bungees. (See Note 13.) | | O |
| 12. Inspect gear forks for damage | | O |
| 13. Inspect nose and main gear actuators. (See Notes 27, 53 and 55.) | | O |
| 14. Inspect main gear trunnion pin. Replace if necessary | | O |
| 15. Inspect hydraulic lines, electrical leads, and attaching parts for condition and security (i.e. - routing, chafing, damage, wear, etc.) | | O |
| 16. Inspect drag and side brace link bolts. (Replace as required.) | | O |
| 17. Inspect gear doors and attachments for condition and security | | O |
| 18. Inspect gear warning horn and light for operation | | O |
| 19. Retract gear - check operation. Observe nose gear tiller roller as it moves from/to the steering arm channel to the tiller track and up and down the tiller track..... | | O |
| 20. Retract gear - inspect doors for clearance and operation | | O |
| 21. Inspect operation of squat switch | | O |
| 22. Inspect down lock switches, up switches, and electrical leads for security | | O |
| 23. Check nose gear down lock compression spring | | O |
| 24. Inspect down locks for operation and adjustment | | O |

NOTE: In the following inspections, refer to Nose Landing Gear; Cleaning, Inspection, and Repair; 32-20-00.

- | | | |
|---|--|---|
| 25. Inspect nose gear steering control and travel. See Nose Landing Gear, Alignment, 32-20-00..... | | O |
| 26. Inspect nose and main gear struts, attachments, torque links, retraction links, bolts, and bushings for condition and security | | O |
| 27. Inspect nose gear upper drag link AN7-35 attach bolt or the alternate NAS6207-50D bolt per Nose Landing Gear, 100 Hour Upper Drag Link Attach Bolt Inspection, 32-20-00 | | O |
| 28. Inspect the nose gear retraction link retention spring (P/N 96178-0) for damage, distortion, or corrosion | | O |

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5. Scheduled Maintenance (continued)

NATURE OF INSPECTION		Inspection Interval (Hrs)	
		50	100
G. LANDING GEAR GROUP (CONTINUED)			
29. Remove triangular shaped, nose gear strut servicing access panel located in the forward baggage compartment.			
a. Inspect nose tiller roller, steering arm channel and tiller track for condition ..			O
b. Examine the tiller, tiller roller, and steering arm channel, turn-stop bosses for damage caused by exceeding nose wheel turn limits when towing with power equipment			O
c. Inspect the AN4-10A bolts attaching the P/N 95393-00 arm to the steering channel for proper torque (50-70 in. lbs). If found loose, replace bolts and re-torque			O
30. Inspect the nose gear drag link center pivot and attachment bolts for condition and security. (Replace as required.)			O
31. Inspect the nose gear down lock link assembly for binding, worn spring retention pin, and any noticeable elongation of the hole associated with the spring retention pin. Inspect the down lock spring for damage, distortion, or corrosion. Clean and lubricate using MIL-PRF-7870C oil. (See Note 42.)			O
32. Inspect the actuator mounting bracket per Nose Landing Gear, 100 Hour Actuator Mounting Bracket Inspection, 32-20-00			O
33. Inspect the bolt and bushing associated with the attachment of the P/N 95712-00 or -04 retraction link assembly to the actuator mounting bracket. Replace if "wear grooves" are noted in either the bolt or bushing			O
34. Inspect the AN23-25 stop bolt in the actuator mounting bracket for condition and security			O
35. Lubricate per Lubrication Chart, 12-20-00	O		O
36. Verify proper adjustment of nose gear down lock link by rigging per Nose Landing Gear, Installation and Rigging, 32-20-00			O
37. Inspect the Tunnel Bracket (P/N 95554-000) installation per Nose Landing Gear, 100 Hour Tunnel Bracket Installation Inspection, 32-20-00	O		
<u>WARNING:</u> DO NOT REMOVE JACKS UNTIL IT HAS BEEN DETERMINED THAT THE LANDING GEAR IS DOWN AND LOCKED.			
38. Remove airplane from jacks			O
H. SPECIAL INSPECTION			
See 5-30-00.			

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NATURE OF INSPECTION

**Inspection
Interval (Hrs)**
50 100

I. OPERATIONAL INSPECTION

NOTE: Refer to Note 10 prior to making operational checks.

1. Check fuel pump and fuel tank selector	<input type="radio"/>	<input type="radio"/>
2. Check fuel quantity, pressure and flow readings	<input type="radio"/>	<input type="radio"/>
3. Check oil pressure and temperature	<input type="radio"/>	<input type="radio"/>
4. Check alternator output	<input type="radio"/>	<input type="radio"/>
5. Check manifold pressure	<input type="radio"/>	<input type="radio"/>
6. Check carburetor air	<input type="radio"/>	<input type="radio"/>
7. Check parking brake	<input type="radio"/>	<input type="radio"/>
8. Check vacuum gauge	<input type="radio"/>	<input type="radio"/>
9. Check gyros for noise and roughness	<input type="radio"/>	<input type="radio"/>
10. Check cabin heater operation	<input type="radio"/>	<input type="radio"/>
11. Check magneto switch operation	<input type="radio"/>	<input type="radio"/>
12. Check magneto RPM variation	<input type="radio"/>	<input type="radio"/>
13. Check throttle and mixture operation	<input type="radio"/>	<input type="radio"/>
14. Check propeller smoothness	<input type="radio"/>	<input type="radio"/>
15. Check propeller governor action	<input type="radio"/>	<input type="radio"/>
16. Check engine idle	<input type="radio"/>	<input type="radio"/>
17. Check electronic equipment operation. (See 25-60-00 for ELT check.)	<input type="radio"/>	<input type="radio"/>
18. Check air conditioner compressor clutch operation	<input type="radio"/>	<input type="radio"/>
19. Check air conditioner compressor scoop operation	<input type="radio"/>	<input type="radio"/>
20. Check operation of flight controls, flaps, and flap indicator	<input type="radio"/>	<input type="radio"/>
21. Check operation of autopilot, including pitch trim and manual electric trim. (Refer to Pilot's Operating Handbook for preflight and flight checks.)	<input type="radio"/>	<input type="radio"/>

J. GENERAL

1. Aircraft conforms to FAA specification (See Note 52 and 56.)	<input type="radio"/>	<input type="radio"/>
2. All FAA Airworthiness Directives complied with	<input type="radio"/>	<input type="radio"/>
3. All Manufacturers' Service Letters and Bulletins complied with	<input type="radio"/>	<input type="radio"/>
4. Check for proper Pilot's Operating Handbook	<input type="radio"/>	<input type="radio"/>
5. Aircraft papers in proper order	<input type="radio"/>	<input type="radio"/>

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5. Scheduled Maintenance (continued)

K. NOTES

1. Refer to Piper's Customer Service Information Aerofiche P/N 1753-755 for latest revision dates to Piper Inspection Reports/Manuals and this maintenance manual. References to Chapter/Section are to the appropriate Chapter/Section in this manual.

WARNING: INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA) FOR ALL NON-PIPER APPROVED STC INSTALLATIONS ARE NOT INCLUDED IN THIS MANUAL. 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 ICA 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, THE PIPER PROVIDED ICA MAY NOT BE VALID FOR AIRPLANES SO MODIFIED.

2. Inspections or operations are to be performed as indicated by a "O" at the 50 or 100 hour inspection interval. Inspections or operations (i.e. - component overhauls/replacements, etc.) required outside the 100 hour cycle are listed as special inspections in section 5-30-00. Inspections must be accomplished by persons authorized by the FAA.
 - (a) The 50 hour inspection accomplishes preventive maintenance, lubrication and servicing as well as inspecting critical components.
 - (b) The 100 hour inspection is a complete inspection of the airplane, identical to an annual inspection.

NOTE: A log book entry should be made upon completion of any inspections.

3. Piper Service Bulletins are of special importance and Piper considers compliance mandatory. In all cases, see Service Bulletin/Service Letter Index P/N 762-332 or Service Bulletin/Service Letter Aerofiche Set P/N 1762-331 to verify latest revision.
4. Piper Service Letters are product improvements and service hints pertaining to servicing the airplane and should be given careful attention.
5. Inspections given for the power plant are based on the engine manufacturer's operator's/maintenance manual ([Seneca IV](#) - X30553 or [Seneca V](#) - X30645A) for this airplane. Any changes issued to the engine manufacturer's operator's manual shall supersede or supplement the inspections outlined in this report.
6. Refer to latest revision of TCM Service Bulletins M86-6, MSB94-8A, MSB96-10, SB-96-11, and SB97-6.
7. For high altitude operations (12,000 feet and up), more frequent ignition system maintenance is required.
8. Refer to 55-20-00, for allowable rudder tab and trim free play.
9. Maintenance cable tensions specified in Chapter 27.
10. Refer to Pilot's Operating Handbook for preflight and flight check, and for intended function in all modes.

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K. NOTES (CONTINUED)

11. Slick only: Use "E" gap method. Bendix only: Refer to latest revision of Bendix Service Bulletin 612 for inspection of Bendix magnetos and ignition harness.
12. Compressor oil level need not be checked unless a refrigerant leak has developed and recharging is required.

CAUTION: ENVIRONMENTAL REGULATIONS MAY REQUIRE SPECIAL EQUIPMENT AND PROCEDURES BE UTILIZED WHEN CHARGING AIR CONDITIONING SYSTEM.

13. Ensure that the nose gear centering spring is secure and correctly installed, with the bolt head down, and washer installed properly as shown in 32-20-00.
14. Examine cables for broken strands by wiping them with a cloth for their entire length. Visually inspect the cable thoroughly for damage not detected by the cloth. Replace any damaged or frayed cables.
 - (a) See Control Cable Inspection, 27-00-00, or the latest edition of FAA AC 43.13-1.
 - (b) At fifteen (15) years time-in-service, begin Cable Fittings, 100 Hour Special Inspection, 27-00-00.
15. Remove and clean the injector fuel inlet strainer at the first 25 hour inspection and each 50 hour inspection thereafter. Damaged strainer O-rings should be replaced.
16. Refer to latest revision of applicable FAR for current requirements.
17. Flexible hose replacement times are in-service times. In-service must be determined by (1) the date the aircraft was licensed, if new or (2) the date entered in the logbook for the replacement hose placed in service. Do not use the date stamped on the hose, as time may be included for shelf life, and not in-service use.
18. In [Seneca IV S/N's 3447001 thru 3447008 only](#), verify compliance with Piper Service Bulletin No. 989.
19. In [Seneca IV S/N's 3447001 thru 3447008 only](#), if currently or previously equipped with pneumatic deice, verify compliance with Piper Service Bulletin No. 988.
20. In [Seneca IV S/N's 3447001 thru 3447029](#) and [Seneca V S/N's 3449002 thru 3449034 only](#), verify compliance with Piper Service Bulletin No. 1014.
21. In [Seneca V S/N's 3449001 thru 3449008 only](#), verify compliance with Piper Service Bulletin No. 1005.
22. Check fuel lever detents. Special care should be taken to inspect the tie strap spacer at the fuel selector levers. Remove cover, as required. Fuel selector levers are held in detent position by the cable tie strap spacer holding the two cable assemblies together. In [Seneca V S/N's 3449001 thru 3449019 only](#), verify compliance with Piper Service Bulletin No. 1010.
23. In [Seneca IV S/N's 3447001 thru 3447008 only](#), verify compliance with Piper Service Bulletin No. 990.
24. In [Seneca IV S/N's 3447001 thru 3447029](#) and [Seneca V S/N's 3449002 thru 3449059 only](#), verify compliance with Piper Service Bulletin No. 1020.
25. In [Seneca IV S/N's 3447001 thru 3447029](#) and [Seneca V S/N's 3449002 thru 3449034 only](#), verify compliance with Piper Service Bulletin No. 1017.

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5. Scheduled Maintenance (continued)

K. NOTES (CONTINUED)

26. In [Seneca IV S/N's 3447001 thru 3447029](#) and [Seneca V S/N's 3449002 thru 3449078 only](#), verify compliance with Piper Service Bulletin No. 1022.
27. In [Seneca IV S/N's 3447001 thru 3447029](#) and [Seneca V S/N's 3449002 thru 3449063 and 3449066 only](#), verify compliance with Piper Service Bulletin No. 1023.
28. In [Seneca IV S/N's 3447001 thru 3447029 only](#), verify compliance with Piper Service Bulletin No. 1026.
29. In [Seneca V S/N's 3449001 thru 3449074 only](#), verify compliance with Piper Service Bulletin No. 1031.
30. In [Seneca V S/N's 3449001 thru 3449262 only](#), verify compliance with McCauley Service Letter No. 2002-24. See Piper Vendor Service Publication No. 145.
31. In [Seneca V S/N's 3449001 thru 3449143 only](#), verify compliance with Piper Service Bulletin No. 1039.
32. In [Seneca IV S/N's 3447001 thru 3447029](#) and [Seneca V S/N's 3449001 thru 3449168 only](#), verify compliance with Piper Service Bulletin No. 1041.
33. In [Seneca V S/N's 3449002 thru 3449152 only](#), verify compliance with Piper Service Bulletin No. 1042.
34. In [Seneca V S/N's 3449105; 3449134; 3449140 thru 3449146; 3449150 thru 3449158; 3449161 thru 3449174 only](#), verify compliance with Piper Service Bulletin No. 1043.
35. In [Seneca V S/N's 3449001 thru 3449222 only](#), verify compliance with Piper Service Bulletin No. 1081A.
36. In [Seneca V S/N's 3449195 thru 3449226 only](#), verify compliance with Piper Service Bulletin No. 1083C.
37. In [Seneca V S/N's 3449200 thru 3449243 only](#), verify compliance with Piper Service Bulletin No. 1097A.
38. In [Seneca IV S/N's 3447001 thru 3447029](#) and [Seneca V S/N's 3449001 thru 3449226, and 3449229 and 3449230 only](#), verify compliance with Piper Service Bulletin No. 1100A.
39. In [Seneca V S/N's 3449002 thru 3449093 only](#), verify compliance with Piper Service Letter No. 1021.
40. In [Seneca V S/N's 3449001 thru 3449226, and 3449230 only](#), verify compliance with Piper Service Letter No. 1036.
41. In [Seneca V S/N's 3449001 thru 3449283 only](#), verify compliance with Piper Service Letter No. 1048A.
42. In [Seneca IV S/N's 3447001 thru 3447029](#) and [Seneca V S/N's 3449001 thru 3449243 less 3449232 only](#), verify compliance with Service Bulletin No. 1113.
43. In [Seneca IV S/N's 3447001 thru 3447029](#) and [Seneca V S/N's 3449001 thru 3449309 only](#), verify compliance with Piper Service Bulletin No. 1127B.
44. In [Seneca IV S/N's 3447001 thru 3447008 only](#), verify compliance with Piper Service Bulletin No. 993.
45. In [Seneca IV S/N's 3447001 thru 3447004 only](#), verify compliance with Piper Service Bulletin No. 996.

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K. NOTES (CONTINUED)

46. In [Seneca V S/N's 3449002 thru 3449044 only](#), verify compliance with Piper Service Bulletin No. 1013.
47. In [Seneca IV S/N's 3447001 thru 3447029](#) and [Seneca V S/N's 3449001 thru 3449284 only](#), verify compliance with Piper Service Bulletin No. 1130.
48. In [Seneca V S/N's 3449152 thru 3449262 only](#), verify compliance with Piper Service Bulletin No. 1135.
49. In [Seneca V S/N's 3449283, 3449284, 3449288 thru 3449290 and 3449292 only](#), verify compliance with Piper Service Bulletin No. 1137.
50. In [Seneca V S/N's 3449042 thru 3449301 only](#), verify compliance with Piper Service Bulletin No. 1139A.
51. In [Seneca V S/N's 3449279 thru 3449290 only](#), verify compliance with Piper Service Bulletin No. 1141.
52. In [Seneca V S/N's 3449303 thru 3449305 only](#), verify compliance with Piper Service Bulletin No. 1151E.
53. In [Seneca IV S/N's 3447001 thru 3447029](#) and [Seneca V S/N's 3449001 thru 3449287 only](#), verify compliance with Cleveland Service Bulletin No. 7073A per Piper Vendor Service Publication No. 137A.
54. In [Seneca IV S/N's 3447001 thru 3447029](#) and [Seneca V S/N's 3449001 and up](#), verify compliance with Kelly Aerospace Service Bulletin No. A-107A per Piper Vendor Service Publication No. 149.
55. In [Seneca IV S/N's 3447001 thru 3447029](#) and [Seneca V S/N's 3449001 thru 3449287 only](#), verify compliance with Cleveland Service Bulletin No. 7076 per Piper Vendor Service Publication No. 155.
56. In [Seneca V S/N's 3449001 thru 3449303](#) and [3449305 thru 3449310 only](#), verify compliance with Piper Service Bulletin No. 1157A.
57. In [Seneca V S/N's 3449001 and up](#), verify initial compliance with Piper Service Letter No. 1087.
58. In [Seneca IV S/N's 3447001 thru 3447029](#) and [Seneca V S/N's 3449001 thru 3449322 only](#), verify compliance with Piper Service Bulletin No. 1161. [For airplanes which have not installed Piper Kits No. 767-397 \(LH\) and 767-398 \(RH\) or new wing rib assemblies with date codes of 8313 or higher](#), conduct 100 Hour Wing Rib Inspection, 57-10-00.
59. [For airplanes equipped with Avidyne FlightMax Entegra EFIS](#), verify compliance with Avidyne Service Alert No. SA-05-001.
60. In [Seneca IV S/N's 3447001 thru 3447029](#) and [Seneca V S/N's 3449001 thru 3449261 and 3449263 thru 3449312](#), verify compliance with Piper Service Bulletin No. 1123B.

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SPECIAL INSPECTIONS

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

The following inspections are required in addition to those listed in 5-20-00. These inspections are required at intervals of:

- A. Flight hours;
- B. Calendar Year; or
- C. the specific operation being conducted or the environment being operated in.

Unless otherwise indicated, these inspections are to be repeated at each occurrence of the specified interval. Note that the items listed herein are guidelines based on past operating experience. Each operator should closely monitor his own unique operating conditions/environment and react accordingly to keep his aircraft airworthy.

NOTE: A log book entry should be made upon completion of any inspections.

1. Per Flight Hour

Each 200 Hours

- ☐ For aircraft 10 years old or older, conduct the following special inspection each 200 hours: Inspect the interior of the wing flap for evidence of dissimilar metal corrosion where aluminum sheet metal is in contact with steel flap brackets. Use a bore scope or other suitable tool. Installation of a new wing flap will relieve this inspection requirement until such time as the replacement wing flap reaches ten years time-in-service.

Each 300 Hours

WARNING: DO NOT USE GREASE OR ANY TYPE OF GREASE FITTING ON ANY OXYGEN SYSTEM. WHEN WORKING WITH AN OXYGEN SYSTEM MAKE SURE HANDS, CLOTHING, TOOLS, AND IMMEDIATE AREA ARE FREE OF GREASE.

- ☐ If installed, each 300 hours time-in-service, inspect the oxygen system regulator, pressure gauge, high and low pressure lines, and outlets per Inspections, 35-10-00.

Each 500 Hours

- ☐ For airplanes equipped with Airborne engine-driven vacuum pumps, replace at 500 hours time-in-service.
- ☐ For airplanes equipped with Aero Accessories vacuum pumps; beginning at 500 hours time-in-service, and each 100 hours thereafter, inspect vacuum pump vane wear per Vacuum Pump(s), Inspection, 37-10-00.
- ☐ Remove propeller; remove sludge from propeller and crankshaft.
- ☐ Remove and flush oil radiator.
- ☐ Inspect magneto(s) distributor block for cracks, burned areas or corrosion.
- ☐ Clean and lubricate stabilator trim drum screw.
- ☐ Replace the drag link bolt AN7-35 or NAS6207-50D every 500 hours.
- ☐ For airplanes which have not installed Piper Kits No. 767-397 (LH) and 767-398 (RH) or new wing rib assemblies with date codes of 8313 or higher, conduct 500 Hour Wing Rib Inspection, 57-10-00.

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Each 1000 Hours

- ☐ Replace engine compartment flexible hoses (fuel, oil, etc.) as required; but not to exceed 1000 hours time-in-service, eight (8) years, or engine overhaul, whichever comes first.
- ☐ Overhaul or replace magnetos.
- ☐ Clean and lubricate all exterior needle bearings.
- ☐ Remove all turbocharger components from the engine. Inspect and repair or replace as necessary. Inspect turbocharger rotor for excessive play, carbon and dirt deposits. Remove and inspect turbine and compressor housings. Inspect turbine wheel and impeller for physical damage and excessive build up of deposits. If excessive, replace turbocharger assembly.
- ☐ Beginning at 2000 hours and each 1000 hours thereafter, inspect the nose gear trunnion (P/N 95723-005) for cracks per 1000 Hour Nose Gear Trunnion Inspection, 32-20-00.
- ☐ Replace fuel tank vent line flexible connections as required, but not to exceed 7 years, 1000 hours, or fuel tank removal, whichever comes first.
- ☐ In flight, with the landing gear retracted, check that gear warning horn sounds with either throttle retarded to 14 ± 2 in.Hg.
- ☐ Remove propeller; remove sludge from propeller and crankshaft.

Each 1500 Hours

- ☐ Overhaul Janitrol combustion heater each 1,500 hours or whenever a Pressure Decay Test is failed. See Janitrol Maintenance and Overhaul Manual, P/N 24E25-1 and AD 2004-21-05.

Each 2000 Hours

- ☐ Each 2000 hours or seven (7) years, whichever occurs first, remove interior cabinets, panels, and headliner and conduct detailed inspection of aircraft structure (skin, bulkheads, stringers, etc.) for condition and security. Inspection of structure concealed by headliner may be accomplished by alternate means (i.e. - through the use of a borescope) without removing the headliner, providing access is obtained to all concealed areas and borescope provides sufficient detail to adequately accomplish the inspection.
- ☐ At engine overhaul or each 2000 hours, whichever comes first, overhaul or replace alternators.
- ☐ Overhaul or replace Hartzell propeller governors each 2000 hours or at engine overhaul. (Verify TBO in latest revision of Hartzell Service Letter No. 61.)
- ☐ Overhaul or replace Hartzell propellers each five (5) or six (6) years or each 2000 or 2400 hours. (Refer to latest revision of Hartzell Service Letter No. 61 to determine specific requirements for individual airplanes.)
- ☐ Overhaul or replace McCauley propellers each six (6) years or 2000 hours; whichever comes first. See latest Revision of McCauley Service Bulletin No. 137.

Each 2400 Hours

- ☐ Overhaul or replace Hartzell propellers each five (5) or six (6) years or each 2000 or 2400 hours. (Refer to latest revision of Hartzell Service Letter No. 61 to determine specific requirements for individual airplanes.)

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2. Per Calendar Year

Each Thirty (30) Days

- ☐ Inspect battery, box or shelf, and cables. Flush box as required and fill battery per instructions on box or in Chapter 24.
- ☐ If installed, check portable fire extinguisher for condition and charge. Verify nozzle is not obstructed and safety seal is intact. Determine charge by "hefting" extinguisher.

Each Ninety (90) Days

- ☐ Remove, drain, and clean fuel strainer bowl and screen located in bottom of fuel selector valve.
- ☐ **For airplanes equipped with the Avidyne Entegra Electronic Flight Instrument System:** if the Standby Attitude Indicator has not been operated in the previous 90 days, charge the battery of the Standby Attitude Indicator. See Standby Attitude Indicator, 34-20-00.

Each Six (6) Months

- ☐ If annual usage is significantly less than 100 Hours, lubricate propeller each six (6) months. See Hartzell Standard Practices Manual No. 202A.

Each Twelve (12) Months

- ☐ Lubricate propeller every 100 Hours or annually, whichever comes first. If annual usage is significantly less than 100 Hours, lubricate propeller each six (6) months. See Hartzell Standard Practices Manual No. 202A.
- ☐ **For airplanes equipped with the Avidyne Entegra Electronic Flight Instrument System:** each twelve months, perform a full capacity test of the Standby Attitude Indicator battery. See Standby Attitude Indicator, 34-20-00.

Each Two (2) Years

- ☐ Test and inspect the static pressure system and altimeters. Ensure compliance with the requirements of FAR 43, Appendix E. (See FAR 91.411.)
- ☐ Test and inspect the transponder. Ensure compliance with the requirements of FAR 43, Appendix F. (See FAR 91.413.)
- ☐ **For airplanes equipped with the Avidyne Entegra Electronic Flight Instrument System:** swing the magnetic compass and recalibrate the magnetometer every two (2) years. See Magnetometer, 34-20-00.
- ☐ Inspect Janitrol combustion heater each 24 months or 100 hours, whichever comes first, per AD 2004-21-05 and latest revision of Janitrol Maintenance and Overhaul Manual, P/N 24E25-1.

Each Three (3) Years

WARNING: DO NOT USE GREASE OR ANY TYPE OF GREASE FITTING ON ANY OXYGEN SYSTEM. WHEN WORKING WITH AN OXYGEN SYSTEM MAKE SURE HANDS, CLOTHING, TOOLS, AND IMMEDIATE AREA ARE FREE OF GREASE.

- ☐ **In Seneca V only:** If installed, remove and hydrostatically test oxygen cylinder every three (3) years (i.e. - light weight composite cylinders - DOT E8162). No lightweight composite oxygen cylinder may exceed fifteen (15) years total time-in-service.
- ☐ **For airplanes equipped with the Avidyne Entegra Electronic Flight Instrument System:** replace the Standby Attitude Indicator battery as required, but at least every three (3) years. See Standby Attitude Indicator, 34-20-00.

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Each Five (5) Years

WARNING: DO NOT USE GREASE OR ANY TYPE OF GREASE FITTING ON ANY OXYGEN SYSTEM. WHEN WORKING WITH AN OXYGEN SYSTEM MAKE SURE HANDS, CLOTHING, TOOLS, AND IMMEDIATE AREA ARE FREE OF GREASE.

- ☐ If installed, for each oxygen system outlet, replace rubber components or entire outlet assembly each five (5) years time-in-service.
- ☐ If installed, replace oxygen system external recharge valve each five (5) years time-in-service.
- ☐ Replace engine-driven fuel pumps at engine overhaul or five (5) years, whichever comes first.
- ☐ Overhaul or replace Hartzell propellers each five (5) or six (6) years or each 2000 or 2400 hours. (Refer to latest revision of Hartzell Service Letter No. 61 to determine specific requirements for individual airplanes.)
- ☐ If installed, replace oxygen system regulator each five (5) years time-in-service.

Each Six (6) Years

- ☐ Overhaul or replace Hartzell propellers each five (5) or six (6) years or each 2000 or 2400 hours. (Refer to latest revision of Hartzell Service Letter No. 61 to determine specific requirements for individual airplanes.)
- ☐ Overhaul or replace McCauley propellers each six (6) years or 2000 hours; whichever comes first. See latest Revision of McCauley Service Bulletin No. 137.

Each Seven (7) Years

- ☐ Each 2000 hours or seven (7) years, whichever occurs first, remove interior cabinets, panels, and headliner and conduct detailed inspection of aircraft structure (skin, bulkheads, stringers, etc.) for condition and security. Inspection of structure concealed by headliner may be accomplished by alternate means (i.e. - through the use of a borescope) without removing the headliner, providing access is obtained to all concealed areas and borescope provides sufficient detail to adequately accomplish the inspection.
- ☐ Replace fuel tank vent line flexible connections as required, but not to exceed 7 years, 1000 hours, or fuel tank removal, whichever comes first.

Each Eight (8) Years

- ☐ Replace engine compartment flexible hoses (fuel, oil, etc.) as required; but not to exceed 1000 hours time-in-service, eight (8) years, or engine overhaul, whichever comes first.

Each Ten (10) Years

- ☐ Each ten (10) years time-in-service, test fuselage and wing fluid hoses to system pressure. Visually inspect for leaks. Hoses that pass inspection may remain in service, but must be rechecked each five (5) years additional time-in-service. No fluid hose may exceed twenty (20) years total time-in-service.
- ☐ **For airplanes equipped with the Avidyne Entegra Electronic Flight Instrument System:** replace the CMOS battery in the multifunction display (MFD) as required, but at least each 10 years. See Multifunction Display (MFD), 34-20-00.

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Each Fifteen (15) Years

WARNING: DO NOT USE GREASE OR ANY TYPE OF GREASE FITTING ON ANY OXYGEN SYSTEM. WHEN WORKING WITH AN OXYGEN SYSTEM MAKE SURE HANDS, CLOTHING, TOOLS, AND IMMEDIATE AREA ARE FREE OF GREASE.

- ☐ **In Seneca V only:** If installed, no lightweight composite oxygen cylinder (i.e. DOT E8162) may exceed fifteen (15) years total time-in-service.

Each Twenty (20) Years

- ☐ No fluid hose may exceed twenty (20) years total time-in-service.

3. Per Specific Operation / Operating Environment

A. Operation in High Dust or Industrial Pollution Environment

CAUTION: DISCONNECT LINES FROM PITOT/STATIC SYSTEM BEFORE CONDUCTING THIS INSPECTION.

Item	Inspection	Inspection Interval
<input type="checkbox"/> Engine Air Filter.	Clean and inspect.	Daily.
<input type="checkbox"/> Cabin Environmental and Instrument Air Filters.	Inspect and replace if necessary.	100 Hours.
<input type="checkbox"/> Pitot/Static system.	Check for obstruction. Reverse flow to lines.	100 Hours or as required.
<input type="checkbox"/> Landing Gear Oleos	Clean.	Before each flight.
	Inspect.	100 Hours.
<input type="checkbox"/> Landing Gear Wheel Bearings.	Clean, inspect and repack.	50 Hours.
<input type="checkbox"/> Windows.	Inspect for cracks, erosion, crazing, visibility, and cleanliness.	Daily.
<input type="checkbox"/> Structure drain holes.	Clean with pipe cleaner.	Before each flight.

B. Operation in High Salt or High Humidity Environment

Item	Inspection	Inspection Interval
<input type="checkbox"/> Fuselage, Empennage, Wings, and Control Surfaces.	Remove floor panels and exterior access plates; inspect for corrosion. using a borescope or other suitable tool.	200 Hours.
<input type="checkbox"/> Landing Gear.	Inspect for corrosion and lubrication.	200 Hours.

WARNING: ENSURE BOTH MAGNETO SWITCHES ARE OFF (GROUNDED), BEFORE TURNING PROPELLER. ENGINE MAY START IF BOTH SWITCHES ARE NOT OFF. USE EXTREME CAUTION WHEN ROTATING PROPELLER BY HAND; PROPELLER MAY KICK BACK.

- ☐ Engines with more than 50 hours total time. Each five days, pull prop through five complete revolutions.
Each 30 days, fly aircraft for 30 minutes or, ground run until oil temperature is in the green arc. Avoid excessive ground run. Each 5 days and each 30 days.

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3. Per Specific Operation / Operating Environment (continued)

<input type="checkbox"/> Engines with less than 50 hours total time.	Each day, pull prop through five complete revolutions. Each 30 days, fly aircraft for 30 minutes or, ground run until oil temperature is in the green arc. Avoid excessive ground run.	Daily and each 30 days.
<input type="checkbox"/> Instruments and Wiring.	Inspect for proper seal of cases and corrosion.	100 Hours.
<input type="checkbox"/> Interior.	Inspect upholstery, seat belts, seats and rugs for corrosion and integrity.	100 Hours.

NOTE: Do not use metallic tie downs (i.e. - chains, cables, etc.) in high salt or high humidity environments.

C. Operation in Extreme Cold

Item	Inspection	Inspection Interval
<input type="checkbox"/> Hydraulic, Pneumatic and Environmental.	Check all fittings and attachments for security and leaks.	First 100 Hour, then as required.

D. Operation from Soft or Unusual Terrain

Item	Inspection	Inspection Interval
<input type="checkbox"/> Landing Gear.	Inspect for cracks, attachment, damage, cleanliness and lubrication.	100 Hours.
<input type="checkbox"/> Wheels.	Inspect for cracks, damage, chipped rims; bearings for damage, corrosion and lubrication.	100 Hours.
<input type="checkbox"/> Tires.	Inspect for cuts, wear, inflation and deterioration.	Daily.
<input type="checkbox"/> Wheel Wells.	Inspect for foreign material, damage and corrosion.	100 Hours.
<input type="checkbox"/> Brakes.	Inspect for damage, foreign material, cracks and overheating.	Daily.
<input type="checkbox"/> Flaps, Lower Fuselage and Wing.	Inspect for damage, cracks and corrosion.	100 Hours.

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UNSCHEDULED MAINTENANCE CHECKS

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

The following inspections are required in response to specific anomalies encountered during aircraft operation. Note that the items listed herein are guidelines based on past operating experience. Each operator should closely monitor his own unique operating conditions/environment and react accordingly to keep his aircraft airworthy.

NOTE: A log book entry should be made upon completion of any inspections.

1. Lightning Strike

Item	Inspection	Inspection Interval
<input type="checkbox"/> Propeller.	Refer to latest Hartzell or McCauley Service Publication. Overhaul prior to return to service.	Each occurrence, before further flight.
<input type="checkbox"/> Engine.	See latest revisions of appropriate Teledyne Continental Motors Service Bulletins and Overhaul Manual.	Each occurrence, before further flight.
<input type="checkbox"/> Electrical and Avionics Systems.	Inspect and check harness, connections, and equipment for high voltage damage, burns and insulation degradation. Replace or overhaul as required. Consult with appropriate avionics vendor(s) for inspections and operational checks. Bench test alternator and voltage regulator(s), see 24-30-00.	Each occurrence, before further flight.
<input type="checkbox"/> All exterior surfaces, skins, and structure.	Inspect for burns, evidence of arcing, and damage on surfaces and bearings. Check for correct material properties in the area of the strike path. Degauss engine mount. Replace or repair affected areas/parts.	Each occurrence, before further flight.
<input type="checkbox"/> System Components.	Inspect instrumentation, vacuum, pitot/static, and fuel systems, for damage and correct operation.	Each occurrence, before further flight.
<input type="checkbox"/> Static Wicks.	Replace.	Each occurrence, before further flight.
<input type="checkbox"/> Bearings.	Inspect all control surface hinges and bearings, and landing gear and wheel bearings for pitting and damage. Replace as required.	Each occurrence, before further flight.

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2. Engine Overspeed, Overtemp, Loss of Oil, or Sudden Stoppage

Item	Inspection	Inspection Interval
<input type="checkbox"/> Engine.	See latest revisions of appropriate Teledyne Continental Motors Service Bulletins and Overhaul Manual.	Each occurrence, before further flight.
<input type="checkbox"/> Propeller.	Propeller overspeed of more than 10%. Refer to latest Hartzell or McCauley Service Publication. Remove and overhaul before return to service.	Each occurrence, before further flight.
<input type="checkbox"/> Engine Mount and Attachments.	Inspect for distortion and damage. Replace or repair as required.	Each occurrence, before further flight.

3. Severe Turbulence, Hard or Overweight Landing

CAUTION: MINOR OR APPARENTLY SUPERFICIAL DAMAGE MAY INDICATE A MORE SEVERE CONDITION SOMEWHERE ELSE IN THE STRUCTURE.

- A. Place aircraft in a normal level attitude.
- B. Make a preliminary inspection of checking alignment and out-of-track condition of engine, wings, tail, landing gear and doors.
- C. Follow Piper and Teledyne Continental Motors Maintenance Manual procedures. If there are any questions regarding repairs or procedures, contact your Piper Dealer's Service Advisor (DSA).
- D. Inspect the following items closely to determine the extent of damage:

Item	Inspection	Inspection Interval
<input type="checkbox"/> Landing Gear Struts. (Not required for severe turbulence.)	Cracks, signs of overstress deformation, loose or damaged strut housings. Axles for cracks, bending or flat spots. Damaged oleos and seals, hydraulic leaks and landing gear alignment.	Each occurrence, before further flight.
<input type="checkbox"/> Wheels, Tires, Brakes. (Not required for severe turbulence.)	Cracks, chips, loose or cracked mounting bolts, alignment of slippage marks, sidewall distress, hydraulic or air leaks. Inspect the wheels (dye penetrant method) and wheel bolts (magnetic particle method).	Each occurrence, before further flight.
<input type="checkbox"/> Wheel Wells and Landing Gear attach points. (Not required for severe turbulence.)	Buckling, cracks, overstress, wing skin buckling, and side brace for damage and condition. Inspect landing gear attachment bolts (magnetic particle method).	Each occurrence, before further flight.

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3. Severe Turbulence, Hard or Overweight Landing (continued)

Item	Inspection	Inspection Interval
<input type="checkbox"/> Wings.	Wing attach bolts for slippage, damage and overstress. Upper and lower wing skins for wrinkles, cracks, popped or loose rivets. Remove access plates and inspect for internal damage to ribs, stringers and sparwebs; and fuel tanks for damage, attachment, and leaks.	Each occurrence, before further flight.
<input type="checkbox"/> Engine.	Engine mounts for distortion and damage to elastomeric parts. Propeller for evidence of ground strike (i.e. - hard or overweight landing).	Each occurrence, before further flight.
<input type="checkbox"/> Fuselage.	Loose or missing rivets, door alignment, windows and attachments for overstress, cracks or damage. Wing carry through member for overstress damage. Stringers, bulkheads, keel beams for buckling, cracks, or damage. Avionics, instruments and accessories installation for security and operation.	Each occurrence, before further flight.
<input type="checkbox"/> Empennage.	Skins for buckling wrinkles, loose or missing rivets. Stabilator, rudder, and vertical fin for security of attachment and overstress of bolts. Ribs, stringers for buckling, cracks and damage.	Each occurrence, before further flight.

4. Flaps Extended Above Maximum Flap Extension Speed (V_{FE})

Item	Inspection	Inspection Interval
<input type="checkbox"/> Flap torque tube/pushrod.	Inspect for distortion. Replace as required. (See Flap Torque Tube/Pushrod Distortion Inspection, 27-50-00.)	Each occurrence, before further flight.
<input type="checkbox"/> Flaps.	Inspect for damage to the skin and attach points. Replace as required.	Each occurrence, before further flight.

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5. Flood Damage, Immersion in Water

- A. These guidelines are general in nature and should be applied or varied to fit the individual aircraft according to water level, length of time of exposure and other variables. Only those areas that might not be obvious to the mechanic are addressed.

CAUTION: MAKE ALL REPAIRS AND/OR ADJUSTMENTS IN ACCORDANCE WITH THE APPROPRIATE PIPER MAINTENANCE MANUAL, THE COMPONENT MANUFACTURER'S MAINTENANCE MANUAL, AND FAR PART 43. PAY PARTICULAR ATTENTION TO SILT, CORROSION AND CONTAMINANTS.

- B. Follow Piper and Teledyne Continental Motors Maintenance Manual procedures. If there are any questions regarding repairs or procedures, contact your Piper Dealer's Service Advisor (DSA).
- C. Determine the water level on the aircraft. Determine which operating and/or electrical components have been exposed to the water.
- D. If the following items were immersed, inspect them closely to determine the extent of damage:

Item	Inspection	Inspection Interval
<input type="checkbox"/> Airframe.	Clean silt and contaminants from airframe.	If immersed, each event, before further flight.
<input type="checkbox"/> Tubular Structures. (i.e. - Engine Mounts, etc.)	Check for internal corrosion. Clean and represerve as required. (See 71-20-00 - Engine Mount Corrosion Inspection, Immersion in Water.)	If immersed, each event, before further flight.
<input type="checkbox"/> Wings.	Inspect to ensure that contaminants are cleaned from fuel cell areas.	If immersed, each event, before further flight.
<input type="checkbox"/> Landing Gear and associated Bearings, Torque Links, Shimmy Dampeners, etc.	Jack airplane and cycle landing gear oleos and torque links to ensure proper operation.	If immersed, each event, before further flight.
<input type="checkbox"/> Control Surfaces.	Remove surface, clean and check all bearings - relube or replace as necessary. Rebalance before installation.	If immersed, each event, before further flight.
<input type="checkbox"/> Flight Control System.	Clean and inspect all cables, pulleys, and bearings for evidence of corrosion. Replace corroded cables. Re-preserve galvanized cable with MIL- C-11796 Class 2 (hot).	If immersed, each event, before further flight.
<input type="checkbox"/> Trim Control System.	Clean and inspect all trim system cables, pulleys, drums, bearings, jack screws, etc. Do not apply preservation to trim cables.	If immersed, each event, before further flight.
<input type="checkbox"/> Actuating Cables.	Inspect "push-pull" actuating cables for powerplant, heating and ventilating system, fuel system, etc. for proper operation.	If immersed, each event, before further flight.

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5. Flood Damage, Immersion in Water (continued)

Item	Inspection	Inspection Interval
<input type="checkbox"/> Engine.	<p>Remove, disassemble, and inspect. Examine all parts paying particular attention for evidence of corrosion, rust or contaminants imbedded on bearing surfaces, piston, mounting flanges or any aluminum, magnesium or bronze surface that may be porous.</p> <p>Remove evidence of rust or corrosion. If pitting in stressed areas is found, the part should not be reused. Silt imbedded in porous surfaces may be removed. Be certain oil passages, dowel holes and similar hidden openings and recesses are thoroughly free from contaminants.</p> <p>Test electrical components and fuel metering devices in accordance with manufacturer's instructions to determine fitness for future use.</p> <p>Reassemble engine using new seals, gaskets, stressed bolts, nuts and crankshaft sludge tubes.</p>	If immersed, each event, before further flight.
<input type="checkbox"/> Engine Accessories.	Inspect. Aircraft systems that supply either fuel or oil to the engine must be thoroughly cleaned, including oil cooler, lines, valves, etc. to prevent contamination of the engine after reinstallation.	If immersed, each event, before further flight.
<input type="checkbox"/> Propeller.	Inspect and repair as necessary in an authorized propeller shop.	If immersed, each event, before further flight.

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5. Flood Damage, Immersion in Water (continued)

Item	Inspection	Inspection Interval
<input type="checkbox"/> Electrical Systems.	<p>Replace all circuit breakers and switches.</p> <p>Replace all solenoids, relays and master contactors.</p> <p>Replace battery.</p> <p>Disassemble all connectors; clean and inspect for corrosion. Replace all corroded or pitted connectors. Inspect for wire corrosion at connector.</p> <p>Check all harness assemblies for entrapped contaminants. Clean and check for short circuits.</p> <p>Remove electric motors and electric pumps.</p> <p>Remove all potted solid state electrical equipment such as alternator inop. switches, low fuel warning switches, etc. Clean, dry and bench test per appropriate maintenance manual.</p> <p>Clean and check voltage regulators and overvoltage relays. Replace as necessary</p> <p>Clean and check all strobe light power supplies. Refer to appropriate maintenance manual.</p> <p>Replace all fuel senders, etc.</p> <p>Clean, inspect and check heated pitot systems.</p>	If immersed, each event, before further flight.
<input type="checkbox"/> Autopilot System. (If Installed.)	<p>Bench test in accordance with appropriate maintenance manual.</p> <p>Pay particular attention to clutch settings.</p>	If immersed, each event, before further flight.

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5. Flood Damage, Immersion in Water (continued)

Item	Inspection	Inspection Interval
<input type="checkbox"/> Vacuum and Pitot-Static Systems.	<p>Replace gyros.</p> <p>Replace filters.</p> <p>Clean and inspect all lines, and pitot and static vents.</p> <p>Clean and check all regulating valves.</p> <p>Remove and inspect engine driven and auxiliary vacuum pumps.</p>	If immersed, each event, before further flight.
<input type="checkbox"/> Induction System.	<p>Clean and inspect for silt and corrosion. Check all ducts and gaskets. Replace as necessary.</p> <p>Clean and inspect all heat shrouds and ducting.</p>	If immersed, each event, before further flight.
<input type="checkbox"/> Fuel System.	<p>Remove and clean fuel cells and fuel cells wing area. Clean all associated lines and pumps.</p> <p>Clean and inspect all fuel tank vents, cap vents and vent lines.</p>	If immersed, each event, before further flight.
<input type="checkbox"/> Instruments.	Clean and inspect instruments. Bench test per appropriate maintenance manual.	If immersed, each event, before further flight.
<input type="checkbox"/> Heating and Ventilating Systems.	<p>Replace blower.</p> <p>Clean and inspect all distribution boxes, ducting and valves.</p> <p>Inspect and check system control cables. Replace corroded or binding cables.</p> <p>If installed, clean and inspect air conditioning evaporator, condenser, and compressor.</p>	If immersed, each event, before further flight.

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5. Flood Damage, Immersion in Water (continued)

Item	Inspection	Inspection Interval
<input type="checkbox"/> Oxygen System. (If installed.)	Disconnect all lines from source and outlets; clean all fittings and lines per MIL-I-5585A. Remove and clean regulator valve per appropriate Scott publication. Replace pressure gauge.	If immersed, each event, before further flight.
<input type="checkbox"/> Avionics Systems.	Replace avionics. Clean and inspect antennas and connectors.	If immersed, each event, before further flight.
<input type="checkbox"/> Insulation and Upholstery.	Remove all wet insulation and upholstery. Thoroughly clean and dry (or replace) to ensure corrosion is not promoted in adjacent structures.	If immersed, each event, before further flight.

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CHAPTER

6

DIMENSIONS AND AREAS

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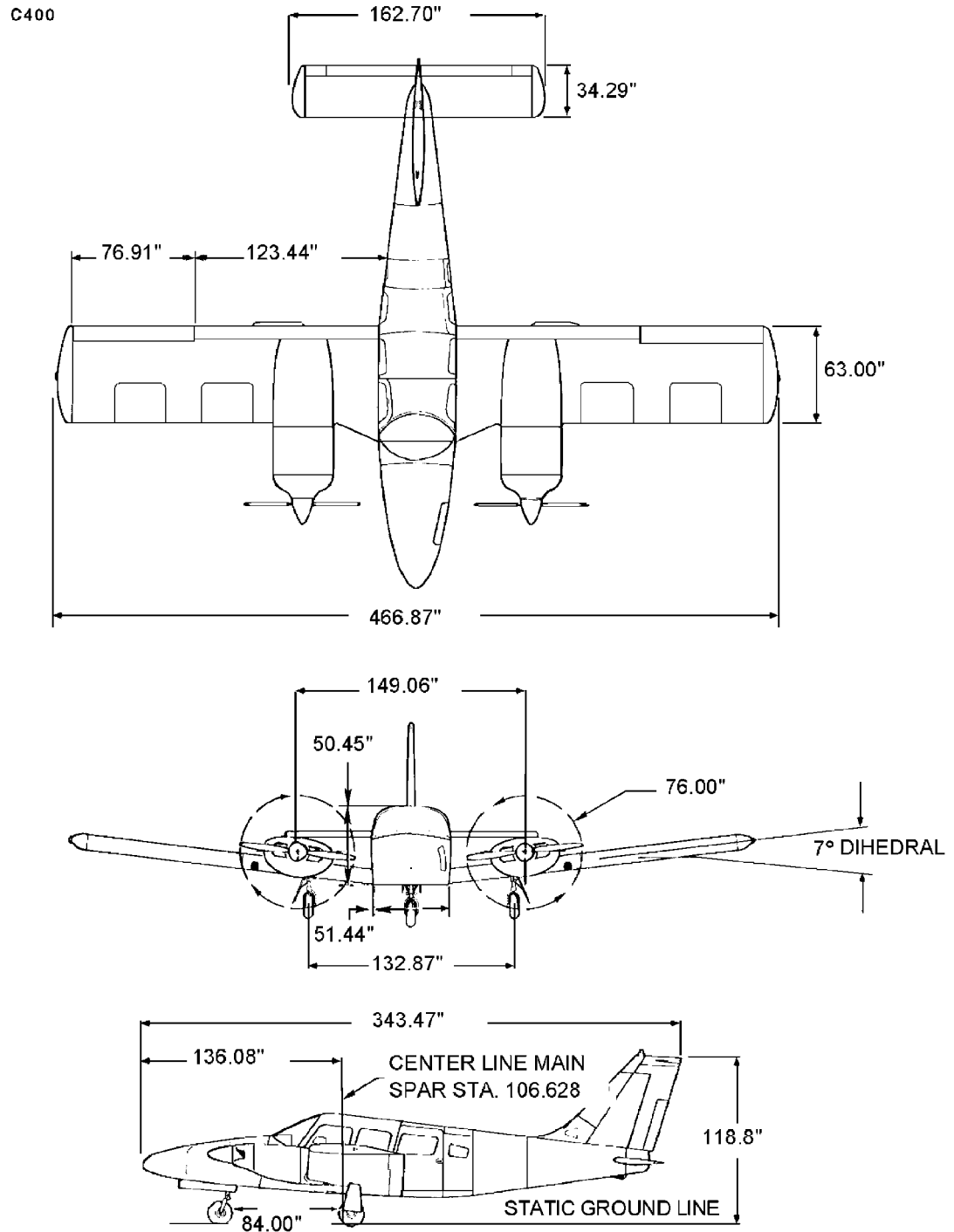
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GENERAL

The principal airplane dimensions are shown in Figure 1, and the leading particulars/principal dimensions are listed in Chart 1. The airplane serial number is located on the Manufacturers Aircraft Association (MAA) plate located on the left side of the fuselage at approximately F.S. 278.6. The engine serial number plate is located on the right side of the engine oil sump just below cylinder number 5.



Three View
Figure 1

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1. Leading Particulars and Principal Dimensions

CHART 1 (Sheet 1 of 4)
LEADING PARTICULARS AND PRINCIPAL DIMENSIONS

MODEL	PA-34-220T SENECA IV
ENGINE	
Manufacturer	Continental
Model - Left (24V)	TSIO-360-KB (CW)
Model - Right (24V)	LTSIO-360-KB (CCW)
FAA Type Certificate	E9CE
Rated Horsepower (Sea Level)	
Max. Takeoff - 5 minute maximum	220 HP
Max. Continuous	200 HP
Rated Speed - RPM	
Max. Takeoff - 5 minute maximum	2800 RPM
Max. Continuous	2600 RPM
Oil SAE Number	See Lubrication Chart
Oil Sump Capacity	8 U.S. quarts
Fuel: Aviation Grade - Minimum Octane	100 or 100LL
Fuel Injector	Continental
Magnetos: (TCM Pressurized)	79020-118
Left (Left Engine)	653303-1
Right (Right Engine)	653303-2
Magneto Timing	20° BTC
Magneto Point Clearance	.018 + .006
Spark Plugs (Shielded):	Refer to latest revision of Teledyne Continental Aircraft Engine Service Bulletin M77-10
Spark Plug Gap Setting	.015 to .019
Firing Order:	
Left Engine	1-6-3-2-5-4
Right Engine	1-4-5-2-3-6
Starter - Prestolite (28-volt):	
Left Engine	646275
Right Engine	646275
Alternator - Teledyne Continental (60 amp):	
Left Engine	653344
Right Engine	653344
Alternator Control Unit - Lamar (28V)	B-00382-1

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CHART 1 (Sheet 2 of 4)
LEADING PARTICULARS AND PRINCIPAL DIMENSIONS

MODEL		PA-34-220T SENECA IV
PROPELLER		
Manufacturer	Hartzell	McCauley
Hub Model:		
Left Engine	BHC-C2YF-2CKUF (Left Eng.) ¹	3AF32C508
Right Engine	BHC-C2YF-2CLKUF (Right Eng.) ¹	3AF32C509
Blade Model:		
Left Engine	FC8459-8R	82NFA-6
Right Engine	FJC8459-8R	L82NFA-6
Diameter, Minimum	75 in.	75 in.
Blade Angle, Low Pitch (High RPM)	12.6° ± 0.2°	11.0° ± 0.2°
Blade Angle, High Pitch (Low RPM)	80° to 81.5°	81.0° to 83.5°
Governor Models (Hartzell):		
Left Engine		E-3-7
Right Engine		E-3-7L (E-8-7L) ²
¹ Propellers to be mounted in pairs only. Do not mix with other propellers. ² With synchrophaser installation only.		
FUEL SYSTEM		
Fuel Tank	64 gal./wing	
Total Capacity (Both Wings)	128 gal.	
Total Usable Fuel	123 gal.	
LANDING GEAR		
Tread (Width From Each Tire Center)		11.1 ft.
Turning Radius		60.4 ft.
Nose Gear Strut		Combination Air-Oil
Nose Tire Pressure		40 PSI
Nose Gear Travel		27 degrees LEFT or RIGHT
CAUTION: DO NOT OVERSTEER THE NOSE GEAR WHEN TOWING AIRCRAFT.		
Main Gear Strut		Combination Air-Oil
Main Tire Pressure		55 PSI
Brakes		30-83
Tires:		
Main		6.00 x 6, 8 ply
Nose		6.00 x 6, 8 ply

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CHART 1 (Sheet 3 of 4)
LEADING PARTICULARS AND PRINCIPAL DIMENSIONS

MODEL	PA-34-220T SENECA V
ENGINE	
Manufacturer	Continental
Model - Left (24V)	TSIO-360-RB (CW)
Model - Right (24V)	LTSIO-360-RB (CCW)
FAA Type Certificate	E9CE
Rated Horsepower (Sea Level)	
Max. Continuous	220 HP 200 HP
Rated Speed - RPM	
Max. Continuous	2600 RPM
Oil SAE Number	See Lubrication Chart
Oil Sump Capacity	8 U.S. quarts
Fuel: Aviation Grade - Minimum Octane	100 or 100LL
Fuel Injector	Precision RSA-5AD2
Magnetos: (Slick Pressurized)	
Left (Left Engine)	Slick 6324, TCM 653292
Right (Right Engine)	Slick 6320, /TCM 653280
Magneto Timing	22° BTC
Magneto Point Clearance	.008 to .012
Spark Plugs (Shielded):	Refer to latest revision of Teledyne Continental Aircraft Engine Service Bulletin M77-10
Spark Plug Gap Setting	.015 to .019
Firing Order:	
Left Engine	1-6-3-2-5-4
Right Engine	1-4-5-2-3-6
Starter - Prestolite (28-volt):	
Left Engine	646275
Right Engine	646275
Alternator - Teledyne Continental (85 amp):	
Left Engine	654200
Right Engine	654200
Alternator Control Unit - Lamar (28V)	B-00382-1

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CHART 1 (Sheet 4 of 4)
LEADING PARTICULARS AND PRINCIPAL DIMENSIONS

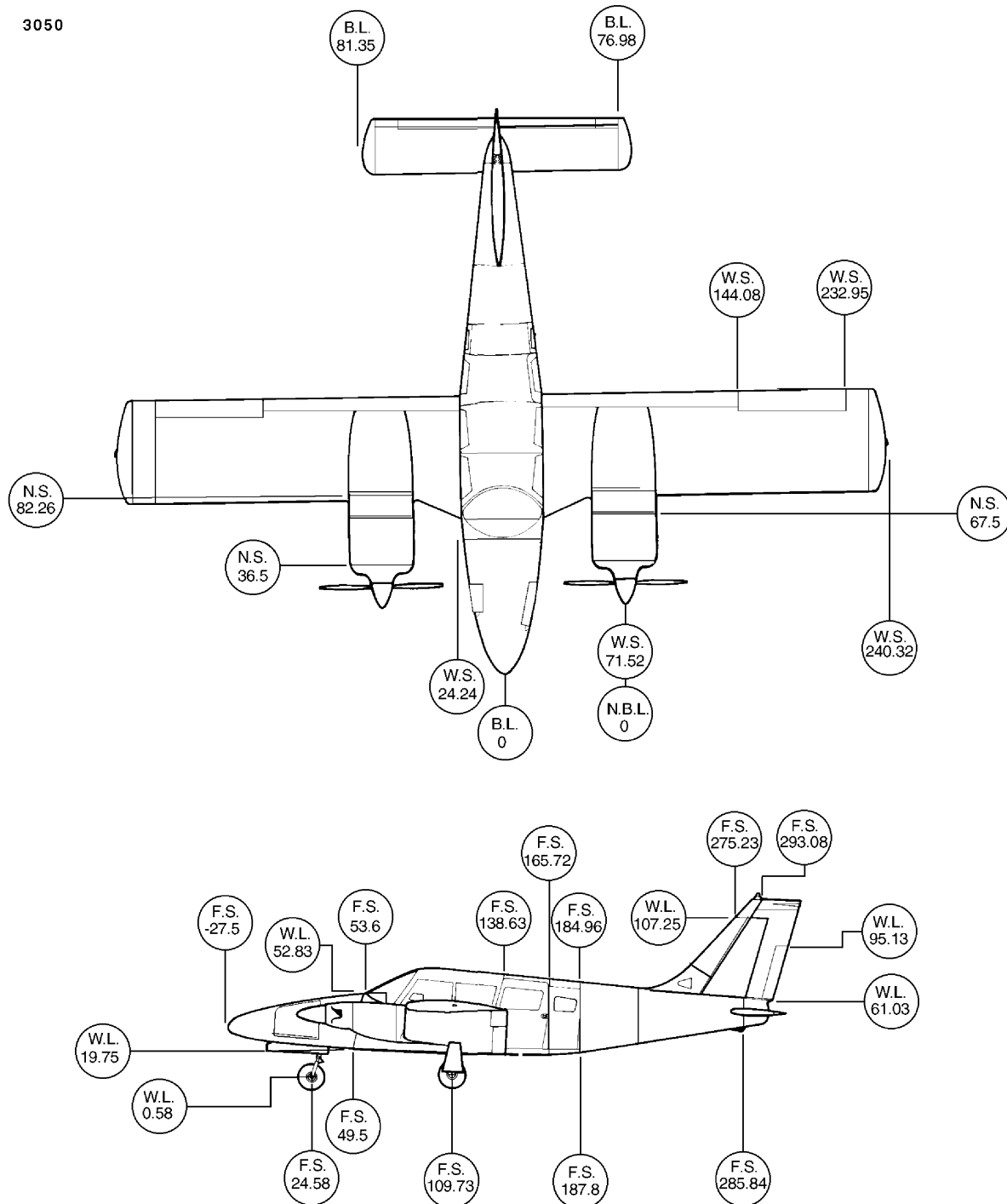
MODEL		PA-34-220T SENECA V
PROPELLER		
Manufacturer	Hartzell	McCauley
Hub Model:		
Left Engine	BHC-J2YF-2CUF (Left Eng.) ¹	3AF32C522
Right Engine	BHC-J2YF-2CLUF (Right Eng.) ¹	3AF32C523
Blade Model:		
Left Engine	FC8459(B)-8R	82NJA-6
Right Engine	FJC8459(B)-8R	L82NFA-6
Diameter, Minimum	75 in.	75 in.
Blade Angle, Low Pitch (High RPM)	14.6° ± 0.2°	12.6° ± 0.2°
Blade Angle, High Pitch (Low RPM)	80° to 81.5°	81.6° to 82.6°
Governor Models (Hartzell):		
Left Engine	E-3-9(U-3-19) ²	
Right Engine	E-3-9L (U-3-19L) ² (U-8-9L) ³ (U-8-19L) ⁴	
¹ Propellers to be mounted in pairs only. Do not mix with other propellers. ² With optional unfeathering installation. ³ With optional syncrophaser installation. ⁴ With optional unfeathering and syncrophaser installation.		
FUEL SYSTEM		
Fuel Tank	64 gal./wing	
Total Capacity (Both Wings)	128 gal.	
Total Usable Fuel	122 gal.	
LANDING GEAR		
Tread (Width From Each Tire Center)	11.1 ft.	
Turning Radius	60.4 ft.	
Nose Gear Strut	Combination Air-Oil	
Nose Tire Pressure	40 PSI	
Nose Gear Travel	27 degrees LEFT or RIGHT	
CAUTION: DO NOT OVERSTEER THE NOSE GEAR WHEN TOWING AIRCRAFT.		
Main Gear Strut	Combination Air-Oil	
Main Tire Pressure	55 PSI	
Brakes	30-83	
Tires:		
Main	6.00 x 6, 8 ply	
Nose	6.00 x 6, 8 ply	

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2. Station Reference Lines

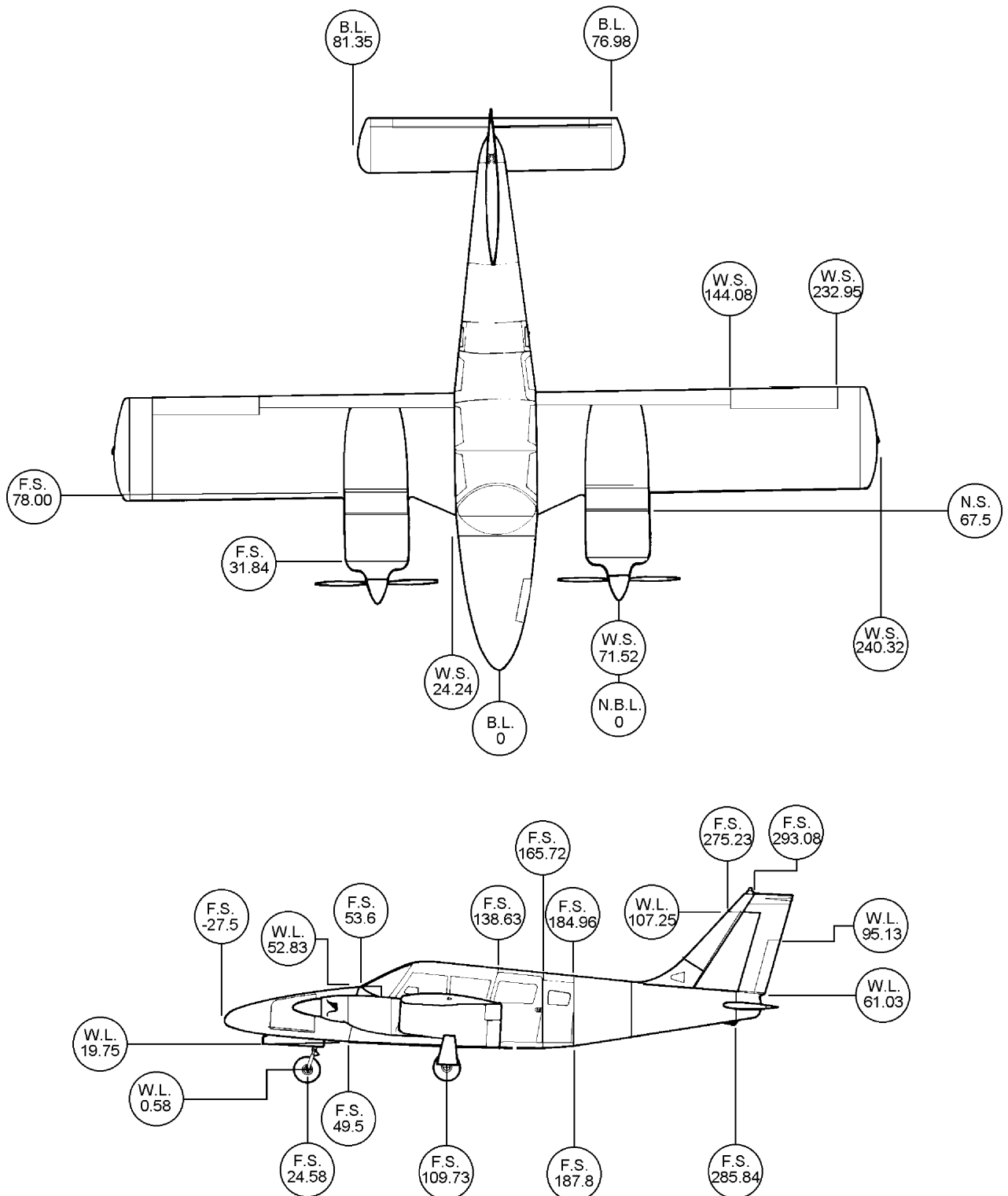
To facilitate locating various components and structural members in the airplane, a method using fuselage station (FS), wing station (WS), buttock line (BL), or waterline (WL) designations is frequently employed in this manual. (See Figure 2). Fuselage and wing stations and buttock and water lines are reference points measured in inches (vertically or horizontally) from a given reference (or zero) line.

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Station Reference Lines **SENECA IV**
Figure 2 (Sheet 1 of 2)

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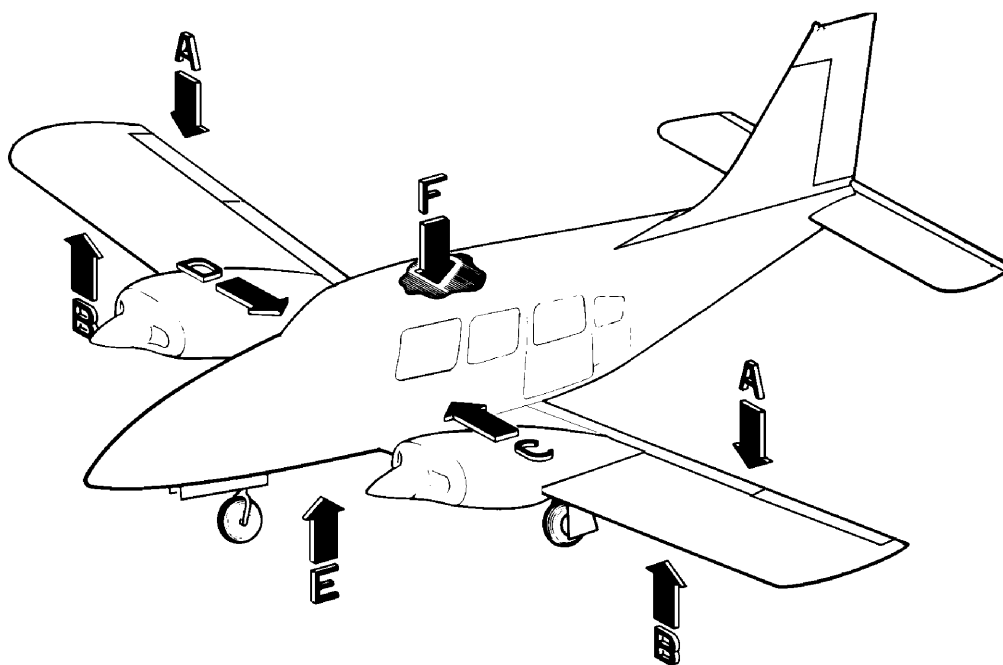
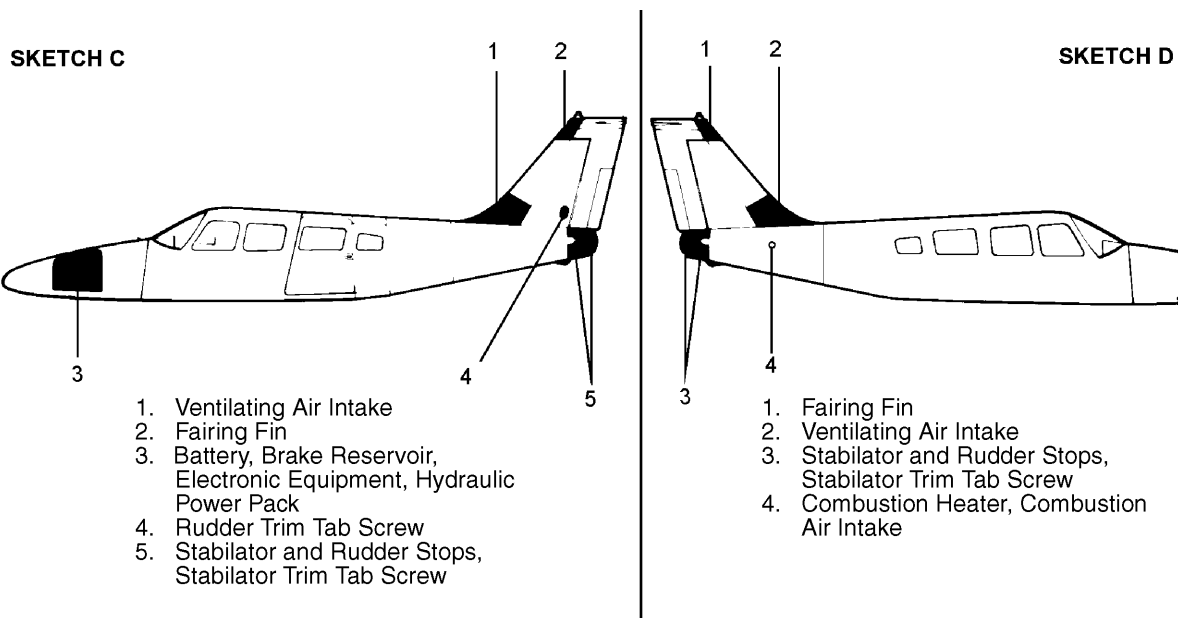
Station Reference Lines **SENECA V**
Figure 2 (Sheet 2 of 2)

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3. Access And Inspection Provisions

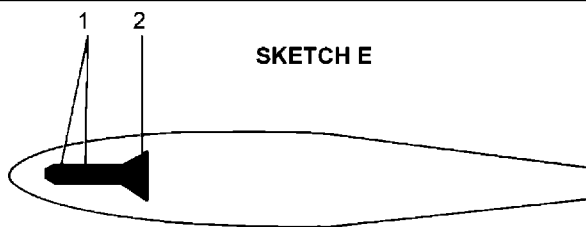
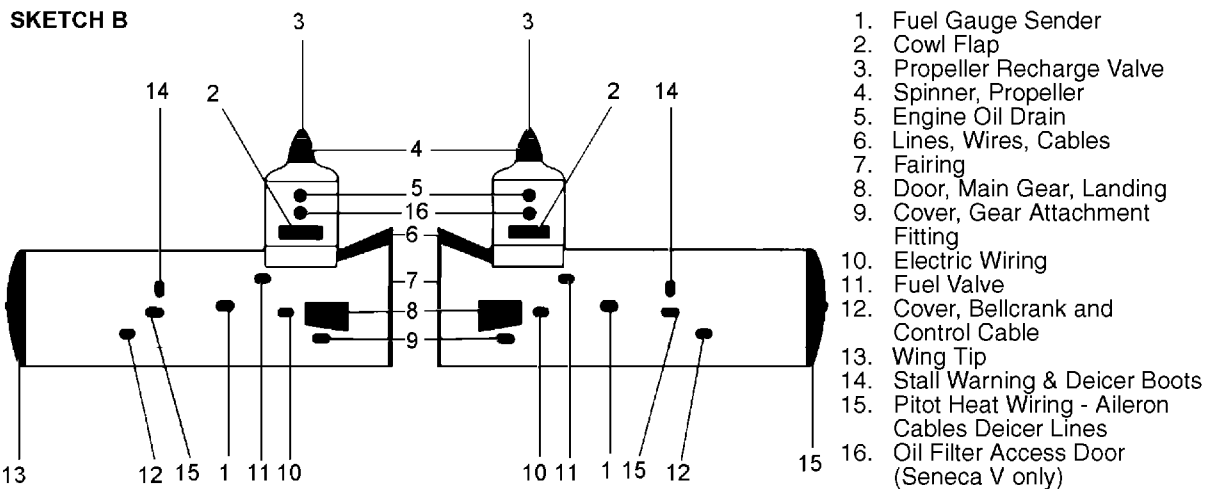
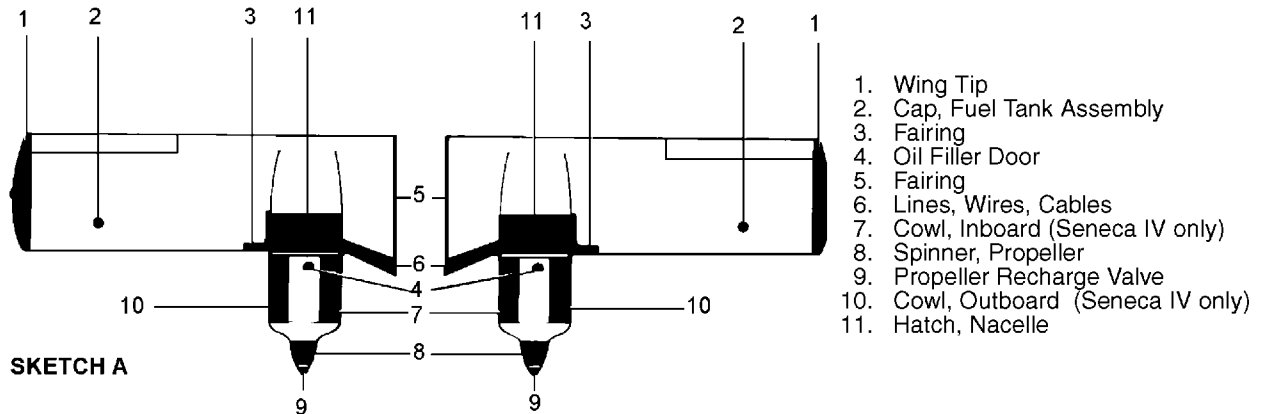
CAUTION: BEFORE ENTERING THE AFT SECTION OF THE FUSELAGE, BE SURE THE AIRPLANE IS SUPPORTED AT THE TAIL SKID.

The access and inspection provisions for the airplane are shown in Figure 3. The component to be serviced or inspected through each opening is identified in the illustration. All access plates and panels are secured by either metal fasteners or screws. To enter the aft section of the fuselage, remove the rear trim panel.

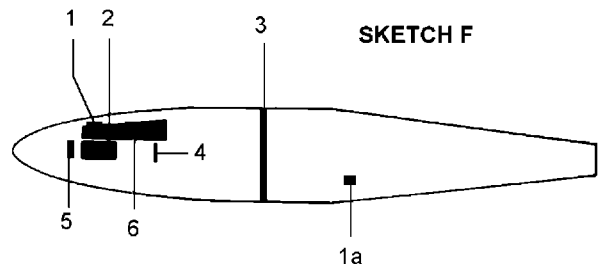


Access Plates and Panels
Figure 3 (Sheet 1 of 2)

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1. Door, Nose Gear, Landing
2. Hydraulic Pressure Switch, Nose Gear Actuating Cylinder and Limit Switch, Voltage Regulators



1. Battery (Seneca IV)
- 1a. Battery (Seneca V)
2. Nose Landing Gear
3. Main Spar
4. Brake Reservoir
5. External Power Plug
6. Radio

Access Plates and Panels
Figure 3 (Sheet 2 of 2)

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CHAPTER

7

LIFTING AND SHORING

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JACKING

Jacking the airplane is necessary to service the landing gear and other operations. The jacking operation is normally performed using tripod jacks. In other situations (i.e. - emergency, post-accident lifting, etc.), slings or air bags may be more appropriate.

If wing or fuselage shoring is required, make sure the support is contoured to conform to the surface it is supporting.

Jacking

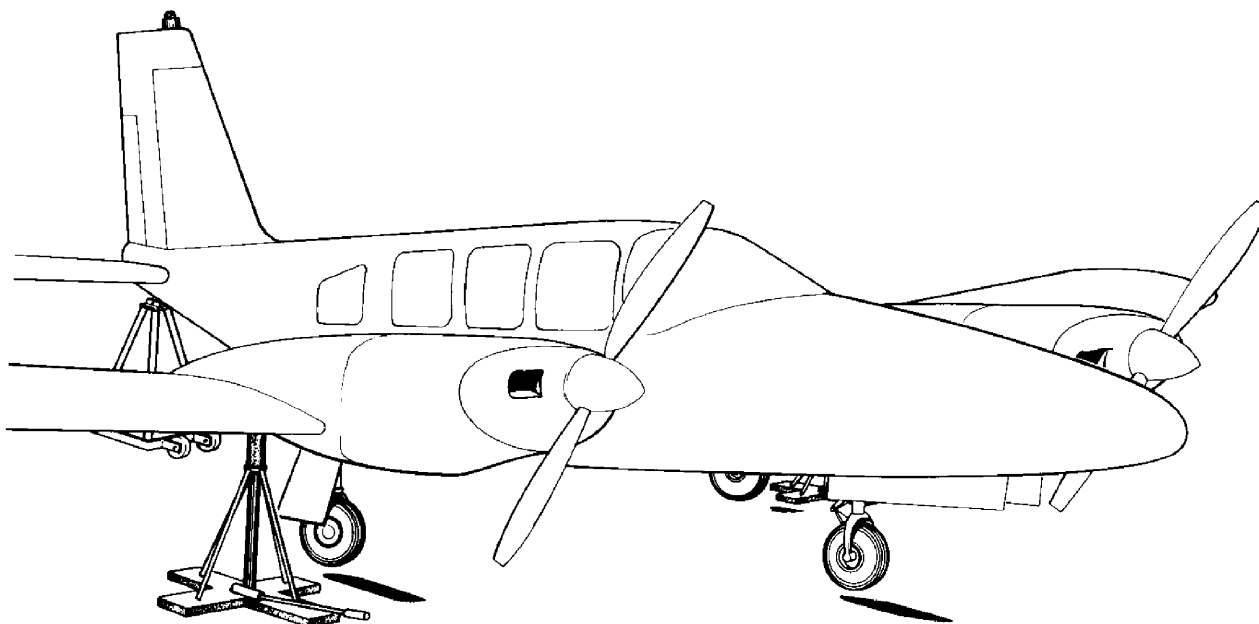
- A. Align jacks under the wing respective pads on the wing front spar.

CAUTION: BE SURE TO APPLY SUFFICIENT TAIL SUPPORT BALLAST. OTHERWISE, THE AIRPLANE WILL SLIP FORWARD AND FALL ON THE FUSELAGE NOSE SECTION.

- B. Attach a tail stand with approximately 600 pounds ballast to tail skid.

- C. Carefully raise jacks until all three wheels are clear of the surface.

CAUTION: IF THE HYDRAULIC SYSTEM IS TO BE SERVICED AT THIS POINT, THE FREE FALL KNOB SHOULD BE PULLED OUT. FOR FURTHER INFORMATION, REFER TO CHAPTER 32.



Jacking
Figure 1

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LEVELING AND WEIGHING

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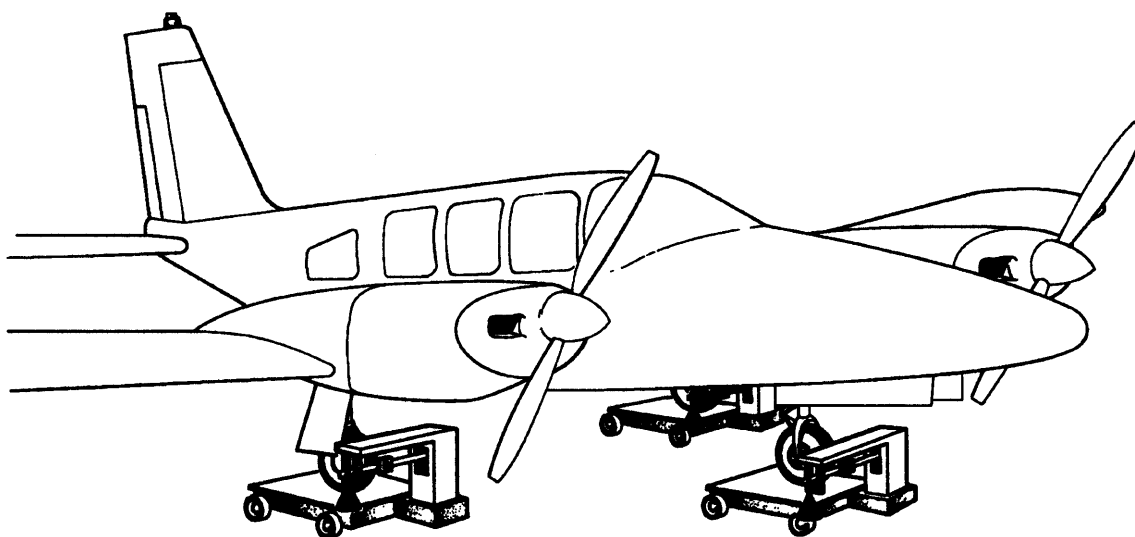
WEIGHING

The airplane may be weighed by the following procedure (see Figure 1):

- A. Position a scale and ramp in front of each of the three wheels.
- B. Secure the scales from rolling forward and tow the airplane up onto the scales. (See Towing, 9-10-00.)
- C. Remove the ramp so as not to interfere with the scales.
- D. If the airplane is to be weighed for weight and balance computations, level the airplane per 8-20-00.

NOTE: See Chapter 6 in the applicable Pilot's Operating Handbook for specific instructions on weighing the aircraft for weight and balance computations.

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Weighing Airplane
Figure 1

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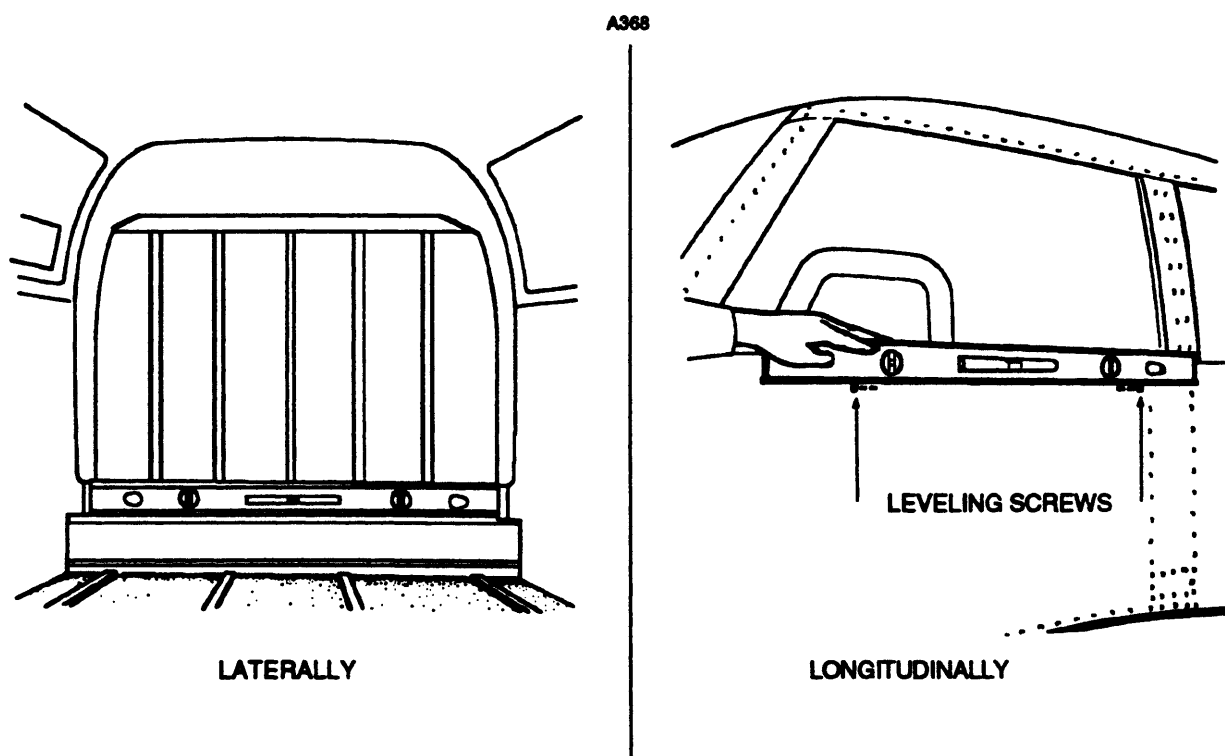
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LEVELING

All configurations of the airplane are provided with a means for longitudinal and lateral leveling. The airplane may be leveled while on jacks, during the weighing procedure while the wheels are on scales, or while the wheels are on the ground. To level the airplane for purposes of weighing or rigging, the following procedures may be used:

NOTE: Always level the airplane laterally first, then level it longitudinally.

- A. To laterally level the airplane, place a spirit level across the baggage compartment floor along the rear bulkhead (See Figure 1) and deflate the tire on the high side of the airplane or adjust either jack until the bubble of the level is centered.
- B. To longitudinally level the airplane, partially withdraw the two leveling screws located immediately below the left front side window. (See Figure 1.) Place a spirit level on these screw heads and deflate the nose wheel tire or adjust the jacks until the bubble of the level is centered.



Leveling Airplane
Figure 1

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TOWING AND TAXIING

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TOWING

Before towing airplane, ground personnel must be informed by a qualified pilot or other qualified personnel about tow turning limits of nose gear and any other system functions required to properly and safely move the airplane.

CAUTION: WHEN TOWING WITH POWER EQUIPMENT, TURNING THE NOSE GEAR IN EITHER DIRECTION BEYOND THE STEERING RADIUS LIMITS WILL RESULT IN DAMAGE TO THE NOSE GEAR AND STEERING MECHANISM.

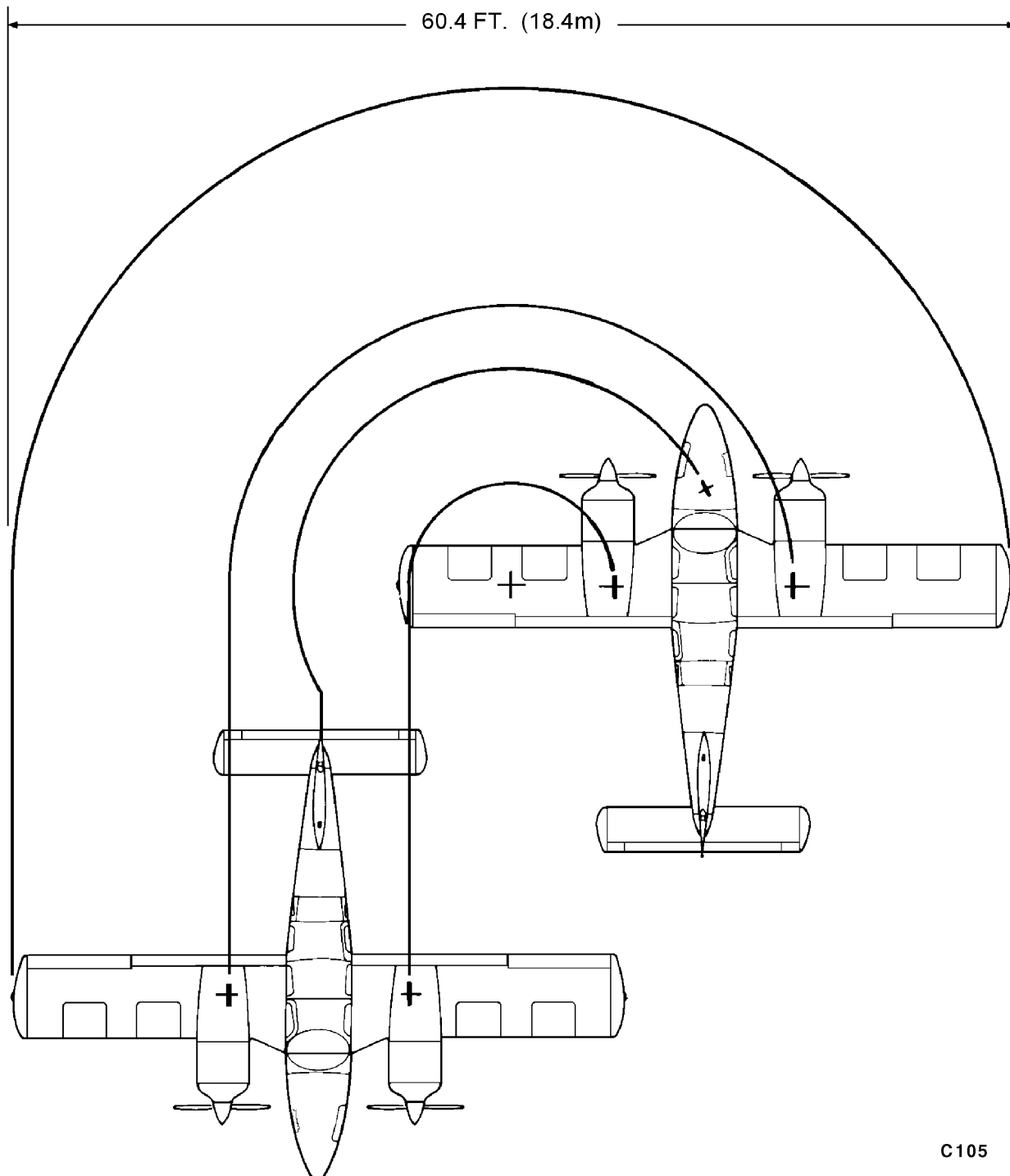
CAUTION: PUSHING ON THE TRAILING EDGE OF THE AILERONS, WHEN MOVING THE AIRCRAFT FORWARD BY HAND, WILL CAUSE THE AILERON CONTOUR TO CHANGE RESULTING IN AN OUT-OF-TRIM CONDITION.

The airplane may be moved by using the nose wheel steering bar that is stowed in the forward baggage compartment or by using power equipment that will not damage or cause excess strain to the nose gear steering assembly. Tow bar engages front axle inside fork.

In the event towing lines are necessary, lines (rope) should be attached to both main gear struts as high up on the tubes as possible. Lines should be long enough to clear the nose and/or tail by not less than 15 feet, and a qualified person to ride in the pilot's seat to maintain control by use of the brakes.

NOTE: See Figure 1 for aircraft turning distance.

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Airplane Turning Radius
Figure 1

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TAXIING

Before attempting to taxi the airplane, ground personnel should be checked out by a qualified pilot or other responsible person. Engine starting and shutdown procedures should be covered as well. When it is ascertained that the propeller back blast and taxi areas are clear, apply power to start the taxi roll and perform the following checks:

CAUTION: DO NOT OPERATE THE ENGINE AT HIGH RPM WHEN RUNNING UP OR TAXIING OVER GROUND CONTAINING LOOSE STONES, GRAVEL OR ANY LOOSE MATERIAL THAT MAY CAUSE DAMAGE TO THE PROPELLER BLADES.

CAUTION: OBSERVE WING CLEARANCES WHEN TAXIING NEAR BUILDINGS OR OTHER STATIONARY OBJECTS. IF POSSIBLE, STATION A GUIDE OUTSIDE THE AIRPLANE TO OBSERVE.

CAUTION: WHEN TAXIING ON UNEVEN GROUND, AVOID HOLES AND RUTS.

- A. Taxi forward a few feet and apply brakes to determine their effectiveness.
- B. Taxi with propeller set in low pitch, high rpm setting.
- C. While taxiing, make slight turns to ascertain the effectiveness of steering.
- D. Observe wing clearances when taxiing near buildings or other stationary objects. If possible, station a guide outside the airplane to observe.
- E. When taxiing on uneven ground, look for and avoid holes and ruts.
- F. Do not operate the engines at high rpm when running up or taxiing over ground containing loose stones, gravel, or any loose material that may cause damage to the propeller blades.

NOTE: See 9-10-00, Figure 1 for aircraft turning distance.

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CHAPTER

10

PARKING AND MOORING

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PARKING

1. Parking

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

- A. To park the airplane, head it into the wind, if possible.
- B. Set the parking brake by pulling back the brake lever and depressing the knob attached to the left side of the handle.
- C. To release the parking brakes, pull back on the brake lever to disengage the catch mechanism. Then allow the handle to swing forward.

NOTE: Take care when setting brakes that are overheated or during cold weather when accumulated moisture may freeze the brakes.

- D. The aileron and stabilator controls may be secured with the pilot's seat belt.

2. Locking Airplane

The right front cabin door, left aft cabin door and the nose baggage compartment door are provided with a key lock on the outside. All doors and the locking gas cap (optional) use the same key, 1995 - 2003.

In [S/N's 3449301](#) and up, and for service replacement 2004 and later, the locking gas cap uses a separate key.

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MOORING

CAUTION: WHEN MOORING, USE SQUARE OR BOWLINE KNOTS. DO NOT USE SLIP KNOTS.

The airplane is moored to ensure its immovability, protection, and security under various weather conditions.

- A. Head the airplane into the wind, if possible.
- B. Block the wheels.
- C. Lock the aileron and stabilator controls by looping the pilot's seat belt around wheel.

CAUTION: WHEN USING ROPE CONSTRUCTED OF NON-SYNTHETIC MATERIAL, LEAVE SUFFICIENT SLACK TO AVOID DAMAGE TO THE AIRPLANE WHEN THE ROPES CONTRACT DUE TO MOISTURE.

- D. Secure tie-down ropes to the wing, tie-down rings and the tail skid at approximately 45 degree angles to the ground.

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

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CHAPTER

11

PLACARDS AND MARKINGS

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CHAPTER 11 - PLACARDS AND MARKINGS

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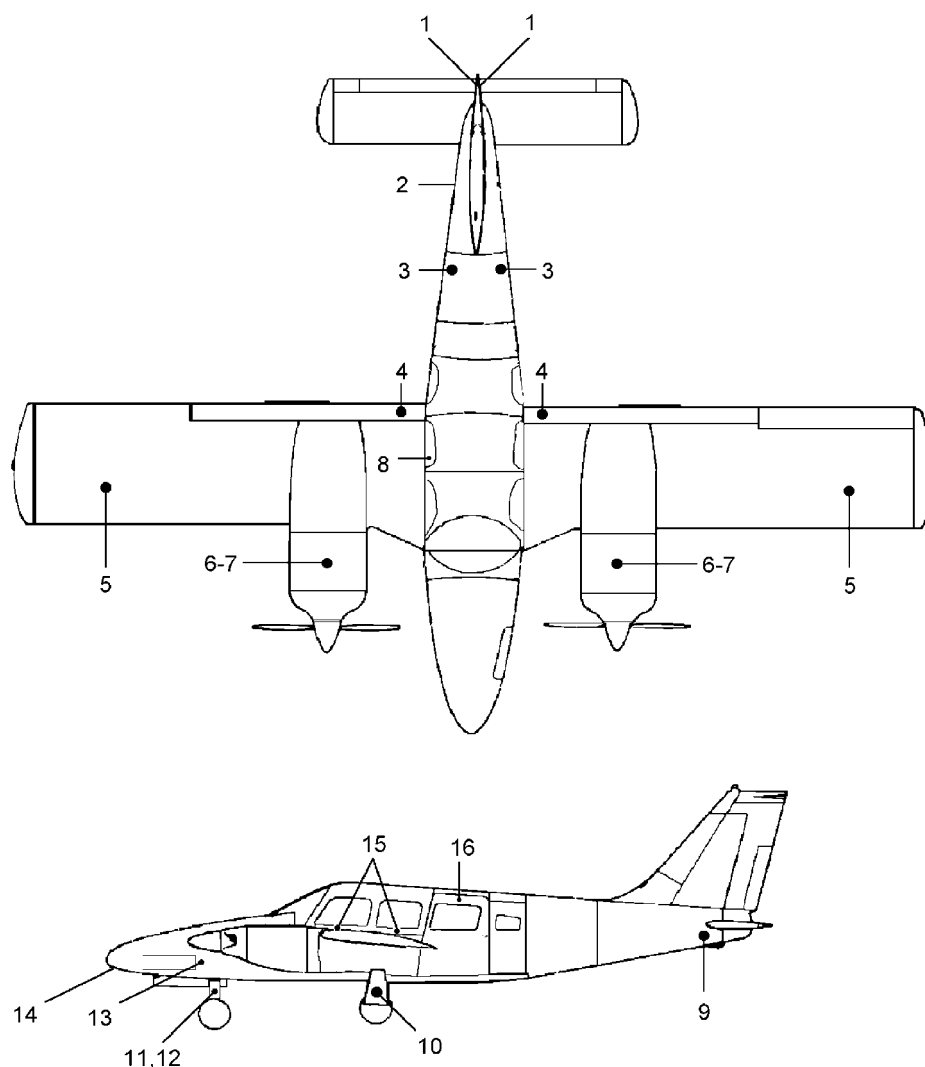
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EXTERIOR PLACARDS AND MARKINGS

The airplane nameplate placard (Figure 1, Item 9) is located on the left side of the fuselage near the stabilator leading edge at approximately F.S. 278.60. The placard identifies the airplane by its model number and serial number. Should a question arise concerning the care of the airplane, it is important to include the airplane serial number in any correspondence to your Piper Dealer's Service Advisor (DSA).

NOTE: Any time an airplane is repainted or touched up, inspect all placards to ensure that they are not covered with paint, are legible, and securely attached.



- | | |
|--|--|
| 1. SILKSCREEN - Do Not Push | 9. PLATE - Airplane Nameplate |
| 2. PLACARD - ELT Warning | 10. PLACARD - Oleo Service Instructions, Main Gear |
| 3. SILKSCREEN - Static Vent | 11. PLACARD - Oleo Service Instructions, Nose Gear |
| 4. SILKSCREEN - No Step | 12. PLACARD - Tow Limitations |
| 5. DECAL - Avgas | 13. SILKSCREEN - Alignment Alert Bar |
| 6. PLACARD - Oil Specifications | 14. PLACARD - 28 Volt External Power |
| 7. PLACARD - Winterization Information | 15. SILKSCREEN - Level Points |
| 8. SILKSCREEN - Piper Aire (Optional) | 16. SILKSCREEN - Door Release |

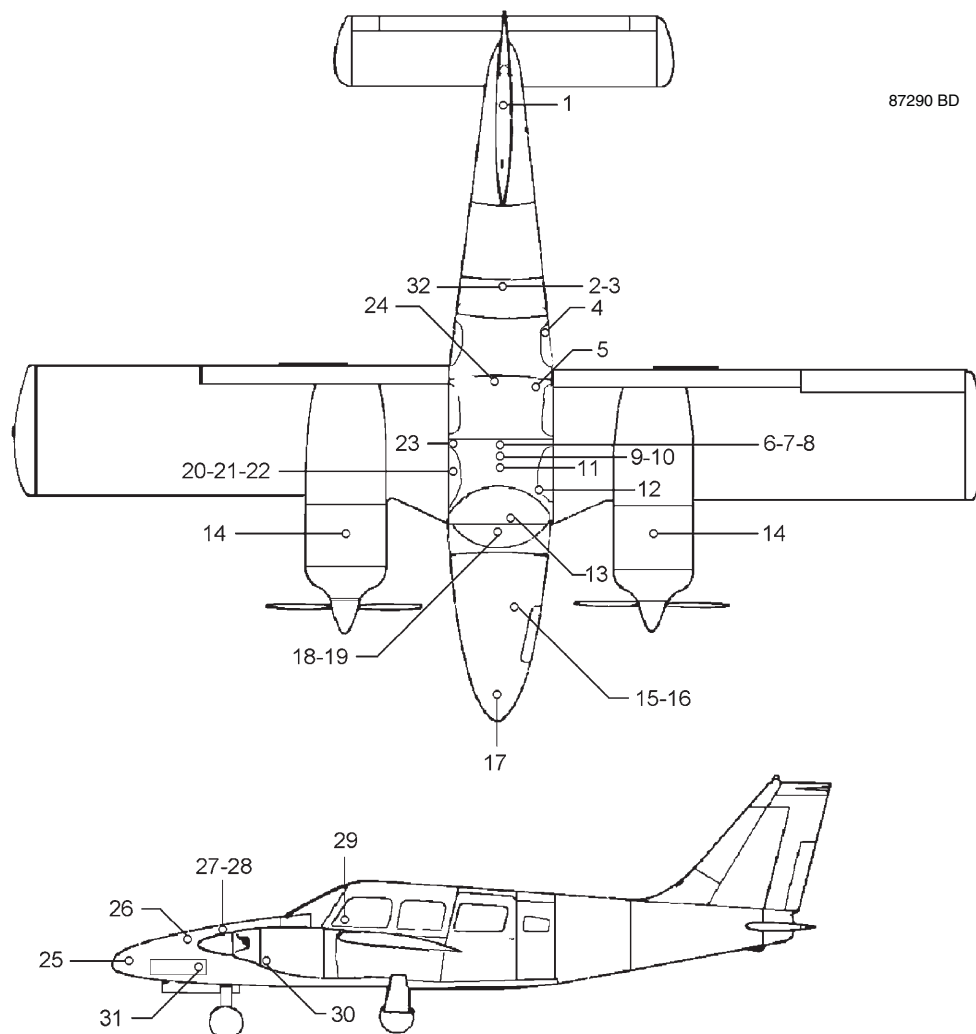
Exterior Placards and Markings
Figure 1

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INTERIOR PLACARDS



87290 BD

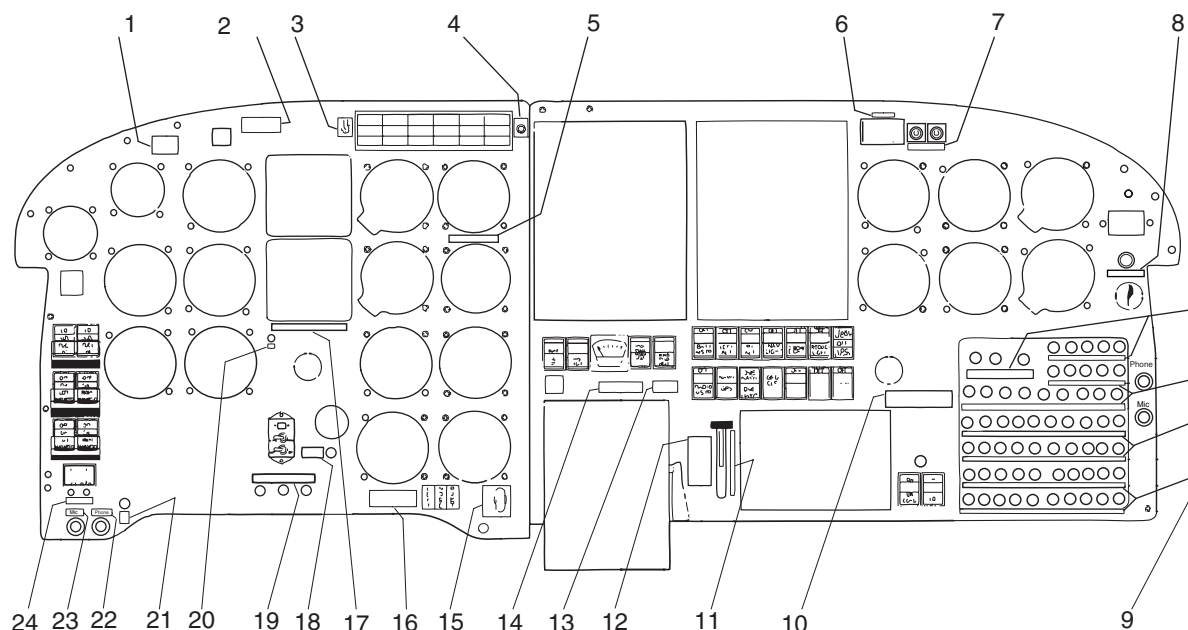
- | | |
|--|---|
| 1. PLACARD - Stabilator Balance Weight | 17. PLACARD - Hydraulic Fluid Specification |
| 2. PLACARD - Baggage Limitations | 18. PLACARD - Propeller Synchrophaser |
| 3. PLACARD - Cabin Bulkhead | 19. PLACARD - Takeoff and Landing Operation |
| 4. PLACARD - Aft Cabin Door Release | 20. PLACARD - Door, Open |
| 5. PLACARD - Table Stowage | 21. PLACARD - Door, Latch |
| 6. PLACARD - Fuel Selector (Gallons Per Side) | 22. PLACARD - Forward Cabin Door Release |
| 7. PLACARD - Heater Control | 23. PLACARD - Sump Drain |
| 8. PLACARD - Heater, Flight and Ground Operation | 24. PLACARD - Oxygen Bottle Installation |
| 9. PLACARD - Cabin Air, Pull Off | 25. PLACARD - External Power |
| 10. PLACARD - Vent Fan (3 Position) | 26. PLACARD - Baggage Limitations |
| 11. PLACARD - Flap Lever | 27. PLACARD - Light Switch, Baggage Door |
| 12. PLACARD - Pitot Drain | 28. PLACARD - Unlatch |
| 13. PLACARD - Control Wheel (Transponder Ident) | 29. PLACARD - Storm Window |
| 14. PLACARD - Oil Drain Probe Location | 30. PLACARD - Oil Drain Probe |
| 15. PLACARD - Brake Reservoir | 31. PLACARD - Press Ball To Unlatch |
| 16. PLACARD - Fuel Level Line, Reservoir | 32. PLACARD - Max. Cabin Structural Load |

Interior Placards
Figure 1 (Sheet 1 of 7)

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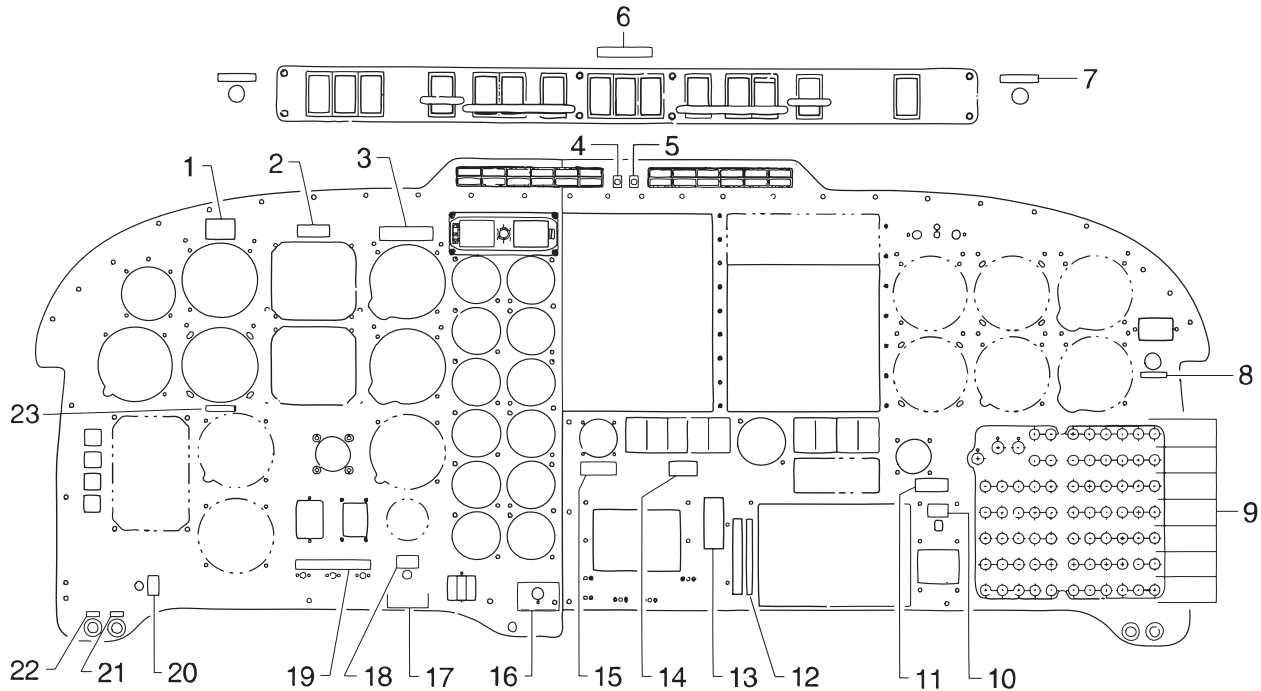


- | | |
|--|---|
| 1. PLACARD - Speed Limitations | 13. PLACARD - Windshield Panel Heat |
| 2. PLACARD - Airplane Registration | 14. PLACARD - Warning - This Aircraft is Not Aproved... |
| 3. PLACARD - Day - Night | 15. PLACARD - Gear Up / Down Maximum Speed |
| 4. PLACARD - Press to Test | 16. PLACARD - Emergency Gear Extension |
| 5. PLACARD - Aviod Continuous Ground Operation... | 17. PLACARD - GPS Limited to VFR Use Only |
| 6. PLACARD - Ammeter | 18. PLACARD - Oxygen - Pull On |
| 7. PLACARD - L. Alt. Amps - R. Alt. Amps | 19. PLACARD - Dimming - Switch - Panel - Avionics |
| 8. PLACARD - KLN-90 Dataloader | 20. PLACARD - GPS |
| 9. PLACARD - Circuit Breaker | 21. PLACARD - Park Brake Pull |
| 10. PLACARD - Warning - Air Conditioner Must Be Off... | 22. PLACARD - Phone |
| 11. PLACARD - Flap Travel | 23. PLACARD - Mic |
| 12. PLACARD - Alternate Static Source | 24. PLACARD - L Primer R |

Interior Placards
Figure 1 (Sheet 2 of 7)

[Effectivity](#)
[Seneca IV](#)

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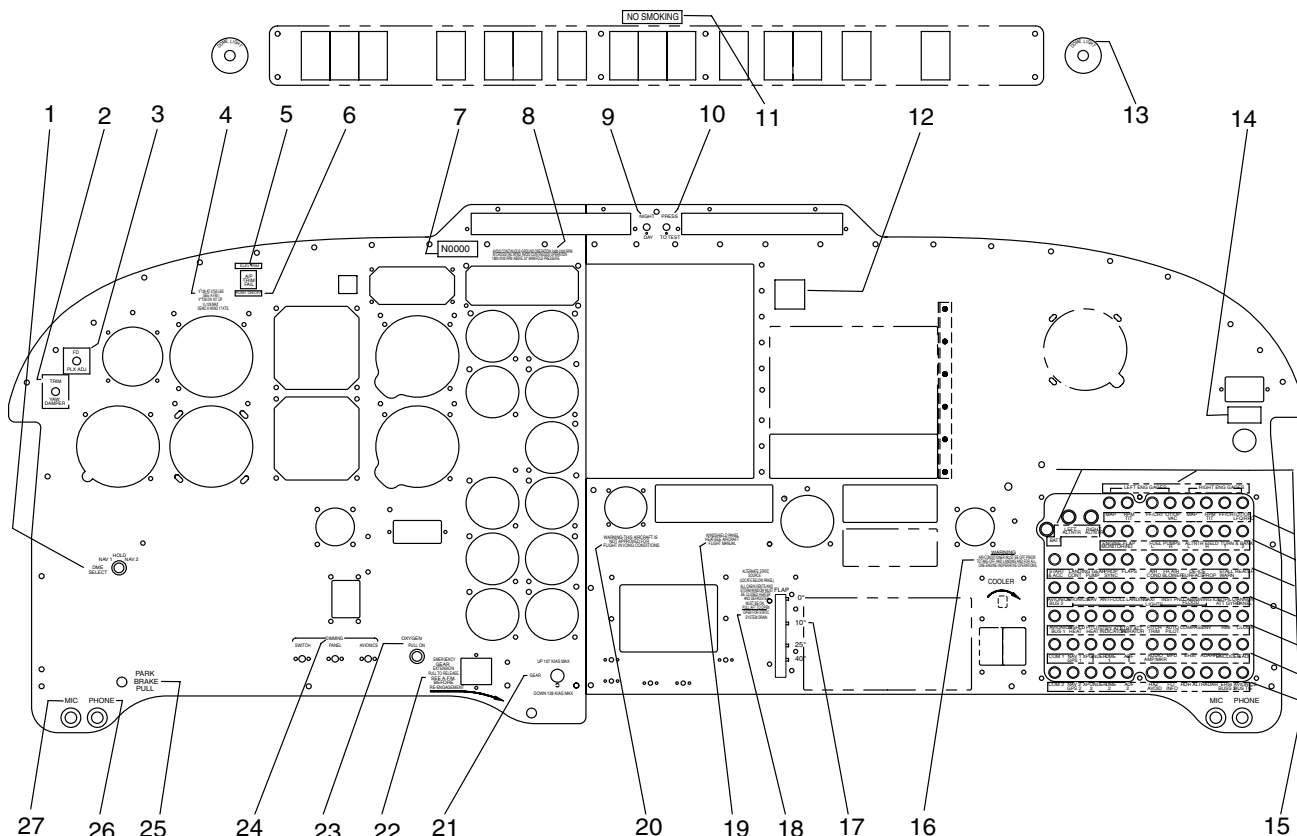
1. PLACARD - Speed Limitations
2. PLACARD - Airplane Registration Number
3. PLACARD - Avoid Continuous Ground Operation...
4. PLACARD - Night/Day
5. PLACARD - Press to Test
6. PLACARD - No Smoking
7. PLACARD - Dome Light
8. PLACARD - KLN-90 Dataloader
9. PLACARDS - Circuit Breaker
10. PLACARD - Cooler
11. PLACARD - Warning - Air Conditioner must be off...
12. PLACARD - Flap Travel
13. PLACARD - Alternate Static Source
14. PLACARD - Windshield Panel Heat
15. PLACARD - Warning - This Aircraft is not approved...
16. PLACARD - Gear Up/Down Maximum Speeds
17. PLACARD - Emergency Gear Extension
18. PLACARD - Oxygen Pull On
19. PLACARD - Dimming - Switch, Panel, Avionics
20. PLACARD - Park Brake Pull
21. PLACARD - Phone
22. PLACARD - Mic
23. PLACARD - Altitude Correction Card
(Aircraft without A/C - S/N's 3449094 and up)

Effectivity

3449001 thru 3449160 and
3449162 thru 3449177

Interior Placards
Figure 1 (Sheet 3 of 7)

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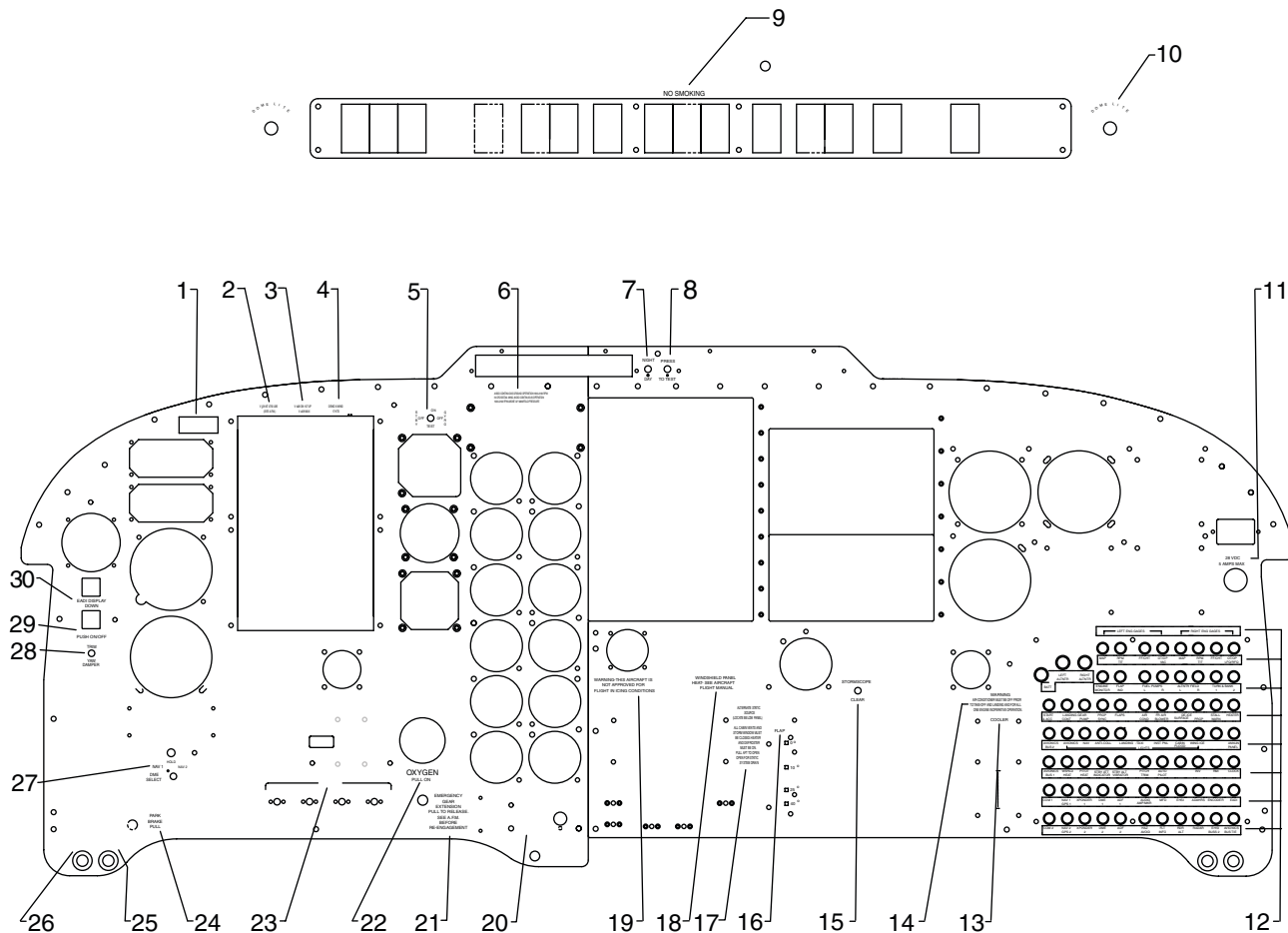
1. PLACARD - DME Select
2. PLACARD - Trim - Yaw Damper
3. PLACARD - FD - PLX ADJ
4. PLACARD - V_A 139 AT 4750 LBS (SEE A.F.M.)
5. PLACARD - Elev. Trim
6. PLACARD - Push ON / OFF
7. PLACARD - Airplane Registration Number
8. PLACARD - Avoid Continuous Ground Operation...
9. PLACARD - Night / Day
10. PLACARD - Press to Test
11. PLACARD - NO SMOKING
12. PLACARD - Stormscope (Optional)
13. PLACARD - Dome Light
14. PLACARD - 28 V DC 5 AMPS

15. PLACARD - Circuit Breakers
16. PLACARD - Warning - A/C Must be Off...
17. PLACARD - Flap Travel
18. PLACARD - Alternate Static Source
19. PLACARD - Windshield Panel Heat
20. PLACARD - Warning - This Aircraft is Not Approved For...
21. PLACARD - Gear Up / Down Max Speeds
22. PLACARD - Emergency Gear Extension
23. PLACARD - Oxygen Pull On
24. PLACARD - Dimming - Switch, Panel, and Avionics
25. PLACARD - Park Break Pull
26. PLACARD - Phone
27. PLACARD - Mic

Interior Placards
Figure 1 (Sheet 4 of 7)

[Effectivity](#)
3449161 and,
3449178 and up

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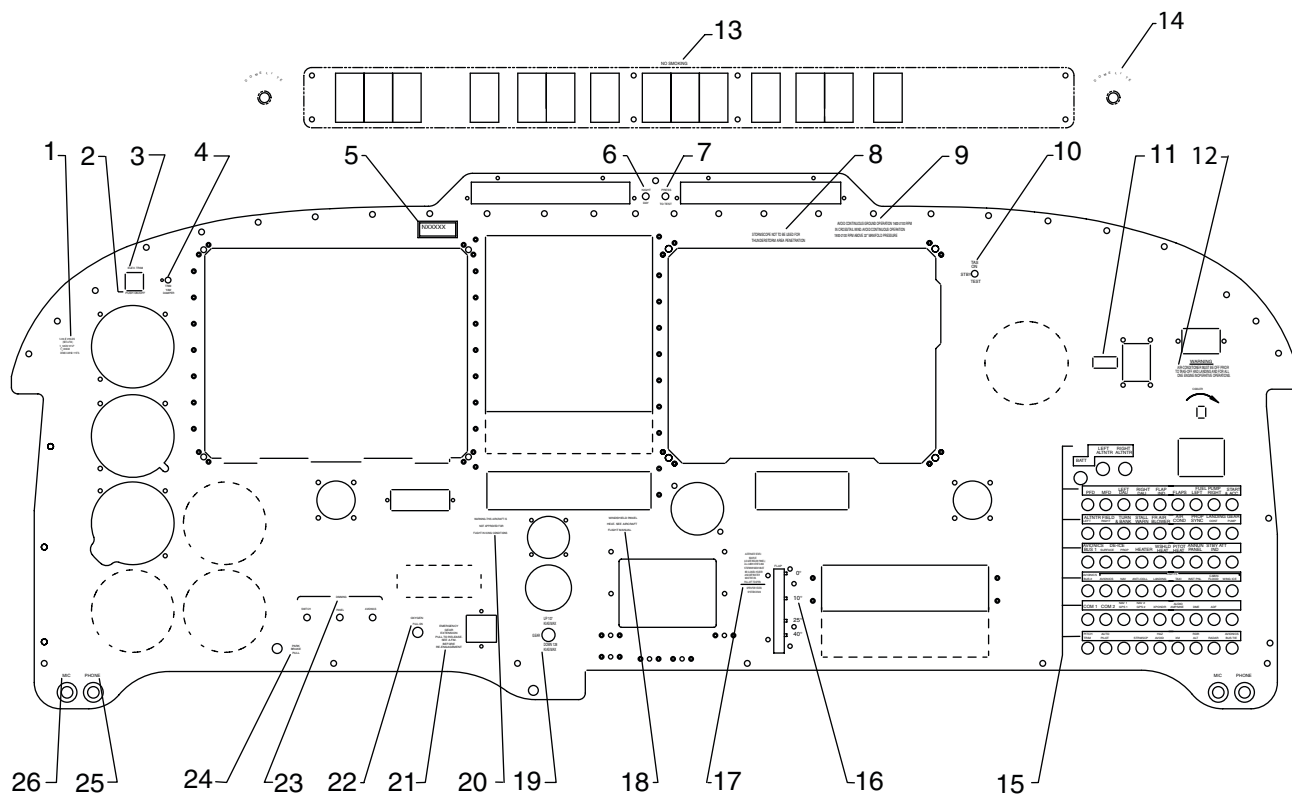


- | | |
|--|--|
| 1. PLACARD - Airplane Registration Number | 16. PLACARD - Flap Handle |
| 2. PLACARD - V_A 139 AT 4750 LBS (SEE A.F.M.) | 17. PLACARD - Alternate Static Source |
| 3. PLACARD - V_{LO} 128 DN 107 UP - V_{LE} 128 MAX | 18. PLACARD - Windshield Panel Heat |
| 4. PLACARD - X-Wind | 19. PLACARD - Warning - This Aircraft is Not Approved... |
| 5. PLACARD - Gyro | 20. PLACARD - Gear Up/Down Max Speeds |
| 6. PLACARD - Avoid Continuous Ground Operation... | 21. PLACARD - Emergency Gear Extension |
| 7. PLACARD - Night/Day | 22. PLACARD - Oxygen Pull On |
| 8. PLACARD - Press to Test | 23. PLACARD - Dimming - Efis, Switch, Panel, Avionics |
| 9. PLACARD - No Smoking | 24. PLACARD - Park Brake Pull |
| 10. PLACARD - Dome Light | 25. PLACARD - Phone |
| 11. PLACARD - 28 VDC 5 AMPS MAX | 26. PLACARD - Mic |
| 12. PLACARD - Circuit Breaker | 27. PLACARD - DME Select |
| 13. PLACARD - A/C Cooler | 28. PLACARD - Trim - Yaw Damper |
| 15. PLACARD - Stormscope (Optional) | 29. PLACARD - Elev. Trim - Push On/Off |
| | 30. PLACARD - EADI Display - Down |

Effectivity
Seneca V
with Meggitt EFIS

Interior Placards
Figure 1 (Sheet 5 of 7)

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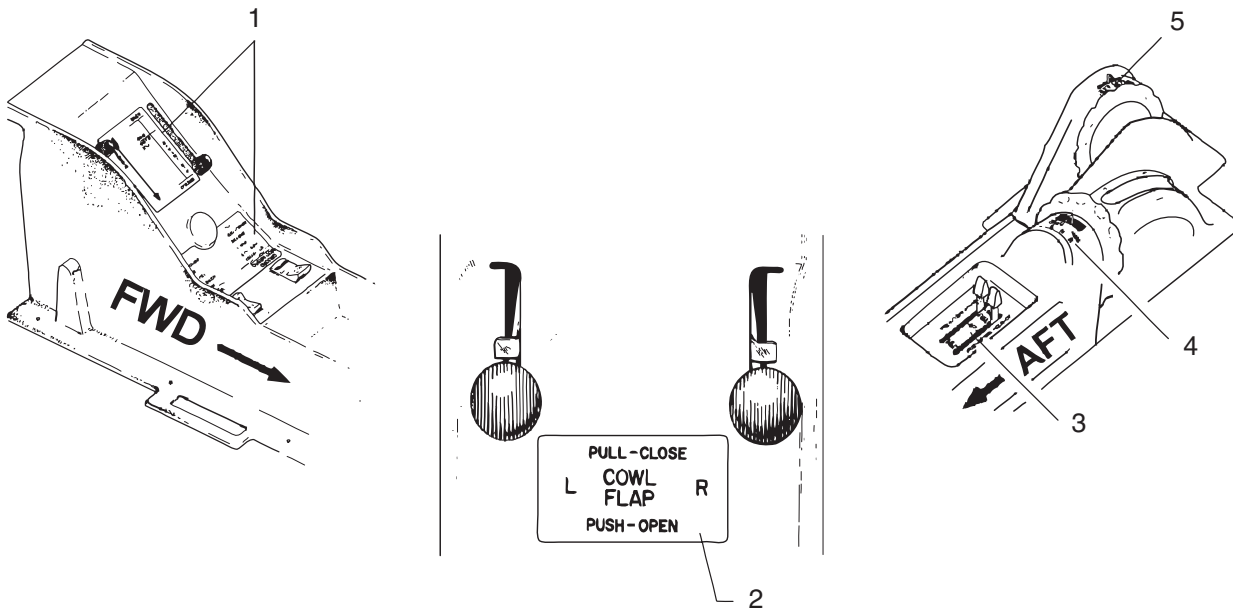
1. PLACARD - V_A 139 AT 4750 LBS (SEE A.F.M.)
2. PLACARD - Push ON/OFF
3. PLACARD - Elev. Trim
4. PLACARD - Trim- Yaw Damper
5. PLACARD - Airplane Registration Number
6. PLACARD - Night/Day
7. PLACARD - Press to Test
8. PLACARD - Stormscope (Optional)
9. PLACARD - Avoid Continuous Ground Operation...
10. PLACARD - TAS
11. PLACARD - ELC
12. PLACARD - Warning - A/C Must Be Off...
13. PLACARD - No Smoking

14. PLACARD - Dome Light
15. PLACARD - Circuit Breaker
16. PLACARD - Flap Travel
17. PLACARD - Alternate Static Source
18. PLACARD - Windshield Panel Heat
19. PLACARD - Gear Up/Down Max Speeds
20. PLACARD - Warning - This Aircraft is Not Approved For...
21. PLACARD - Emergency Gear Extension
22. PLACARD - Oxygen Pull On
23. PLACARD - Dimming - Switch, Panel, and Avionics
24. PLACARD - Park Brake Pull
25. PLACARD - Phone
26. PLACARD - Mic

Interior Placards
Figure 1 (Sheet 6 of 7)

[Effectivity](#)
[Seneca V](#)
[with AvidyneEFIS](#)

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1. PLACARD - Heater/Fan Operation
2. PLACARD - Cowl Flaps
3. PLACARD - Fuel Controls
4. PLACARD - Rudder Trim
5. PLACARD - Elevator Trim

Interior Placards
Figure 1 (Sheet 7 of 7)

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Meyercord Decals

(PIR-PPS-65104, Rev. F.)

Decals installed on the instrument panel are Meyercord type manufactured by Mark-It, 1055 Paramount Tarkway, Batavia. IL 60510. The following procedures should be followed in the event one or more of these decals must be replaced.

A. Removal

CAUTION: DO NOT USE LACQUER THINNER ON ANY PANEL THAT HAS BEEN PAINTED WITH ENAMEL OR LACQUER. INSTRUMENT PANELS ARE PAINTED AT THE FACTORY WITH POLYURETHANE PAINTS.

Remove placard to be replaced with a clean cloth **dampened** with lacquer thinner.

CAUTION: MARK-IT J-70 SOLVENT WILL REMOVE ENAMEL, LACQUER, AND POLYURETHANE BASED PAINT PRODUCTS IF LIQUID IS DROPPED ONTO PAINTED SURFACE AND NOT REMOVED IMMEDIATELY.

If panel is painted with enamel or lacquer use a clean cloth **dampened** with Mark-It J-70 solvent to remove placard to be replaced.

B. Installation

- (1) If required, clean surface to receive decal using alcohol. Newly painted surfaces need no preparation.
- (2) Mix a solution consisting of six (6) parts water and one (1) part J-70 solvent (P/N 179-497).
- (3) Submerge decal in the mixed J-70 solution for approximately 3 to 5 seconds.
- (4) Remove decal from mixed solution and lay in position.
- (5) Using a plastic squeegee, squeegee out from center to edges to remove excess solution.
- (6) Wait approximately 30 to 60 seconds, then slide the backing paper off and wipe up the excess solution with a damp cloth.
- (7) Wait at least 30 minutes at room temperature before wiping the face of the decal with a damp cloth to remove excess solvent residue.
- (8) Allow the decal to dry thoroughly, (tack free in 2 hours at room temp) before handling.

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CHAPTER

12

SERVICING

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Landing Gear, Nose		7	1J1
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GENERAL

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

This chapter covers all routine servicing of airplane, scheduled and non-scheduled, including replenishment of fuel, oil, brake fluid, oxygen (if installed), tire pressure, lubrication requirements, servicing of oleo struts with air and oil, etc. Pay special attention to all WARNINGS and CAUTIONS.

1. Aircraft Finish Care

WARNING: DO NOT USE GASOLINE, ALCOHOL, BENZENE, CARBON TETRACHLORIDE, THINNER, ACETONE OR WINDOW CLEANING SPRAYS TO CLEAN AIRPLANE.

The entire airplane is carefully finished inside and out to assure maximum service life. The external surfaces are coated with durable polyurethane enamel.

A. Dupont Imron 6000 Paint System

CAUTION: FAILURE TO OBSERVE THE PROPER "FINISH CARE" GUIDELINES MAY RESULT IN DAMAGE OR LOSS OF SHINE OF THE AIRCRAFT PAINT. IMPROPER CARE MAY ALSO VOID THE WARRANTY REGARDING THE AIRCRAFT FINISH.

New Piper aircraft delivered in 1999 and later ([Seneca V S/N's 3449097 and up](#)), use the new Dupont Imron 6000 paint system. The guidelines outlined below must be followed to prevent damage to the finish and ensure long paint life.

- (1) For the first 30 days after painting:
 - (a) Hand wash the aircraft often. Use fresh water only.
 - (b) Avoid parking under trees or places where birds roost. If sap, bird droppings, or insect remains are discovered, rinse them off immediately. (Sap, bird droppings, or insect remains will damage the paint during this period.)
- (2) For the first 120 days after painting:
 - (a) To remove heavy soil, use mild liquid soap. Never use detergent.
 - (b) DO NOT WAX THE AIRCRAFT WITHIN 120 DAYS OF PAINTING!
- (3) For long term paint finish protection:
 - (a) Park in a sheltered area whenever possible.
 - (b) Never use a scraper to remove ice or snow from painted surfaces.
 - (c) Never let avgas, oil, or hydraulic fluid stand on painted surfaces. (This will permanently damage the finish.)
 - (d) Never wash the aircraft in the hot sun.
 - (e) Never wipe the finish with a dry cloth, always use fresh water.
 - (f) Avoid abrasive cleaners, chemicals, abrasive wax, or brushes.
 - (g) Have paint nicks or scratches touched up as soon as possible to maintain the aircraft's corrosion protection.

To summarize, New Piper aircraft using the new Dupont paint system need special attention in the early days of ownership.

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B. Cleaning

WARNING: DO NOT USE GASOLINE, KEROSENE, ALCOHOL, BENZENE, CARBON TETRACHLORIDE, THINNER, ACETONE OR WINDOW CLEANING SPRAYS TO CLEAN AIRPLANE.

CAUTION: IF PAINT IS LESS THAN SIX MONTHS, SEE "DUPONT IMRON 6000 PAINT SYSTEM," ABOVE.

CAUTION: DO NOT DIRECT ANY STREAM OF WATER OR CLEANING SOLUTION AT THE OPENINGS IN THE PITOT HEAD, STATIC PORTS, ALTERNATE STATIC PORTS OR FUSELAGE DRAINS.

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

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

2. Cleaning

A. Exterior Surfaces - see "Aircraft Finish Care," above, and "Windshield and Windows," below.

B. Engine Compartment

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

- (1) Place a pan under the engine to catch waste.

CAUTION: DO NOT SPRAY SOLVENT INTO THE ALTERNATOR, STARTER, VACUUM PUMP(S), AIR INTAKE AND ALTERNATE AIR INLETS.

- (2) With the engine cowling removed, spray or brush the engine with solvent or a mixture of solvent and degreaser, as desired. It may be necessary to brush areas that were sprayed where heavy grease and dirt deposits have collected in order to clean them.
- (3) Allow the solvent to remain on the engine from five to ten minutes; then rinse the engine clean with additional solvent and allow to dry.

CAUTION: DO NOT OPERATE ENGINE UNTIL EXCESS SOLVENT HAS EVAPORATED OR OTHERWISE BEEN REMOVED.

- (4) Remove the protective covers from the magnetos.
- (5) Lubricate controls, bearing surfaces, etc., per Lubrication Charts, 12-20-00.

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C. Landing Gear

(1) Struts and Torque Links

Before cleaning the landing gear struts and torque links, remove wheel pants and place a plastic cover or similar material over the wheel and brake assembly.

- (a) Place a pan under the gear to catch waste.
- (b) Spray (low pressure only) or brush the gear area with solvent or a mixture of solvent and degreaser.
- (c) Allow the solvent to remain on the gear for five to ten minutes. Rinse gear with additional solvent and allow to dry.
- (d) Remove cover from wheel and remove the catch pan.
- (e) Lubricate gear per Lubrication Chart, 12-20-00.
- (f) Reinstall wheel pants, if not proceeding to wheels and brakes, below.

(2) Wheels and Brakes

CAUTION: DO NOT USE HIGH PRESSURE SPRAY WASH EQUIPMENT. ITS USE CAN INJECT SOAP SOLUTION AND WATER INTO THE WHEEL BEARINGS AND OTHER INTERNAL CAVITIES RESULTING IN CORROSION AND REDUCED SERVICE LIFE.

- (a) Remove wheel pants, if not already removed, above.
- (b) Hand wash wheels and brakes with a mild soap and water solution.
- (c) Rinse with low-pressure spray.
- (d) Lubricate gear per Lubrication Chart, 12-20-00, if not already done, above.
- (e) Reinstall wheel pants.

D. Windshield and Windows

WARNING: DO NOT USE GASOLINE, ALCOHOL, BENZENE, CARBON TETRACHLORIDE, THINNER, ACETONE, STRONG SOLVENTS OR WINDOW CLEANING SPRAYS. DO NOT USE PLASTIC CLEANER ON HEATED GLASS WINDSHIELDS.

- (1) Remove dirt, mud, etc., from exterior surfaces with clean water.
- (2) Wash with mild soap and warm water, or an aircraft plastic cleaner using a soft cloth or sponge and a straight rubbing motion. Do not rub surfaces harshly.
- (3) Remove oil and grease with a cloth moistened with kerosene.
- (4) After cleaning plastic surfaces, apply a thin coat of hard polishing wax. Rub lightly with a soft cloth. Do not use a circular motion.
- (5) A superficial scratch or mar in plastic can be removed by using jeweler's rouge to rub out the scratch. Smooth both sides and apply wax.
- (6) To improve visibility through windshield and windows during flight through rain, a rain repellent such as REPCON should be applied to windshield and windows. The surfaces of the windshield and windows treated becomes so smooth that water beads up and readily flows off the surface. Apply this product in accordance with the manufacturer's instructions. (See 91-10-00, Consumable Materials and Vendor Contact Information.)

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E. Cleaning Interior

WARNING: SOLVENT CLEANERS REQUIRE ADEQUATE VENTILATION.

- (1) Vinyl interior surfaces may be cleaned with a damp cloth and mild soap and water solution.
- (2) Leather may be cleaned with a mild hand soap and water solution or with a 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.

CAUTION: USE OF COMMON HOUSEHOLD CLEANERS AND POLISHES ON WOOD LAMINATED SURFACES COULD BE VERY HARMFUL.

- (3) Wood laminated surfaces should be maintained using only a high grade furniture wax.
- (4) All upholstery fabrics are Scotchguard treated and may be cleaned as follows:
 - (a) 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 gently 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:
 - (b) Water-based stains such as ketchup, milk, ice cream, coffee:
 - 1 Wipe the stain with a cloth wet with water containing a detergent or ammonia (4 fluid ounces of ammonia to one gallon of water). Repeat if necessary.
 - 2 Oil based stains such as salad dressing, butter or mayonnaise may be removed by either of the following procedures:
 - a Apply "Texize K-2R Spot Remover" by spraying or rubbing into the fabric and let dry. Vacuum off the residual powder. Repeat if necessary.
 - b 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.
 - 3 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.

NOTE: Test the cleaner on an inconspicuous portion of the fabric to test for discoloration. Also avoid soaking or harsh rubbing.

- (5) Headliner, Side Panels and Seats
Clean headliner, side panels, and seats with a stiff brush and vacuum where necessary.
- (6) Carpets

WARNING: SOLVENT CLEANERS REQUIRE ADEQUATE VENTILATION.

Use a small whisk broom or vacuum cleaner to remove dirt. For soiled spots, use a nonflammable dry cleaning fluid. Floor carpets may be removed and cleaned like any household carpet.

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F. Cleaning Surface Deicing Equipment

The deice boots 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 flow of warm air along the region being cleaned, using a portable type ground heater.

CAUTION: PETROLEUM PRODUCTS ARE INJURIOUS TO RUBBER AND THEREFORE SHOULD BE USED SPARINGLY IF AT ALL.

As an alternate cleaning solvent, use benzol or non-leaded 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.

When deice boots are clean, a coating of B.F. Goodrich Icx should be applied. Icx is compounded to lower the strength of adhesion between ice and rubber surface of the deice boots.

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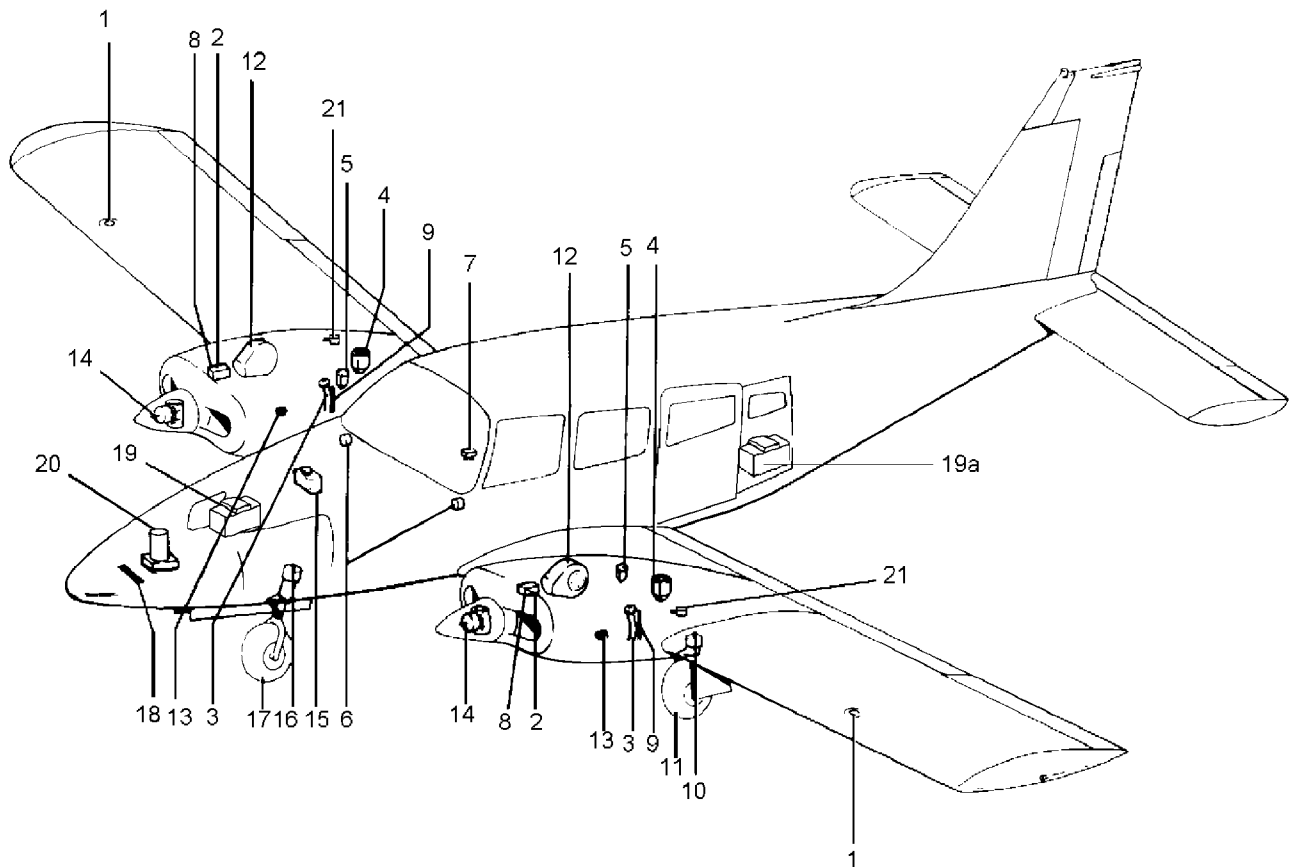
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REPLENISHING



- | | |
|-------------------------------|-------------------------------|
| 1. FUEL FILLERS | 12. INDUCTION AIR FILTERS |
| 2. FUEL INJECTORS & STRAINERS | 13. ENGINE OIL SUCTION SCREEN |
| 3. ENGINE OIL FILL | 14. PROPELLER AIR CHARGE |
| 4. ENGINE OIL FILTERS | 15. BRAKE RESERVOIR |
| 5. FUEL FILTERS | 16. NOSE GEAR STRUT |
| 6. INSTRUMENT AIR FILTERS | 17. NOSE GEAR TIRE |
| 7. FUEL SYSTEM DRAINS | 18. EXTERNAL POWER RECEPTACLE |
| 8. FUEL METERING CONTROL UNIT | 19. BATTERY (Seneca IV) |
| 9. OIL DIPSTICK | 19a. BATTERY (Seneca V) |
| 10. MAIN GEAR STRUT | 20. HYDRAULIC RESERVOIR |
| 11. MAIN GEAR TIRES | 21. VACUUM REGULATOR FILTER |

Service Points
Figure 1

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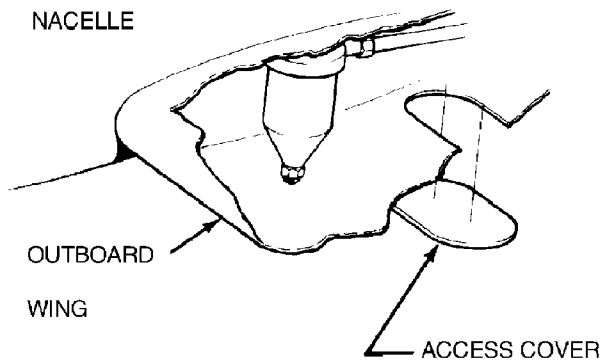
1. Fuel System

A. Fuel Filter

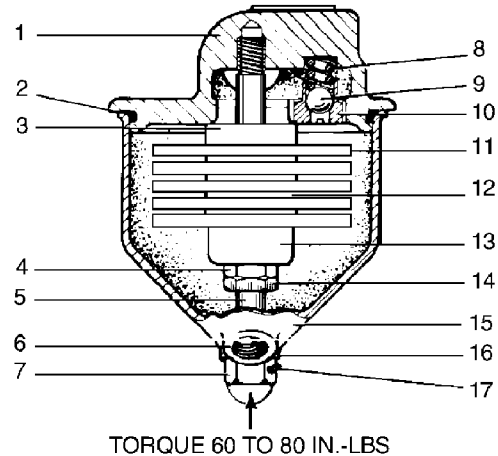
At intervals of 50 hours or 90 days, whichever comes first, clean the fuel screen/filter (i.e. - strainer). The filter in the bowl of the fuel selector valve (refer to Figure 2) is located under the floorboard aft of the main spar and accessed from below the airplane through an access plate.

- (1) Move the system's fuel selector valve to its off position.
- (2) Just outboard of the nacelle (refer to Figures 1 and 2), and under the wing, remove the access panel forward of the main spar at wing station 91.0.
- (3) With the drain cup, drain any fuel still in the bowl from the drain valve under the wing.
- (4) Disconnect the filter drain line from the bowl and cap the line.
- (5) Cut the safety wire and remove cap nut from bottom of bowl.
- (6) Remove bowl and O-ring seal from body.
- (7) Remove the check and retaining nuts from the stud, and slide the filter down off the stud.
- (8) The filter discs and washers need not be separated for normal cleaning. If necessary, proceed as follows:
 - (a) Remove retainer cup from outer tube.
 - (b) Slide discs and washers from outer tube. DO NOT use a sharp tool (screwdriver, etc.) to separate them.
- (9) Remove and clean the fuel injector strainer at the first 25 hour inspection and each 50 hour inspection thereafter.

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- TORQUE 60 TO 80 IN.-LBS
- | | |
|---------------------------|-------------------|
| 1. BODY, FILTER | 10. SEAT, RELIEF |
| 2. O-RING SEAL | 11. DISCS, FILTER |
| 3. TUBE, OUTER | 12. WASHERS |
| 4. NUT | 13. CUP, RETAINER |
| 5. STUD | 14. NUT, CHECK |
| 6. DRAIN, FILTER, FITTING | 15. BOWL, FILTER |
| 7. NUT | 16. WASHER |
| 8. SPRING | 17. SAFETY WIRE |
| 9. BALL, RELIEF | |

Fuel Strainer Bowl and Screen
Figure 2

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B. Fuel Tanks

(1) Filling

CAUTION: WHEN USING ADDITIVES, MAKE SURE THE CORRECT PROCEDURES ARE FOLLOWED. WHEN REFUELING, OBSERVE ALL SAFETY PRECAUTIONS AND USE FUEL SPECIFIED ON FILLER PLACARD.

CAUTION: MAKE SURE THAT ANTI-ICING ADDITIVE IS DIRECTED INTO THE FLOWING FUEL STREAM, STARTING AFTER, AND STOPPING BEFORE THE FUEL FLOW. DO NOT PERMIT ADDITIVE TO COME IN DIRECT CONTACT WITH PAINTED SURFACES OR INTERIOR SURFACES OF TANKS.

CAUTION: DO NOT ADD FURTHER BLENDING TO PREBLENDED FUELS. FUEL ADDITIVES DO NOT ELIMINATE PREFLIGHT FUEL DRAINING.

Each fuel system is filled through a single filler neck in its outboard tank. The standard fuel system involves two 24.5 gallon tanks per side and one 15 gallon bladder cell per side comprising a total of 64 gallons per side.

Anti-icing additives complying with MIL-1-27686, may be added when filling the system. Refer to the next paragraph for the proper method.

(2) Draining Moisture

CAUTION: WHEN DRAINING ANY AMOUNT OF FUEL, INSURE THAT NO FIRE HAZARD EXISTS BEFORE STARTING ENGINE.

The fuel systems are designed to allow moisture and foreign matter to be drained at the systems' lowest points. Two drains are located under the wing (see placards) from the inboard tank and fuel filter. Quick drains for the two systems are mounted underneath the fuselage.

Ice contamination can be prevented by introducing an anti-icing additive (per MIL-I-27686) to the fuel. If an additive is to be used, it must be uniformly blended with the fuel while refueling, and not exceed .15%, by volume, of the refueled quantity. The blend should not be less than 0.10% by volume. A good example would be 1 1/2 liquid ounces per 10 gallons of fuel. For best results follow manufacturer's mixing or blending instructions. If possible, a blender supplied by the manufacturer should be used. The List of Consumable Materials should be utilized for purchasing information.

CAUTION: AFTER EACH USE OF THE QUICK DRAIN VALVE, CHECK THE FUEL SELECTOR VALVE DRAIN TO ENSURE THAT THE QUICK DRAIN VALVE HAS PROPERLY SEATED AND THAT THERE IS NO LOSS OF FUEL FROM THE DRAIN.

The fuel system should be drained daily prior to first flight and after refueling to avoid the accumulation of water sediment. Each aluminum fuel tank is equipped with an individual quick drain located at the lower inboard rear corner of the tank. This allows each wing to be drained individually. The fuel selector valve is provided with a quick drain valve located on the forward face of the spar box. Drain fuel tanks and selector valve per the following:

- (a) Drain each wing through its individual quick drain located at the lower inboard rear corner of the aluminum fuel tank, making sure that enough fuel has been drained to insure that all water and sediment is removed.

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- (b) Place a container under the fuel selector valve drain. Depress the quick drain handle and allow a sufficient amount of fuel to drain from the strainer.

NOTE: The fuel selector should be positioned in the following sequence while draining the strainer: "OFF," "LEFT" and "RIGHT." This is done to insure that the fuel in the lines between each tank outlet and the fuel strainer is drained, as well as the fuel in the fuel strainer. When the fuel tanks are full, it will take approximately six seconds to drain all the fuel in one of the lines from a tank to the fuel strainer. If the fuel tanks are less than full, it will take a few seconds longer.

- (c) Examine the contents of the container placed under the fuel selector valve drain for water and sediment and dispose of the contents.

(3) Draining Entirely

CAUTION: WHEN DRAINING ANY AMOUNT OF FUEL, INSURE THAT NO FIRE HAZARD EXISTS BEFORE STARTING ENGINE.

Fuel may be drained from the system by opening the valve at the inboard end of each aluminum fuel tank. The flush type drain valve requires the drain cup pin to hold the valve open. The remaining fuel in the system may be drained through the filter bowl. Either wing may be drained by closing the selector valve and then draining as desired.

C. Flushing Tanks and Selector Valve

- (1) To flush the fuel tanks and selector valve, disconnect the fuel line at the carburetor ([Seneca IV](#)) or fuel injector ([Seneca V](#)).
- (2) Select a fuel tank, turn on the electric fuel pump and flush fuel through the system until it is determined there is no dirt and foreign matter in the fuel valve or tank. During this operation, agitation of the fuel within the tank will help pick up and remove any dirt.
- (3) Repeat this procedure for each tank.
- (4) When all tanks are flushed, clean all filters.

2. Oil System

CAUTION: DO NOT INTRODUCE ANY TRADE ADDITIVE TO THE BASIC LUBRICANT UNLESS RECOMMENDED BY THE ENGINE MANUFACTURER.

CAUTION: THE ENGINE MANUFACTURER DOES NOT RECOMMEND OILS BY BRAND NAMES. USE A QUALITY BRAND AVIATION GRADE OIL OF THE PROPER SEASON VISCOSITY.

Engine oil level should be checked before each flight. The engine oil and full flow cartridge filter should be changed every 50 hours or four months, whichever occurs first. Refer to the latest revision of Lycoming Service Bulletin 480. Should fuel other than the specified octane rating for the power plant be used, refer to the latest revision Lycoming Service Letter No. L185, for additional information and recommended service procedures. Use a quality brand Aviation Grade Oil of the proper season viscosity. For information on the use of detergent oil, refer to recommendations for Changing Oil and/or the latest revision of Lycoming Service Instruction No. 1014.

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A. Oil Sump

NOTE: Warm the engine to operating temperature before draining to ensure complete drainage.

(1) Draining

To drain the oil sump, provide a suitable container with a minimum capacity of that required to fill the sump. Remove the engine cowl and open the oil drain located on the underside of the engine by pushing the arms of the drain up and turning counterclockwise. This will hold the drain in the open position. It is recommended the engine be warmed to operating temperature to insure complete draining of the old oil.

(2) Filling

The oil sump should normally be filled with oil to the mark on the engine dipstick. The quantity of oil required for the engine may be found in 6-00-00, Chart 1. The specified grade of oil may be found in 12-20-00, Figure 5; on the inside surface of the engine oil filler access door; or in the appropriate vendor publication. To service the engine with oil, open the quick release oil filler access door on top of the cowl, and remove the oil filler cap with dipstick.

(3) Oil Screen (Suction)

The oil suction screen, located on the bottom aft end of the engine sump is installed horizontally. To remove, cut the safety wire and remove the hex head plug. The screen should be cleaned at each oil change to remove any accumulation of sludge and to examine for metal filings or chips. If metal particles are found in the screen, the engine should be examined for internal damage. To avoid possible damage to the screen, after cleaning and inspection, place the screen inside the recess in the hex head plug, and insert the screen into the housing. When certain that the screen is properly seated, tighten and safety the plug with MS-20995-C41 safety wire.

(4) Recommendations for Changing Oil

NOTE: Lycoming recommends changing the oil and filter each 50 hours of operation or every four months, whichever occurs first - for engines equipped with full flow cartridge filters. Refer to the latest revision of Lycoming Service Instruction No. 1014 and Lycoming Service Bulletins No. 446 and No. 480.

The engine manufacturer recommends that the oil supply be drained and the entire sump filled with fresh oil after each 100 hours of engine operation. Always start and warm the engine to operating temperature before performing an oil change. While draining the oil, the screens should be removed from the crankcase cover and cleaned thoroughly. If sludge deposits are heavy, subsequent oil changes should be made at shorter intervals. Detergent oil that meets Continental Motors Corporation Specification MHS-24, is the only recommended lubricating oil. Use SAE-30 or 10W-30 below 50°F ambient air (sea level) and SAE-50 above 50°F ambient air (sea level). When the average ambient air temperature is approximately at the dividing line, use the lighter oil.

- (a) A change to additive oil should be made with a degree of caution in engines that have been operating on straight mineral oil for several hundred hours, since the cleaning action of some additive oils will tend to loosen sludge deposits and cause plugged oil passages. On any engine that has been operating on straight mineral oil, and is known to be in excessive dirty condition, do not switch to an additive or compounded oil until the engine has been overhauled.

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(b) When changing from straight mineral oil to compounded oil, the following precautionary steps should be taken:

- 1 Do not add additive oil to straight mineral oil. Drain the straight mineral oil from the engine and fill with additive oil.
- 2 Do not operate the engine longer than five hours before the first oil change.
- 3 Check all oil screens for evidence of sludge or plugging and change oil every ten hours if sludge conditions are evident. Resume normal oil drain periods after sludge conditions improve.

B. Oil Filter (Full Flow)

- (1) The oil filter should be replaced after each 50 hours of engine operation. This is accomplished by removing the lockwire from the bolt head at the end of the filter housing, loosening the bolt, and removing the filter assembly from the adapter.
- (2) Before discarding the throwaway filter, remove the element for inspection by using a Champion cutter tool, CT-470, available from Champion Spark Plug Co., Toledo, Ohio 43601. It will cut open any spin-on type oil filter for inspection. Examine the material trapped in the filter for evidence of internal engine damage, such as chips or particles from bearings. In new or newly overhauled engines, some small particles of metallic shavings might be found; these are generally of no consequence and should not be confused with particles produced by impacting, abrasion or pressure. Evidence of internal engine damage found in the oil filter justifies further examination to determine the cause.
- (3) After the filter has been replaced, tighten the cartridge to 18 to 20 foot-pounds of torque. Lockwire the bolt through the loops on the side of the housing to the drilled head of the thermostatic valve. Be sure the lockwire is replaced at both the attaching bolt head and the thermostatic oil cooler bypass valve. Use MS-20995-C41 safety wire.

3. Landing Gear

The landing gear consists of tires, brakes and oleo strut assemblies. These should be inspected for scored piston tubes, possible hydraulic fluid leakage and security and condition of all connection points. Check the brake linings for wear and frayed edges, and brake discs for scoring. Replace if necessary. Minor servicing is described in the following paragraphs. For detailed services and overhaul instructions, See 32-10-00.

A. Servicing Oleo Struts

(PIR-PPS-50045, Rev. K.)

CAUTION: DO NOT EXCEED SPECIFIED TUBE EXPOSURES.

Air-oil struts are incorporated in each landing gear oleo to absorb the shock resulting from the impact of the wheels on the runway during landing. To obtain proper oleo action, the nose gear oleo strut must have approximately $1.2 \pm .25$ inches of piston tube exposed, while the main gear struts require approximately $3.25 \pm .50$ inches of tube exposure.

NOTE: Normal static load is the empty weight of the airplane plus full fuel and oil.

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WARNING: DO NOT RELEASE AIR BY REMOVING THE STRUT VALVE CORE OR FILLER PLUG. DEPRESS THE VALVE CORE PIN UNTIL STRUT CHAMBER PRESSURE HAS DIMINISHED.

CAUTION: DIRT AND FOREIGN PARTICLES ACCUMULATE AROUND THE FILLER PLUGS OF THE LANDING GEAR STRUTS. THEREFORE, BEFORE ATTEMPTING TO REMOVE THESE PLUGS, THE TOPS OF THE STRUTS SHOULD BE CLEANED WITH COMPRESSED AIR AND/OR WITH A DRY SOLVENT.

These measurements are taken with the airplane setting on a level surface under normal static load (empty weight of airplane plus full fuel and oil). If the strut has less tube exposed than that prescribed, determine whether it needs air or oil by raising the airplane on jacks. With the strut extended, remove the cap from the air valve at the top of the housing and depress the valve core to allow air to escape from the strut piston until it is fully compressed. Allow the foam from the air-oil mixture to settle and then determine if oil is visible up to the bottom of the filler plug hole. If the oil is visible at the bottom of the hole, then all that is required is that the valve be checked for unsatisfactory conditions and air added as described in Inflating Oleo Struts, below. Should fluid be at any level below the bottom of the filler plug hole, the oleo should be checked for leaks, etc, and oil added as described in Filling Nose Gear Oleo Strut, below; or, Filling Main Gear Oleo Strut, below, respectively. For repair procedures of the landing gear and/or oleo struts, see 32-10-00 and 32-20-00.

B. Filling Nose Gear Oleo Strut

To fill the nose gear oleo strut with hydraulic fluid (MIL-H-5606), whether it be only the addition of a small amount or if the unit has been completely emptied and will required a large amount, it should be filled as follows:

- (1) Raise the airplane on jacks until the nose wheel is completely clear of the ground. (See 7-10-00.)
- (2) Place a pan under the gear to catch spillage.
- (3) If not previously accomplished, remove the engine cowl and relieve air from the strut housing chamber by removing the cap from the air valve and depressing the valve core.
- (4) There are two methods by which the strut chamber may be filled as follows:
 - (a) Method 1 (Addition of small amount of fluid):
 - 1 Remove valve core from filler plug at the top of strut housing. Do not remove plug.
 - 2 Attach one end of a clear plastic hose to the valve stem of the filler plug and submerge the other end in a container of hydraulic fluid. Ascertain that the end of the hose on the valve stem is tight and the fluid container is approximately equal in height to the top of the strut housing.

NOTE: An air tight connection is necessary between the plastic tube and the valve stem. Without such a connection, a small amount of air will be sucked into the oleo strut during each sequence, resulting in an inordinate amount of air bubbles and prolonged filling operations.
 - 3 Fully compress and extend strut to draw fluid from the fluid container and expel air from strut chamber. By watching the fluid pass through the plastic hose, determine when the strut is full and no air is present in the chamber.
 - 4 When air bubbles cease to flow through hose, compress strut fully and remove hose from the valve stem.

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- 5 With strut compressed, remove filler plug to determine that the fluid level is visible up to the bottom of filler plug hole.
 - 6 Install core in filler plug. Apply an appropriate thread lubricant to threads of filler plug and install plug in top of strut housing. Torque plug from 350 to 400 inch-pounds.
- (b) Method II (Filling completely empty struts.):
- 1 Remove filler plug from top of strut housing.
 - 2 Raise strut piston until fully compressed.
 - 3 Pour fluid from a clean container through filler opening until it reaches bottom of filler plug hole.
 - 4 Install filler plug finger tight. Extend and compress the strut two or three times to remove any air that may be trapped in housing.
 - 5 Remove filler plug. Raise strut to full compression and fill with fluid if needed.
 - 6 Apply an appropriate thread lubricant to threads of filler plug and install filler plug in the top of strut housing. Torque plug from 350 to 400 inch-pounds.
- (5) With airplane raised, compress and extend the gear strut several times. Ensure strut actuates freely. The weight of the gear fork and wheel should extend strut.
 - (6) Clean off overflow of fluid, and inflate strut with air to 120 + 12 psi as described in Inflating Oleo Struts, below.
 - (7) Check that fluid is not leaking from around strut piston at bottom of housing.
- C. Filling Main Gear Oleo Strut
- Fill partly full or completely emptied main gear oleo strut with MIL-H-5606 fluid as follows:
- (1) Raise the airplane on jacks until the main wheel is off the ground.
 - (2) Place a pan under the gear to catch spillage.
 - (3) If not previously accomplished, remove a cap on top wing to gain access to top of strut housing. Release air from strut housing chamber by removing cap from air valve and depressing valve core.
 - (4) Fill the main gear housing by one or two methods which are as follows:
 - (a) Method I (Addition of small amount of fluid.):
 - 1 Remove valve core from filler plug at top of strut housing. Do not remove plug.
 - 2 Attach one end of a clear plastic hose to valve stem of filler plug and submerge the other end in a container of hydraulic fluid.

NOTE: An air tight connection is necessary between the plastic tube and the valve stem. Without such a connection, a small amount of air will be sucked into the oleo strut during each sequence, resulting in an inordinate amount of air bubbles and prolonged filling operations.
 - 3 Fully compress and extend strut to draw fluid into the strut. By watching fluid pass through plastic hose, determine when the strut is full and no air is present.
 - 4 When air bubbles cease to flow through hose, compress strut fully and remove hose from valve stem.
 - 5 With strut fully compressed, remove filler plug to determine that fluid level is visible up to bottom of filler plug hole.
 - 6 Install core in filler plug. Apply an appropriate thread lubricant to threads of filler plug and install plug in the top of strut housing. Torque plug from 350 to 400 inch-pounds.

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(b) Method II (Filling completely empty struts.):

- 1 Remove the filler plug from the top of the strut housing.
- 2 Raise the strut to full compression.
- 3 Pour fluid from a clean container through the filler opening until it is visible at the top of the strut chamber.
- 4 Lower the gear until the wheel touches the ground and then fully compress and extend the strut three or four times to remove any air from the housing.

NOTE: Gear assemblies with the air valve/filler plug on the side of the strut housing may be serviced in the horizontal position with the air valve/filler plug hole vertical.

- 5 Raise the strut to full compression and if needed, fill with fluid to the bottom of the filler plug.
 - 6 Apply thread lubricant (Parker 6PB) to the threads of the filler plug. Reinstall the filler plug and torque from 350 to 400 inch-pounds.
- (5) With airplane raised, retract and extend gear strut several times to ascertain that the strut actuates freely. The weight of gear fork and wheel should extend strut.
- (6) Clean off overflow of fluid and inflate strut with air to 250 + 25 psi as described in Inflating Oleo Struts.
- (7) Check that fluid is not leaking around the strut piston at the bottom of the housing.

D. Inflating Oleo Struts

Make certain that oleo strut has sufficient fluid and that torque link is properly connected. Attach a strut pump to air valve and inflate oleo strut to proper visible piston extension, or a pressure of 250 + 25 psi (for the main gear struts) and 120 + 12 psi for the nose gear strut.

When using pressure method, pistons must be fully extended by raising aircraft off ground. (Refer to 7-10-00.)

When using the extension method, the aircraft should be fully serviced with fuel and engine oil and resting on its landing gear. Inflate strut until correct inches of piston is exposed. Rock aircraft several times to ascertain that gear settles back to the correct strut position. If a strut pump is not available, raise aircraft and use line pressure from a high pressure air system. Lower aircraft and, while rocking it, bring strut down to proper extension by releasing air from valve.

Check for valve core leakage before capping valve.

4. Brake System

The brake system incorporates a hydraulic fluid reservoir through which the brake system is periodically serviced. Fluid is drawn from the reservoir by the brake cylinders to maintain the volume of fluid required for maximum braking efficiency. Spongy brake pedal action is often an indication that the brake fluid reservoir is running low on fluid. Instructions for filling the reservoir are given in Filling Brake Cylinder Reservoir. When found necessary to accomplish repairs to any of the brake system components, or to bleed the system, these instructions may be found in 32-40-00.

A. Filling Brake Cylinder Reservoir

The brake cylinder reservoir is located on the left side of the firewall in the engine compartment. It should be checked at every 50 hour inspection and replenished as necessary. Fill with MIL-H-5606 fluid to level marked on reservoir. No brake adjustment is necessary, though they should be checked periodically per instructions given in 32-40-00.

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B. Draining Brake System

- (1) Connect a hose to bleeder fitting on the bottom of the cylinder.
- (2) Place other end of hose in a suitable container.
- (3) Open bleeder fitting and slowly pump hand brake lever and appropriate brake pedal until fluid ceases to flow.
- (4) Clean brake system by flushing with denatured alcohol.

5. Tires

The airplane may be equipped with either tubed or tubeless tires.

Tubeless tires are designed to permit any air or nitrogen that is trapped in the cords or that diffuses through the liner to escape through special sidewall vents. This venting prevents pressure build-up within the cord body which might cause tread, sidewall or ply separation. Discounting tire growth after initial inflation, once the tire has been inflated, the maximum permissible pressure drop due to diffusion is 5% in any 24 hour period.

Vent holes penetrate the sidewall rubber to, or into, the cord body and may vary in size, depth and angle. Therefore, the amount of diffusion through these holes will vary.

When water or a soap solution is brushed over the outside of an inflated tubeless tire, bubbles form. Some vents may emit a continuous stream of bubbles. Others may produce intermittent bubbles. And some may not bubble at all. This variety is normal and does not mean that there is anything wrong with the tire. In fact, as long as a tubeless tire is inflated, there will be some diffusion from the vents. When the loss rate exceeds 5% in 24 hours, recheck for possible injuries. Vents should remain open, so check periodically to make sure they have not been covered over or closed by tire paint or spilled solvent. And since vents may be covered during retreading, check for evidence that your retreads have been revented.

A. Several basic characteristics of tubeless aircraft tires may be mistaken for problems:

- (1) Tire growth in the first 12 to 24 hours after inflation will result in a seemingly severe pressure drop. Simply inflate, wait for another 24 hours, then check pressure. It will probably be within specs.
- (2) Make sure that initial inflation is to recommended operating pressure to ensure full tire growth.
- (3) It is normal for tubeless tires to show a small amount of pressure leakage throughout the life of the tires.

B. Maintain tires at pressure specified in 6-00-00, Chart 1. When checking tire pressure, examine tires for wear, cuts, bruises and slippage on the wheel. Check that index mark on tire is aligned with index mark on wheel. Apply Age-Master #1 to tires to protect against ozone attack and weathering as follows:

- (1) Clean oil and grease from all tire surfaces.
- (2) Apply single heavy coat using brush at 0.4 - 0.5 fluid ounces per square foot. Cover surface completely and evenly; allow to dry for 5 - 10 minutes.
- (3) Apply second coat per step 2; allow to dry for 20 - 30 minutes before handling.
- (4) Remove agent on wheel assembly with cleaning solvent.
- (5) Apply as conditions dictate.

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6. Hydraulic System

The hydraulic pump and landing gear actuating cylinders should be checked for leaks, tightness of line fittings and general condition. The cylinder rods are to be free of all dirt and grit. To clean the rods, use an oil soaked rag and carefully wipe them. All the hydraulic lines should also be checked for leaks, kinks, corrosion and attachment fittings for tightness and security. Repair and check procedures for the hydraulic pump, cylinders, and various components may be found in Chapter 29.

Hydraulic Pump/Reservoir

The fluid level of the reservoir of the combination pump and reservoir should be checked every 50 hours by viewing the fluid through the filler plug hole in the hydraulic pump. Access to the pump is through the panel at the right forward side of the nose baggage compartment.

To check fluid level, remove the filler plug located on the forward side of the pump and ascertain that fluid is visible up to the bottom of the filler plug hole. Should fluid be below the hole, loosen the vent screw and add fluid, MIL-H-5606, through the filler hole until full. Reinstall the filler plug.

NOTE: A small vent hole is located under the vent screw head. Retain .015 inch clearance between the screw head and the small vent hole.

7. Battery

The battery is located in the aft fuselage, aft of the rear baggage compartment. Check battery for proper fluid level. Do not fill battery above the baffle plates. Do not fill the battery with acid - use water only. A hydrometer check will determine the percent of charge in the battery.

Check for spilled electrolyte and corrosion at each 50 hour inspection or every 30 days, whichever comes first. Should corrosion be found on or around the battery, remove the battery and clean it and the surrounding area in accordance with the instructions in Chapter 24.

8. Oxygen System

See 35-10-00.

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SCHEDULED SERVICING

Routine cleaning and lubrication of the airplane and its component parts will significantly extend its service life and reduce the frequency of repairs.

1. Servicing Steering Bungees

At the specified frequency according to the Lubrication Chart, the steering bungees must be serviced as follows:

- A. Remove the access panels located in the forward baggage compartment.
- B. Clamp the rudder pedals in the neutral position as shown in Chapter 27.
- C. Remove the nut, washers, and bolt that secures the steering bungee and the steering arm.
- D. Remove the clamp that secures the boot, on the frame at station 49.50, to the bungee.
- E. Within the fuselage, disconnect the bungee from the rudder pedal arm by removing the nut, washer and bolt.
- F. Remove the steering bungee from the aircraft.
- G. Cut the safety wire from the bungee retainer.
- H. Carefully remove the retainer and release the spring.
- I. Apply Aero Lubriplate to the spring and mounting hardware as specified in the Lubrication Chart.
- J. Compress the spring into the bungee tube and install the retainer securing with MIL-W-6713 Type 316 safety wire.
- K. Ascertain that the measurement taken between the facing sides of the washers at the rod end is 13.71 inches.
- L. With the nose gear in the neutral position, install the steering bungee into position. The web must be in the vertical position. (See 32-20-00.)
- M. Install the bolt, washers, and nut that secures the bungee to the steering arm.
- N. Install the bolt, washer, and nut that secures the bungee to the rudder pedal arm.
- O. Install the boot clamp.
- P. Repeat this procedure for the other steering bungee.
- Q. Align the nose gear. (See 32-20-00).
- R. Remove the rudder pedal clamps and check the operation of the steering bungees.
- S. Install the access panels in the forward baggage compartment with the attachment hardware.

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2. Induction Air Filter

Check induction air filter each 50 hour maintenance inspection. Clean or replace if found to be dirty. Replace the filter after one year, ten cleanings or 500 flight hours, whichever comes first.

A. Removal

The induction air filter is located on the right rear side of the engine compartment and may be removed by the following procedure:

(1) **Seneca IV**

- (a) Remove the upper cowling.
- (b) Release the three stud fasteners, remove filter cover.
- (c) Remove the filter.

(2) **Seneca V**

- (a) Remove the upper cowling.
- (b) Disconnect alternate air linkage/cable.
- (c) Remove induction air hose.
- (d) Remove lower cowl.
- (e) Remove six screws securing cover.
- (f) Remove filter.

B. Cleaning

- (1) When returning existing filter to service, rap gently on a hard flat surface to remove embedded debris. Be careful not to damage sealing ends.
- (2) Inspect filter housing for damage.
- (3) The filter housing may be cleaned by wiping with a clean cloth soaked in a suitable quick drying type solvent.

C. Installation

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

3. Alternate Air Door

The alternate door is located in the air induction box to provide a source of air to the engine should there be an air stoppage through the filter system. The following should be checked during inspection:

- A. Check that air door seals are tight and that the hinge is secure.
- B. Check that when the cockpit control is in the closed position, the door is properly seated in the closed position.
- C. Actuate the door by operating the control lever in the cockpit to determine that it is not sticking or binding.
- D. Check the cockpit control cable for free travel.

4. Electrical System

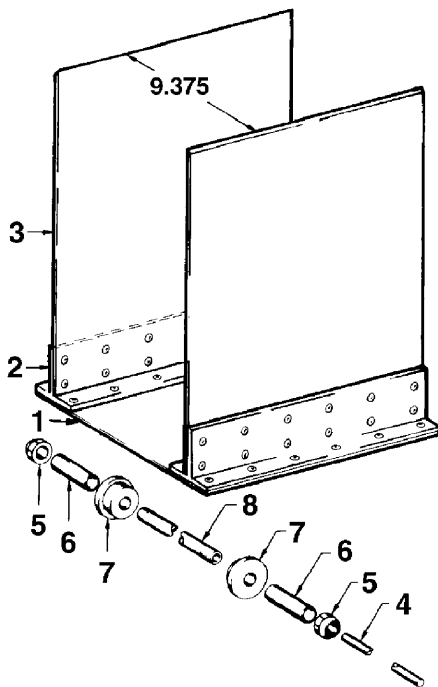
Servicing the electrical system involves adding distilled water to the battery to maintain correct electrolyte level, and checking for any spilled electrolyte that would lead to corrosion. The security of all electrical connections should be checked as well as the operation of all lights, general condition of the generator or alternator and starter. All electrical wires should be inspected for chafing and bare wires. For detailed information on this system, see 24-30-00.

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5. Tire Balance

Proper balancing is critical for the life of aircraft tires. If a new tire is balanced upon installation it will usually remain balanced for the life of the tire without having any shimmy or flat spots. An inexpensive balancer can be made that will balance almost any tire for light aircraft. See Figure 1 for balancer details. Balance the tire as follows:

- (1) Mount tire and tube (if one is used) on wheel, but do not install the securing bolts. Install wheel bearings in wheel; then, using the -7 bushings, -6 spacers, and -5 nuts, (refer to Figure 1) install the wheel-tire assembly on the pipe. Secure the nuts finger-tight so that the wheel halves touch each other. Be sure the bolt holes are aligned. Insert the axle through the pipe and place the wheel in the center of the balancer. Make sure the axle is only on the chamfered edges of the balancer and that it is at 90° to the sides of the balancer.



USE THE FOLLOWING LIST OF MATERIALS TO MAKE THE BALANCER

- 1. 1 EA BASE	12 X 11	0.190 2024 T3 CLAD ALUMINUM ALLOY
- 2. 2 EA TEE	2.5 X 2 X 11	0.190 2024 T4 EXTRUDED ALUMINUM ALLOY
- 3. 2 EA SIDES	14 X 11	0128 2024 T3 CLAD ALUMINUM ALLOY
- 4. 2 EA AXLE	0.125 X 10.25	4130, STEEL, NORMALIZED
- 5. 2 EA NUTS	AN 365-624	
- 6. 2 EA SPACER	0.50 X 2.25	5052-0 ALUMINUM TUBING
2 EA SPACER	0.50 X 1.25	5052-0 ALUMINUM TUBING
- 7. 2 EA BUSHING	1.480 X 1.625 X 1.00	PHENOLIC OR ALUMINUM
2 EA BUSHING	2.240 X 1.37 X 1.00	PHENOLIC OR ALUMINUM
- 8. 1 EA PIPE	1/8 X 9.3	BLACK STEEL PIPE
* 2 EA BEARINGS	SAVE TWO OF EACH SIZE WORN WHEEL BEARINGS FROM PREVIOUS INSPECTIONS.	

Wheel Balancer
Figure 1

- (2) Release the tire. If it is out of balance it will rotate, coming to rest with the heaviest point on the bottom. Tape a one-half (1/2) ounce patch across top center of the tire. Rotate the tire 45° and release it again. If the tire returns to the same position, add a one (1) ounce patch and again rotate the tire and release it. Continue this procedure until the tire is balanced.
- (3) When balance is attained, put a chalk mark on the sidewall directly below the patch. Use one mark for each half ounce of weight needed. Mark the valve stem location on the tire and the opposite wheel half to assure reassembly in the same position. Remove the wheel from the balance stand, break it down and clean the inside of the tire with toluol. Apply a coat of patch cement to both the patch and the inside center of the tire in line with the chalk marks. When the cement has dried, install the patches making certain they are on the center line of the tire and aligned with the chalk marks on the sidewall. Burnish the patches to remove trapped air, etc.

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- (4) When reassembling the wheel, powder the inside of the tire. Mount the tire on the valve side of the wheel in the same position it was in when it was balanced. Install the other wheel half, aligning the chalk marks. Install the bolts and tighten to required torque, then air the tire and recheck the balance. The wheel should not be more than one-half (1/2) ounce out of balance.

6. Airframe Lubrication

Proper lubrication procedures are valuable for prolonging the service life of the airplane and as a means of reducing the frequency of extensive and expensive repairs. The periodic application of recommended lubricants to their relevant bearing surfaces, combined with cleanliness, as detailed in the following paragraphs, ensures maximum efficiency and utmost service of all moving parts. Lubrication instruction regarding the locations, time intervals, and type of lubricants used are found in proper lubrication charts.

- A. To ensure the best possible results from the application of lubricants, observe the following precautions:

NOTE: If the airplane is inactive for long periods of time, it should be lubricated in accordance with the Lubrication Charts every 90 days.

- (1) Use only recommended lubricants. Where general purpose lubricating oil is specified, but unavailable, clean reciprocating engine oil may be used as a satisfactory substitute.
- (2) Check components for evidence of excessive wear and replace as necessary.
- (3) Remove all excess lubricants from components to prevent collecting dirt and sand in quantities capable of causing excessive wear or damage to bearing surfaces.

B. Application of Grease

When lubricating bearings and bearings surfaces with a grease gun, ensure gun is filled with new, clean grease of the grade specified for the particular application before applying lubricant to grease fittings.

- (1) If a reservoir is not provided around a bearing, apply lubricant sparingly and wipe off excess.
- (2) Remove wheel bearings from the wheel hub and clean thoroughly with a suitable solvent. When packing with grease, be sure the lubricant enters the space between the rollers in the retainer ring. Do not pack the grease into the wheel hub.
- (3) Use extra care when greasing propeller hub to avoid blowing clamp gaskets. Remove one grease fitting and apply grease to the other fitting until fresh grease appears at the hole of the removed fitting. Uneven greasing effects propeller balance.

C. Application of Oil

If specific lubrication instructions for certain components are not available, observe the following precautions:

CAUTION: AFTER THOROUGHLY WASHING AIRPLANE, ENSURE LANDING GEAR, FLIGHT CONTROLS, FLAP TRACKS, ELEVATOR TRIM SCREW, AND ENGINE COMPARTMENT ARE STILL PROPERLY LUBRICATED.

CAUTION: BE CAREFUL NOT TO ADD TOO MUCH OIL, BECAUSE THE EXCESS WILL BE THROWN OFF DURING OPERATION AND WILL CAUSE PITTING AND BURNING OF THE MAGNETO POINTS.

- (1) Apply oil sparingly. Never apply more than enough to coat the bearing surfaces.
- (2) Do not oil control cables.
- (3) For Bendix magnetos only: Squeeze the magneto cam follower felts at regular inspection periods. If oil appears on fingers, do not add oil. If the felt is dry, moisten with light oil.

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D. Lubrication Charts

The lubrication charts consist of individual illustrations for the various aircraft systems, and each component to be lubricated is indicated by a number, the type of lubricant and the frequency of application. Special instructions are listed at the beginning of the lubrication charts and with the applicable component illustration. See 91-10-00 for a List of Consumable Materials and suggested vendors.

CAUTION: MIL-G-23827 AND MIL-G-81322, CONTAIN CHEMICALS WHICH MAY BE HARMFUL TO PAINTED SURFACES.

CAUTION: DRY LUBRICANT (I.E. - PTFE BASED MS-122DF) WILL ATTACK ANY ACRYLIC BASED PLASTIC (LUCITE), POLYCARBONATES (LEXAN), POLYSTYRENE AND ITS COPOLYMERS (ABS), AND CELLULOSE ACETATE.

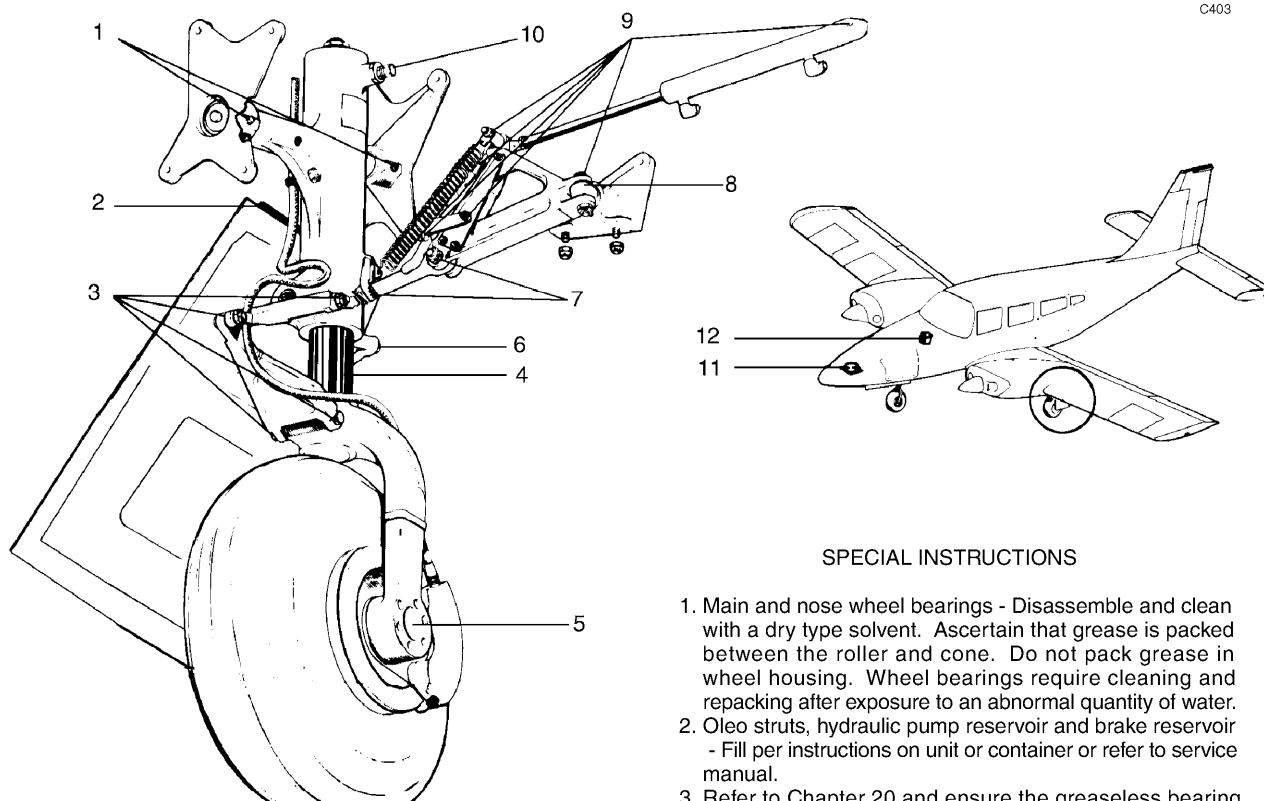
SPECIAL INSTRUCTIONS

1. BEARINGS AND BUSHINGS - CLEAN EXTERIOR WITH A DRY TYPE SOLVENT BEFORE LUBRICATING.
2. LUBRICATING POINTS - WIPE ALL LUBRICATION POINTS CLEAN OF OLD GREASE, OIL, DIRT, ETC., BEFORE LUBRICATING.
3. REMOVE ALL EXCESS GREASE FROM GREASE FITTINGS.
4. AIR FILTER (6X ONLY) - TO CLEAN FILTER, TAP GENTLY TO REMOVE DIRT PARTICLES OR WASH IN WARM WATER AND MILD DETERGENT AND DRY. DO NOT BLOW OUT WITH COMPRESSED AIR. DO NOT USE OIL. REPLACE FILTER IF DAMAGED.
4. AIR FILTER (6XT ONLY) - TO CLEAN FILTER, BLOW OUT WITH COMPRESSED AIR FROM GASKET SIDE OR WASH IN WARM WATER AND MILD DETERGENT AND DRY. DO NOT USE OIL.
5. WHEEL BEARINGS - DISASSEMBLE AND CLEAN WITH A DRY TYPE SOLVENT. ASCERTAIN THAT GREASE IS PACKED BETWEEN THE ROLLER AND CONE. DO NOT PACK GREASE IN WHEEL HOUSING. WHEEL BEARINGS REQUIRE CLEANING AND REPACKING AFTER EXPOSURE TO AN ABNORMAL QUANTITY OF WATER.
6. OLEO STRUTS AND BRAKE RESERVOIR - FILL PER INSTRUCTIONS ON UNIT OR CONTAINER, OR REFER TO APPLICABLE CHAPTER IN THIS MANUAL.
7. DOOR SEALS - APPLY RELEASE AGENT/DRY LUBRICANT TO DOOR SEALS AT LEAST EVERY 30 DAYS TO IMPROVE SEALING AND TO PREVENT THE SEAL FROM STICKING.
8. OIL AND FILTER - LYCOMING RECOMMENDS CHANGING THE OIL AND FILTER EVERY 50 HOURS OR FOUR MONTHS, WHICHEVER COMES FIRST.
9. PROPELLER - FOR EACH BLADE: REMOVE A GREASE FITTING; APPLY GREASE THROUGH THE REMAINING FITTING UNTIL FRESH GREASE APPEARS AT HOLE OF REMOVED FITTING. IF ANNUAL USAGE IS SIGNIFICANTLY LESS THAN 100 HOURS, INCREASE LUBRICATION FREQUENCY TO EVERY SIX MONTHS.
10. FUEL SELECTOR VALVE - LUBRICATE AREA WHERE DETENT BALL MOVES ACROSS COVER PLATE (ON EXTERNAL VALVE ONLY).
11. DO NOT USE HYDRAULIC FLUID WITH A CASTOR OIL OR ESTER BASE.
12. DO NOT OVER LUBRICATE COCKPIT CONTROLS.
13. DO NOT OIL CONTROL CABLES. GREASE CONTROL CABLES WHERE THEY PASS OVER A PULLEY OR THROUGH A FAIRLEAD.
14. SEE THE LATEST REVISION OF LYCOMING SERVICE INSTRUCTIONS NO. 1014 FOR USE OF DETERGENT OIL.

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COMPONENT	LUBRICANT	FREQUENCY
1. MAIN GEAR PIVOT POINTS (SEE NOTE 3)	MIL-G-81322	100 HRS
2. MAIN GEAR DOOR HINGE	MIL-L-7870	100 HRS
3. MAIN GEAR TORQUE LINKS	MIL-L-7870	100 HRS
4. EXPOSED OLEO STRUT MAIN	FLUOROCARBON RELEASE AGENT DRY LUBRICANT #MS-122	100 HRS
5. MAIN GEAR WHEEL BEARINGS	MIL-G-81322	100 HRS
6. MAIN GEAR DOOR CONTROL ROD ENDS	MIL-L-7870	100 HRS
7. MAIN GEAR SIDE BRACE LINK ASSEMBLY	MIL-G-81322	100 HRS
8. UPPER SIDE BRACE SWIVEL FITTING	MIL-G-81322	100 HRS
9. RETRACTION FITTING AND CYLINDER ATTACHMENT POINTS	MIL-L-7870	100 HRS
10. OLEO STRUT FILLER POINT (MAIN GEAR)	MIL-H-5606	AS REQUIRED
11. HYDRAULIC PUMP RESERVOIR	MIL-H-5606	100 HRS
12. BRAKE RESERVOIR	MIL-H-5606	100 HRS

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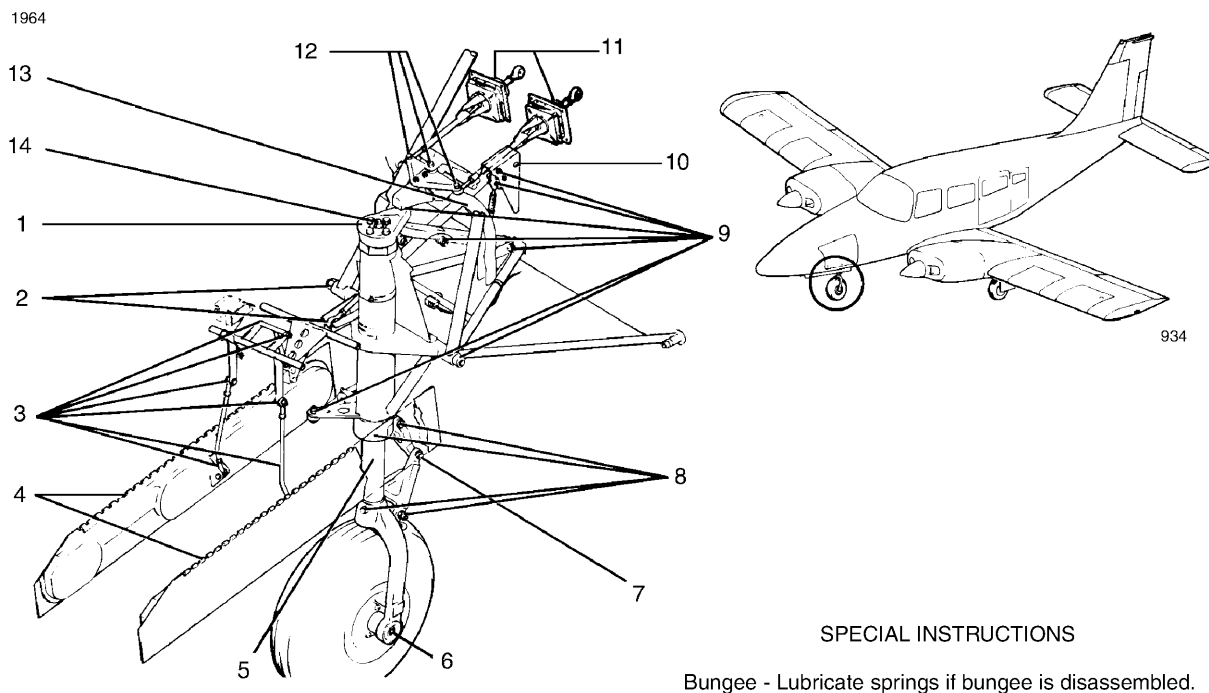
SPECIAL INSTRUCTIONS

1. Main and nose wheel bearings - Disassemble and clean with a dry type solvent. Ascertain that grease is packed between the roller and cone. Do not pack grease in wheel housing. Wheel bearings require cleaning and repacking after exposure to an abnormal quantity of water.
2. Oleo struts, hydraulic pump reservoir and brake reservoir - Fill per instructions on unit or container or refer to service manual.
3. Refer to Chapter 20 and ensure the greaseless bearing is in good condition. Check for looseness.

Lubrication Chart - Landing Gear, Main
Figure 2

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COMPONENT	LUBRICANT	FREQUENCY
1. NOSE GEAR STRUT HOUSING	MIL-G-81322	100 HRS
2. NOSE GEAR PIVOT POINT AND HYDRAULIC CYLINDER ROD END	MIL-L-7870	100 HRS
3. NOSE GEAR DOOR RETRACTION MECHANISM	MIL-L-7870	100 HRS
4. NOSE GEAR DOOR HINGES	MIL-L-7870	100 HRS
5. EXPOSED OLEO STRUT	FLUOROCARBON RELEASE AGENT DRY LUBRICANT #MS-122	100 HRS
6. NOSE WHEEL BEARINGS	MIL-G-81322	100 HRS
7. NOSE GEAR TORQUE LINK ASSEMBLY	MIL-L-7870	100 HRS
8. NOSE GEAR TORQUE LINK ASSEMBLY AND STRUT HOUSING	MIL-G-81322	100 HRS
9. NOSE GEAR PIVOT POINT, DRAG LINK ASSEMBLY, DOWNLOCK AND CYLINDER ASSEMBLY, STEERING ROLLER AND CENTERING SPRING PIVOT POINTS	MIL-L-7870	100 HRS
10. LINK BUSHING	MIL-L-7870	100 HRS
11. BUNGEEES	MIL-G-81322	100 HRS
12. STEERING BELLCRANK PIVOT POINTS AND ROD ENDS	MIL-L-7870	100 HRS
13. NOSE GEAR ROLLER TRACK	MIL-G-7711	100 HRS
14. NOSE GEAR OLEO STRUT FILLER POINT	MIL-H-5606	AS REQUIRED

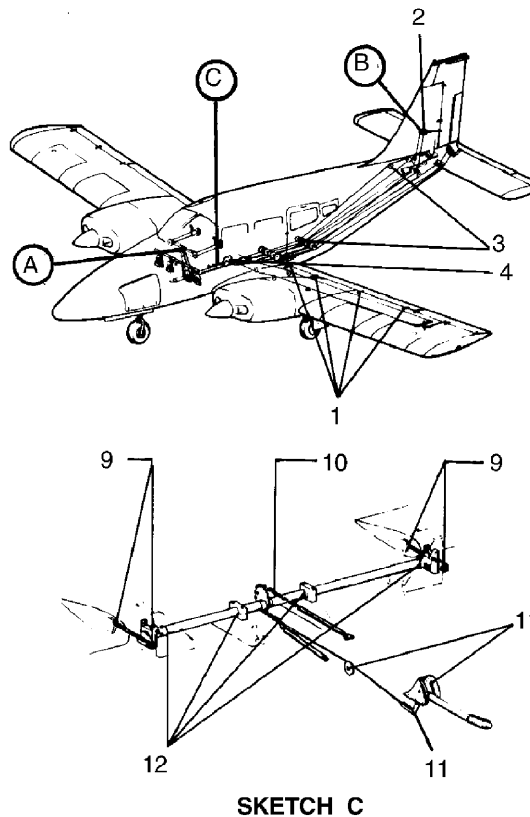
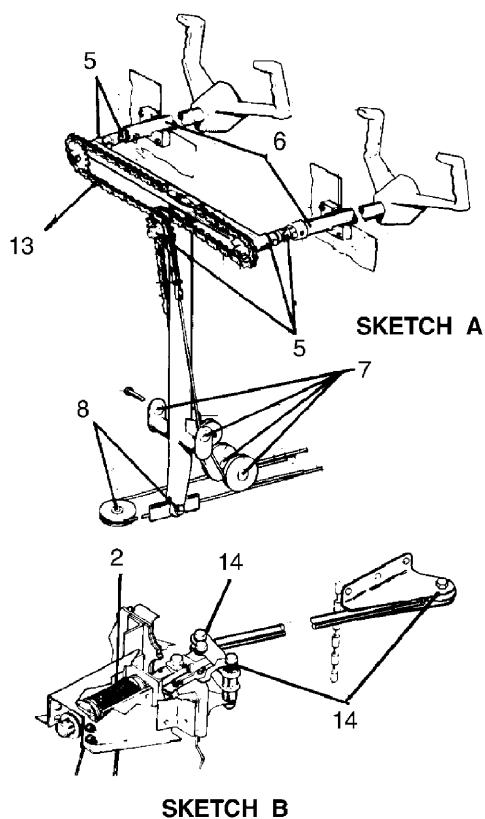


Lubrication Chart - Nose Gear
Figure 3

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CAUTION: DO NOT LUBRICATE CONTROL WHEEL SHAFT OR BUSHING. CLEAN ONLY WITH ALCOHOL OR OTHER SUITABLE SOLVENT.

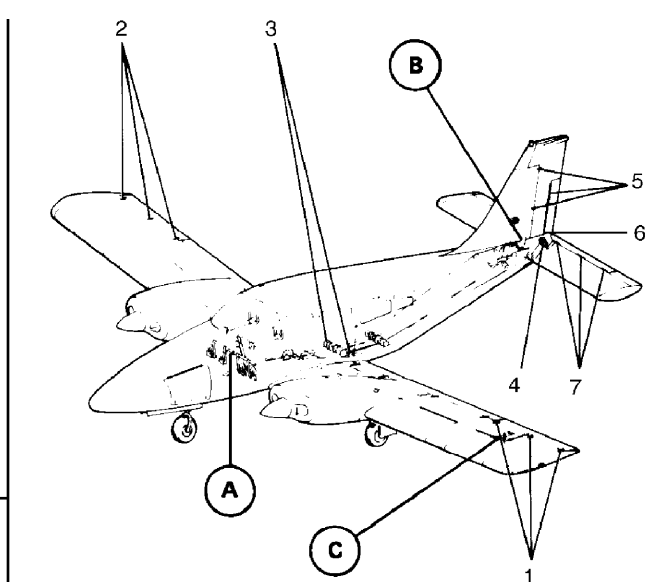
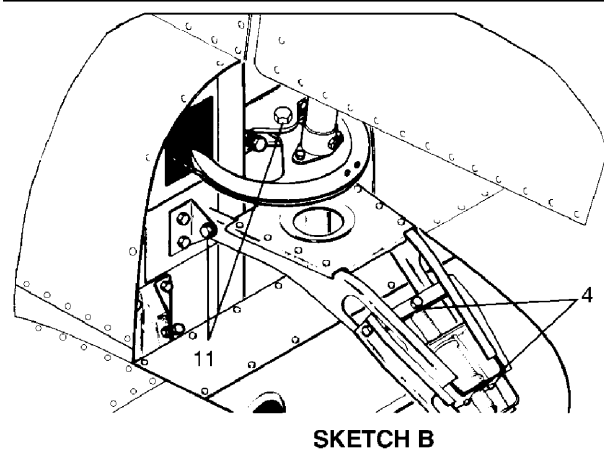
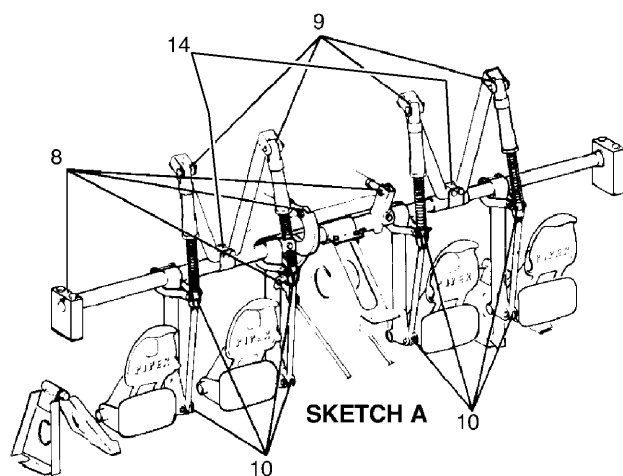
COMPONENT	LUBRICANT	FREQUENCY
1. FLAP HINGE BEARINGS	MIL-L-7870	100 HRS
2. RUDDER TRIM SCREWS	MIL-G-81322	100 HRS
3. CONTROL CABLE PULLEYS	MIL-L-7870	100 HRS
4. TRIM CONTROL WHEELS, STABILATOR AND RUDDER	MIL-L-7870	100 HRS
5. CONTROL COLUMN FLEX JOINT AND SPROCKET	MIL-L-7870	100 HRS
6. O-RING CONTROL SHAFT BUSHING	FLUOROCARBON RELEASE AGENT DRY LUBRICANT #MS-122	100 HRS
7. TEE BAR PIVOT POINTS, AILERON AND STABILATOR CONTROL PULLEYS	MIL-L-7870	100 HRS
8. STABILATOR CONTROL ROD AND IDLER PULLEY	MIL-L-7870	100 HRS
9. FLAP CONTROL ROD END BEARINGS	MIL-L-7870	100 HRS
10. TORQUE TUBE	MIL-L-7870	100 HRS
11. FLAP SERVO	MIL-L-7870	100 HRS
12. FLAP TORQUE TUBE BEARING BLOCK	MIL-L-7870	100 HRS
13. AILERON AND STABILATOR CONTROL CHAIN	MIL-L-7870	500 HRS
14. RUDDER TAB ROD END BEARINGS	MIL-L-7870	100 HRS
* AILERON, ELEVATOR, RUDDER AND TRIM CABLES (* Not Shown) (Do not oil control cables. Grease cables where they pass over a pulley or through a fairlead.)	MIL-L-81322	100 HRS



Lubrication Chart - Control System (Sheet 1 of 2)
Figure 4

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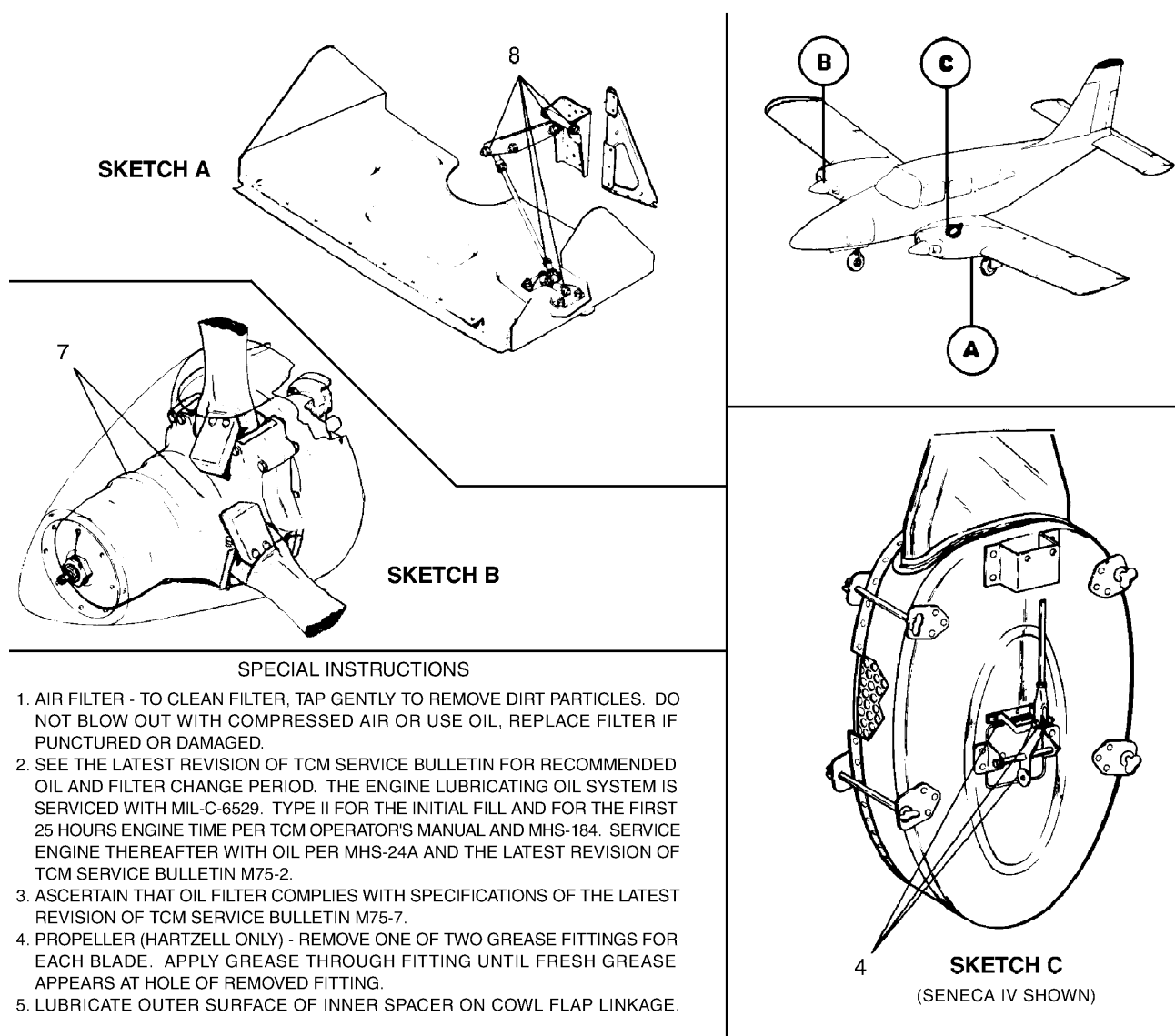
COMPONENT	LUBRICANT	FREQUENCY
1. AILERON HINGE PINS	MIL-L-7870	100 HRS
2. AILERON HINGE PINS	MIL-L-7870	100 HRS
3. CONTROL CABLE PULLEYS	MIL-L-7870	100 HRS
4. STABILATOR TRIM SCREW	MIL-G-81322	100 HRS
5. RUDDER HINGE AND TAB HINGE BEARINGS	MIL-L-7870	100 HRS
6. ARM BUSHING	MIL-L-7870	100 HRS
7. STABILATOR TRIM TAB HINGE PINS	MIL-L-7870	100 HRS
8. RUDDER TUBE CONNECTIONS, TUBE CABLE ENDS AND STEERING ROD ENDS	MIL-L-7870	100 HRS
9. TOE BRAKE ATTACHMENTS	MIL-L-7870	100 HRS
10. BRAKE ROD ENDS	MIL-L-7870	100 HRS
11. RUDDER SECTOR AND STABILATOR TRIM PIVOT POINTS	MIL-L-7870	100 HRS
12. AILERON CONTROL ROD END BEARINGS	MIL-L-7870	100 HRS
13. AILERON BELLCRANK CABLE ENDS	MIL-L-7870	100 HRS
14. TOE BRAKE BRACES	MIL-L-7711	100 HRS
* AILERON, ELEVATOR, RUDDER AND TRIM CABLES (* Not Shown) (Do not oil control cables. Grease cables where they pass over a pulley or through a fairlead.)	MIL-L-81322	100 HRS



Lubrication Chart - Control System (Sheet 2 of 2)
Figure 4

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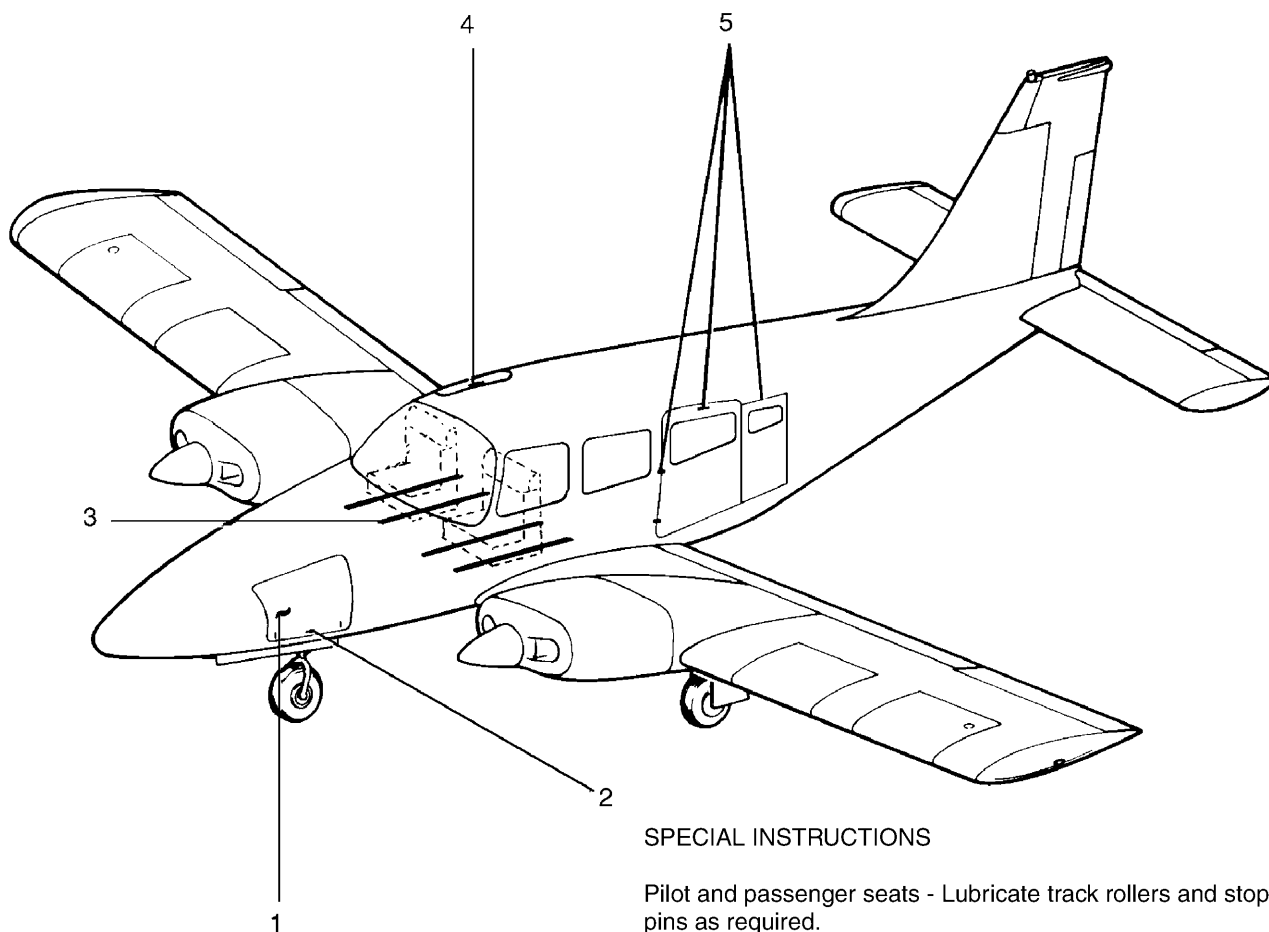
COMPONENT	LUBRICANT	FREQUENCY
1. ENGINE OIL SUMPS	SEE CONTINENTAL SPEC. MHS-24A AND LATEST REVISION OF SERVICE BULLETIN M75-2	100 HRS
2. OIL FILTERS	SEE SPECIAL INSTRUCTIONS NO. 2 AND 3	50 HRS
3. INDUCTION AIR FILTERS	CLEAN AS OFTEN AS NECESSARY. EVERY DAY UNDER SEVERE CONDITIONS.	
4. ALTERNATE AIR DOORS	MIL-L-7870	100 HRS
5. GOVERNOR CONTROLS	MIL-L-7870	100 HRS
6. CONTROL QUADRANT CONTROLS	MIL-L-7870	100 HRS
7. PROPELLER ASSEMBLY (HARTZELL ONLY)	AEROSHELL 6	100 HRS
8. COWL FLAP ACTUATING MECHANISM	MIL-G-81322	500 HRS



Lubrication Chart - Power Plant and Propeller
Figure 5

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COMPONENT	LUBRICANT	FREQUENCY
1. FORWARD BAGGAGE DOOR	MIL-L-7870	100 HRS
2. LATCH MECHANISM	MIL-G-7711	500 HRS
3. PILOT AND COPILOT SEAT ADJUSTMENT	MIL-L-7870	100 HRS
4. MAIN DOOR HINGES AND LATCH MECHANISM	MIL-L-7870	100 HRS
5. BAGGAGE AND REAR DOOR HINGES AND LATCH MECHANISM	MIL-L-7870	100 HRS



Lubrication Chart - Cabin Door, Baggage Door and Seats
Figure 6

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CHAPTER

20

STANDARD PRACTICES - AIRFRAME

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CHAPTER 20

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CHAPTER 20 - STANDARD PRACTICES - AIRFRAME

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GENERAL

1. Description

This chapter contains general information pertaining to standard aircraft hardware installation and removal practices.

For standard repair practices of a minor nature, refer to AC 43.13-1 (latest revision).

If non-destructive testing is needed after repair of 4130 steel, use a magnetic particle inspection method such as Magnaflux.

Testing and inspecting of aluminum castings and machined aluminum parts may be done by the dye penetrant method.

Usually, a good visual inspection with a 10X magnifying glass will show any damage or defect in a repair that is of a significant nature.

2. Torque Wrenches

Torque wrenches should be checked daily and calibrated by means of weights and a measured lever arm to make sure that inaccuracies are not present. Checking one torque wrench against another is not sufficient and is not recommended. Some wrenches are quite sensitive as to the way they are supported during a tightening operation. Any instructions furnished by the manufacturer must be followed explicitly.

When it is necessary to use a special extension or adapter wrench together with a torque wrench, a simple mathematical equation must be worked out to arrive at the correct torque reading. Following is the formula to be used: (See Figure 1.)

T = Torque desired at the part.

A = Basic lever length from center of wrench shank to center of handle or stamped on wrench or listed for that model wrench.

B = Length of adapter extension, center of bolt to center of shank.

C = Scale reading needed to obtain desired torque (T).

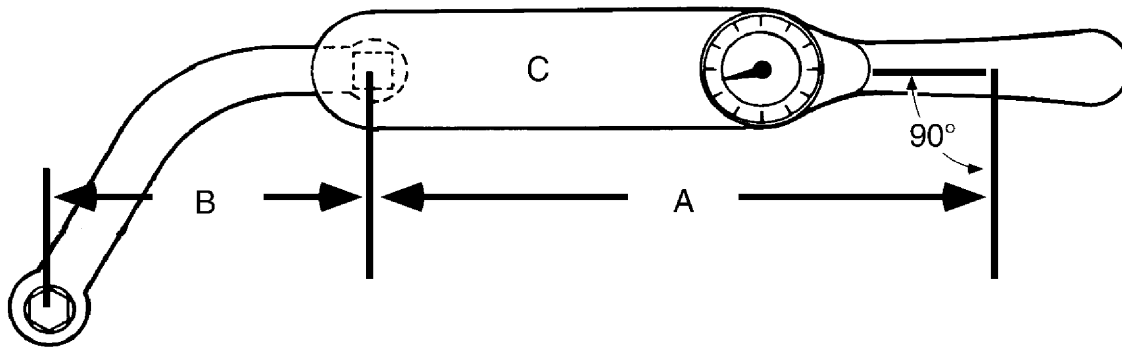
The formula:
$$C = \frac{A \times T}{A + B}$$

EXAMPLE: A bolt requires 30 foot pounds and a 3 inch adapter (one-quarter of a foot or 0.25') is needed to get at it. You want to know what scale reading it will take on a one-foot lever arm wrench to obtain the 30 foot pounds at the bolt.

$$C = \frac{1 \times 30}{1 + 0.25} \text{ or } C = \frac{30}{1.25}$$

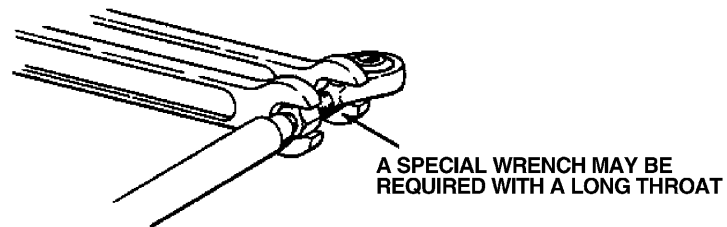
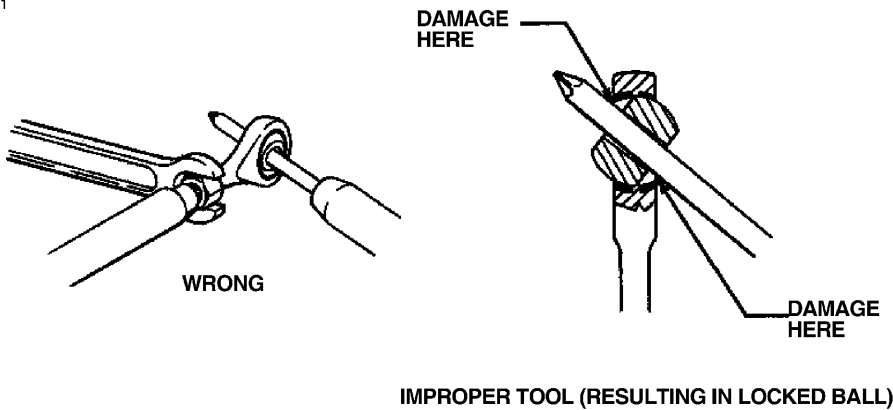
Remember, the 3 inch adapter must be projecting 3 inches straight along the wrench axis. In general, avoid all complex assemblages or adapters and extensions of flex joints.

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Torque Wrench Formula
Figure 1

901



ONLY CORRECT METHOD

Installing Rod End Bearings
Figure 2

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3. Installing Rod End Bearings

Install rod end bearings as shown in Figure 2.

4. Removing Cherrylock Rivets

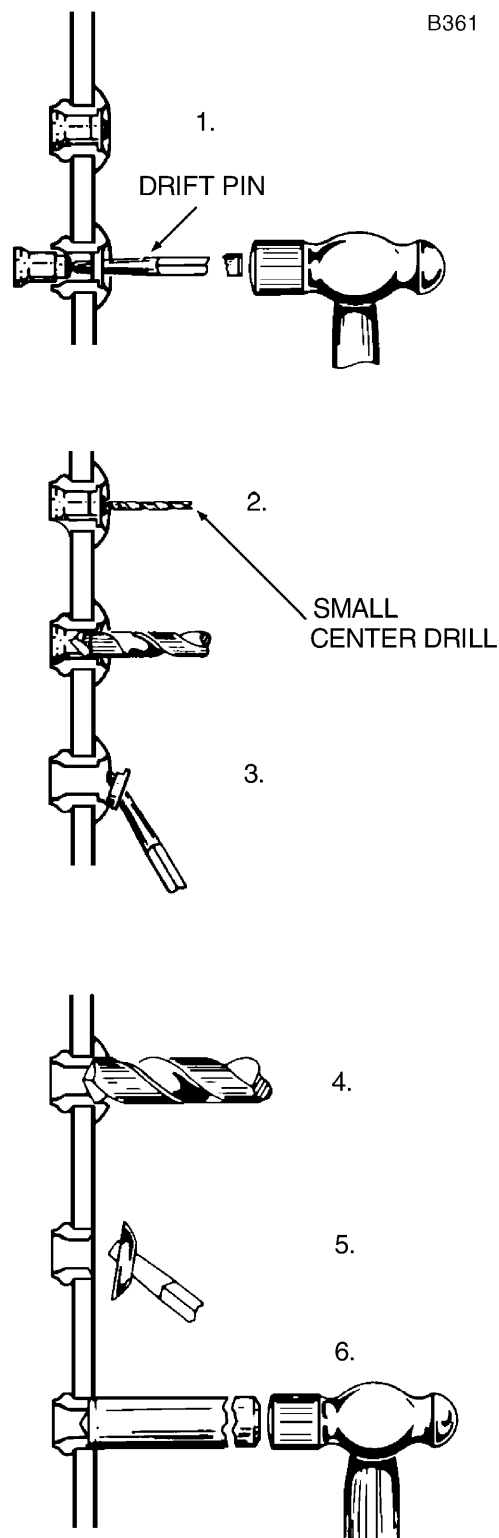
Use following procedure to remove cherrylock rivets:

- A. To remove from thick material, use a tapered steel drift pin to drive out rivet stem. (See Figure 3, View 1.)

CAUTION: DRIVING OUT THE LOCKED STEM OF RIVETS INSTALLED IN THIN MATERIAL MAY DAMAGE THE MATERIAL.

NOTE: Drilling completely through the rivet sleeve, when removing rivets, tends to enlarge hole.

- B. To remove from thin material, drill away tapered portion of stem to destroy the lock. Use a small center drill bit on top of the rivet stem to provide a guide for a larger bit. (See Figure 3, Views 2 and 3.)
- C. Pry remainder of locking collar out of rivet head with a drift pin. (See Figure 3, View 3.)
- D. Drill almost, but not completely, through head of rivet. Use a drill bit the same size as the rivet shank. (See Figure 3, View 4.)
- E. Use a drift pin as a lever to break off rivet head. (See Figure 3, View 5.)
- F. Drive out remaining rivet shank with a pin having same diameter as rivet shank. (See Figure 3, View 6.)



Removing Cherrylock Rivets
Figure 3

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5. Identification of Fluid Lines (See Figure 4.)

Aircraft fluid lines are identified by color code markers, words and geometric symbols. The markers identify each line's function, content, primary hazard, and the direction of fluid flow.

Most fluid lines are marked with 1 inch tape or decals. Paint is used on lines in the engine induction system.

Certain lines may also be identified as to the specific function within a system. For example: DRAIN, VENT, PRESSURE or RETURN.

Lines conveying fuel may be marked FLAM. Lines containing toxic materials are marked TOXIC. Line containing physically dangerous materials, such as oxygen, nitrogen, or freon, are marked PHDAN.

The aircraft and engine manufacturer is responsible for the original installation of identification markers, Aircraft maintenance personnel are responsible for their replacement when it becomes necessary.

Tapes, paint, tags and decals are placed on both ends of a line and at least once in each compartment through which the line runs. Identification markers are also placed immediately adjacent to each valve, regulator, filter or other accessory within a line.

6. Inspection of Flexible Hoses

NOTE: During the manufacturing process, a condition known as "rubber strike-through" occasionally occurs. This condition is such that rubber material protrudes through the wire braid cover. This condition has no effect on hose quality.

It is recommended that flexible hoses be inspected every 100 hours, especially those in the engine compartments. When inspecting hoses, look for the following conditions:

- A. Check each installation to be sure the hose is not kinked, twisted, or distorted. Check for evidence of abrasion, cuts, and broken wires. Random broken wires are acceptable since wire breaks sometimes occur during manufacture. Discard hose if two or more broken wires are found per plait (braid) or more than six broken wires per lineal foot. Broken wires in an area where kinking is evident is also a cause for rejection.

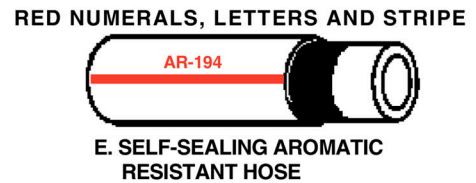
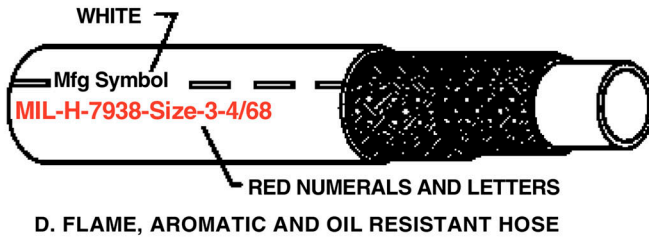
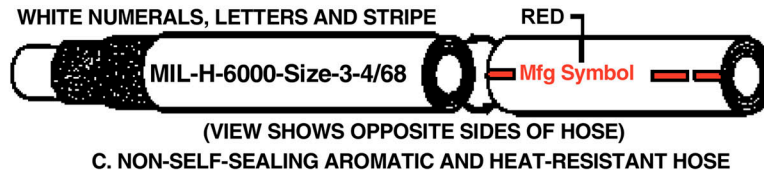
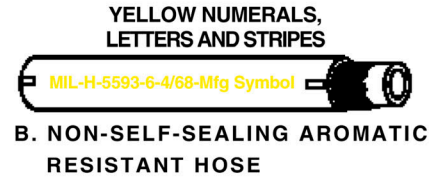
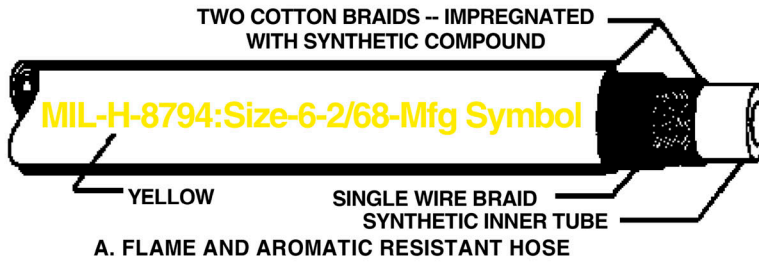
CAUTION: PUNCTURING THE OUTER COVER OF THE HOSE MAY CAUSE DAMAGE TO THE HOSE.

- B. Check each assembly for deterioration, ply separation of cover or braid, cracks, weather checking, lack of flexibility, blisters or bulging, collapse, or sharp bending. Blisters on the outer synthetic cover do not necessarily indicate a faulty hose.
- C. Remove hose from assembly if hose shows any visible wear. Inspect hose interior and check for signs of deterioration, tube collapse, cut rubber, wire braid puncture, or restriction. To inspect hoses with elbow fittings, use flexible inspection light and viewer, or inspection ball as described in Chart 1. Replace hose if any deterioration exists.

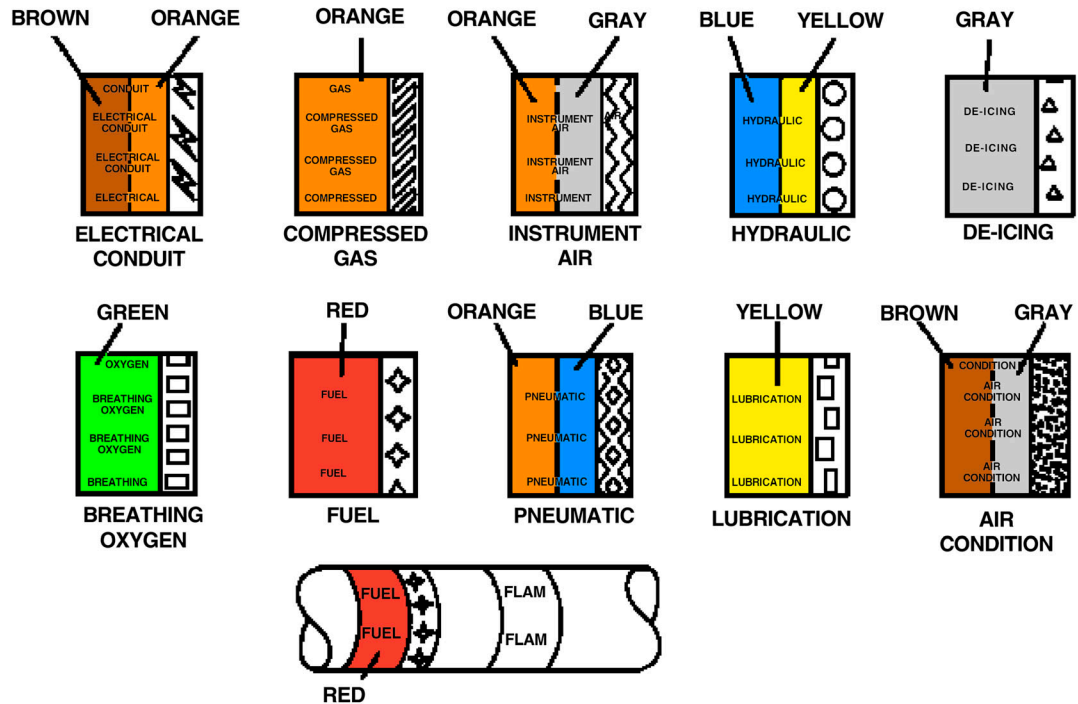
CHART 1
BALL DIAMETERS FOR TESTING HOSE RESTRICTIONS

Hose Size	Ball Size
- 4	5/64
- 5	9/65
- 6	13/64
- 8	9/32
- 10	3/8
- 12	1/2
- 16	47/64
- 20	61/64

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HOSE IDENTIFICATION MARKINGS



Hose, Tube, and Line Markings
Figure 4

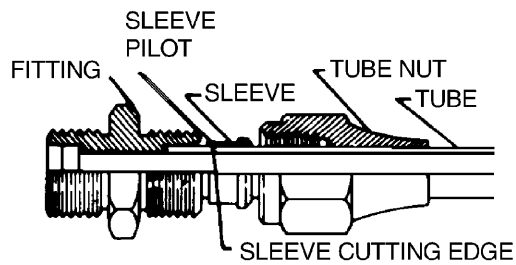
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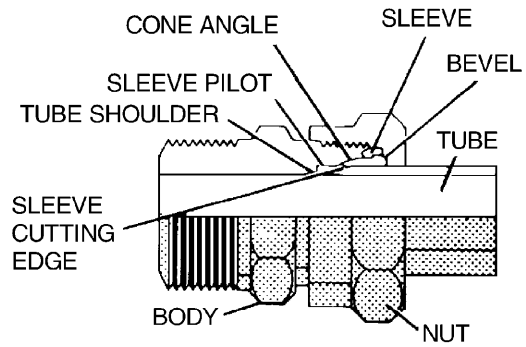
TUBING AND HOSE LUBRICANTS

TUBING SYSTEM	LUBRICANT
HYDRAULIC	MIL-H-5606
FUEL	MIL-H-5656
OIL	SYSTEM OIL
PNEUMATIC	MIL-L-4343
OXYGEN *	NONE

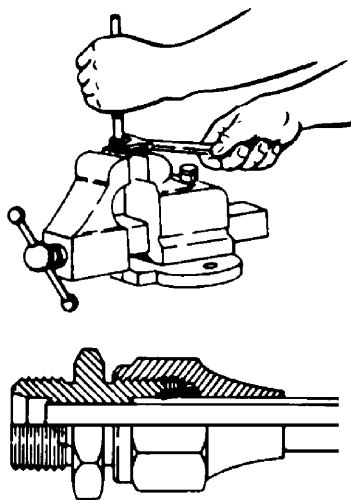
* SEE 35-10-00.



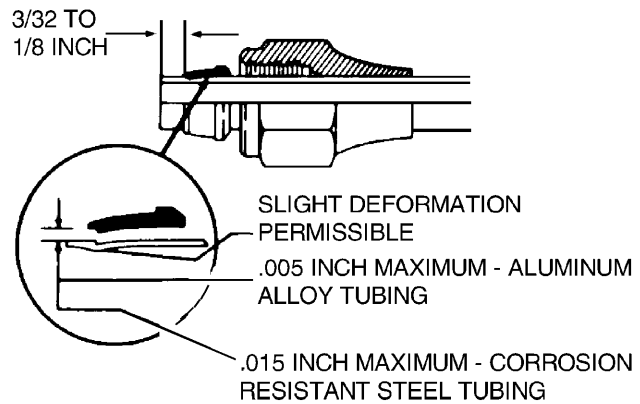
STEP 1



FLARELESS-TUBE FITTING



STEP 2



STEP 3

Presetting Flareless Tube Fittings
Figure 5

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7. Flareless Tube Assemblies

The use of flareless tube fittings eliminates all tube flaring. An operation, referred to as presetting, is necessary prior to installing a new flareless tube assembly. Presetting is performed as follows:

- A. Cut tube to correct length. Ensure ends are perfectly square. Deburr inside and outside of tube. Slip nut, then sleeve, over the tube. (See Figure 5, Step 1.)
- B. Lubricate fitting and nut threads as specified in table contained in Figure 5.
- C. Place fitting in a vise (See Figure 5, Step 2). Hold tubing firmly and squarely on seat in fitting. (Tube must bottom firmly in the fitting.) Tighten nut until cutting edge of sleeve grips tube. This point is determined by slowly turning tube back and forth while tightening nut. When tube no longer turns, nut is ready for final tightening.
- D. Final tightening depends upon type and size of tubing. On aluminum alloy tubing up to and including half inch outside diameter, tighten nut from 1 to 1-1/6 turns. On aluminum alloy tubing over half inch outside diameter, or steel tubing, tighten nut from 1-1/6 to 1-1/2 turns.
- E. After presetting the sleeve, disconnect tubing from fitting and check the following points (Figure 5, Step 3):
 - (1) Tube extends 3/32 to 1/8 inch beyond sleeve pilot to prevent blow off.
 - (2) Sleeve pilot contacts tube. A maximum clearance of 0.005 inch for aluminum alloy tubing, or 0.015 inch for steel tubing, is acceptable.
 - (3) A slight collapse of tube at sleeve cut is permissible. No movement of sleeve pilot, except rotation, is permissible.

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8. Support Clamps

CAUTION: MAKE CERTAIN THAT CLAMPS ARE OF THE CORRECT SIZE. CLAMPS OR SUPPORTING CLIPS SMALLER THAN THE OUTSIDE DIAMETER OF THE HOSE MAY RESTRICT THE FLOW OF FLUID THROUGH THE HOSE.

Support clamps are used to secure the various lines to the airframe or power plant assemblies. Several type of support clamps are used for this purpose. The rubber cushioned and plain are the most commonly used clamps. The rubber cushioned clamp is used to secure lines subject to vibration; the cushioning prevents chafing of the tubing. The plain clamp is used to secure lines in areas not subject to vibration.

A teflon cushioned clamp is used in areas where the deteriorating effects of hydraulic fluid or fuel is expected, however, because it is less resilient, it does not provide as good a vibration damping effect as other cushion materials.

Use bonded clamps to secure metal hydraulic, fuel and oil lines in place. Unbonded clamps should be used only for securing wiring. Remove any paint or anodizing from the portion of the tube at the bonding clamp location.

All plumbing lines must be secured at specified intervals. The maximum distance between supports for rigid fluid tubing is shown in Chart 2.

9. "V" Band Coupling (Clamp)

"V" Band couplings used in the Cabin Heating and/or any other system must be lock wired so that failure of the "T" bolt will not allow the coupling to separate.

10. Self-Lubricating Impregnated Bearing/Bushings (See Figure 6.)

Many systems and assemblies throughout the aircraft utilize bearings (bushings) that are self-lubricating or impregnated with oil. These parts are designed and built into the assemblies to provide lubricated bearing surfaces requiring little or no mechanical lubrication, or attention.

The most commonly used bearings are of the Garlock "DU" type. Unless absolutely specified, grease should not be used on these bearings although they can be oiled. It is significant to note that these bearings are designed to function wet or dry; however, with alternating conditions, greater bedding in will occur and greatly reduce dry operation wear resistance.

CHART 2
MAXIMUM DISTANCE BETWEEN SUPPORTS FOR FLUID TUBING

Tube O.D. (IN.)	Distance Between Supports (IN.)	
	Aluminum Alloy	Steel
1/8	9-1/2	11-1/2
3/16	12	14
1/4	13-1/2	16
5/16	15	18
3/8	16-1/2	20
1/2	19	23
5/8	22	25-1/2
3/4	24	27-1/2
1	26-1/2	30

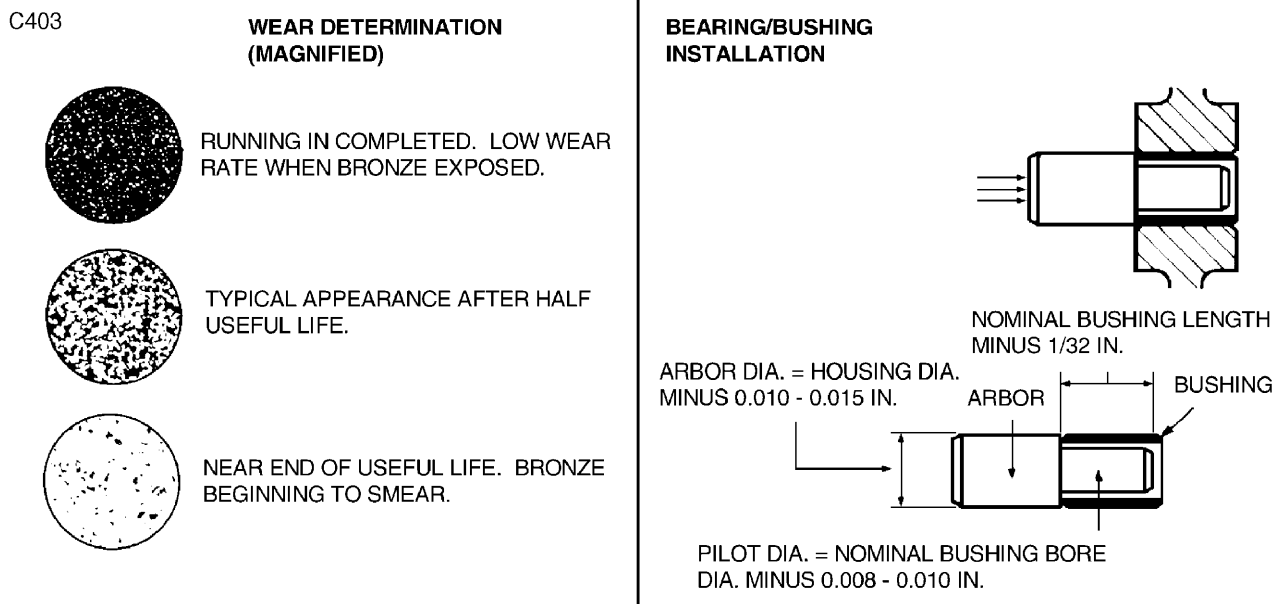
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During normal operation, self-lubricating bearings generally bed in and deposit the overlay material on the mating surface of the bolt, etc., which forms a lubricant film. The bearing rubbing surfaces often acquire at this time, a grey green color, exposing a bronze matrix over about 10% of the bearing surface. During the run in period the surface layer may shed slightly exhibiting fine feathery particles. As the bronze surface is exposed and friction increases, the heat expands the bronze providing lubrication to the assembly. As shown in Figure 6, the level of bronze in time is slowly exposed to the point where the bearing should be replaced. When the bearing reaches the end of its useful life, about 70% of the bearing surface will be exposed.

Removal of these bushings is relatively easy using a drift pin. Installation however, is critical to the life of the bearing. Care must be taken to ensure the bearing is squarely inserted in its housing to avoid damage to the lining material. The bearing should be installed as follows:

- A. Apply a smear of oil to the outside surface of the bearing.
- B. With an arbor press, obtain an arbor 0.010 to 0.015 of an inch smaller than the housing aperture.
- C. Carefully align the bearing in the housing and press the bushing into the housing. **MAKE SURE** the bearing goes in squarely.

NOTE: For large type bushings or bearings where the previous procedure becomes impractical, other methods can be used provided care is taken to protect the edge of the bearing from being damaged. Steps must be taken to maintain alignment of the bearing during assembly. **MAKE SURE THE LINING MATERIAL IS NOT SCRATCHED OR CHIPPED.**



Self-Lubricating Impregnated Bearing/Bushings
Figure 6

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11. Dye Penetrant Inspections

NOTE: The following procedure is general in nature. See manufacturer's instructions, included with dye penetrant kit, for specifics.

- A. Using a volatile cleaner, thoroughly remove dirt, loose scale, oil and grease from surface to be inspected.
- B. Heat surface to at least 70°F (21°C), but not exceeding 130°F (54°C).
- C. Apply penetrant by brushing, spraying, or dipping. Let stand 2 to 15 minutes, depending on temperature.
- D. Remove surplus penetrant by applying special cleaner recommended by penetrant manufacturer, or by rinsing with water. Allow housing to dry.
- E. Apply a light, even coat of developer by spraying, brushing, or dipping. Cracks or other opening in surface being inspected will appear as bright red. An indication of size of the defect may be obtained by watching the size and rate of growth of red indication.

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PAINTING

1. Painting Safety

WARNING: OVERSPRAY FROM CERTAIN ENAMELS, IF PUT IN WATER, IS FLAMMABLE. STORE ALL OVERSPRAY IN COVERED CONTAINERS AWAY FROM BUILDINGS WHERE SPRAYING OPERATIONS ARE CONDUCTED.

WARNING: WASH ALL RAGS AND SPONGES USED TO APPLY ANY PHOSPHORIC ACID CONVERSION COATINGS (ALODINE) BEFORE DISPOSAL. IF MATERIAL DRIES ON RAG, THERE IS DANGER OF SPONTANEOUS COMBUSTION.

WARNING: MIX DOPES AND LACQUERS WITH AIR DRILL. DO NOT USE ELECTRIC DRILL. ARCING ELECTRIC DRILL MOTOR WILL IGNITE FUMES.

WARNING: VERIFY SPRAY ROOM IS WELL VENTILATED. A CONCENTRATION OF FUMES WILL CAUSE A DANGEROUS FIRE HAZARD OR INSUFFICIENT OXYGEN FOR THE OPERATOR.

CAUTION: DO NOT ALLOW PAINT STRIPPER TO CONTACT FIBERGLASS REINFORCED PARTS SUCH AS RADOMES, RADIO ANTENNAS, WING PARTS, OR WING TIPS. FIBERGLASS STRUCTURES MAY BE FINISHED WITH ACRYLIC LACQUER OR POLYURETHANE ENAMEL AND ARE DAMAGED BY THE STRIPPER.

2. Polyurethane Paint Safety

WARNING: POLYURETHANE PAINT MAY BE DANGEROUS TO YOUR HEALTH. SERIOUS INJURY WILL RESULT IF SAFETY PRECAUTIONS ARE NOT FOLLOWED.

WARNING: DURING TRANSIT AND STORAGE CHECK FOR SIGNS OF A BULGING CAN, OTHER THAN NORMAL ODOR, OR A CHANGE IN RESIN FROM A CLEAR TO A CLOUDY STATE. A SLOW CARBON DIOXIDE BUILDUP WILL CAUSE CAN TO BURST. REMOVE AND PROPERLY DISPOSE ANY DEFECTIVE CANS.

WARNING: ENSURE ADEQUATE VENTILATION AND WEAR APPROPRIATE BREATHING PROTECTION FACE MASK WHEN PAINTING.

WARNING: POLYURETHANE PAINTS CAN PRODUCE IRRITATION OF THE SKIN, EYES, AND RESPIRATORY TRACT DURING MIXING AND APPLICATION. EXPOSURE TO SPRAY VAPORS AND MISTS DURING SPRAY APPLICATION MAY CAUSE BREATHING DIFFICULTY, SHORTNESS OF BREATH, AND DRY COUGH. INDIVIDUAL SUSCEPTIBILITY IS A CONTROLLING FACTOR. ONCE SENSITIZED, MANY PEOPLE CANNOT TOLERATE ANY EXPOSURE AND MUST THEREAFTER AVOID EXPOSED WORK AREAS.

WARNING: PRODUCTION TYPE MIXING AND SPRAY PAINTING OPERATIONS MUST BE IN SPECIALLY DESIGNED, EXHAUST-VENTILATED AREAS.

WARNING: PAINTERS MUST BE FULLY CLOTHED WITH COLLARS BUTTONED AND SLEEVES TAPED AT THE WRIST. PAINTERS MUST WEAR FITTED, DOUBLE CARTRIDGE ORGANIC VAPOR RESPIRATOR WITH FRESH CARTRIDGE INSERTED DAILY, SOLVENT-RESISTANT GAUNTLET STYLE GLOVES, AND SAFETY GOGGLES.

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3. Paint Application

WARNING: GROUND AIRCRAFT BEFORE PAINTING SO NO STATIC ELECTRICITY CHARGES BUILD UP AND DISCHARGE.

CAUTION: PROTECT WINDSHIELD WHEN MASKING AIRCRAFT. PAINT STRIPPERS, METAL BRIGHTENERS, AND SOLVENTS WILL DAMAGE WINDSHIELD.

CAUTION: BALANCE MOVABLE CONTROL SURFACES AFTER PAINTING. REFER TO APPROPRIATE MAINTENANCE MANUAL SECTIONS.

CAUTION: BEFORE FORCE DRYING AT ELEVATED TEMPERATURES, VERIFY THAT ALL FUEL TANK VENTS ARE UNOBSTRUCTED AND WILL NOT RESULT IN EXPANDED FUEL SPILLING ON NEWLY PAINTED SURFACES OR PAINT BOOTH FLOOR.

CAUTION: DO NOT PAINT PITOT TUBES, GAS CAPS, OR ANTENNA COVERS THAT WERE NOT FACTORY PAINTED.

CAUTION: DO NOT USE METALLIC PAINTS ON RADAR CONES OR ANTENNA COVERS.

CAUTION: DO NOT ALLOW SILICONE LUBRICANTS TO CONTACT ANY SURFACES TO BE PAINTED. SILICONE LUBRICANT IS VERY DIFFICULT TO REMOVE COMPLETELY.

4. Painting Sequence

For primer, tack, finish coats, and lacquer application:

- A. Position airplane so airflow is from tail toward nose and overspray ahead of you.
- B. To minimize overspray problems, have two painters work simultaneously on opposite sides of airplane.
- C. Paint difficult areas such as landing gear, and wheel wells before flat surfaces. Paint the ends and leading edges of ailerons and flaps. Paint flap and aileron wells, wing tips, and leading and trailing edges.
- D. Paint the bottom of the airplane first including bottom of horizontal tail surfaces. Starting at the root and working outward, spray chordwise. Work up fuselage and allow spray to cover sides. Work up to engine. Spray wing bottom. Start each painter at the root and work toward tip, spraying chordwise.
- E. Lower airplane tail enough to reach fin top. When spraying fuselage top, tilt spray gun so overspray is ahead of area being painted and new paint will wipe out overspray. Spray primer across fuselage, vertical and horizontal tail surfaces, and wing.

5. Color Matching

See aircraft logbooks for color codes.

6. Trim and Registration Numbers

Apply predominant color first over entire surface. Apply trim colors over base color after it dries. When top of fuselage is to be painted white with a dark color adjoining it, apply light color and feather into area to be painted with dark color. When light color dries, place masking tape and paper along separation line, and apply dark color.

Allow paint to dry several hours before removing masking tape. Remove tape by pulling slowly parallel to surface. This will reduce the possibility of peeling off finish with tape.

Apply registration numbers by painting or affixing self-adhering plastic figures. They must be solid color lines contrasting with background. Location and size of identification numbers vary, per aircraft size. Location and size are found in the Federal Aviation Regulations.

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7. Paint System Compatibility

Before applying new paint, find what type finish was used previously. Refer to the Piper parts catalog for correct paint number and color.

Identify paint finishes by applying engine oil to a small surface area. Old nitrocellulose finishes will soften in a few minutes. Acrylics, urethanes, and epoxy finishes show no effects.

If not identified, wipe down a small area with rag wet with methy ethyl ketone. MEK picks up pigments from acrylic finishes, but not from epoxy or cured urethane coatings. Wipe surface, do not rub. Heavy rubbing picks up epoxy and urethane pigments from coatings not fully cured.

The use of different types of paint, with several coatings, make repair of damaged and deteriorated areas difficult. Paint finishes are not always compatible. The following are general rules for compatibility and are not necessarily listed in order of importance.

- A. Old type zinc chromate primer may be used directly for touchup of bare metal surfaces and on interior finishes. It may be overcoated with wash primers if in good condition. Acrylic lacquer finishes will not adhere to this material.
- B. Modified zinc chromate primer will not adhere to bare metal. Never use it over a dried film of acrylic nitrocellulose lacquer.
- C. Nitrocellulose coatings will adhere to acrylic finishes, but reverse is not true. Do not use acrylic nitrocellulose lacquers over old nitrocellulose finishes.
- D. Acrylic nitrocellulose lacquers will not adhere to nitrocellulose and epoxy finishes and to bare metal. For best results, apply lacquers over fresh, successive coatings of wash primer and modified zinc chromate. They also adhere to freshly applied epoxy coatings (dried less than 6 hours).
- E. Epoxy topcoats adhere to all paint systems in good condition. Use epoxy for general touch touchup, including touchup of defects in baked enamel coatings.
- F. Old wash primer coats may be overcoated directly with epoxy finishes. Apply a new second coat of wash primer if an acrylic finish is to be applied.
- G. Old acrylic finishes may be refinished with new acrylic provided old coating is thoroughly softened using acrylic nitrocellulose thinner before paint touchup.
- H. Repair damage to epoxy finishes by using more epoxy. Neither lacquer finish will stick to epoxy surfaces. In some instances, air drying enamels may be used for touchup of epoxy coatings if edges of damaged areas are roughened with abrasive paper.

8. Common Paint Troubles

- A. Poor Adhesion - Paint properly applied to correctly pretreated surfaces will adhere satisfactorily. When thoroughly dry, paint must not be easily removed. Poor adhesion can result from:
 - (1) Inadequate cleaning and pretreatment.
 - (2) Inadequate stirring of paint or primer.
 - (3) Coating at incorrect time intervals.
 - (4) Application under adverse conditions.
 - (5) Bad application.
- B. Spray Dust - Spray dust caused by atomized particles drying before reaching surface being painted fail to flow as a continuous film. Usual causes are incorrect air pressure or distance gun is held from work.

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- C. Sags and Runs - Excess paint causes wet paint film to move by gravity and presents a sagging appearance. Incorrect viscosity, air pressure, and gun handling, or inadequate surface preparation are frequent causes.
- D. Spray Mottle - Sometimes known as orange peel or pebble, is caused by incorrect paint viscosity, air pressure, spray gun setting, or the distance the gun is held from work.
- E. Blushing is one of the most common troubles. It appears as clouding or blooming of paint film. It is more common with cellulose than synthetic materials. It may be caused by moisture in air supply line, adverse humidity, drafts, or sudden temperature changes.

9. Storage

- A. Store paint, enamel, and other finishing material in dry storage away from direct sunlight and heat. Mark each container with a code for identification.
- B. Storage facilities must comply to Occupational Safety and Health Act (OSHA) requirements regarding air circulation, lighting, and fire protection. Lock storage facilities to prevent children and unauthorized personnel entry.
- C. Invert pigmented materials every inventory so pigments will not pack to can bottom. Properly dispose of empty containers.
- D. Use older materials first. Useful life of some finishes is limited.
- E. Storage area temperatures must be approximately 50-90°F. If finishes are stored in temperature extremes, allow them to return to room temperature before using.

10. Painting Facility

WARNING: DO NOT BREATHE PAINT FUMES. FUMES DEplete THE OXYGEN SUPPLY REQUIRED BY THE BODY.

- A. Painting facilities must conform to local, state, and OSHA standards with respect to air circulation, exhaust emissions, lighting, and fire protection.
- B. Provide sufficient air movement in painting area so there is only a slight finishing material odor. Exhaust fans must be belt-driven and located near floor level. Locate fan's motor away from fumes.
- C. All spraying area personnel must wear approved respiration safety equipment.

11. Aircraft Finish Care

See Aircraft Finish Care, 12-00-00.

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AIRPLANE MAINTENANCE MANUAL

CARD 2 OF 7

PA-34-220T

Seneca IV

(SN's 3447001 THRU 3447029)

SENECA

(SN's 3449001 AND UP)

THE NEW PIPER AIRCRAFT, INC.

Published by
Technical Publications

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Manufacturers Association

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AEROFICHE REVISION STATUS

Revisions to Maintenance Manual (P/N 761-888) issued July 12, 1995, are as follows:

<u>Revision</u>	<u>Publication Date</u>	<u>Aerofiche Card Effectivity</u>
ORG950712	November 7, 1996	1, 2, 3, 4 and 5
PR980415	April 15, 1998	1, 2, 3, 4 and 5
PR981115	November 15, 1998	1, 2, 3, 4 and 5
PR020531	May 31, 2002	1
CR050819	August 19, 2005	1, 2, 3, 4, 5, 6 and 7
PR051107	November 7, 2005	1, 2, 4 and 5
PR060428*	April 28, 2006	1, 2, 3, 4, 5, 6 and 7

*** PARTIAL REVISION OF MAINTENANCE MANUAL 761-888**

Revisions appear in Aerofiche Cards 1, 2, 3, 4, 5, 6, and 7. Accordingly, discard your existing Aerofiche Cards and replace them with the cards dated April 28, 2006.

Consult the Customer Service Information Aerofiche (P/N 1753-755) for current revision dates for this manual.

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INTRODUCTION

1. Instructions for Continued Airworthiness

WARNING: INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA) FOR ALL NON-PIPER APPROVED STC INSTALLATIONS ARE NOT INCLUDED IN THIS MANUAL. 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 ICA 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, THE PIPER PROVIDED ICA MAY NOT BE VALID FOR AIRPLANES SO MODIFIED.

The PIPER PA-34-220T Seneca IV / V Maintenance Manual constitutes the Instructions for Continued Airworthiness (ICA) as required by Federal Aviation Regulations (FAR) Part 23, Appendix G. Chapter 4 contains the Airworthiness Limitations section (4-00-00) and the Inspection Program is in Chapter 5 (5-20-00).

2. General

This publication is prepared in accordance with the General Aviation Manufacturers Association (GAMA) Specification No. 2, with respect to the arrangement and content of the System/Chapters within the designated Chapter/Section-numbering system.

WARNING: USE ONLY GENUINE PIPER AIRCRAFT PARTS OR PIPER AIRCRAFT APPROVED PARTS OBTAINED FROM PIPER APPROVED SOURCES, IN CONNECTION WITH THE MAINTENANCE AND REPAIR OF PIPER AIRPLANES.

This manual generally does not contain hardware callouts for installation. Hardware callouts are only indicated where a special application is required. To confirm the correct hardware used, refer to the PA-34-220T Parts Catalog, P/N 761-887, and FAR 43 for proper use.

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.

THE NEW PIPER AIRCRAFT, INC. expressly disclaims any responsibility for malfunctions, failures, damage or injury caused by use of non-PIPER approved parts.

NOTE: THE NEW PIPER AIRCRAFT, INC. expressly reserves the right to supersede, cancel and/or declare obsolete any part, part numbers, kits or publication that may be referenced in this manual without prior notice.

In any question concerning the care of your airplane, be sure to include the airplane serial number in any correspondence.

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3. Effectivity

This maintenance manual is effective for PA-34-220T Seneca IV airplanes, serial numbers 3447001 thru 3447029, and Seneca V airplanes, serial numbers 3449001 and up.

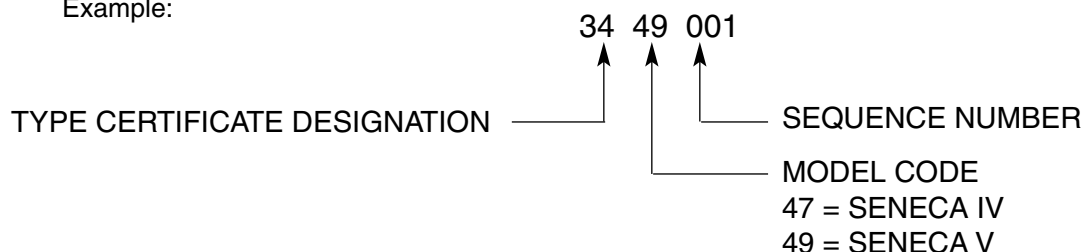
This encompasses the following model years:

NOTE: The following is provided as a general reference only.

<u>Model</u>	<u>Serial Numbers</u>	<u>Model Year</u>
Seneca IV	3447001 thru 3447012	1995
	3447013 thru 3447029	1996
Seneca V	3449001	Prototype
	3449002 thru 3449041	1997
	3449042 thru 3449096	1998
	3449097 thru 3449151	1999
	3449152 thru 3449195	2000
	3449196 thru 3449231	2001
	3449232,	2002
	3449237 thru 3449239, and	
	3449241 thru 3449268	
	3449269, 3449273, and	2003
	3449275 thru 3449300	
	3449301 thru 3449310	2004
	3449311 thru 3449322	2005
	3449323 and Up	2006

4. Serial Number Explanation

Example:



5. Assignment of Subject Material

This publication is divided into industry standard, three element, numeric subject groupings as follows:

- A. System/Chapter - The various groups are broken down into major systems such as Environmental Systems, Electrical Power, Landing Gear, etc. They are assigned a number, which becomes the first element of the standardized numbering system. Thus, the element "28" of the number 28-40-01 refers to the chapter "Fuel". Everything concerning the fuel system will be covered in this chapter.
- B. Sub-System/Section - The major systems/chapters of an airplane are broken down into subsystems. These sub-systems are identified by the second element of the standard numbering system. The element "40" of the number 28-40-01 concerns itself with the indicating section of the fuel system.

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- C. Unit/Subject - The individual units within a sub-system/section may be identified by the third element of the standard numbering system. The element "01" of the number 28-40-01 is a subject designator. This element is assigned at the option of the manufacturer and is normally zeroed out by PIPER.

Refer to paragraph 14, Chapter/Section Index Guide, for a complete breakdown and list. The material is arranged in ascending numerical sequence.

6. Pagination

The Chapter - Section (i.e. - 28-40-00) numbering system (explained above) forms the primary page numbering system for this manual. Within each Section, pages are numbered consecutively beginning with Page 1 (i.e. - 28-40-00, Page 1). Additionally, the aerofiche grid numbering system (explained below) is also used to indicate location within the manual.

7. Aerofiche Effectivity

- A. The General Aviation Manufacturers Association (GAMA) has developed specifications for microfiche reproduction of aircraft publications. The information compiled in this Aerofiche Maintenance Manual will be kept current by revisions distributed periodically. These revisions will supersede all previous revisions and will be complete Aerofiche card replacements and shall supersede Aerofiche cards of the same number in the set. The "Aerofiche Effectivity" page at the front of this manual lists the current revision for each card in this set.

- B. Conversion of Aerofiche alpha/numeric grid code numbers:

First number is the Aerofiche card number.

Letter is the horizontal row reference per card.

Second number is the vertical column reference per card.

Example: 2J16 = Aerofiche card number two, row J, column 16.

- C. To aid in locating information, the following is provided at the beginning of each aerofiche card:

- (1) A complete Introduction containing the Chapter/Section Index Guide for all fiche in this set.
- (2) A complete subject Index for all fiche in this set.

8. Identifying Revised Material

A revision to a page is defined as any change to the printed matter that existed previously. Revisions, additions and deletions are identified by a vertical line (i.e. - change bar) along the left-hand margin of the page opposite only that portion of the printed matter that was changed.

A change bar in the left-hand margin opposite the footer (i.e. - chapter/section/subject, page number and date), indicates that the text was unchanged but the material was relocated to a different page.

Example.

NOTE: Change bars are not used in the title pages, list of effective pages, or index.

9. Indexing

An alphabetically arranged subject Index follows this introduction to assist the user in locating desired information. In addition, each System/Chapter begins with an individual Table of Contents.

10. List of Effective Pages

Each System/Chapter has a List of Effective Pages preceding the Table of Contents to identify the effective revision date for each page in that chapter.

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11. Warnings, Cautions and Notes

These adjuncts to the text are used to highlight or emphasize important points when necessary. **Warnings** call attention to use of materials, processes, methods, procedures or limits which must be followed precisely to avoid injury or death to persons. **Cautions** call attention to methods and procedures which must be followed to avoid damage to equipment. **Notes** call attention to methods which make the job easier. Warnings and Cautions shall be located directly above and Notes directly beneath the text and be in line with the paragraphs to which they apply.

12. Accident/Incident Reporting

To improve our Service and Reliability system and aid in our compliance with FAR 21.3, knowledge of all incidents and/or accidents must be reported to Piper immediately. To expedite and assist in reporting all incidents and accidents, Piper Form 420-01 has been created. See Service Letter 1041 for latest revision. This procedure is to be used by all Dealers, Service Centers and Repair Facilities.

13. Supplementary Publications

The following publications/sources provide servicing, overhaul and parts information for the PA-34-220T Seneca IV / V airplanes and their various components. Use them to supplement this manual.

A. Piper Publications: (by Part Number)	Seneca IV	Seneca V
(1) Parts Catalog:	761-887	761-887
(2) Periodic Inspection Report:	230-1061	767-012
(3) Progressive Inspection Manual (50 Hour):	761-753	767-006

B. Vendor Publications:

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY.

(1) AIR CONDITIONING COMPRESSOR:

Vendor:	Sanden International (USA), Inc. 601 South Sanden Blvd. Wylie, TX 75098-4999 http://www.sanden.com	PH: - (972) 442-8400
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(2) AUTOFLIGHT:

Vendor(s):	Honeywell One Technology Center 23500 W. 105th St., M/D #45 Olathe, Kansas 66061-1950 http://www.bendixking.com/	(or)	S-TEC Corporation One S-TEC Way Mineral Wells, Tx 76067 PH: - (940) 325-9406 www.s-tec.com
Flight Control:	Bendix/King		
System Flight Line Installation Manual:	KFC 150 P/N 006-0287-00		

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(3) BATTERY:

Vendor:	GILL Batteries A Division of Teledyne Continental Motors http://www.gillbatteries.com	PH: - (800) 456-0070
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(4) BRAKES AND WHEELS:

Vendor:	Parker Hannifin Corp. Aircraft Wheel and Brake Division 1160 Center Road Avon, Ohio 44011 http://www.parker.com/cleveland/Universe/book.pdf	PH: - (800) 272-5464
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(5) ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS):

Vendor:	Meggitt Avionics, Inc. 10 Ammon Drive Manchester, NH 03103-7406 http://www.meggittavi.com/	PH: - (603) 669-0940 FAX: - (603) 669-0931
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Vendor:	Avidyne Corporation 55 Old Bedford Road Lincoln, MA 01773 http://www.avidyne.com/index.htm	PH - (800) 284-3963
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Instructions for Continued Airworthiness

Primary Flight Display and Magnetometer/OAT:	Document No. AVPFD-174
Multifunction Display:	Document No. AVMFD-167
Data Acquisition Unit:	Document No. AVSIU-011

(6) EMERGENCY LOCATOR TRANSMITTER:

Vendor:	Artex Aircraft Supplies 14405 Keil Road NE Aurora, Oregon 97002 http://www.artex.net/	PH: - (800) 547-8901
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(7) ENGINE:

Vendor:	Teledyne Continental Motors Attn: Aircraft Products Division Mobile, Alabama 36601	PH: - (800) 718-3411 FAX: - (251) 432-7352
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[SENECA IV](#)

Overhaul Manual =	CONTINENTAL - Form No. X-30030A
Parts Catalog =	CONTINENTAL - Form No. X-30031A
Operators Handbook =	CONTINENTAL - Form No. X-30553

[SENECA V](#)

Maintenance Manual =	CONTINENTAL - Form No. X-30645A
Overhaul Manual =	CONTINENTAL - Form No. X-30596A

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(8) FIRE EXTINGUISHER (PORTABLE):

Vendor:	H3R Inc. 43 Magnolia Ave # 4 San Francisco, California 94123-2911 http://www.h3r.com/index.htm	PH: - (800) 249-4289
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(9) FUEL CELLS:

Vendor:	Engineered Fabrics Corporation 669 Goodyear Street Rockmart, Georgia 30153-0548 http://www.kfefc.com/index.htm	PH: - (770) 684-7855 FAX: - (770) 684-7438
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(10) FUEL PUMP:

Vendor:	Weldon Pumps P.O. Box 46579 640 Golden Oak Parkway Oakwood Village, Ohio 44146 http://www.weldonpumps.com/index.html	PH: - (440) 232-2282 FAX: - (440) 232-0606
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(11) GEAR LOCKING ACTUATORS, HYDRAULIC PUMP, AND ALL HYDRAULIC COMPONENTS:

Vendor:	Parker Hannifin Corporation 6035 Parkland Boulevard Cleveland, OH 44124-4141 USA email: c-parker@parker.com	PH: - (800) C-PARKER (800) 272-7537 FAX: - (440) 266-7400
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(12) KEVLAR:

Vendor:	KEVLAR Special Products E.I. DuPont De Nemours & Co. Inc. Textile Fibers Department Centre Road Building Wilmington, Delaware 19898
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A Guide to Cutting and Machining Kevlar Aramid

(13) LIGHTS - NAVIGATION, STROBE, AND MAP LIGHTS:

Vendor:	Whelen Engineering Co. Inc. Route 145, Winthrop Rd. Chester, Connecticut 06412 http://www.whelen.com/	PH: - (860) 526-9504 FAX: - (860) 526-2009
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(14) MAGNETOS:

Vendor: TCM Aircraft Products PH: - (800) 718-3411
P. O. Box 90 FAX: - (251) 432-7352
Mobile, AL 36601
<http://www.tcmlink.com/>

Installation, Operation and Maintenance Teledyne Continental Motors (TCM)
Service Support Manual, P/N x42002

Instructions = S-20 / S-200 Series High Tension Magnetos

or,

Vendor: Slick Aircraft Products PH: - (904) 739-4000
Unison Industries FAX: - (904) 739-4006
Attn: Subscription Service
7575 Baymeadows Way
Jacksonville, FL 32256
http://www.unisonindustries.com/news/service_documents.html

Installation, Operation and Maintenance F1100 MASTER SERVICE MANUAL,
4300/6300 SERIES MAGNETO MAINTENANCE AND
Instructions: OVERHAUL MANUAL - L-1363

(15) NAVIGATION, COMMUNICATIONS, AND GPS (NAV/COM/GPS):

Vendor: Garmin International PH: - (913) 397-8200
1200 East 151ST Street
Olathe, KS 66062
<http://www.garmin.com>

(16) OXYGEN SYSTEM:

Vendor: Scott Aviation PH: - (716) 683-5100
2225 Erie Street
Lancaster, New York 14086
<http://www.scottaviation.com/>

(17) PROPELLER:

Vendor: Hartzell Propeller Inc. PH: - (937) 778-4379
One Propeller Place FAX: - (937) 778-4321
Piqua, OH 45356-2634
<http://www.hartzellprop.com/index2.htm>

Overhaul Instructions: Manual No. 117

or,

Vendor: McCauley Accessory Division
3535 McCauley Drive
P.O. Drawer 5053
Vandalia, Ohio 45377-5053

McCAULEY C500 SERIES SERVICE MANUAL - P/N 810915

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(18) STANDBY ATTITUDE INDICATOR:

Vendor Address: Mid-Continent Instruments Co., Inc. PH - (316) 630-0101
9400 E. 34 TH Street N. FAX - (316) 630-0723
Wichita, KS 67226
<http://www.mcico.com/index.html>

Installation Manual and
Operating Instructions: Manual No. 9015762

(19) STARTER:

Electro Systems, Inc.
(see "Voltage Regulator," below)

(20) VACUUM PUMP:

Vendor: Aero Accessories, Inc. PH: - (800) 822-3200
1240 Springwood Avenue
Gibsonville, NC 27249
<http://www.aeroaccessories.com/index.html>

(21) VACUUM REGULATOR:

Vendor: Parker Hannifin Corp. PH: - (800) 382-8422
Airborne Division
711 Taylor Street
Elyria, Ohio 44035
<http://www.parker.com/cleveland/Universe/book.pdf>

(22) VOLTAGE REGULATOR:

Vendor: Electro Systems, Inc. PH: - (888) 461-6077
Airport Complex
P. O. Box 273
Fort Deposit, Alabama 36032
<http://www.kellyaerospace.com/index.htm/>

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14. Chapter/Section Index Guide

NOTE: The following GAMA Specification No. 2 standard chapters are not included in this Maintenance Manual: 23, 36, 38, 49, 53, 54, 60, 72, 75, and 83. These chapters are omitted because the subject system is either: not installed in these airplanes; adequately covered in vendor or other manuals; or, for ease of use, has been combined with another chapter.

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5	TIME LIMITS/MAINTENANCE CHECKS		1C9
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		20 Scheduled Maintenance	
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6	DIMENSIONS AND AREAS		1E11
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		60 Propellers	
		80 Detection	
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32	LANDING GEAR		4C17
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		30 Extension and Retraction	
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GENERAL

This chapter deals with the operating, servicing, and inspecting procedures for the heating, air conditioning, and ventilating systems.

Description

There are six overhead fresh air vents which are supplied by a separate inlet in the dorsal fin. This system can be supplemented by an optional blower.

A Janitrol Model B3500 (91E88-1 or 91E88-1(EL)) combustion heater is installed as standard equipment.

When the optional air conditioning system is not installed cabin ventilation and cooling is provided solely by fresh air through the overhead vent system.

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DISTRIBUTION

1. Cabin Vent System

Overhead Vent Blower

The blower is mounted in the aft section of the fuselage and is connected to the overhead vent system. The blower draws air in from the dorsal fin and forces it through the ducting, whenever desired. (The three position blower switch in the overhead panel controls the two speed blower.)

A. Removal

- (1) Remove the access door from the aft wall of the baggage area.
- (2) With the master switch off, disconnect the plug assemblies at the blower assembly.
- (3) Remove the inlet and outlet hoses from the blower assembly by removing the clamps.
- (4) Remove the screws, washers and nuts that secure the blower assembly to the hanger braces.
- (5) Remove the screws and washers which secure the blower assembly to the retainer and hangers.
- (6) Remove the blower assembly from the aircraft.

B. Dismantling

- (1) Remove the hose duct from the forward edge of the blower assembly by removing the nuts, washers and screws.
- (2) Remove the cover from the blower assembly by removing the nuts, washers and screws.
- (3) Remove the blower fan from the motor shaft by removing the set screw.
- (4) For removal of the motor, proceed as follows:
 - a Separate the plate from the motor cover by carefully drilling out the connecting rivets.
 - b Cut the motor wires at the edge of the receptacle and plug and remove the wire ends from the blocks.
 - c Remove the motor from the mounting plate by removing the nuts, washers and bolts.

C. Rebuilding

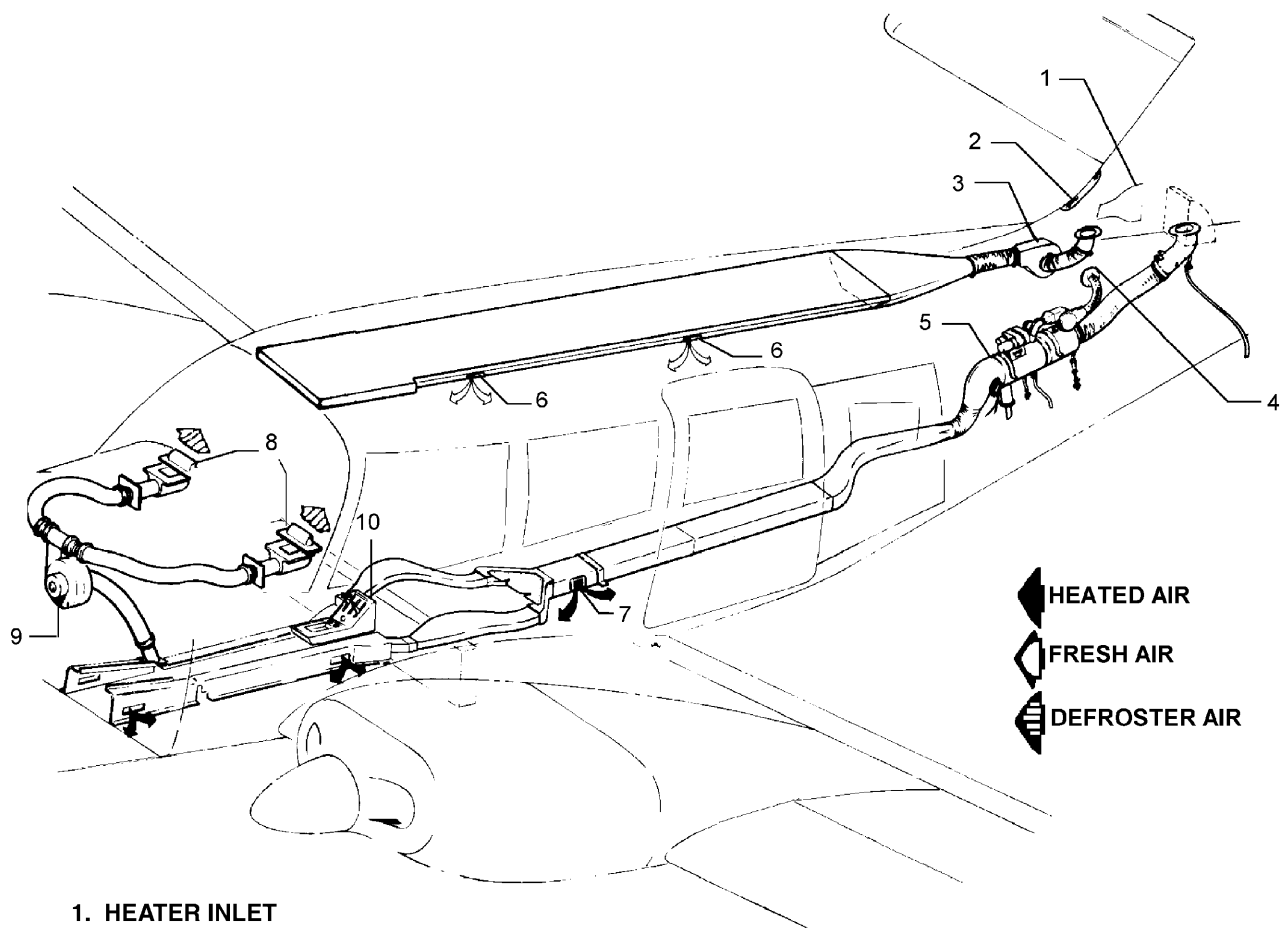
- (1) Mount the motor on the plate and secure it with the bolts, washers and nuts. Be sure that the motor nuts are snug and the shaft spins freely.
- (2) Position the cover over the motor plate with the motor wires protruding through the cover grommet.

**CHART 1
BLOWER WIRE COLOR CODES**

MOTOR - 24Vdc Dukes 1482-22-1		
	Pin Nos.	Wire Color
Ground	1	Green
Low Speed	2	Red
High Speed	2	Orange
NOTE: Pin number 1 is at the pointed side of the plug and receptacle.		

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37069 78629 78630



Cabin Heater, Defrosters, and Overhead Vent System
Figure 1

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- (3) With the holes in the cover matching the holes in the motor plate, secure the two parts together with rivets.
- (4) Apply PR-307 sealant to fill any opening left after the wires are brought through the grommet.
- (5) Install the wires in the plug and receptacle.
- (6) Position the blower fin on the motor shaft and secure with set screw.
- (7) Secure the cover to the blower assembly with screws, washers and nuts.
- (8) Position the hose duct on the blower assembly and secure it with screws, washers and nuts. The screws must be installed with their heads inside the duct.
- (9) After cleaning the surfaces of all old sealant, use white rubber chalk PR-307 sealant to seal where the duct attaches to the blower assembly.

D. Installation

- (1) Position the blower assembly in the hangers and retainer and install the washers and screws.
- (2) Install the nuts, washers and screws securing the blower assembly to the hanger braces.
- (3) Seal all hose joints with 3M 390 Duct Tape; then install the inlet and outlet hoses securing them with the clamps.
- (4) With the master switch off, connect the plug and receptacles at the blower.
- (5) Check the blower for the proper operation.
- (6) Install the access door to the aft wall of the baggage area and secure with the attaching hardware.

2. Avionics Cooling Blower (Optional) (See Figure 2.)

The avionics cooling blower is installed on the right side of the fuselage, behind the instrument panel, at F.S. 49.50. The cooling air is directed through ducts to installed avionics equipment.

NOTE: Actual equipment served will vary depending on optional equipment installed.

A. Removal

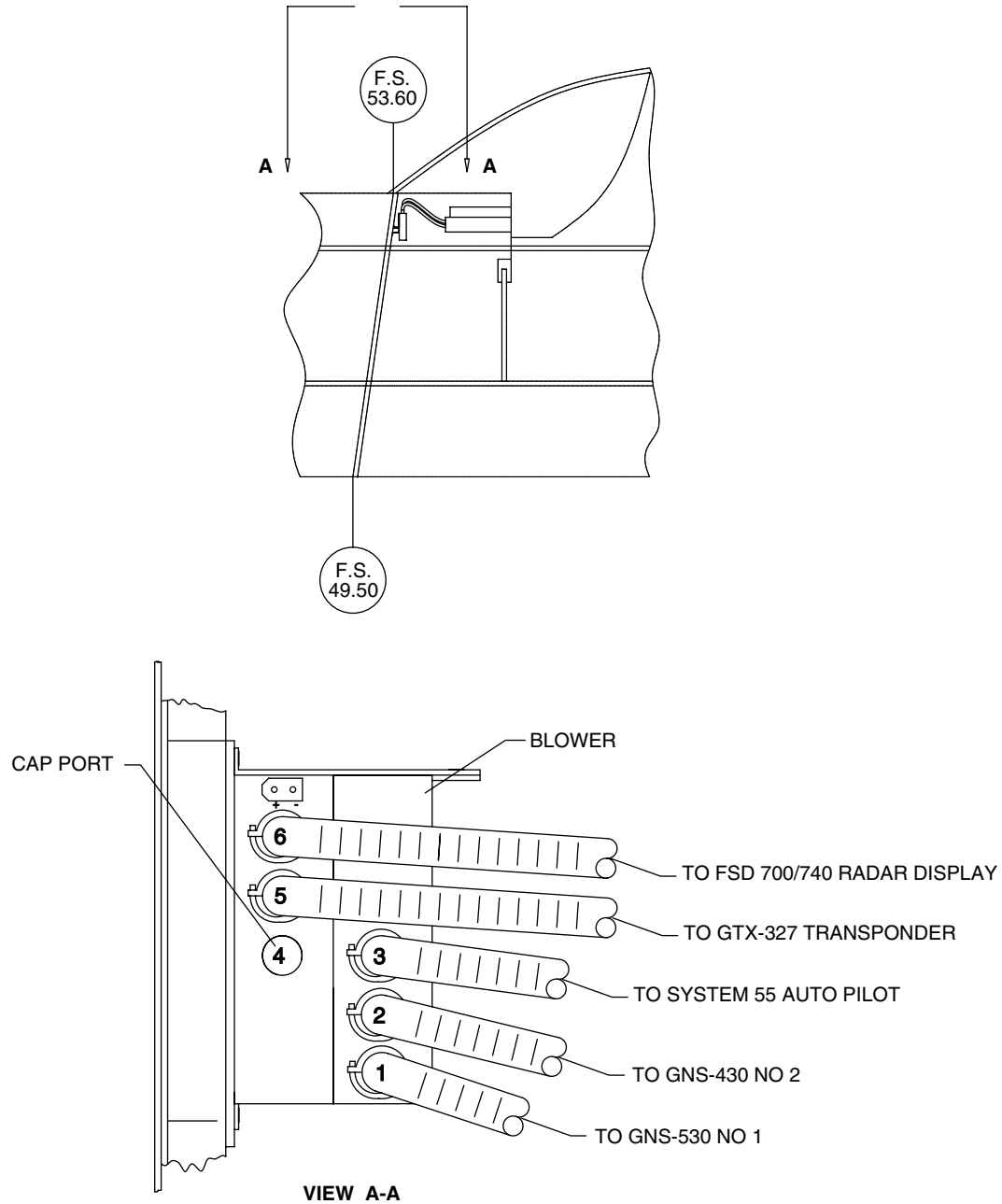
- (1) Remove ducts from top of blower. (Ducts are held in place by Ty-Raps.)
- (2) Disconnect blower motor wires at connector.
- (3) Remove screws, washers and nuts that attach the blower assembly to its mounting bracket.

B. Installation

- (1) Attach the blower assembly to the mounting bracket with the screws, washers and nuts.
- (2) Reconnect the blower motor wires.
- (3) Attach the ducts to the tops of the blower assembly. Ensure that the duct ends overlap the ports on top of the blower one-half inch minimum. Secure with Ty-Raps.

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Avionics Cooling
Figure 2

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HEATING

1. Description

A Janitrol Model B3500 (91E88-1 or 91E88-1(EL)) combustion heater is installed as standard equipment.

Heated air for the cabin and defroster operation is obtained from the combustion heater located in the tail section of the airplane. Fresh air is supplied to the heater from an intake located in the dorsal fin and routed through the heater and into the cabin through six adjustable outlets. Operation of the heater is controlled by a three-position switch located on the heater control console between the pilot's and copilot's seats and labeled FAN, OFF and HEATER. The FAN position will operate the ventilation blower on the heater and may be used for cabin ventilation or windshield defogging on the ground when heat is not desired. There is a defroster blower in the same distribution system to provide additional defrost capability when required. The defroster control switch must be in the ON position to energize the defroster blower.

For cabin heat, the air intake lever located on the heater control console must be partially or fully open and the three-position switch set to HEATER. This will start the fuel flow and ignite the burner simultaneously. With instant starting and no need for priming, heat should be felt within a few seconds. There are two safety switches installed at the intake valve located aft of the heater unit which are activated by the intake valve and wired to prevent both fan and heater operation unless the air intake valve is moved off the closed position.

Regulating the heater and airflow is accomplished by adjusting the levers on the heater control console. The right-hand lever regulates the air intake valve, while the left-hand lever regulates cabin temperature. Cabin temperature and air circulation can be varied to suit individual requirements by various combinations of lever settings.

Heat may be supplied before starting the engines by turning on the master switch, opening the air intake valve, and placing the heater switch in the HEATER position.

An overheat limit switch is located in the forward outboard end of the heater vent jacket, which acts as a safety device to render the heater inoperative if a malfunction should occur. A red reset button on the switch can be reached through the bulkhead access panel into the aft fuselage; operation of this switch results in illumination of the overheat warning light in the annunciator panel (red). To prevent activation of the overheat limit switch upon normal heater shutdown during ground operation, turn the switch to the FAN position for two minutes, while leaving the air intake lever in the open position, before turning the switch to the OFF position.

2. Troubleshooting

See Chart 1.

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**CHART 1 (Sheet 1 of 3)
TROUBLESHOOTING HEATER**

Trouble	Cause	Remedy
Heater fails to light.	Heater switch or circuit breaker off.	Turn on heater switch or close circuit breaker.
	Low voltage supply.	Apply external power supply. Attempt to start heater.
	Fuel cut off from tank.	Turn on heater switch.
	Regulator not operating properly.	Check for low pressure or replace regulator.
	<p>NOTE: When making the fuel pressure check, be sure fuel is flowing through the nozzle. The fuel regulator can be adjusted. Turn the adjusting screw clockwise to increase fuel pressure and counterclockwise to decrease it.</p>	
	Restriction in fuel nozzle orifice.	Remove nozzle and clean or replace it.
	Fuel heater solenoid not operating.	Remove and check solenoid. Replace if faulty.
	Fuel lines clogged or broken.	Inspect all lines and connections. It may be necessary to disconnect lines at various points to determine where the restriction is located.
	Ignition vibrator inoperative.	Replace vibrator.
	Manual reset limit (overheat) switch open.	Press reset button firmly (overheat light will illuminate when heater switch is on) and recheck to determine reason for switch opening.
Ventilating air blower fails to run.	Combustion air pressure switch open. (Defective switch or low combustion air blower output.)	Check for low blower output due to low voltage and correct it. If switch is defective, replace it.
	Cycling switch open.	Replace if defective.
	Duct switch open.	Operate control to see if switch will come on. Replace switch if defective.
	Heater switch "OFF". Broken or loose wiring to motor.	Energize the heater switch. Check and repair wiring.
	Circuit breaker open.	Close circuit breaker.

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**CHART 1 (Sheet 2 of 3)
TROUBLESHOOTING HEATER**

Trouble	Cause	Remedy
Worn motor brushes.	Blower wheel jammed.	Replace motor brushes. Remove and check the ventilating air blower wheel and realign if necessary.
	Motor burned out.	Remove blower assembly and replace motor.
	Defective radio-noise filter.	Replace filter.
Combustion air blower fails to run.	Faulty wiring to motor.	Inspect and replace faulty wiring.
	Poor ground connection.	Tighten ground screw.
	Worn motor brushes.	Replace motor brushes.
	Blower wheel jammed. (Usually indicated by hot motor housing.)	Overhaul the combustion air blower.
	Defective radio-noise filter.	Replace filter.
	Faulty or burned-out motor.	Remove combustion air motor for overhaul or replacement of motor.
Heater fires, but burns unsteadily.	Insufficient fuel supply.	Inspect fuel supply to heater, including shutoff valve, solenoid valve and fuel lines. Make necessary repairs.
	Spark plug partially fouled.	Replace spark plug. See Caution.
	CAUTION: DO NOT CREATE A SPARK GAP BY HOLDING THE LEAD TO THE HEATER JACKET. THIS CAN RESULT IN DAMAGE TO THE LEAD AND IGNITION UNIT AND THE OPERATOR MAY RECEIVE AN ELECTRICAL SHOCK.	
	Loose primary connection at ignition assembly.	Tighten the connection.
	Faulty vibrator.	Replace the vibrator.
	Combustion air blower speed fluctuates. (Can be caused by low voltage, loose blower wheel, worn brushes or motor.)	Remove and overhaul the combustion air blower assembly as required or correct low voltage condition.
	Heater fires, but burns	High voltage leak in lead
		Replace ignition assembly.

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**CHART 1 (Sheet 3 of 3)
TROUBLESHOOTING HEATER**

Trouble	Cause	Remedy
unsteadily. (cont.)	between ignition assembly and spark plug.	
	Inoperative ignition assembly.	If vibrator is in good condition, replace ignition assembly only.
	Restriction in fuel nozzle orifice.	Clean or replace nozzle.
	Nozzle loose in retainer or improper spray angle.	Tighten or replace the nozzle as required.
Heater starts then goes out.	Lack of fuel at heater.	Check fuel supply through all components from the tank to the heater. Make necessary corrections.
	Inoperative or chattering combustion air pressure switch.	Adjust or replace switch.
	Inoperative overheat switch.	Replace switch.
	Inoperative cycling switch.	Adjust or replace the switch.
	Low voltage.	Attach external power.
Heater fails to shut off.	Fuel solenoid valve in heater stuck open.	Remove and replace solenoid assembly.
	Inoperative duct and cycling switch.	Check and repair.
	Defective heater switch.	Replace the heater switch.

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3. Heater System - Operational Test

- A. Check all fittings and connections for condition and security of mounting, and all ducts for freedom of obstructions.
- B. Disconnect wire (H 10A) from the heater terminal No. 2; this will remove electrical power to the fuel valve and pump so heater will not ignite.
- C. Turn the master switch and "HEATER" switch on and open the air intake valve. Both blowers (combustion air and ventilating air) should operate. Check at heater exhaust and ventilating air outlets to ensure airflow.
- D. Momentarily insert a wedge under the leaf of the main gear squat switch. The ventilation blower should stop operating.
- E. Turn off heater switch and remove wedge at squat switch.
- F. To ensure that the heater fuel line is free of airlock, cautiously loosen the fuel connection at the heater. This will bleed the line between the heater and fuel source. Then tighten the fuel line connection.
- G. Reconnect the wire (H 10A) to the heater terminal No. 2.
- H. Place the air intake lever in the "OPEN" position and the temperature control lever in the center of its travel.
- I. Install a 0 to 10 psi pressure gauge in the outlet line of the fuel regulator by installing a "T" fitting in the OUTLET opening of the regulator.
- J. Turn on the master switch; then press the press-to-test in the annunciator panel — red overheat light should illuminate with other warning lights.
- K. Turn on heater switch. The heater should ignite and continue to operate until the thermostat turns it off. Cycling in this manner should continue until the heater switch is turned off.
- L. With the heater in operation, check the pressure gauge. The gauge should read from 6.5 to 7.5 psi; if the heater is running and the pressure indicated is more or less than required, adjust the regulator accordingly. If the required pressure cannot be reached after a couple turns of the regulator's adjustment screw, troubleshoot the fuel pump.
- M. Place the heater switch in the "FAN" position. The heater should turn off and the ventilation blower should continue to operate. Allow this blower to operate for a full two minutes; then place the air intake lever in the closed position. The blower should turn off.

NOTE: This procedure should be followed after every shutdown to cool off the burn chamber.
- N. With the air intake closed, turn on the heater switch; the heater should not ignite and neither fan should operate. Turn off the heater switch and master switch.
- O. Remove the pressure gauge and "T" fitting from the regulator.

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4. Heater and Basic Components

A. Spark - Spray Ignition (See Figure 2.)

The controlled atomized spray from a specially designed spray nozzle, coupled with high voltage spark plug ignition, ensures instant firing and continuous burning under all flight conditions.

Heat is produced by burning a fuel-air mixture in the combustion chamber of the heater. Aviation gasoline is injected into the combustion chamber through the spray nozzle. The resulting cone-shaped fuel spray mixes with combustion air and is ignited by a spark from the spark plug. Electric current for ignition is supplied by an ignition unit which converts 28 volts to high voltage oscillating current to provide a continuous spark across the spark plug gap. A shielded, high voltage lead connects the ignition assembly to the spark plug. Combustion air enters the combustion chamber tangent to its surface and imparts a whirling or spinning action to the air. This produces a whirling flame that is stable and sustains combustion under the most adverse conditions because it is whirled around itself many times. Therefore, ignition is continuous and the combustion process is self-piloting. The burning gases travel the length of the combustion tube, flow around the inside of the inner tube, pass through crossover passages into an outer radiating area, then travel the length of this surface and out the exhaust.

Ventilating air passes through the heater between the jacket and combustion tube assembly outer surface and through an inner passage in the assembly. Consequently, ventilating air comes into contact with two or more heated cylindrical surfaces.

B. Fuel Regulator and Shutoff Valve (See Figure 9.)

This unit provides preset, regulated fuel pressure as well as remote shutoff to the heater, regardless of fuel inlet pressure variations. It is set for $7.5 \pm .5$ psi. The shutoff valve is operated by a solenoid.

C. Duct Switch (See Figure 3.)

This switch is installed in the ventilating manifold upstream from the heater to sense the ventilating air outlet temperature. To select the desired cabin temperature, the switch may be adjusted manually from a high of $250^{\circ}\text{F} + 10^{\circ}$ downward through a range of $146^{\circ}\text{F} \pm 6^{\circ}$. The switch has a differential of $15^{\circ}\text{F} \pm 5^{\circ}$ at any given setting.

D. Combustion Air Blower

This centrifugal type blower supplies combustion air to the combustion chamber of the heater.

E. Ventilating Air Blower

This blower is attached to the inlet end of the heater assembly and provides a source of ventilating air through the heater. Ram air from the air intake is used during flight.

F. Heater Hour Meter (Optional) (See Figure 1.)

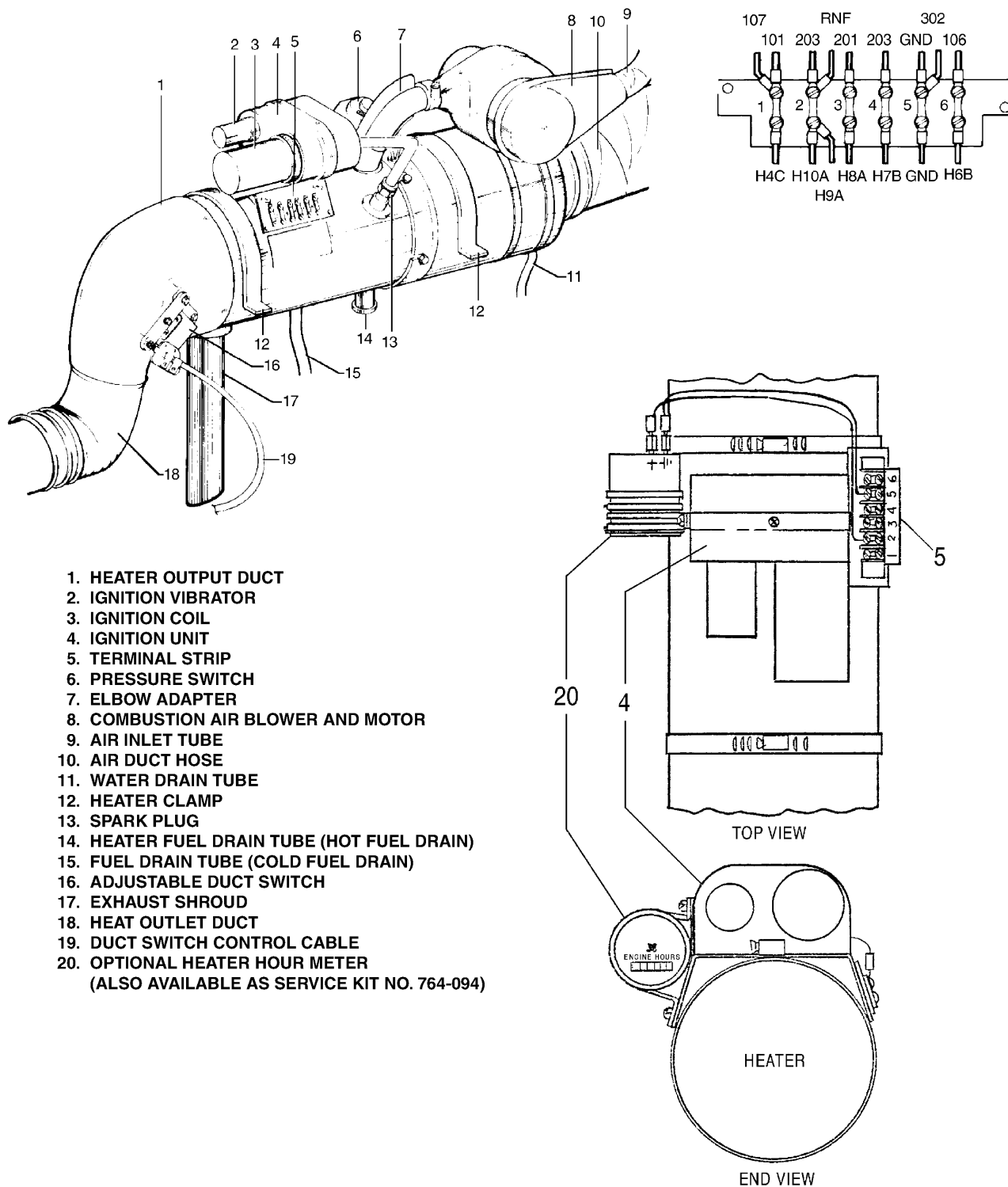
A heater hour meter is available as an original equipment option; or, as a service kit (No. 764-094) from your Piper Distributor. Use of a heater hour meter permits heater maintenance and overhaul to be based on actual hours of operation.

G. Operating Controls (See 21-20-00, Figure 1.)

NOTE: The schematic diagram (Figure 4) shows the heater circuit including the electrical wiring in the airplane.

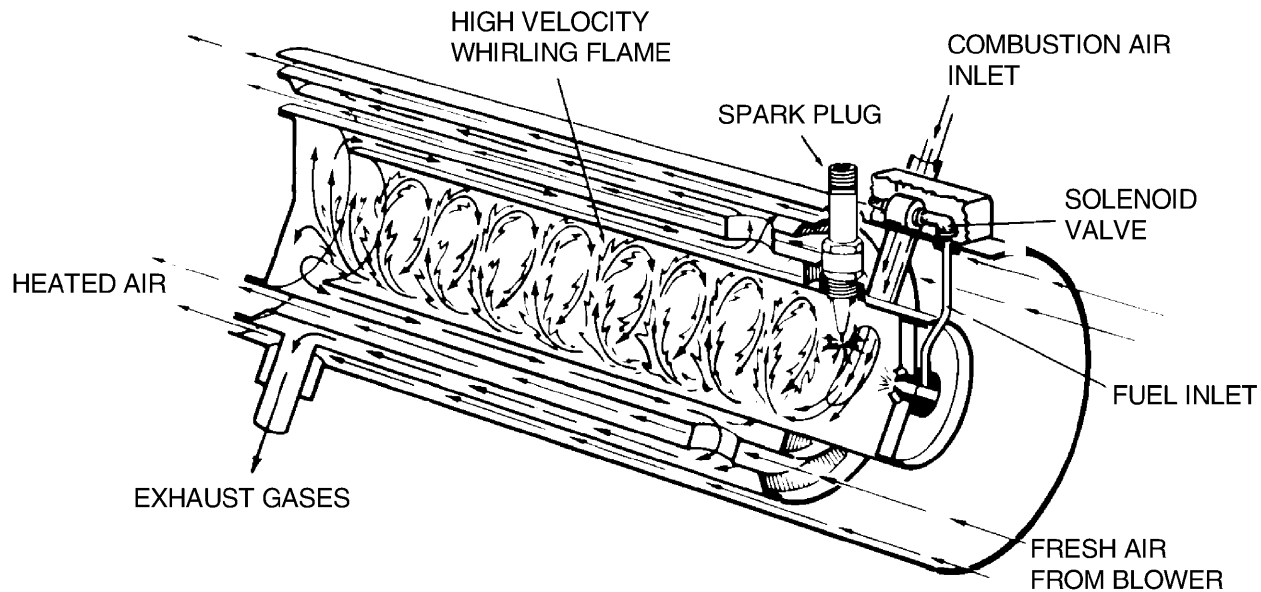
The HEATER SWITCH is connected in the line that supplies electrical power to all heater equipment and controls. When this switch is in the OFF position, the entire heater system is inoperative. This switch has a FAN position which permits use of the ventilating air blower to circulate cool air through the system for summer ground operation. With the switch in FAN position, the heater is inoperative and only the ventilating air blower is energized.

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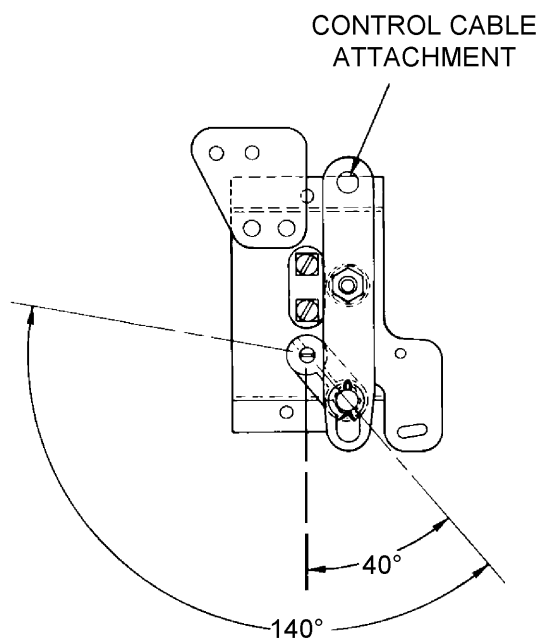
Heater and Combustion Air Blower Assembly
Figure 1

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Diagrammatic Cutaway of Heater to Show Whirling Flame Action
Figure 2

A360



Top View - Duct Switch
Figure 3

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H. Operating Procedure

- (1) Place the master and heater switches in their ON position and place the air intake lever in the OPEN position. The ventilating air and combustion air blowers will operate and the heater will ignite.

NOTE: The blowers will not operate and the heater will not ignite with the air intake lever in the CLOSED position.

- (2) Set the temperature control lever to the desired temperature setting. This controls the duct switch.

NOTE: If this control is set for ground operating comfort, it may be necessary to reposition it after being airborne, since ram air will increase the ventilating airflow and heater output.

- (3) To stop the heater operation, turn the heater switch to the FAN position. The heater will shut off and the ventilating air blower will continue to operate. Allow the blower to operate for two minutes; this will cool down the heater before turning the heater switch off and closing the air intake valve. Turn off master switch.

5. Maintenance Service

Instructions contained in this section consist of periodic inspection, adjustments, and minor corrections required at normal designated intervals for the purpose of maintaining the heating system in peak operating condition. These inspections assume that a heating system includes accessory components mentioned in preceding paragraphs.

6. Inspection of Heater and Heater Components

A. 50 Hour Inspection

- (1) Inspect the ventilating air inlet, combustion air inlet, exhaust outlet and fuel drains for possible obstructions. Make sure that all of these openings are clear of any restrictions and that no damage has occurred to the exhaust, cold or hot fuel drains, water drain or fuel line drain.

- (2) Perform an operational check as follows:

Place the HEATER SWITCH in the ON (or HEAT) position. The ventilating air blower and combustion air blower should operate.

NOTE: Proceed with the Heater System Operational Test.

B. 100 Hour Inspection

- (1) Perform 50 hour inspection check.
- (2) Inspect ventilating air and combustion air inlets and exhaust outlet for restrictions and security at the airplane skin line.
- (3) Inspect the drain lines to make sure they are free of obstructions. Run a wire through them if necessary to clear any obstructions.
- (4) Check all fuel lines for security at joints and shrouds, making sure that no evidence of leaks exists. Also, check for security of attachment of fuel lines at the various attaching points in the airplane.
- (5) Inspect electrical wiring at the heater terminal block and components for loose connections, possible chafing of insulation and security of attachment points.
- (6) Inspect the high voltage cable connection at the spark plug to make sure it is tight. Also, examine the cable sheath for any possible indications of arcing which would be evidenced by burning or discoloration of the sheath.
- (7) Inspect the combustion air blower assembly for security of mounting and security of connecting tubing and wiring. Tighten any loose electrical terminals and air tube connections.

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C. Removal of Heater (See Figure 1.)

- (1) Ascertain that all heater controls are off.
- (2) Remove the access panel to the aft section of the fuselage.
- (3) Disconnect the heater outlet hose from the heater air distribution box by releasing the hose attachment clamp.
- (4) Disconnect the duct switch control cable from the left side of the air distribution box.
- (5) Note the hookup of the electrical leads to facilitate reinstallation. Disconnect the leads from the heater terminal block.
- (6) Disconnect the fuel supply line at the heater by removing the cover of the fuel line connection shroud and disconnecting the line from the solenoid valve.
- (7) Disconnect the fuel and water drains from the bottom of the heater and allow them to slide down.
- (8) Disconnect the air inlet hose from the inlet end of the heater by releasing the hose attachment clamp.
- (9) Disconnect the combustion air blower inlet hose from the blower assembly by removing the cotter key and clevis pin at the blower.
- (10) Loosen the clamps from around the heater and remove the heater from the airplane. The exhaust shroud should remain in the airplane.
- (11) With the heater removed, the necessary maintenance may be performed as required.

D. Installation of Heater (See Figure 1.)

- (1) Ascertain that all the heater components are on the heater. Position the exhaust tube shroud on the tube mounting flange located in the fuselage.
- (2) Position the heater over its mounting brackets and ascertain that the exhaust tube extends into the exhaust shroud. Lower the heater to its mounting brackets. The exhaust tube should extend out the bottom of the fuselage.
- (3) Move the heater slightly to obtain the best fit of the exhaust tube shroud and heater. Place the heater clamps around the heater and mounting bracket flanges and secure.
- (4) Connect the combustion air blower inlet hose to the combustion air blower assembly on the heater and secure in place with the clevis pin and cotter key.
- (5) Connect the air inlet hose to the inlet end of the heater and secure with clamp.
- (6) Connect the fuel and water drain lines to the bottom of the heater.
- (7) Connect the fuel supply line to the heater and cover over the fuel shroud and secure with two screws.
- (8) Attach the duct switch control cable to the switch.
- (9) Connect the electrical leads to the heater terminal block on the heater as shown in Figure 1.
- (10) Check the operation of the heater per previous instructions.
- (11) Install the access panel to the aft section of the fuselage.

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7. Heater Electrical System Checks

A. Electrical Checks

These tests are listed as an aid in isolating open circuited or inoperative components.

NOTE: The schematic wiring diagram (Figure 4) shows, in addition to the heater circuitry, the aircraft control circuit. For the purposes of this manual, the circuitry shown in these illustrations will be utilized to describe voltage checks.

It must be assumed that power, which is furnished through the heater circuit breaker, is present at the HEATER SWITCH at all times. Always check the circuit breaker before performing voltage checks.

B. Vent Blower Power Circuit Check

With the HEATER SWITCH in the FAN position, voltage (28-volts nominal) should be present at the following locations: (See Figure 4.)

- (1) Terminal No. 6 on the heater terminal strip if the air valve is open.
- (2) From terminal No. 6 of the heater terminal strip through the radio noise filter to the ventilating air motor.
- (3) Electrical ground circuit for the ventilating air motor is provided from terminal No. 5 of the heater terminal strip. Ventilating air motor is inoperative when the landing gear is up or air valve is closed.

C. Heater Power Circuit Check

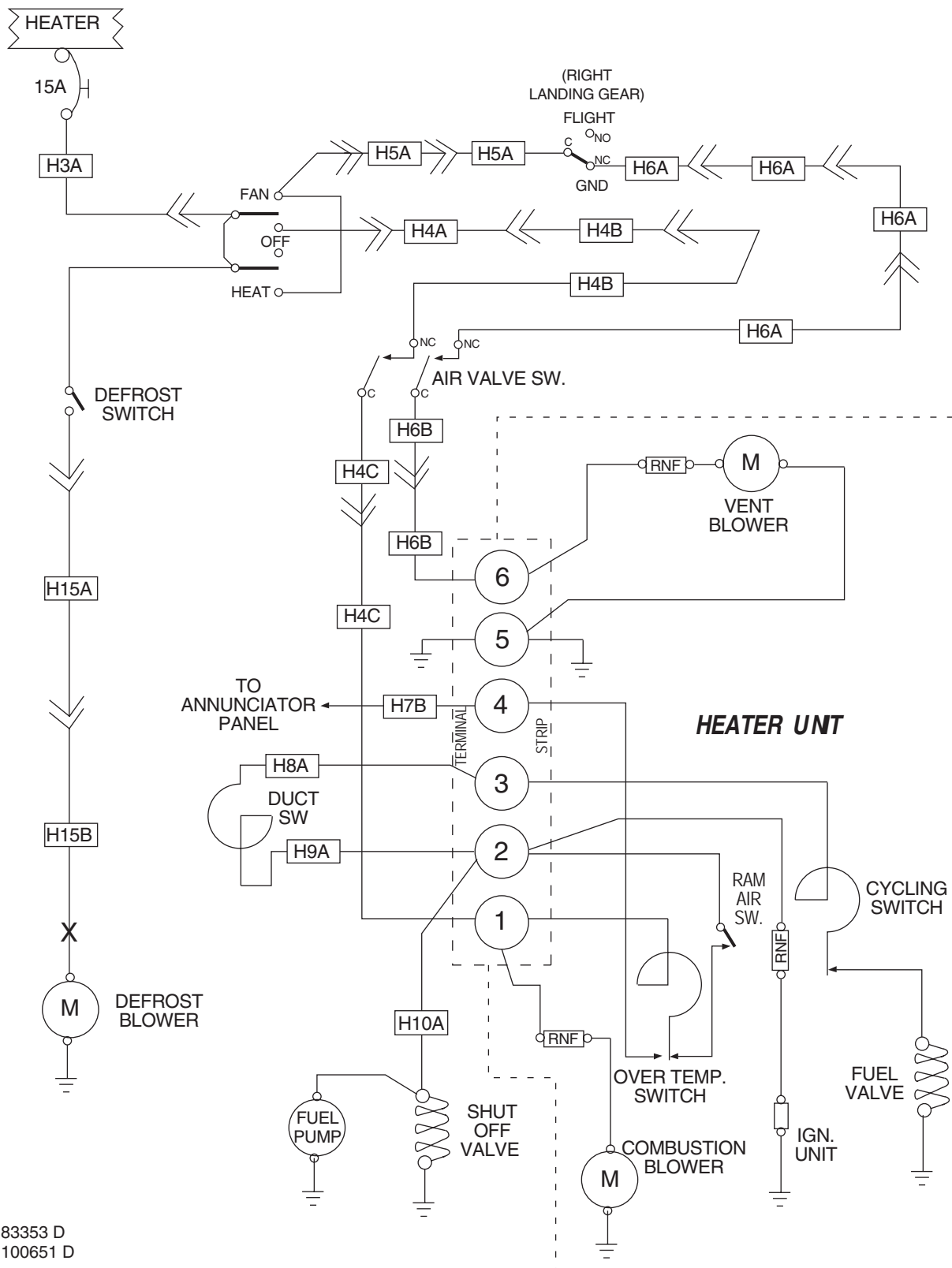
With the HEATER SWITCH in the HEAT position, voltage should be present at the following locations: (See Figure 4.)

NOTE: Power for the ventilating air blower is the same as described above except that power is now supplied through the HEAT side of the HEATER SWITCH.

- (1) Terminal No. 1 of the heater terminal strip if the air valve is open.
- (2) From terminal No. 1 of the heater terminal strip through the radio noise filter to the combustion air motor and to terminal No. 1 of the overheat switch.
- (3) From terminal No. 3 of the overheat switch through the combustion air pressure switch to terminal No. 2 of the heater terminal strip.
- (4) From terminal No. 2 of the heater terminal strip to the ignition unit to the fuel regulator and shutoff valve and fuel pump through the adjustable duct switch to terminal No. 3 of the heater terminal strip.
- (5) From terminal No. 3 of the heater terminal strip through the cycling switch to the fuel solenoid valve.

In the event that voltage is not present at one or more of the above listed points, the wiring must be traced back to the power source. If components are still inoperative after the wiring inspection, check the individual inoperative components for voltage and, if necessary, replace them.

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Heater and Defroster Wiring Diagram
Figure 4

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8. General Maintenance

Instructions in this paragraph pertain to maintenance of the basic heater and components while the heater is installed in the airplane. Instructions for removal of components are included provided the installation permits accessibility.

NOTE: No special service tools are required for normal periodic maintenance.

A. Combustion Air Blower

(1) Removal:

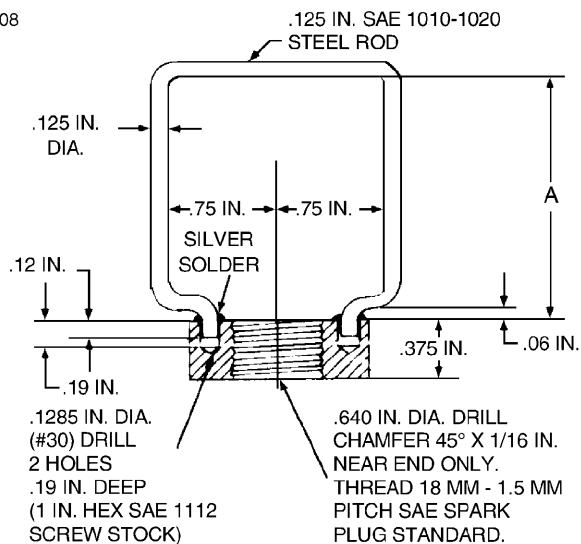
- (a) Disconnect wire at quick-disconnect terminal.
- (b) Disconnect the inlet tubing from the inlet air adapter.
- (c) Loosen the clamps that hold the combustion air blower assembly in the support bracket and slide the motor out of the bracket.

(2) Replacing Motor Brushes: (See Figure 13.)

- (a) Remove the brush cap at one of the brush locations. Note position of brush inside the guide and carefully lift the brush and brush spring out of the guide. Be sure to hold the brush so that it can be reinstalled in precisely the same position if no brush replacement is required.
- (b) Inspect the brush for wear. If brushes are worn to a length of .187 of an inch, they must be replaced.
- (c) Looking through the brush guide, inspect the commutator which should be smooth and medium brown to dark brown in color. Remove all dust from commutator with compressed air. If the commutator is grooved in the brush track, gouged, scored or shows signs of having burned spots, replace the complete motor assembly. If the commutator is in good condition, install new motor brushes and tighten brush caps into place. Make sure each brush is oriented so that the curved end fits the curvature of the commutator.
- (d) After installing new brushes, it is advisable to run in the brushes as follows: Connect the motor to a controlled voltage supply (rheostat). Operate the motor at approximately 1/2 its normal speed for the first hour; then gradually increase the speed until it is rotating at approximately normal speed. Continue the run in operation for at least two hours to properly seat the brushes before installing the blower in the aircraft.

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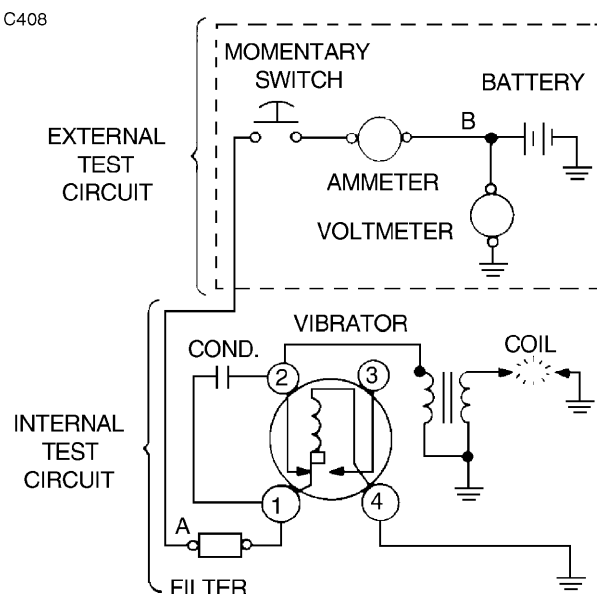


NOTE:
DIMENSION "A" VARIES WITH LENGTH
OF SPARK PLUG.

GAP OF ALL SPARK PLUGS
IS TO BE $.187 + .000 - .030$

Spark Plug Fixture
Figure 5

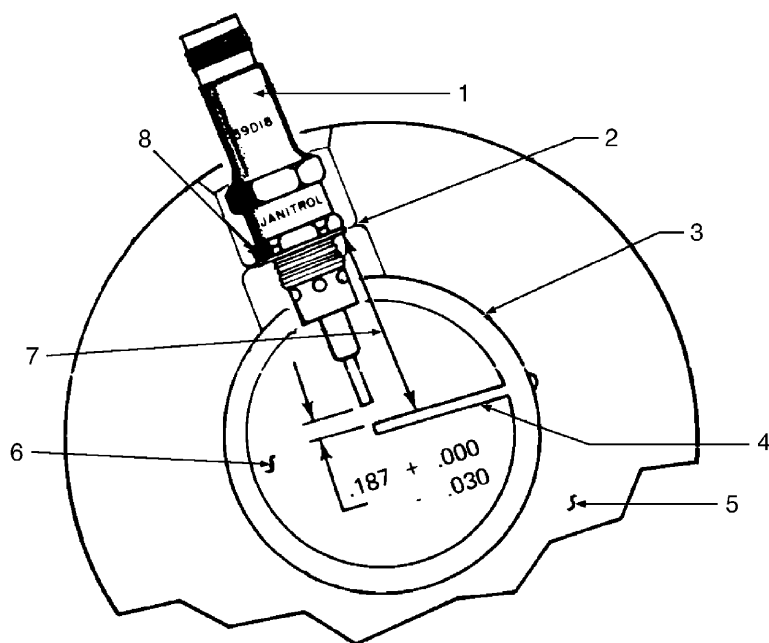
C408



TOTAL RESISTANCE A TO B MUST NOT
EXCEED 0.3 OHMS.

Wiring Test Setup
Figure 6

425



1. SPARK PLUG
2. SEATING SURFACE
3. COMBUSTION TUBE ASSEMBLY
4. GROUND ELECTRODE
5. JACKET ASSEMBLY
6. COMBUSTION HEAD ASSEMBLY
7. MEASURE
8. GASKET

Spark Plug Gap Adjustment
Figure 7

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- (3) Installation:
- (a) Prior to installing the combustion air blower, inspect all parts of the assembly for loose screws, loose nuts, and poor ground connection on the blower housing. Make sure the blower wheel is tight on the shaft and properly located in the housing. It should have just enough clearance to rotate at full speed without binding against the inlet housing. Blower performance is based upon this close-tolerance clearance. It is recommended that correct voltage be applied for this clearance check.
 - (b) Install the blower inlet adapter in the same orientation as before removal.
 - (c) Place the combustion air blower assembly in position in the attaching clamp so the air tubing can be connected and slide the tubing into position at the point where it was disconnected during removal. Do not tighten until after tightening the motor in the attaching strap.
 - (d) Tighten the blower motor mounting strap securely making certain the air tubing is in proper alignment.
 - (e) Secure the air tubing by tightening the clamp or installing the sheet metal attaching screws.
 - (f) Connect the wire lead at the quick-disconnect terminal.
 - (g) Connect the ground lead securely to the mounting bracket.
 - (h) Check motor operation. By disconnecting the wire at the No. 3 terminal on heater terminal strip, blower can be operated without fuel flow to the heater.
- B. Spark Plug

(1) Removal: (See Figure 12.)

- (a) Remove the necessary access panels on the rear of the fuselage to expose the spark plug area of the heater assembly.

NOTE: Ensure that heater electrical circuits are de-energized.

- (b) Unscrew and remove the high voltage lead connector at the spark plug. Exercise care to avoid fouling or damaging the connector.
- (c) Remove the grommet.
- (d) Using a 7/8 inch deep hex socket, unscrew and remove the spark plug. Make sure the spark plug gasket is removed with the spark plug. It will normally stick on the spark plug threads, but if gasket should drop into the ventilating air passages of the heater, remove with a wire hook.

(2) Inspection and Servicing (Spark Plug):

If the spark plug appears to be in good condition, except for a mild coating of oxide on the porcelain and electrodes, it may be cleaned and reused. Cleaning is accomplished on a conventional airplane type spark plug cleaner, except that it will be necessary to use two or more adapters in order to raise the long extension of the plug far enough out of the cleaner nozzle opening to perform an effective job. Plug the ceramic insert cavity at the terminal end of the plug with a piece of paper or cloth to keep out any of the cleaning sand. Wipe this cavity out thoroughly with a cloth wet with carbon tetrachloride. If after cleaning the spark plug porcelain is white and the electrodes are not eroded, proceed to check the ground electrode in the heater and adjust the spark gap in accordance with Step 3 of this paragraph.

NOTE: If the spark plug fails to clean up properly and/or if the electrodes are badly eroded, it should be replaced.

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(3) Spark Gap Check and Adjustment: (See Figure 7.)

A spark gap of 0.156 to 0.188 inches must be maintained on the P/N 39D18 spark plug. This gap should be checked any time a plug is replaced or at the time of heater overhaul. A spark gap greater than that specified can shorten the life of the ignition assembly. There are several methods in which the spark gap of this heater may be checked. Method I is recommended when the heater is being overhauled and before the installation of the fuel nozzle. Methods II and III are suitable for checking the gap through the spark plug well when the heater is not disassembled.

(a) Method I.

- 1 Using a 5/32 inch drill (0.156) or a piece of 5/32 rod, reach through the small opening in the combustion head and find the ground electrode. (It is welded inside the head.)
- 2 Move the drill along the side of the electrode on the spark plug side. (Movement should be from the outer edge towards the center.) The drill should just pass through the spark plug gap opening. Should the drill fail to pass through this opening, the gap is too narrow. If it passes through too freely, the gap is too wide. In either case, it will be necessary to bend the ground electrode in the direction required. This may be done by removing the spark plug and reaching through the opening.
- 3 Recheck the gap after repositioning the ground electrode.

(b) Method II.

- 1 Measure the distance between the seating surface of the spark plug with a new gasket installed to the end of the plug electrode.
- 2 Using a depth gauge, measure the distance between the ground electrode in the heater to the spark plug seating surface in the heater jacket and check this measurement against the measurement obtained in Step A. The difference should be between 0.156 to 0.188 of an inch.
- 3 The ground electrode can be bent to obtain the required gap.

(c) Method III.

- 1 Purchase from Piper or fabricate the special tool from dimensions given in 95-00-00 for the spark plug gap adjustment tool.
- 2 Install the threaded end of the tool into the spark plug hole.
- 3 Slide the rod of the tool into the combustion head until it contacts the ground electrode.
- 4 Check that the indicator ring on the rod lines up with the end of the tool. The ground electrode may be bent to obtain the required gap.

NOTE: Inspect the ground electrode for erosion. If it is eroded to approximately half of its original 1/8 inch diameter, it should be replaced. This can be done as follows:

- a Grind off the head of the rivet where it projects through the combustion head and remove the electrode.
- b Install a new CRES rivet AN125452 which is 1.500 inches in length.
- c Heliarc tack weld the rivet head to hold it in place.
- d Check spark gap as noted in Methods I or II.

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- (4) Installation: (Refer to Figure 7.)
- (a) If a new spark plug is being installed, be sure to adjust the spark gap. Do not bend the electrode on the spark plug.
 - (b) Place a new spark plug gasket on the threads. If the gasket does not hold on the threads and would be likely to fall off during installation, place a small drop of Aviation Permatex or similar material on the gasket to stick it temporarily to the plug shell.
 - (c) Screw the spark plug into the heater with a deep socket wrench. Tighten to a torque of 28 foot-pounds.
 - (d) Install the grommet (see item 39, Figure 12) in the heater jacket opening.
 - (e) Carefully insert the spring connector on the high voltage lead into the spark plug shell; press down gently and start the nut on the threads. Tighten the nut to 20 foot-pounds.
 - (f) Operate the heater to check dependability and close all access openings.
- C. Ignition Unit

This unit converts 28-volt DC to high voltage, oscillating current capable of producing a continuous spark in the combustion chamber of the heater. This unit remains energized and produces a continuous spark during heater operation. It contains a condenser, resistor, radio noise filter and vibrator socket. It also has an externally mounted vibrator and ignition coil.

(1) Removal and Installation

- (a) Removal: (See Figure 12.)

NOTE: Make sure heater electrical circuits are de-energized.

- 1 Disconnect the primary wire from the primary terminal of the ignition assembly.
- 2 Carefully unscrew and disconnect the high voltage ignition cable at the spark plug. Exercise care to avoid fouling or damaging the connector.
- 3 Remove the four attaching screws and lift the ignition assembly off the heater jacket.

- (b) Installation: (See Figure 12.)

- 1 Place the ignition assembly in position on the heater jacket with the high voltage cable facing the spark plug end of the heater.
- 2 Install the four screws. Tighten the screws securely.
- 3 Carefully connect the high voltage lead to the spark plug.
- 4 Connect the primary lead to the primary terminal on the ignition unit and tighten the nut securely.
- 5 Check for proper heater operation.

(2) Inspection

Inspect components as directed in Chart 2 and Figure 8.

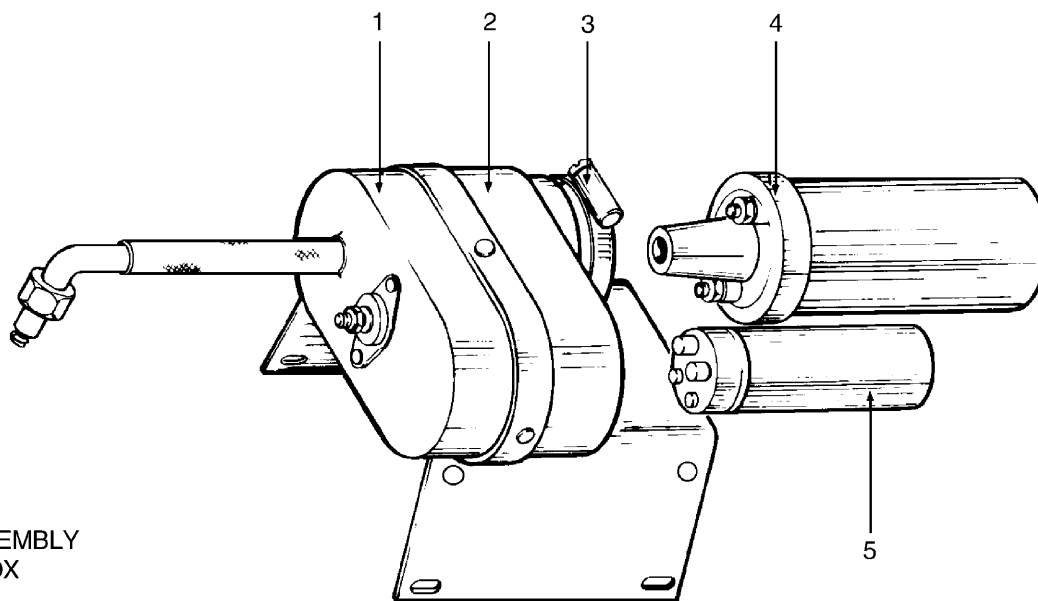
NOTE: Replace any component that fails to meet checks listed in Chart 2.

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**CHART 2
INSPECTION (IGNITION UNIT)**

Index No.	Nomenclature	Inspection
1	Cover Assembly	Inspection for security of lead assembly to cover. Ignition cable, grommet, terminal and connector for carbon tracks, cracks or distortion. Repair or replace for any of above conditions.
2	Ignition Coil	Inspect for broken bakelite, carbon tracks, oil leaks, and dents in coil cover. Replace for any of the above conditions.

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1. COVER ASSEMBLY
2. IGNITION BOX
3. CLAMP
4. IGNITION COIL
5. VIBRATOR

Ignition Unit Assembly
Figure 8

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(3) Testing

CAUTION: WHEN TESTING AN IGNITION UNIT, DO NOT USE A SCREWDRIVER AS A SUBSTITUTE FOR A SPARK PLUG AND SPARK PLUG FIXTURE.

The ignition unit does not require complete overhaul. The following test will indicate whether or not the unit is operational and whether the vibrator should be replaced before reinstallation in the aircraft. The following equipment is required to test the components:

- (a) A battery that will supply power at approximately 28 volts DC.
- (b) A voltmeter with a range of 0-30-volts.
- (c) A lead from the battery to the test fixture in which is included an ammeter with a range of 0-3 amperes and a normally open, momentary-closed switch. The total resistance of the lead including the ammeter and switch must not exceed 0.3 ohms.
- (d) A spark gap of 0.187 inch (plus 0, minus .030). A convenient means of arranging the correct spark gap is to install a spark plug, P/N 39D18, in a test fixture arranged to provide a ground electrode and a .187 inch spark gap. (See Figure 5 for information on fabricating this fixture.)

NOTE: Any one of several spark plugs may be used with the spark plug fixture detailed in Figure 5. However, the "A" dimension in that sketch must be varied with the length of spark plug electrode to provide a gap of .187 inch for all spark plugs.

- (e) The high tension shielded ignition lead between the ignition unit and the spark plug is a part of the cover assembly.
- (f) Arrange the test equipment as shown in Figure 6.

(4) Operational Test

- (a) Close the momentary switch and read the voltmeter and ammeter. Release the momentary switch immediately.
- (b) The amperage reading at 14-volts DC must be 1.50 + 0.25 amperes.
- (c) The amperage reading at 28-volts DC must not be more than 1.5 amperes.

(5) Vibrator

The vibrators should be replaced after 250 hours of operation. This schedule applies equally to vibrators installed in new units as well as new vibrators installed in ignition units that have been in service.

Removal and Installation (See Figure 8.)

- (a) Remove the clamp.
- (b) Remove the vibrator from the ignition unit; it may require a slight back-and-forth movement to remove it from the unit. A piece of masking or friction tape around the exposed portion of the vibrator will help to grip the vibrator for removal.
- (c) Install the new vibrator with the index mark aligned. The connector pins on the vibrator can be felt entering the pin sockets in the vibrator socket; then press the vibrator fully and firmly into position. Secure with the clamp.

NOTE: If replacement of vibrator fails to correct operational failure, further disassembly and inspection may be required.

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D. Cycling Switch and Limit (Overheat) Switch (See Figure 12.)

(1) Removal:

- (a) If the limit switch is damaged or defective, disconnect the three electrical leads from the switch terminals. Be sure to mark the leads for proper reassembly. (The switch terminals are identified by numbers "1", "2" and "3".)
- (b) Remove the two attaching screws and lift the limit switch and spacers (gaskets) from the jacket opening.
- (c) If the cycling switch is damaged or defective, disconnect the electrical leads being sure to mark them for proper reassembly.
- (d) Remove the two screws and lift the cycling switch from the jacket opening.

NOTE: No attempt should be made to repair either of these switches. If they do not operate properly, they should be replaced.

(2) Installation: (See Figure 12.)

- (a) Install the limit switch and spacers (gaskets) by placing them in position in the heater jacket opening and installing two screws.
- (b) Tighten screws securely; then reconnect the electrical leads in accordance with markings made during disassembly. (Refer to wiring diagram, Figure 4.)
- (c) Install the cycling switch (See Figure 12) by placing it in position in the heater jacket opening and securing it with the two screws. Tighten screws securely; then reconnect the electrical leads to their respective terminals as marked during disassembly. (See wiring diagram, Figure 4.)

E. Combustion Air Pressure Switch (See Figure 12.)

(1) Removal:

- (a) Disconnect electrical leads from the terminals of the combustion air pressure switch, being sure to mark them for proper reassembly. Disconnect the tube from the switch cap. Exercise caution not to exert excessive bending of the tube. (It is "tacked" to the combustion chamber inside the jacket.)
- (b) Unscrew and remove the combustion air pressure switch from the fitting on the combustion air inlet tube.

(2) Installation:

- (a) Install the combustion air pressure switch by rotating it on the threaded fitting of the combustion air inlet tube and tighten it securely. Exercise caution not to over-torque the switch as this could change the setting.
- (b) Connect electrical leads to their respective terminals in accordance with markings made during removal. If in doubt regarding proper connections, refer to the wiring diagram, Figure 4. Connect the tube to the switch cap.
- (c) Check for proper heater operation.

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F. Fuel Regulator and Shutoff Valve (See Figure 9.)

The fuel regulator and shutoff valve is located below the floor panel between the main and rear spar on the right side of the cabin. The assembly is enclosed in a special fiberglass box with a removable access panel.

(1) 100 hour Inspection.

Visually inspect the valve body for signs of fuel stains, paying careful attention to the diaphragm joint and the threaded mounting holes located in sides of the valve body (see Figure 9). Fuel leakage may appear as a greenish blue stain or residue in the area of the diaphragm joint or threaded mount hole. Use supplemental lighting if needed to facilitate visual inspection. Visual inspection must include all four sides of the regulator valve body. If signs of fuel leakage are found replace the valve using a new valve of appropriate part number with a manufacture date code of 02/02 or later. Record valve replacement in the logbook.

(2) Removal

- (a) Ascertain that the left fuel tanks are empty and the fuel selector controls are in the OFF position.
- (b) Gain access to the regulator and disconnect the electrical leads from regulator and shutoff valve.
- (c) Disconnect the fuel line from the outlet port and remove the regulator from the heater fuel pump. Cap all open fuel lines to prevent contamination.

(3) Adjustment

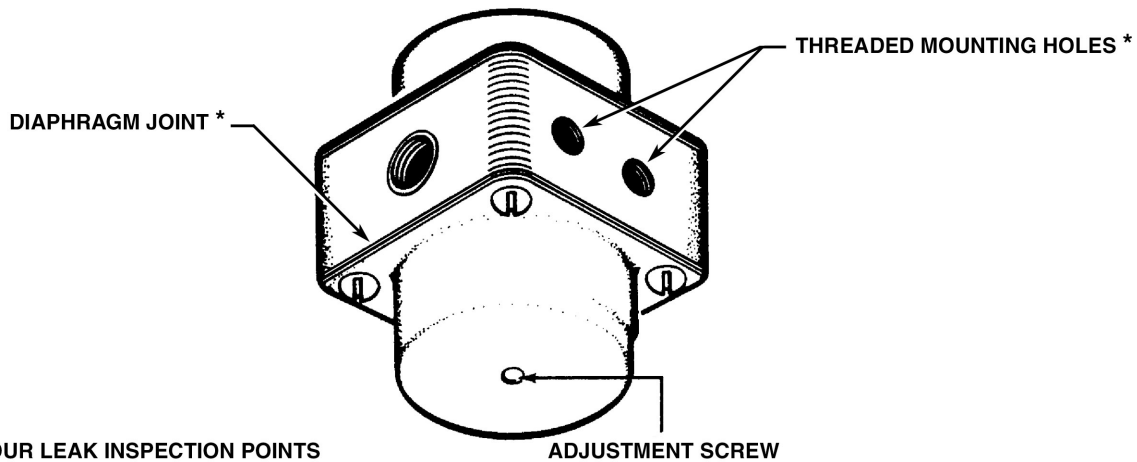
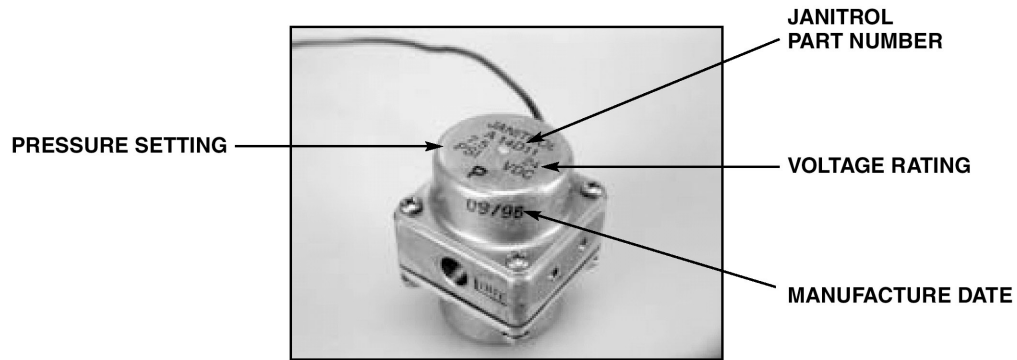
The fuel regulator and shutoff valve used in this system is adjustable but not repairable. The following steps cover the proper adjustment of this unit:

- (a) Install the regulator in a test stand similar to that shown in Figure 10.
- (b) Install a 2.0 gph nozzle (Janitrol Part No. C08D09). Gasoline or Stoddard solvent can be used for testing.
- (c) Apply fluid pressure from fuel pump and energize the solenoid. Outlet pressure should be $7.0 \pm .5$ psi, if not, correct accordingly.
- (d) Using a screwdriver, break the seal over the adjustment screw and adjust the regulated outlet pressure to $7.0 \pm .5$ psi. (Turn clockwise to increase pressure or counterclockwise to decrease pressure.)
- (e) De-energize and energize the solenoid at least twice. The outlet pressure should be 6.5 to 7.5 psi with the solenoid energized. When the solenoid is de-energized, the pressure should drop to zero and the fuel flow from the nozzle should stop.
- (f) During the above test, observe for signs of external leakage. Any leakage is cause for rejection of the regulator. After satisfactory adjustment has been made, apply Glyptol around the threads of the adjustment screw and in the slot.

(4) Installation

- (a) Position the regulator between the fuel line and fuel pump. Ascertain that the inlet side of the regulator is towards the fuel pump.
- (b) Connect the regulator to the pump and the heater fuel line to the regulator outlet port.
- (c) Connect the electrical leads from the regulator.
- (d) Operate the heater to make sure the unit is functioning properly.

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Fuel Regulator and Shutoff Valve
Figure 9

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G. Heater Fuel Pump Maintenance (See Figure 11.)

The maintenance required for this type of fuel pump is very limited, consisting of inspection and replacing parts that are worn or broken.

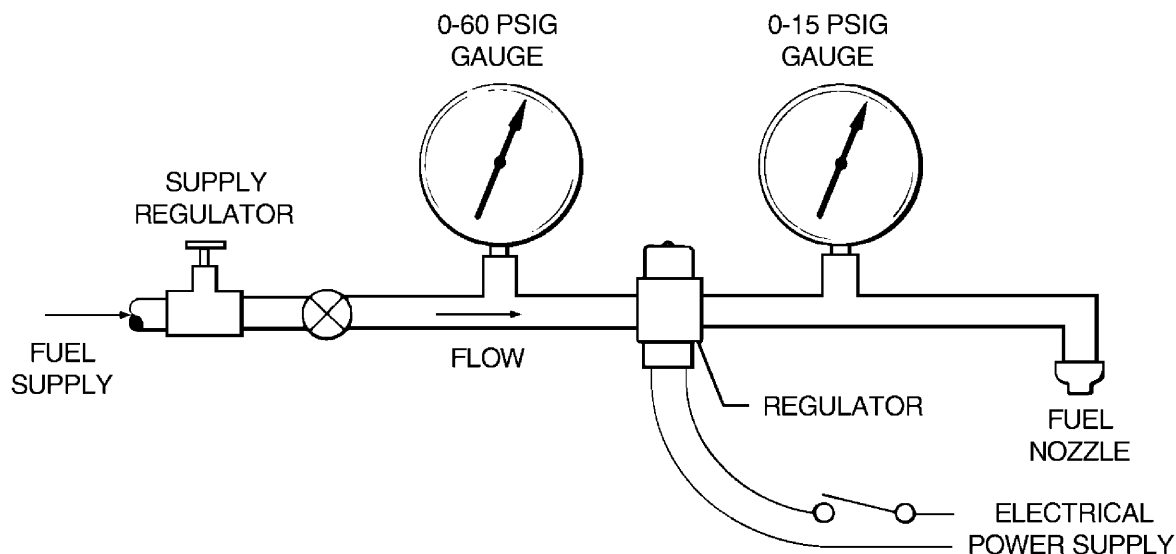
(1) Removal

The heater fuel pump is located below the cabin floor panel between the main and rear spar on the right side of the cabin. It is enclosed in a fiberglass compartment which has a removable access cover.

- (a) Ascertain that the right fuel tanks are empty and both fuel selector controls are in the OFF position.
- (b) Disconnect the electrical lead from the pump.
- (c) Drain fuel remaining in lines using the low-point drains located on the lower right fuselage.
- (d) Disconnect the fuel line from the inlet end of the pump and the regulator from the outlet end. Cap all open fuel lines to prevent contamination.
- (e) Remove the bolts which secure the pump to its mounting bracket.

(2) Disassembly (See Figure 11.)

- (a) Remove the safety wire that secures the bottom cover to the pump.
- (b) Using a 5/8 inch wrench, release the bottom cover from the bayonet fittings. Twist the cover by hand to remove it from the pump body.
- (c) Remove the filter, magnet and cover gasket.
- (d) Remove the retainer spring from the plunger tube using thin nose pliers to spread and remove ends of retainer from tube.
- (e) Remove washers, O-ring seal, cup valve, plunger spring and plunger from the tube.

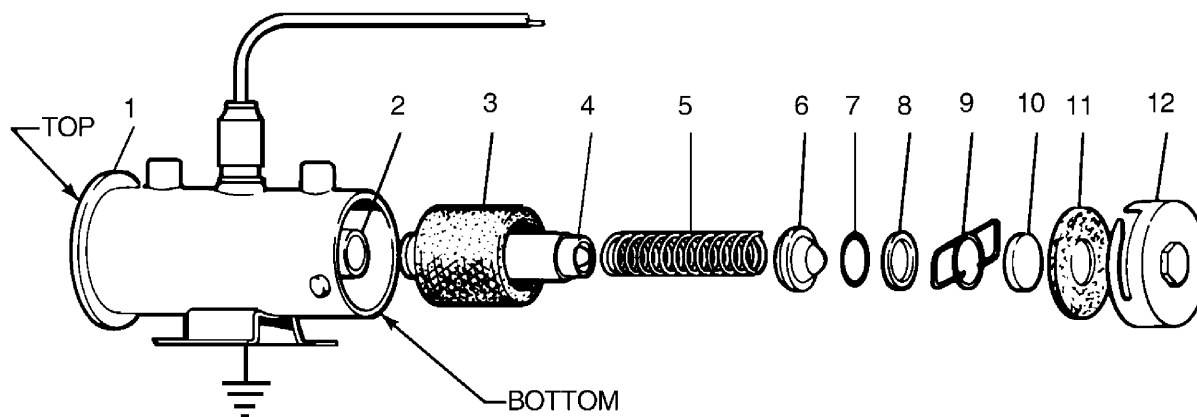


Test Setup for Fuel Regulator and Shutoff Valve
Figure 10

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- (3) Cleaning
 - (a) Wash all parts in cleaning solvent and blow out with air pressure.
 - (b) If plunger does not wash clean or if there are any rough spots, gently clean the surface with crocus cloth.
 - (c) Slosh the pump assembly in cleaning solvent and blow out with air pressure.
 - (d) Swab the inside of the tube with a cloth wrapped around a stick.
- (4) Inspection and Repair
 - (a) Disassemble the pump.
 - (b) The filter usually comes off with the cover; it may stick inside the fuel pump. Carefully remove the filter and replace it, if distorted.
 - (c) Check cover gasket and replace if deteriorated.
 - (d) Check the O-ring seal and plunger spring. Replace if worn.
- (5) Assembly (See Figure 11.)
 - (a) Insert the plunger into the tube with the buffer spring end first. Check fit by slowly raising and lowering the plunger in the tube. It should move fully without any tendency to stick. If a click cannot be heard, the interrupter assembly is not functioning properly in which case the pump should be replaced.
 - (b) Install the plunger spring, cup valve, O-ring seal and washer.
 - (c) Compress spring and assembly retainer with ends of retainer in side holes of tube.

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- | | |
|------------------|-------------------|
| 1. PUMP, BODY | 7. O-RING |
| 2. TUBE, PLUNGER | 8. WASHER |
| 3. FILTER | 9. RETAINER |
| 4. PLUNGER | 10. MAGNET |
| 5. SPRING | 11. GASKET, COVER |
| 6. CUP VALVE | 12. COVER |

Heater Fuel Pump
Figure 11

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- (d) Place the cover gasket and magnet in the bottom cover and assemble the filter and cover assembly.
- (e) Twist the cover by hand to hold in position on pump housing. Using a 5/8 inch wrench, securely tighten the bottom cover with the bayonet fittings on the pump body and install safety wire.
- (6) Installation
 - (a) Position the fuel pump on the forward bulkhead assembly and secure in place with bolts.
 - (b) Connect the regulator to the pump outlet and the fuel line to the pump inlet.
 - (c) Connect the electrical lead from the pump.
 - (d) Operate the heater to make sure the unit is functioning properly.
 - (e) Replace nose cone and secure.
- H. Duct Switch (See Figure 1.)
 - (1) Removal:
 - (a) Disconnect the electrical leads from the terminals on the exposed face of the switch and mark to facilitate installation.
 - (b) Remove the two attaching screws and washers from the duct switch bracket.
 - (c) Carefully lift out the switch and gasket (if gasket is used).
 - (2) Cleaning and Inspection:

Brush off any dust or lint from the switch operating mechanism (exposed inside the duct) and wipe the external surfaces with a clean cloth.
 - (3) Installation:
 - (a) Insert the switch carefully with gasket (if used) into the ventilating duct opening and secure with the two attaching screws and washers.
 - (b) Connect the two electrical leads to their respective terminals on the face of the switch as marked during removal.
 - (c) Operate the heater with the duct switch set above ambient temperature to check operation.

9. Overhaul Instructions

The heater assembly shall be overhauled after 1500 hours of heater time or when the "Pressure Decay Test" requirements cannot be met. See latest Janitrol Maintenance and Overhaul Manual, P/N 24E25-1.

10. Test Procedure

A. General Information

A test of all components should have been made after overhaul to ensure proper operation. Some shops may not have complete testing facilities for measuring airflows, pressure drops, and other factors which would be accomplished in a laboratory-type test. If such a test cannot be made, install the heater and check operation on the ground and in the air to determine if operation is normal. In shops where complete test equipment is available and a complete functional test can be performed, the test routine described in subsequent paragraphs should be made.

B. Equipment Required (See Figure 14.)

- (1) An improvised stand to hold the heater during test. The heater should be located far enough away from any combustible material or atmosphere to avoid hazard. A location should be chosen where exhaust can be dispelled. Do not add an excessive extension to the heater exhaust.
- (2) A source of fuel capable of being regulated at seven psi.

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- (3) The combustion air blower to be used with the heater should be used for the test.
- (4) A 12-volt current supply which may be a dc generator with a rheostat, ammeter, and voltmeter in the line to control and indicate the current draw and voltage output.
- (5) Two water manometers (zero to 5.0 inch water column) for measuring the pressure in the ventilating air duct and in the combustion air stream.
- (6) A piece of duct to be attached to the downstream end of the heater. It should have a minimum length of 24 inches and the same diameter as the heater being tested. A 2.25 inch diameter orifice should be centrally located at the outlet end. An aperture should be provided for the thermometer and duct switch and a static tap should be attached as shown in Figure 14.
- (7) A thermometer with 500°F scale.
- (8) A fuel-pressure gauge.
- (9) A controlled source of compressed air for final leakage test.

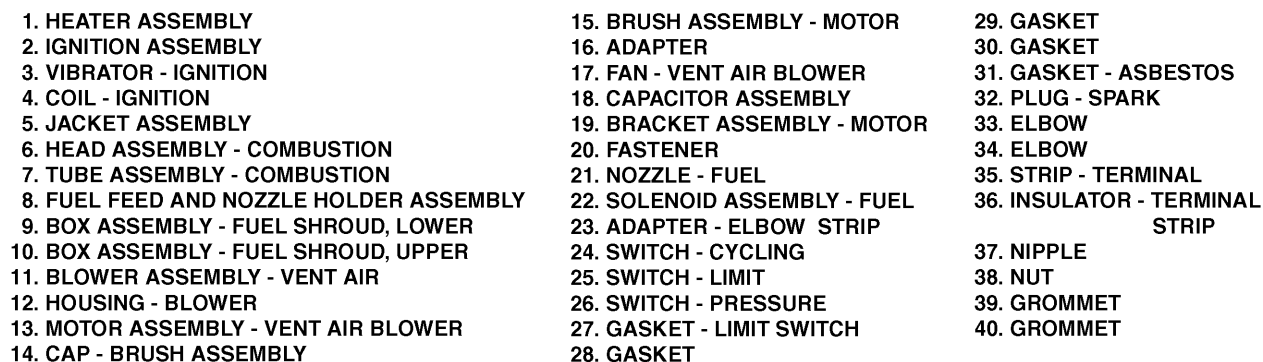
C. Operational Test (On Test Bench) (See Figures 14 and 15.)

- (1) Connect the heater to the test setup as shown in Figure 14. Make sure the combustion air blower is mounted securely and that the heater is clamped to its supporting stand.
- (2) Insert the duct switch in the sheet metal extension tube at the location shown in Figure 14.
- (3) Connect components and heater as outlined in the wiring connection diagram, Figure 15. The power supply switch should be open.
- (4) Connect the power source to the heater.
- (5) Disconnect wire lead from terminal No. 3 on the heater side of heater terminal strip to prevent the heater from lighting and close the power source switch to check operation of blowers. The combustion air blower and ventilating air blower should operate at full speed with no blower wheel interference. If either blower fails to run, locate and correct the trouble before proceeding with the test.
- (6) Connect a voltmeter from open side of combustion air pressure switch terminal to ground to determine if the switch is closed, which would be indicated by a full voltage reading on the meter. If a full voltage reading is not obtained, the combustion air supply is either inadequate or the switch is defective or improperly adjusted. Make necessary corrections.
- (7) Observe the manometer connected to the ventilating air pressure tap, which should show a reading of 1.1 inches of water (minimum) at rated voltage.
- (8) Observe the manometer connected to the combustion air tube tap, which should show a reading of 1.5 inches of water (minimum) at rated voltage.
- (9) Open the power supply switch and reconnect the terminal lead disconnected in preceding Step 5.
- (10) Close the power supply switch and turn on the fuel supply. The heater should light within five seconds (may require slightly longer for air to be purged from fuel lines on the first trial).
- (11) Observe operation of duct switch, which should control heater operation according to the switch setting.
- (12) If the duct switch fails to control the temperature according to the setting, place the control lever in high "H" position and notice the control variation. A high reading of 250°F ± 10° should be obtained (reading will vary in different applications).

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- (13) Connect a jumper across the terminals of the duct switch to make it inoperative and observe action of the cycling switch. The cycling switch should cycle to control the outlet air temperature at approximately 250°F (nominal). This is a function of ambient temperature and airflow conditions. If operation is within a range of 190°F to 290°F, the switch is operating normally. If the switch is out of range, it can be reset in the same manner as described for the duct switch, except that no control lever or indicator stop are used. If adjustment fails to restore proper temperature range, replace the switch.
 - (14) With duct switch still jumped, place a jumper across the cycling switch terminals to check operation of the overheat switch. Block the ventilation air outlet and notice if the overheat switch shuts off the heater. It should open at between 300°F and 402°F. (This is also a function of ambient temperature and airflow.) After the switch shuts off, remove ventilating air restriction; remove jumpers from cycling and duct switches and press firmly on the overheat switch reset button until it "clicks." The heater should light and operate.
 - (15) Shut down the heater and check all components visually to make sure no damage has occurred to any of them.
 - (16) Remove heater and other components from the test setup and install it in the airplane.
11. Inspection of Fuel Nozzle Orifice (See Figure 12.)
- A. Loosen the four screws and rotate the blower and motor housing to disengage the ventilating air blower from the end of the heater jacket. It is not necessary to disconnect the electrical connections to remove the nozzle.
 - B. Remove the fuel shroud cover by removing the screws. Remove solenoid and elbow.
 - C. Reach inside the inlet end of the jacket assembly with a 3/4 inch deep socket to remove the nut, washer and gasket and lower fuel shroud box.
 - D. Remove the two screws and carefully withdraw the nozzle holder and valve assembly from the combustion head assembly.
 - E. Carefully unscrew and remove the spray nozzle from the nozzle holder. Remove the gasket.
 - F. After cleaning the nozzle, reinstall the parts removed in essentially the reverse order from removal. Be sure to hold the fuel-tube fitting when tightening the nut to avoid damage to the fuel tube.

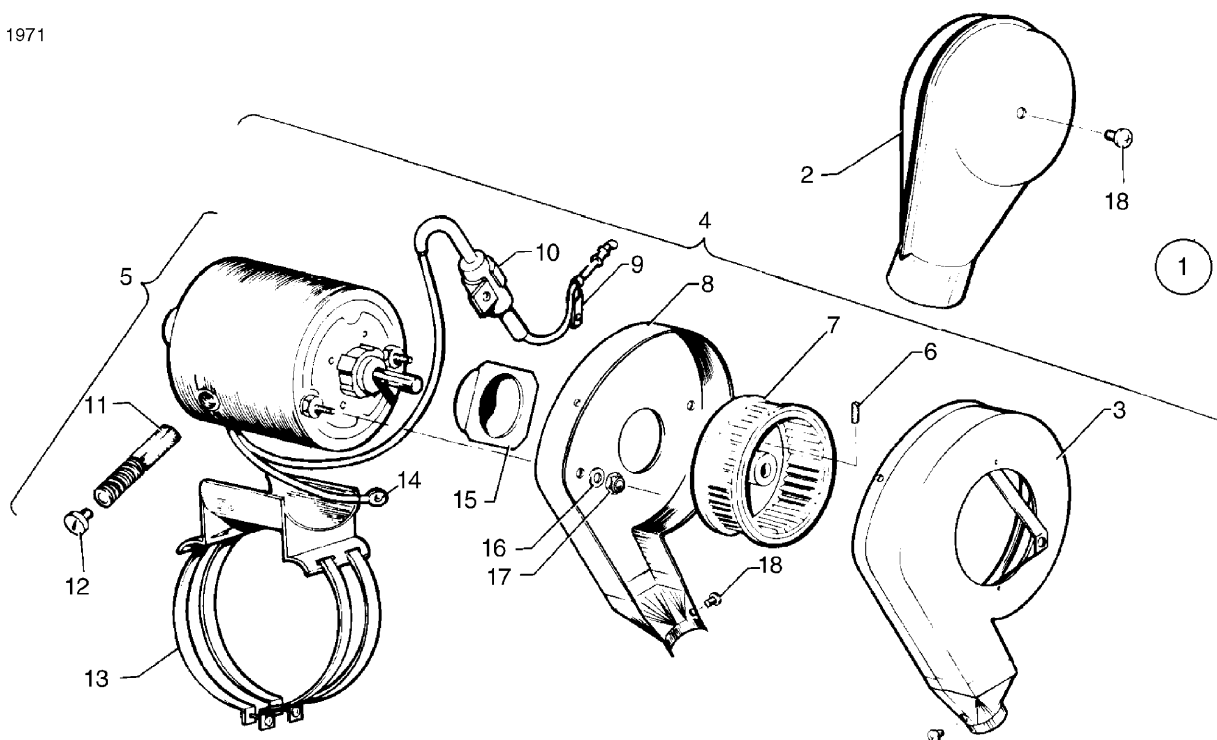
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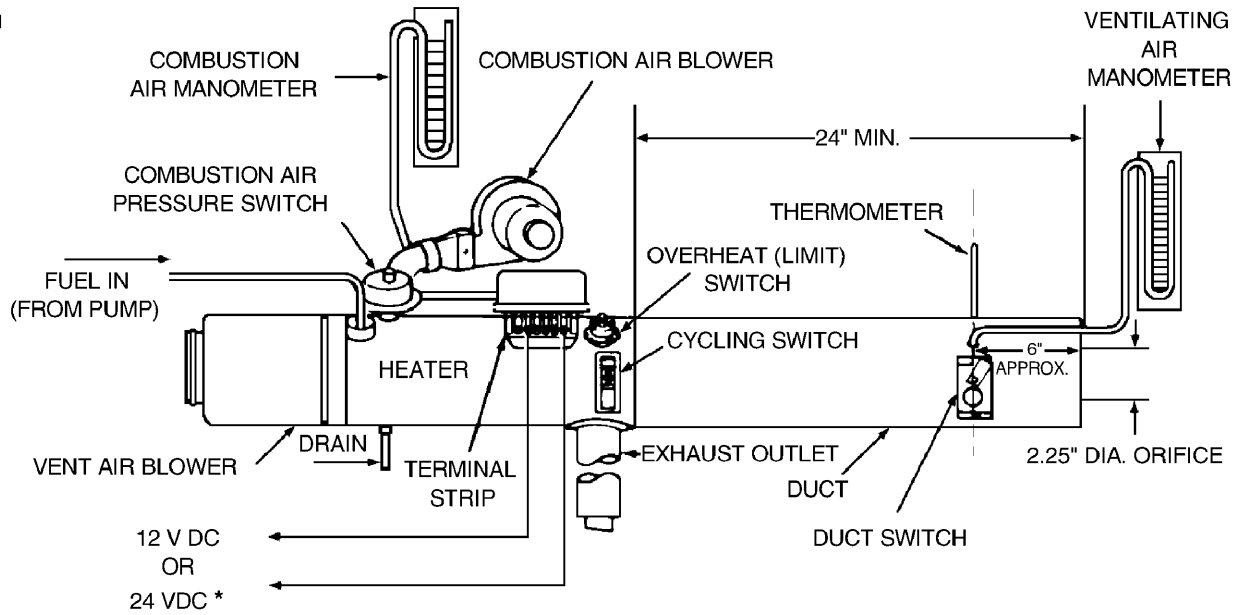


1. COMBUSTION AIR BLOWER AND MOTOR ASSEMBLY
2. ADAPTER ASSEMBLY - BLOWER INLET
3. HOUSING - BLOWER OUTER HALF
4. COMBUSTION AIR BLOWER AND MOTOR
5. MOTOR ASSEMBLY - COMBUSTION AIR BLOWER
6. SET SCREW - BLOWER FAN
7. FAN - COMBUSTION AIR BLOWER
8. HOUSING - BLOWER INNER HALF
9. STRAP - CABLE
10. CAPACITOR
11. BRUSH ASSEMBLY
12. CAP - BRUSH ASSEMBLY
13. MOUNT - COMBUSTION AIR BLOWER SUPPORT
14. ELECTRICAL LEAD
15. SPACER
16. WASHER
17. LOCKNUT - AN345-10
18. SCREWS

Exploded View - Combustion Air Blower and Motor Assembly
Figure 13

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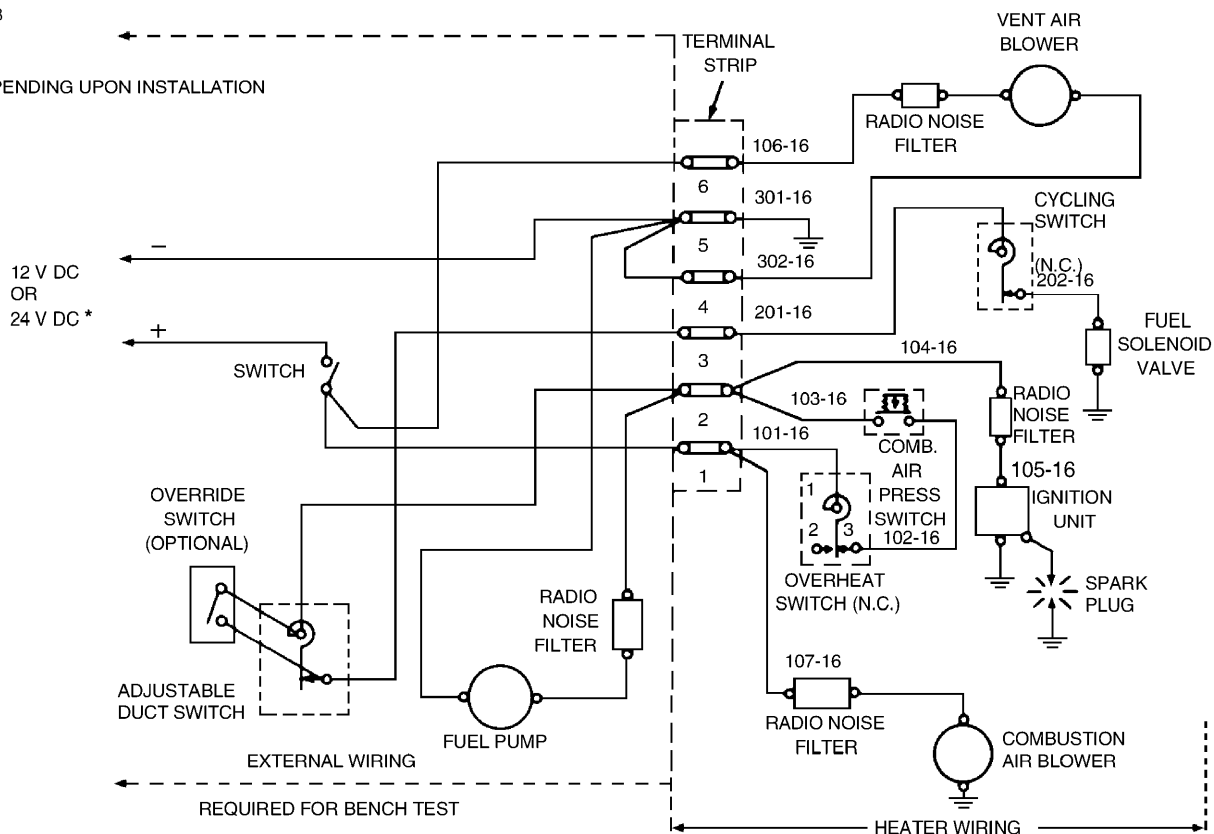
* DEPENDING UPON INSTALLATION

Suggested Setup of Heater Operation Test
Figure 14

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* DEPENDING UPON INSTALLATION



**Wiring Connection for Heater Operation Test
Figure 15**

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**GRIDS 2E8 THRU 2E14
INTENTIONALLY BLANK**

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COOLING

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

1. Fresh Air (Standard) (See 21-20-00.)

When the optional air conditioning system is not installed cabin ventilation and cooling is provided solely by fresh air through the overhead vent system.

2. Air Conditioning (Optional)

A. Description and Operation (See Figure 1.)

WARNING: REFRIGERANT R12 IS USED IN THE SENECA IV AND REFRIGERANT R134A IS USED IN THE SENECA V. IT IS IMPORTANT THAT ANYONE SERVICING THE AIR CONDITIONING SYSTEM BE FAMILIAR WITH THE REFRIGERANT, LUBRICANT, AND COMPONENTS USED IN THAT PARTICULAR SYSTEM.

NOTE: Operate air conditioning system at least once a month to keep system lubricated and prevent sticking valves.

Besides the specific plumbing, the air conditioning installation, from a servicing standpoint, actually involves five significant component installations; the compressor, condenser, condenser scoop, evaporator-dehydrator, and controls installations.

The compressor, a piston type unit, is mounted to the left, rear side of the left engine. A V-belt connection from a gear box extension off the accessory case, drives the compressor through an electromagnetic clutch. The compressor is supported and made adjustable by front and rear brackets also mounted to the accessory case. Access to the unit and lines can be made by removing the upper cowl of the left engine.

The condenser is mounted on the left nacelle to its air scoop support structure and is accessible upon removal of the upper nacelle hatch cover. A scoop is also located at the same location, and is designed to be electrically open. The design is such that the condenser can be cooled without increasing drag. A set of louvers further back on the nacelle allows air flow out of the nacelle.

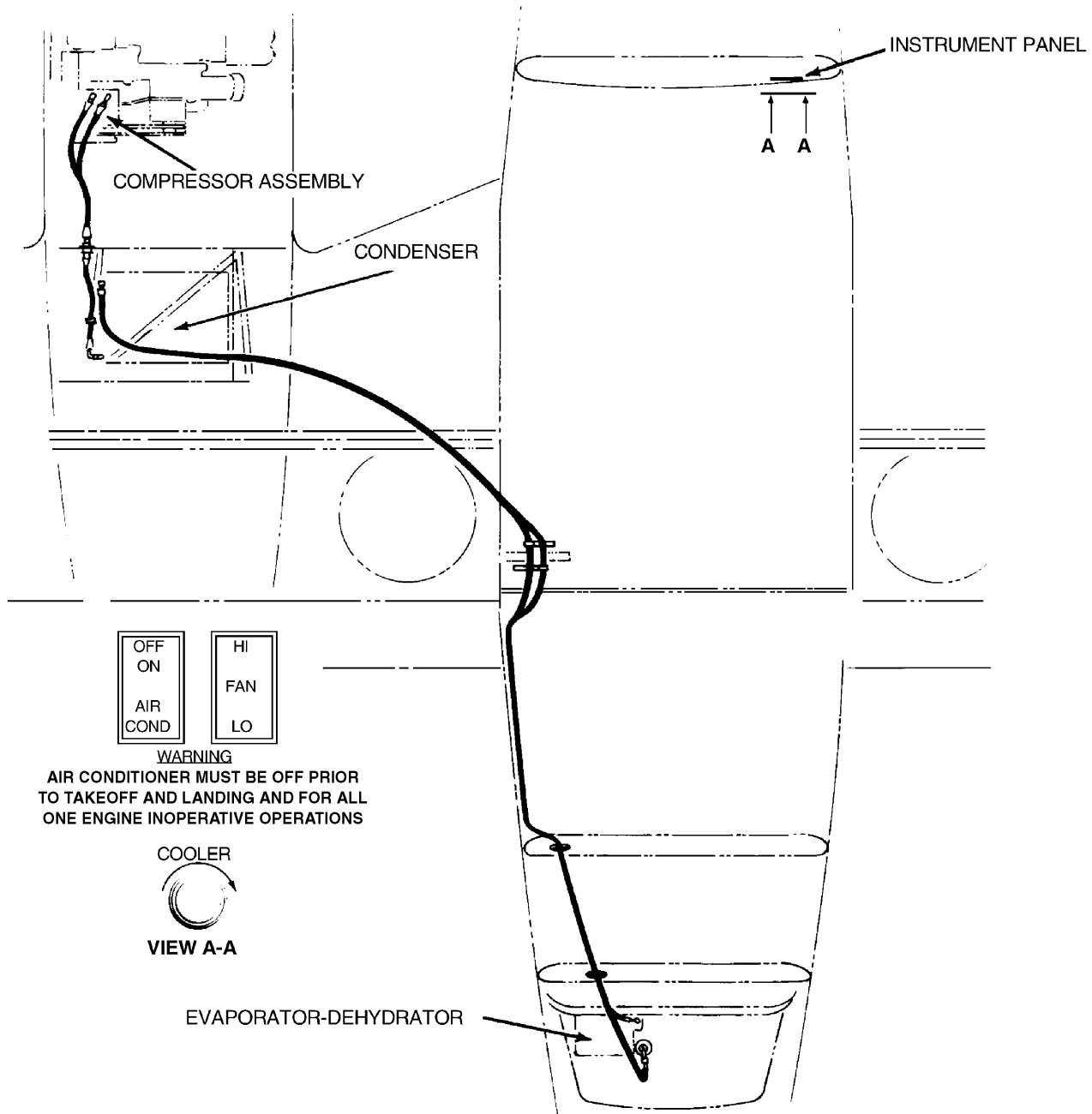
The evaporator-dehydrator installation is incorporated in the rear of the fuselage just aft of the baggage compartment. Access to the unit can be made by removing the false bulkhead in the rear of the baggage area.

Controls for the system are located on the right side of the instrument panel and consist of a HIGH-OFF-LOW fan switch, an ON-OFF air conditioning switch, and thermostat control.

The air conditioning system is also an independent unit which filters, dehumidifies and cools the cabin air by recirculating it through the evaporator-dehydrator. To operate the system, the fan switch must first be placed in the HIGH or LOW position to provide power to the air condition switch. This also provides a second way of using the system in that the fan can be used only to recirculate the air. With the fan and air condition switches on, the clutch on the compressor is engaged, the scoop opened, and the circulating fan turned on. Temperature is then controlled by a radial thermostat control on the copilot's side of the instrument panel.

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Air Conditioning Installation
Figure 1

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In the [Seneca IV](#), with the system in operation, refrigerant is pulled into the compressor as a vapor. The vapor is compressed and routed to the condenser where it is cooled and turned into a liquid. The liquid refrigerant then passes to the receiver-dehydrator where fluid is filtered and any moisture removed. At this point the liquid is regulated at a steady flow by an expansion valve. This thermally controlled metering valve governs the flow of the liquid refrigerant into the evaporator where the liquid changes to a gas and absorbs the heat from the air passing over the coils. From the evaporator the vaporized liquid returns to the compressor to restart the cycle. A pressure switch is also incorporated in the system to automatically control the condenser maximum head pressure by temporarily declutching the -compressor in the event the pressure becomes excessively high.

NOTE: The air conditioning system should be operated at least once a month to prevent sticking valves and keep the system lubricated.

The air conditioning system in the [Seneca V](#) uses HFC-134a. Refrigerant enters the compressor as a vapor. The compressor pressurizes the heat laden vapor until the vapor temperature becomes warmer than the outside air temperature. The compressor then pumps the vapor to the condenser where the refrigerant is cooled and changes to liquid. The liquid now passes to the receiver/dehydrator. The receiver/dehydrator filter removes moisture and ensures a steady flow of liquid refrigerant (which is visible in the receiver/dehydrator's sight glass) into the evaporator through the expansion valve. The expansion valve is a temperature controlled metering valve which regulates the flow of liquid refrigerant to evaporator. The evaporator enables the liquid refrigerant to absorb heat from the outside air passing over coils, converting it back to a vapor. From the evaporator, heat laden refrigerant in a vapor state returns to compressor, and the cycle repeats.

B. Troubleshooting

See Chart 1.

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**CHART 1 (Sheet 1 of 5)
TROUBLESHOOTING AIR CONDITIONING SYSTEM**

Trouble	Cause	Remedy
High discharge pressure.	Refrigerant overcharge.	Purge excess refrigerant.
	Air in system.	Check for leaks. Bleed charge from system. Evacuate and recharge system.
	Overheated condenser due to blocked air passage.	Clean bugs and dirt from condenser fins. Straighten bent fins.
	Flooded evaporator indicated by heavy frosting on suction line and compressor suction service valve.	Check capillary bulb is securely clamped to suction line. If capillary bulb is OK, replace expansion valve.
	Restriction in liquid line from condenser.	Check for kinked hoses and clogged filter.
Low discharge pressure.	Refrigerant undercharge. Sight glass shows bubbles or foam.	Add refrigerant until bubbles disappear. Check system for leaks.
	Damaged compressor valves or dirt under valves.	Replace compressor.
	Damaged compressor. Worn or broken piston or piston rings.	Replace compressor.
Low suction pressure accompanied by icing of evaporator.	Low air supply through evaporator.	Repair blower or blower motor. Clean stoppage in air ducts.
	Very dirty evaporator fins and coils.	Clean and flush with water.
Low suction pressure. (Evaporator not cold enough.) Suction gauge reads vacuum indicating evaporator lacks refrigerant.	Refrigerant undercharge. Moisture freezing in expansion valve. Valve shows frost.	Add refrigerant. Install new dryer. Evacuate and recharge.
	Expansion valve inlet screen clogged. Inoperative expansion valve. Valve stuck closed or capillary bulb has lost charge.	Remove screen. Clean with solvent and replace. Warm capillary by holding in hand. If suction pressure does not change replace expansion valve.
	Restriction in liquid line. Restriction will show frost.	Locate restriction and repair.

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CHART 1 (Sheet 2 of 5)
TROUBLESHOOTING AIR CONDITIONING SYSTEM

Trouble	Cause	Remedy
High suction pressure.	Capillary bulb clamp loose on suction line. Suction line shows frost.	Clean contact surfaces of suction line and cap bulb. Tighten clamp.
	Expansion valve not closing. Evaporator flooded. Suction line frosted to compressor.	Replace expansion valve.
	Compressor drive belt slipping.	Adjust belt tension.
	Magnetic clutch slipping.	Check electrical circuit for proper voltage to clutch coil. Clean oily clutch surfaces.
	Leaking or broken compressor.	Replace compressor valves.
Condenser door will not close when air conditioner switch is in OFF position.	Faulty K-2 relay.	Replace relay.
System does not cool.	If electrical:	
	Blown fuse in control head.	Replace fuse.
	Open circuit breaker.	Set circuit breaker.
	Broken or disconnected electrical wire.	Check all terminals for loose connections. Check wiring for hidden breaks.
	Broken or disconnected ground wire.	Check ground wire is not loose, broken, or disconnected.
	Clutch coil burned out or disconnected.	Verify voltage to clutch. Replace if inoperative.
	Thermostat sensing element defective.	Check thermostat and cabin comfort control panel.
	Blower motor disconnected or burned out motor.	Verify voltage to blower. Repair or replace if inoperative.

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**CHART 1 (Sheet 3 of 5)
TROUBLESHOOTING AIR CONDITIONING SYSTEM**

Trouble	Cause	Remedy
System does not cool. (cont.)	If mechanical:	
	Loose or broken drive belt.	Replace drive belts and tighten to specifications.
	Compressor partially or completely frozen.	Remove compressor. Service or replace.
	Expansion valve stuck in open position.	Replace expansion valve.
	If refrigeration:	
	Broken refrigerant line.	Examine all lines for evidence of breakage by external stress or rubbing wear.
	Leak in system.	Evacuate system, apply static charge, leak test system, and repair leak as necessary.
System cooling inadequate.	Compressor shaft seal leaking.	Replace compressor.
	Clogged screen or screens in receiver dehydrator or expansion valve; plugged hose or coil.	Repair as necessary.
	If electrical:	
	Blower motor operation sluggish.	Remove blower motor for service or replacement.
	If mechanical:	
	Compressor clutch slipping.	Remove clutch assembly for service or replacement. Check clutch airgap and coil.
	Obstructed blower passage.	Examine passage for obstruction. Correct as necessary.
	Insufficient air circulation over condenser coils; fins clogged with dirt or bugs.	Clean condenser coils.
	Clogged evaporator filter.	Clean with solvent.

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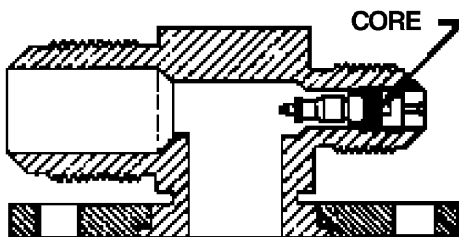
CHART 1 (Sheet 4 of 5)
TROUBLESHOOTING AIR CONDITIONING SYSTEM

Trouble	Cause	Remedy
System cooling inadequate. (cont.)	If refrigeration:	
	System refrigerant low.	Recharge system until bubbles disappear in receiver dehydrator and gauge readings stabilize to specifications.
	Clogged screen in expansion valve.	Purge system, replace expansion valve.
	Expansion valve thermal bulb has no charge.	Purge system, replace expansion valve.
	Clogged receiver dehydrator screen.	Purge system, replace receiver dehydrator.
	Excessive moisture in system.	Purge system, replace receiver dehydrator.
	Air in system.	Purge, evacuate, and charge system. (Replace receiver dehydrator.)
Excessively noisy system.	If electrical:	
	Defective winding or connection in compressor clutch coil.	Replace or repair as necessary.
	If mechanical:	
	Loose or worn drive belts, crankshaft pulley, or idler pulley or bearing.	Tighten or replace as required.
	Engine components such as: alternator, water pump, valves, timing or mounts.	Check.
	Compressor mounting bolts or brackets - broken or loose.	Check, repair, replace.
	Compressor oil level low.	Fill with proper amount of specified oil.
	Compressor failure.	Check shaft turning smoothness. Remove compressor for service or replacement.
	Magnetic clutch failure.	Check airgap, clutch pulley, front plate, coil, and bearing. Adjust, repair, or replace, as required.

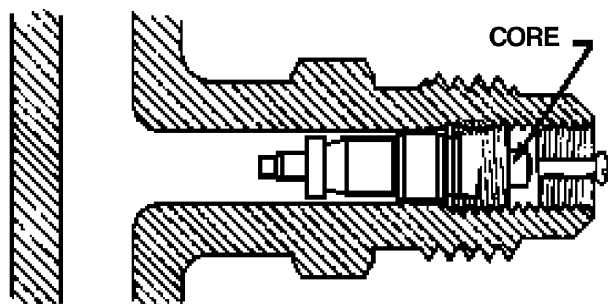
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**CHART 1 (Sheet 5 of 5)
TROUBLESHOOTING AIR CONDITIONING SYSTEM**

Trouble	Cause	Remedy
Excessively noisy system. (cont.)	If refrigeration:	
	Excessive system charge.	Remove excess refrigerant until high pressure gauge drops within specifications.
	Low system charge.	Check system for leaks. Recharge system.
	Excessive moisture in system.	Replace dehydrator, purge, evacuate, and recharge system.

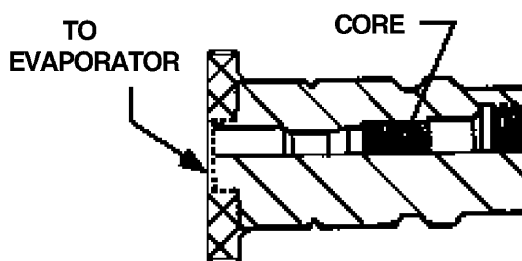


COMPRESSOR VALVE (SCHRADER CHARGING)

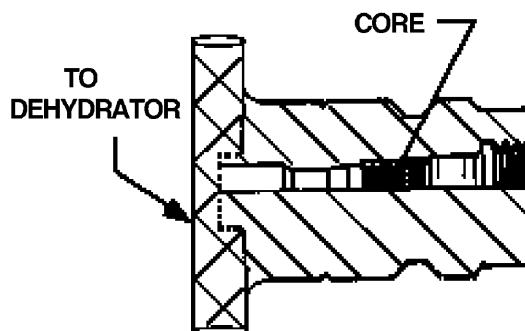


INLINE SERVICE VALVE (SCHRADER)

SENECA IV



LOW SIDE (PRESSURE) VALVE



HIGH SIDE (PRESSURE) VALVE

SENECA V

Service Valves
Figure 2

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3. Servicing Cooling System

NOTE: The maximum refrigerant capacity is 2.25 pounds. The total refrigerant capacity required is determined separately for each system and is the amount that will result in bubble-free operation at the sight gauge, as specified in the post charging operational check.

A. Definitions

- (1) High Side. The "high side" consists of all lines and components between the compressor outlet and the expansion valves. It includes the condenser and receiver/dryer sight gauge.
- (2) Low Side. The "low side" consists of all lines and components between the expansion valves and the compressor inlet. It includes the evaporators.

B. Service Valves (i.e. - ports) (See Figures 1, 2, and 14.)

(1) Description

The aircraft is equipped with inline service valves mounted in the suction and discharge lines of the evaporator assembly located behind the cabin rear closeout panel. These valves are installed to Test, Bleed (Discharge), Evacuate and Charge the air conditioning system. All normal air conditioning service should be performed at the manifold assembly mounted valves.

On the **Seneca IV**, these valves are the two-position screw-on type Schrader valves. On the **Seneca V**, these valves are the quick disconnect type Schrader valves.

The valve in the short line between the receiver and the expansion valve is the high side service port. The other valve, located nearby, is the low side service port.

NOTE: On **Seneca IV** models, service valves are also located on the compressor. However, use of these valves in servicing is not recommended.

NOTE: If a Schrader service valve is not serviceable, the core assembly must be replaced.

(2) Replacement

CAUTION: WHENEVER THE AIR CONDITIONING REFRIGERANT LINES OR SYSTEM ARE OPENED FOR ANY REASON, THE LINES AND FITTINGS SHOULD BE CAPPED AND SEALED IMMEDIATELY TO PREVENT DIRT AND OTHER CONTAMINANTS FROM ENTERING THE SYSTEM. (DO NOT PUT A PLUG INTO THE HOSES OR FITTINGS.)

The **Seneca IV** models have service valves on the compressor. These valves are sealed with a gasket placed in the valve port boss. Lubricate the gasket with refrigerant oil of the type used in the compressor, place the valves with the tube fitting facing aft and secure with .312 bolts. torque to 15-23 inch-pounds.

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**CHART 2
TEMPERATURE VS. PRESSURE**

Refrigerant R12		Refrigerant HFC134a	
Evaporator Pressure Gauge Reading psi	Evaporator Temperature °F	Evaporator Pressure Gauge Reading psi	Evaporator Temperature °F.
0	-21	-5	-27
2.4	-15	0	-15
4.5	-10	2	-9
10.1	2	4	-4
11.2	4	6	0
12.3	6	8	4
13.4	8	10	7
14.6	10	12	11
15.8	12	14	14
17.1	14	16	17
18.3	16	18	20
19.7	18	20	22
21	20	22	25
22.4	22	24	28
23.1	23	26	30
23.8	24	28	33
24.6	25	30	35
25.3	26	32	37
26.1	27	34	39
26.8	28	36	41
27.6	29	38	43
28.4	30	40	45
29.2	31	42	47
30	32	44	49
30.9	33	46	51
31.7	34	48	53
32.5	35	50	54
33.4	36	55	58
34.3	37	60	62
35.1	38	65	66
36	39	70	69
36.9	40		
37.9	41		
38.8	42		
39.7	43		
41.7	45		
43.6	47		
45.6	49		
48.7	52		
49.8	53		
55.4	57		
60	62		
64.9	66		

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C. Malfunction Detection

NOTE: If the cooling system has leaked refrigerant or is discharged, the compressor oil level must be checked.

Detection of system malfunction largely depends on the mechanic's ability to interpret gauge pressure readings into system problems. A system operating normally will have a low side gauge pressure reading that will correspond with the temperature of the refrigerant evaporating, allowing for a few degrees temperature rise due to loss in tube walls and fins. The high side will have a gauge pressure that will correspond with the temperature of the refrigerant condensing in the condenser, allowing for a few degrees temperature drop due to loss in tube walls and fins.

Any deviation from that which is normal indicates a malfunction within the system due to faulty control device, obstruction, defective part, or improper installation.

Detection of system malfunction is made easier with knowledge of the relationship between temperature and pressure of the refrigerant. See Chart 2 for specific values.

NOTE: Gauge readings are about one inch mercury or 1/2 psi higher than chart reads for each 1000 feet elevation above sea level.

Actual air temperature of air passing over the evaporator coils will be several degrees warmer allowing for a temperature rise caused by the loss in the fins and tubing of the evaporator.

The importance of a seasonal check-up of the air conditioning system should be brought to the attention of the customer whenever possible. A thorough check of the system performed in a methodical manner will reveal trouble the customer is often not aware of. Locating and repairing the trouble early will usually result in savings to the customer both in time and additional troubles that too often result from neglect.

A performance test of the system is the only positive way in which the complete system can be checked for efficient operation. The air conditioning system should be given this test before work begins on the system whenever possible. However, if the system is completely inoperative, repairs must be performed before the system can be properly tested. The test can uncover further work that must be performed before the system is brought to its full operating efficiency. The performance test should always be performed after repair work has been done and before the airplane is released to the customer. The serviceman performing this test carefully will ensure that the repairs have been properly performed and that the system will operate satisfactorily.

The performance test, when properly performed includes a thorough examination of the outside of the system as well as the inside. Many related parts are overlooked because it is felt they are of no bearing on the operating efficiency of the unit. For this reason, a thorough visual inspection of the complete system should be performed, followed by an operating inspection of the system.

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D. Special Servicing Procedures

The efficiency of this system depends upon the pressure-temperature relationship of pure refrigerant. As long as the system contains only pure refrigerant plus a specified amount of compressor oil (which is mixed with the refrigerant), it is considered to be chemically stable. Foreign materials within the system will affect the chemical stability, contaminate the system, and decrease its efficiency.

(1) Refrigerant Safety Precautions:

WARNING: REFRIGERANT R12 IS USED IN THE SENECA IV AND REFRIGERANT R134A IS USED IN THE SENECA V. IT IS IMPORTANT THAT ANYONE SERVICING THE AIR CONDITIONING SYSTEM BE FAMILIAR WITH THE REFRIGERANT, LUBRICANT, AND COMPONENTS USED IN THAT PARTICULAR SYSTEM.

WARNING: AIR CONDITIONING REFRIGERANT (BOTH R12 AND R134A) IS ODORLESS AND COLORLESS IN EITHER ITS LIQUID OR GASEOUS STATE. BOTH R12 AND R134A, USED FOR CHARGING REFRIGERATION SYSTEMS, ARE IN A PRESSURIZED CONTAINER IN LIQUID FORM. BOTH REFRIGERANTS ARE INERT AT ROOM TEMPERATURE. THE PRESSURE AND REFRIGERATION EFFECTS OF RELEASE AND EVAPORATION OF THE PRESSURIZED LIQUID IS DANGEROUS.

WARNING: WEAR SUITABLE EYE PROTECTION WHEN HANDLING REFRIGERANTS. THE EYE WILL FREEZE IF CONTACTED BY ESCAPING LIQUID REFRIGERANT.

IF LIQUID REFRIGERANT CONTACTS THE EYE, THE FOLLOWING ACTIONS SHOULD BE TAKEN:

- (A) DO NOT RUB THE EYE.
- (B) SPLASH LARGE QUANTITIES OF COOL WATER INTO THE EYE TO RAISE THE TEMPERATURE.
- (C) TAPE ON AN EYE PATCH TO AVOID THE POSSIBILITY OF DIRT ENTERING THE EYE.
- (D) RUSH TO A PHYSICIAN OR HOSPITAL FOR IMMEDIATE PROFESSIONAL AID.
- (E) DO NOT ATTEMPT TO TREAT IT YOURSELF.

WARNING: IF LIQUID REFRIGERANT STRIKES THE SKIN, FROSTBITE CAN OCCUR. TREAT WITH COOL WATER AND PROTECT WITH PETROLEUM JELLY.

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(2) System Servicing Precautions:

WARNING: DISCHARGE SYSTEMS SLOWLY TO PREVENT THE ESCAPE OF LIQUID REFRIGERANT AND THE LOSS OF THE LUBRICATING OIL.

NOTE: The term "Discharge," as used throughout this section, in no sense implies or suggests discharging refrigerant to atmosphere. In all cases when discharging, an environmentally approved refrigerant recovery station is to be used.

WARNING: DO NOT LEAVE SYSTEMS OPEN TO THE ATMOSPHERE WHEN DISCHARGED. MOISTURE AND OTHER CONTAMINATION MAY ENTER AND DAMAGE OPEN SYSTEMS.

NOTE: When HFC-134a comes in contact with moisture it absorbs it into the system, which will lead to system failure.

WARNING: USE ONLY APPROVED REFRIGERATION OIL IN THE COMPRESSOR:

-- MINERAL OIL FOR SENECA IV OR POLYALKYLENE GLYCOL (PAG) FOR SENECA V.

IF ANY DOUBT EXISTS ABOUT THE CLEANLINESS OF THE COMPRESSOR OIL, REPLACE IT WITH NEW OIL.

WARNING: NEVER INTRODUCE ANYTHING BUT PURE R12 REFRIGERANT (SENECA IV) OR R134A REFRIGERANT (SENECA V) INTO THE SYSTEM.

WARNING: KEEP REFRIGERANT OIL CONTAINERS TIGHTLY SEALED AND CLEAN TO PREVENT ABSORPTION OF MOISTURE OR OTHER CONTAMINATION.

WARNING: NEVER REUSE OIL REMOVED FROM THE SYSTEM -- DISCARD IT.

CAUTION: WHEN LOCTITE REFRIGERANT SEALANT HAS BEEN USED ON A JOINT IT MUST BE HEATED TO 400°F PRIOR TO DISASSEMBLY. LOCTITE MUST BE USED TO SEAL ANY PIPE THREADS IN THE SYSTEM LINES.

CAUTION: REPLACE THE RECEIVER-DEHYDRATOR ASSEMBLY ON ANY SYSTEM WHICH HAS BEEN OPERATING WITH A LEAK ALLOWING AIR TO ENTER THE SYSTEM. IF A RECEIVER-DEHYDRATOR IS LEFT OPEN TO THE ATMOSPHERE IT SHOULD BE REPLACED DUE TO THE LOSS OF EFFECTIVENESS OF THE DRYING COMPOUND IT CONTAINS.

CAUTION: A NEW RECEIVER-DEHYDRATOR SHOULD BE OPENED AND CONNECTED TO THE SYSTEM ONLY WHEN READY TO CHARGE THE SYSTEM WITH REFRIGERANT.

CAUTION: RECOMMENDED TORQUE VALUES MUST BE USED ON ALL FLARE FITTING AND O-RING JOINTS. SEE CHART 3.

CAUTION: IF AIR CONDITIONING REFRIGERANT LINES OR SYSTEM IS OPENED, LINES AND FITTINGS MUST BE CAPPED AND SEALED IMMEDIATELY TO PREVENT DIRT AND OTHER CONTAMINANTS FROM ENTERING THE SYSTEM. (DO NOT PUT A PLUG INTO THE HOSES OR FITTINGS.)

CAUTION: UNITED STATES ENVIRONMENTAL REGULATIONS PROHIBIT THE RELEASE OF REFRIGERANT INTO THE ATMOSPHERE. SPECIAL EQUIPMENT IS REQUIRED WHEN TESTING, DISCHARGING, OR CHARGING THE SYSTEM.

CAUTION: UNITED STATES ENVIRONMENTAL REGULATIONS REQUIRE THAT AIR CONDITIONING SYSTEM REPAIRS BE ACCOMPLISHED BY A QUALIFIED SHOP WITH APPROPRIATELY TRAINED PERSONNEL.

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**CHART 3
RECOMMENDED TORQUE SPECIFICATIONS**

ALUMINUM TUBING					
Metal Tube O.D.		Thread and Fitting Size		Ft./Lb.	
1/4		7/16		5-7	
3/8		5/8		11-13	
1/2		3/4		15-20	
5/8		7/8		21-27	
3/4		1-1/16		28-33	
FLARE CONNECTIONS			O-RING CONNECTIONS		
Tube OD	Thread size	Ft./Lb.	Tube OD	Thread size	Ft./Lb.
3/8	5/8	18-20	3/8	5/8	11-13
1/2	3/4	36-39	1/2	3/4	15-20
5/8	7/8	52-57	5/8	7/8	21-27

E. Servicing the System with a Charging Stand

(PIR-PPS-50003-3, Rev. E)

CAUTION: MINERAL OIL AND PAG ARE NOT COMPATIBLE. USE A SEPARATE MANIFOLD TEST SET AND / OR TEST/CHARGING STAND AND RECOVERY SYSTEM FOR EACH REFRIGERANT TYPE.

CAUTION: USE RECOVERY UNIT SPECIFICALLY DESIGNED FOR THE TYPE OF REFRIGERANT USED IN THE AIRCRAFT SYSTEM. UNINTENDED EFFECTS MAY OCCUR IF REFRIGERANTS ARE COMBINED.

- (1) Discharging (Bleeding/Purging) the System (with a Robinair 34700 or similar charging stand/recovery station) (see Figures 3 and 6). (Required only if system contains refrigerant.)

CAUTION: REFRIGERANT CAN CAUSE FREEZING OF SKIN. BE PARTICULARLY CAREFUL NOT TO ALLOW CONTACT WITH THE EYES.

CAUTION: DO NOT ALLOW REFRIGERANT TO ESCAPE TOO RAPIDLY, AS EXCESSIVE OIL MAY BE CARRIED OUT OF SYSTEM. WHEN HISsing STOPS, SYSTEM IS EMPTY AND VALVE SHOULD BE CLOSED IF NO FURTHER WORK IS PLANNED.

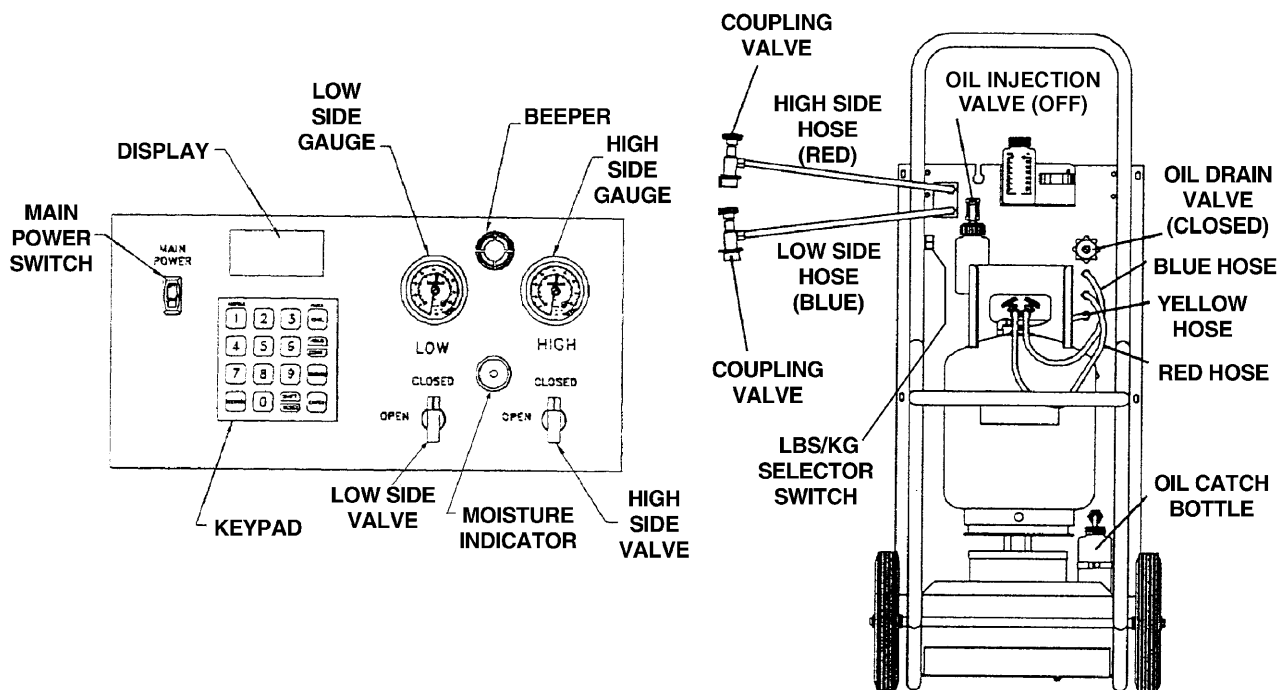
CAUTION: APPLIES TO ROBINAIR 34700 OR SIMILAR CHARGING/RECOVERY STATION. SEE OPERATOR'S MANUAL OF STATION BEING USED FOR DETAILED INSTRUCTIONS FOR DISCHARGING SYSTEM.

CAUTION: UNITED STATES ENVIRONMENTAL REGULATIONS PROHIBIT THE RELEASE OF REFRIGERANT INTO THE ATMOSPHERE. SPECIAL EQUIPMENT IS REQUIRED WHEN TESTING, DISCHARGING, OR CHARGING THE SYSTEM.

NOTE: The term "Discharge," as used throughout this section, in no sense implies or suggests discharging refrigerant to atmosphere. In all cases when discharging, an environmentally approved refrigerant recovery station is to be used.

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- (a) Gain access to service valves by removing rear closeout panel in cabin.
- (b) Remove protective caps from service valves.
- (c) Connect high side (red) hose to air conditioner high side service valve. On systems equipped with quick disconnect connections, open coupler valve.
- (d) Connect low side (blue) hose to air conditioner low side service valve. On systems equipped with quick disconnect connections, open coupler valve.
- (e) Check the low side gauge (GAUGE 1) and high side gauge (GAUGE 2) to determine that there is pressure in the system. If there is no pressure, there is no refrigerant in the system to recover.
- (f) Check that the oil drain valve is closed.
- (g) Open both the low side and high side valves on control panel.
- (h) Open the red GAS (vapor) valve and the blue LIQUID valve on the charging station's refrigerant tank.
- (i) Slowly open the oil drain valve to see if system oil separator contains oil. If it does, let oil drain into the oil drain bottle (located at the bottom of the rear side of the charging station) until separator is empty.
- (j) Close the oil drain valve. Dispose of collected oil in an environmentally accepted manner. Return collection bottle to its place on the charging stand.
- (k) Plug unit into a proper voltage outlet. Turn MAIN POWER switch ON.
- (l) Press the RECOVER key on charging station keypad.



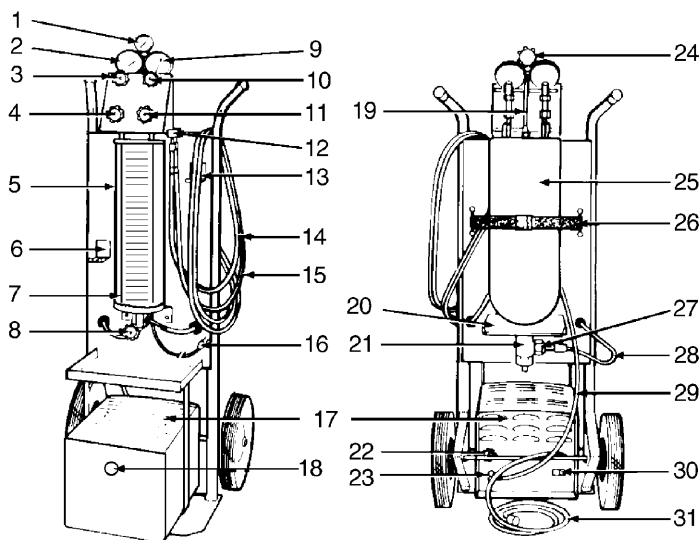
Robinair 34700 Charging Stand
Figure 3

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- (m) To assure complete recovery of refrigerant:
 - 1 Wait 5 minutes. Observe pressure gauges for a rise above zero.
 - 2 If a rise occurs, press the HOLD/CONT key.
 - 3 Repeat as necessary until system maintains pressure for two minutes.
 - (n) Slowly open oil drain valve. Drain oil into the oil catch bottle. When all recovered oil has been completely drained, close oil drain valve.
- NOTE:** Drain oil separator after each job. Display will indicate OIL (OUNCES) or OIL (GRAMS) as a reminder.
- (o) Measure the amount of oil in the catch bottle. The same amount of new oil must be added to the system before charging the system.
 - (p) To enter diagnostic mode, simultaneously press the SHIFT/RESET and ENTER keys. To display amount of refrigerant recovered by the unit, press the 3 key. The panel display will read the amount of recovered refrigerant in pounds or kilograms.
 - (q) Simultaneously press the SHIFT/RESET and ENTER keys to clear internal counter. Press SHIFT/RESET to return to the main menu.

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1. CYLINDER PRESSURE GAUGE
2. COMPOUND GAUGE
3. VALVE, LOW PRESSURE CONTROL
4. VALVE, VACUUM CONTROL
5. CHARGING CYLINDER
6. BRACKET
7. SIGHT GLASS
8. CYLINDER BASE VALVE
9. HIGH PRESSURE GAUGE
10. VALVE, HIGH PRESSURE CONTROL
11. VALVE, REFRIG. CONTROL
12. CHARGING LINE HOSE HOLDER
13. BRACKET
14. LOW PRESSURE CHARGING LINE
15. HIGH PRESSURE CHARGING LINE
16. HEATING ELEMENT PLUG
17. VACUUM PUMP
18. OIL FILL LOCATION
19. NECK ASSEMBLY
20. REFRIGERANT DRUM SUPPORT
21. REFRIGERANT DRUM VALVE
22. VACUUM PUMP VALVE
23. VACUUM PUMP EXHAUST PORT
24. TOP CYLINDER VALVE
25. REFRIGERANT DRUM
26. WEB STRAP
27. REFRIGERANT DRUM REDUCER
28. CHARGING CYLINDER HOSE
29. VACUUM PUMP INTAKE HOSE
30. VACUUM PUMP SWITCH
31. VACUUM PUMP POWER CORD



Kent Moore J23500 Charging Stand
 Figure 4

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(2) Leak Detection (See Figures 2 and 3)

When using a charging stand, a leak may be located as follows:

- (a) Ensure that aircraft and/or ground power is OFF.
- (b) Close all valves on the charging stand.
- (c) Remove the protective caps from the high and low side service ports on the evaporator.
- (d) Connect the blue and red hoses to the service ports as shown in Figure 5.
- (e) Proceed following the instructions in either paragraph (f) or (g), below.
- (f) Using gaseous dry nitrogen:
 - 1 Remove the pressure switch located on the evaporator assembly.
 - 2 Connect a regulated (0-300 psig) gaseous dry nitrogen source to the pressure switch port on the evaporator assembly.
 - 3 Slowly pressurize the system to 200 psig max. with nitrogen and turn off the nitrogen source.
 - 4 Monitor pressure on the charging station gauge for 20 minutes. A leak free system will maintain the 200 psig pressure for 20 minutes.
 - 5 If there is no pressure drop for 20 minutes, slowly release nitrogen pressure and disconnect the nitrogen source from the evaporator assembly. Re-install the pressure switch, lubricating the threads with Retro-fix CCI ESTER-25065 oil (P/N 197-511). Proceed to step (i).
 - 6 If there is a pressure drop, find leak(s) by applying a soap solution to all connections.
 - 7 Tighten/re-tighten fittings as necessary to stop leak(s). If leaks are due to damaged or worn components, proceed with refrigerant recovery/system discharge, perform repairs or component replacement and repeat leak detection procedure.
- (g) Using HFC-134a refrigerant:
 - 1 Ensure that there is at least one pound of refrigerant in the charging cylinder.
 - 2 Open the high pressure control valve and the refrigerant control valve on the charging stand. Allow one pound of refrigerant to enter the system.
 - 3 Close the high pressure control valve and the refrigerant control valve.

CAUTION: IT IS RECOMMENDED THAT A THICK SOLUTION OF SOAP AND WATER BE USED TO CHECK FOR LEAKS INSTEAD OF THE PROPANE LEAK DETECTOR THAT IS PROVIDED WITH SOME BRANDS OF CHARGING STANDS.
 - 4 Locate leak(s) using an electronic leak detector designed to detect HFC134a refrigerant. Or, use soap and water in a thick solution.
 - 5 If no leaks are found, proceed to step (h).
 - 6 Tighten/re-tighten fittings as necessary to stop leak(s). If leaks are due to damaged or worn components, proceed with refrigerant recovery/system discharge, perform repairs or component replacement and repeat leak detection procedure.
- (h) Recover remaining refrigerant from system using the Robinair 34700 (or other approved) charging station (see Discharging the System, above). Any quantity of oil recovered from aircraft must be measured and an equal amount of new oil (i.e. - PAG with HFC134a) must be added to system before recharging.
- (i) Evacuate the system, see below.

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(3) Evacuating the System

NOTE: Perform a Leak Detection check, above, before evacuating the system.

If the system has been operated in a discharged condition or anytime the system has been open to atmospheric pressure, the receiver-dehydrator must be replaced and the system evacuated to remove any trapped air and moisture which has entered it. A vacuum pump capable of pulling 29 inches of mercury or better should be used. As the pressure in the air conditioning system is lowered, the boiling temperature of the water (moisture) that may be present is also lowered. This then forces any moisture, in the form of water vapor, out of the system. Chart 4 demonstrates the effectiveness of moisture removal under a given vacuum.

NOTE: Compound gauge reading will be approximately one inch lower, numerically, for each 1000 feet elevation above sea level.

(a) Using a Kent Moore J23500 or similar charging stand: (See Figure 4.)

- 1 Ensure that aircraft and/or ground power is OFF.
- 2 Close all valves on the charging stand.
- 3 Remove closeout panel at the rear of the cabin to gain access to the service valves.
- 4 Remove protective caps from the high and low side service ports on the evaporator.
- 5 Remove the protective cap from the vacuum pump outlet.
- 6 Connect the blue and red hoses to the service ports.
- 7 Start the vacuum pump.
- 8 Open the valve on the vacuum pump. Open the low pressure control valve and the vacuum control valve on the charging stand.
- 9 After five minutes of pump operation, the high pressure gauge should indicate slightly below zero.
 - a If it doesn't, stop the pump and eliminate the blockage in the system replacing the faulty component, then repeat steps (1)-(9).
 - b If it does, open the high pressure control valve on the charging stand and continue to evacuate the system.
- 10 Operate the vacuum pump for fifteen minutes, or until the compound gauge indicates 24 to 26 in. Hg. whichever occurs first.
- 11 Close the low pressure control valve and the high pressure control valve on the charging stand. Stop the vacuum pump and observe the compound gauge. If the gauge rises at a rate faster than 1 in. Hg. in 5 minutes, there is a leak in the system. Locate and fix the leak. Repeat the evacuation steps above.

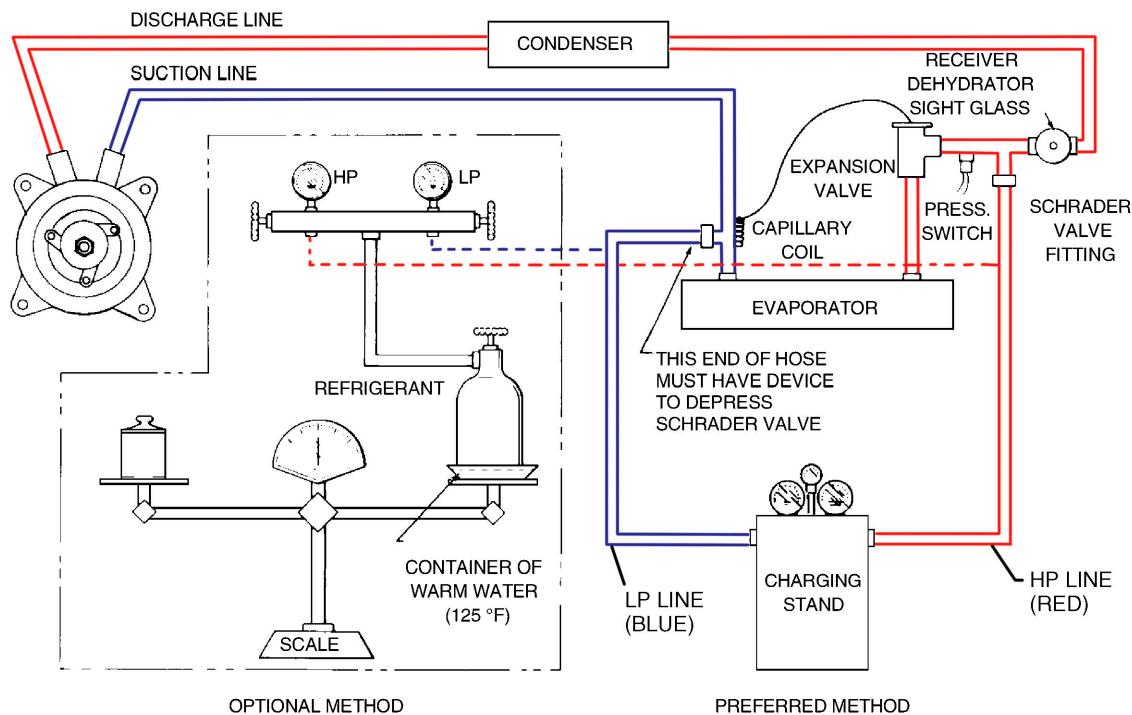
**CHART 4
SYSTEM VACUUM**

	System Vacuum	Boiling Point of Water °F / °C
	27.99	101 / 37.78
COMPOUND GAUGE READING IN INCHES OF MERCURY VACUUM	28.89	80 / 26.67
	29.40	60 / 15.56
	29.71	40 / 4.44
	29.82	20 / -6.67
	29.88	0 / -17.78

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- 12 Open the low pressure control valve and the high pressure control valve on the charging stand. Continue pumping and hold the system pressure below 26 in. Hg. for a minimum of 30 minutes. All the pumping time specified above may be included in the 30 minutes provided that no leaks or blockages are noted, and provided that the system is not opened by removal or disconnection of components.
 - 13 Close the low pressure control valve, the high pressure control valve and the vacuum control valve. Stop the vacuum pump and perform the charging procedure immediately.
- (b) Using a Robinair 34700 or similar charging/recovery stand: (See Figure 3.)
- 1 Ensure that aircraft and/or ground power is OFF.
 - 2 Close all valves on charging stand.
 - 3 Remove closeout panel at rear of cabin to gain access to service valves.
 - 4 Remove protective caps from the high and low side service ports on the evaporator.
 - 5 Connect the blue and red hoses to the service ports (See Figure 6), on systems equipped with quick disconnect connections, open coupler valves.
 - 6 Open blue (low side) valve (1) on unit's control panel.
 - 7 Open both the red GAS (vapor) valve and the blue LIQUID valve on the tank (See Figure 6).

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Charging Hookup
Figure 5

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- 8 Program the length of evacuation time.

 - a Press the VACUUM key on control panel key pad.
 - b Display will show unit is in VACUUM mode.
 - c See operator's manual for further detail.
- 9 Enter the required time in minutes and seconds (30:00 minutes minimum) by pressing appropriate keys and then ENTER on keypad. The display will show selected time in minutes and seconds. Example: one hour and fifteen minutes (1:15) would be entered as 7500. The display will show 75:00. Thirty minutes is entered as 3000. The display will show 30:00.
- 10 To start the vacuum pump press the VACUUM key on keypad again.
- 11 Vacuum sequence will continue for the programmed time. Digital display will then show CPL, indicating that the evacuation is completed.
- 12 If, after 5 minutes of pump operation, the RED gauge does not indicate a little below zero:

 - a Stop the pump by pressing the "1" key or the SHFT/RESET key.
 - b Eliminate blockage in the system by replacing faulty parts.
 - c Repeat steps (1) through (12).
- 13 If, after 5 minutes of pump operation, the RED gauge indicates a little below zero, open red (high side) valve (2), and continue evacuation.

 - a System vacuum (i.e. - low side gauge (GAUGE 1)) should attain 24 to 26 inches of mercury (in. Hg.) in 10 to 15 minutes.
 - b Allow pump to hold a vacuum of 26 in. Hg. (or below) for a minimum of 15 minutes.
 - c Failure to achieve or hold a vacuum of 26 in. Hg. (or below) in either (a) or (b), above, indicates a leak in the system. Locate leak as described in Leak Detection, above.
 - d Repair leak. Repeat steps (1) through (13).
- 14 With the low side (1) and high side (2) valves OPEN, continue pumping, holding system below 26 in. Hg. for a minimum of 30 minutes.

Note: All specified pumping times may be included in the 0:30 minutes, provided no blockage or leaks are noted, and provided the system is not opened by disconnecting or removing components.
- 15 When panel display reads CPL (complete), close both the low side valve (1) and the high side (2) valves.
- 16 Perform charging procedure immediately, see Charging the System, below.

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(4) Charging the System

Note: Always evacuate the system (see above), before charging.

(a) Using a Kent Moore J23500 or similar charging stand (See Figures 4 and 5)

- 1 Open the valve at the base of the charging cylinder and fill the charging cylinder with sufficient refrigerant to charge the system. If refrigerant stops filling the cylinder, open the bleed valve at the top of the charging cylinder to relieve head pressure and allow refrigerant to continue filling the charging cylinder.
- 2 Close the bleed valve and the valve at the base of the charging cylinder.
- 3 Turn the charging cylinder sight glass to match the pressure reading on the charging cylinder pressure gauge. Keep the sight glass in this position during the remainder of the charging operation.
- 4 Connect the heating element plug to a 110 volt power outlet.
- 5 With the low pressure control valve (3) closed, open the refrigerant control valve (11) and the high pressure control valve (10).
- 6 Allow the correct amount of refrigerant to enter the high side of the system.
- 7 Close the high pressure control valve (10) and the refrigerant control valve (11).
- 8 Disconnect the hoses from the airplane's system.

(b) Using a Robinair 34700 charging station or equivalent (See Figures 3 and 6.)

CAUTION: THE FOLLOWING PROCEDURE APPLIES TO ROBINAIR 34700 OR SIMILAR CHARGING STATION. SEE OPERATOR'S MANUAL OF CHARGING STATION BEING USED, FOR DETAILED INSTRUCTIONS FOR CHARGING SYSTEM.

- 1 Check that main power switch and/or ground power is OFF.
- 2 Check that the LBS/KG selector switch on back of unit is in desired measurement mode. Be sure to turn OFF the main power switch before changing the measurement mode.

NOTE: You may enter the amount of refrigerant to be charged when the unit is turned ON. The unit will store the amount in memory until it is turned off.

- 3 Remove protective caps from the high and low side service ports on the evaporator.
- 4 Connect the blue and red hoses to the service ports (ref. Figure 6), on systems equipped with quick disconnect connections, open coupler valves.

CAUTION: DO NOT PLACE ANY WEIGHT, INCLUDING HANDS AND/OR FEET, ON REFRIGERANT TANK OR SCALE DURING CHARGING PROCESS. ANY WEIGHT DISTURBANCE WILL CAUSE AN INDIRECT TRANSFER OF REFRIGERANT.

CAUTION: ADD REFRIGERANT THROUGH THE LOW PRESSURE SIDE ONLY.

- 5 Open the low side (blue) valve on the unit's control panel.
- 6 If the messages PROGRAM and CHARGE do not display, press the CHG key to enter the PROGRAM mode.

NOTE: The amount of refrigerant required must be determined for each airplane. It is the amount that will result in bubble-free operation at the system sight gauge. The PA-34-220T requires approximately 2.25 LBS.

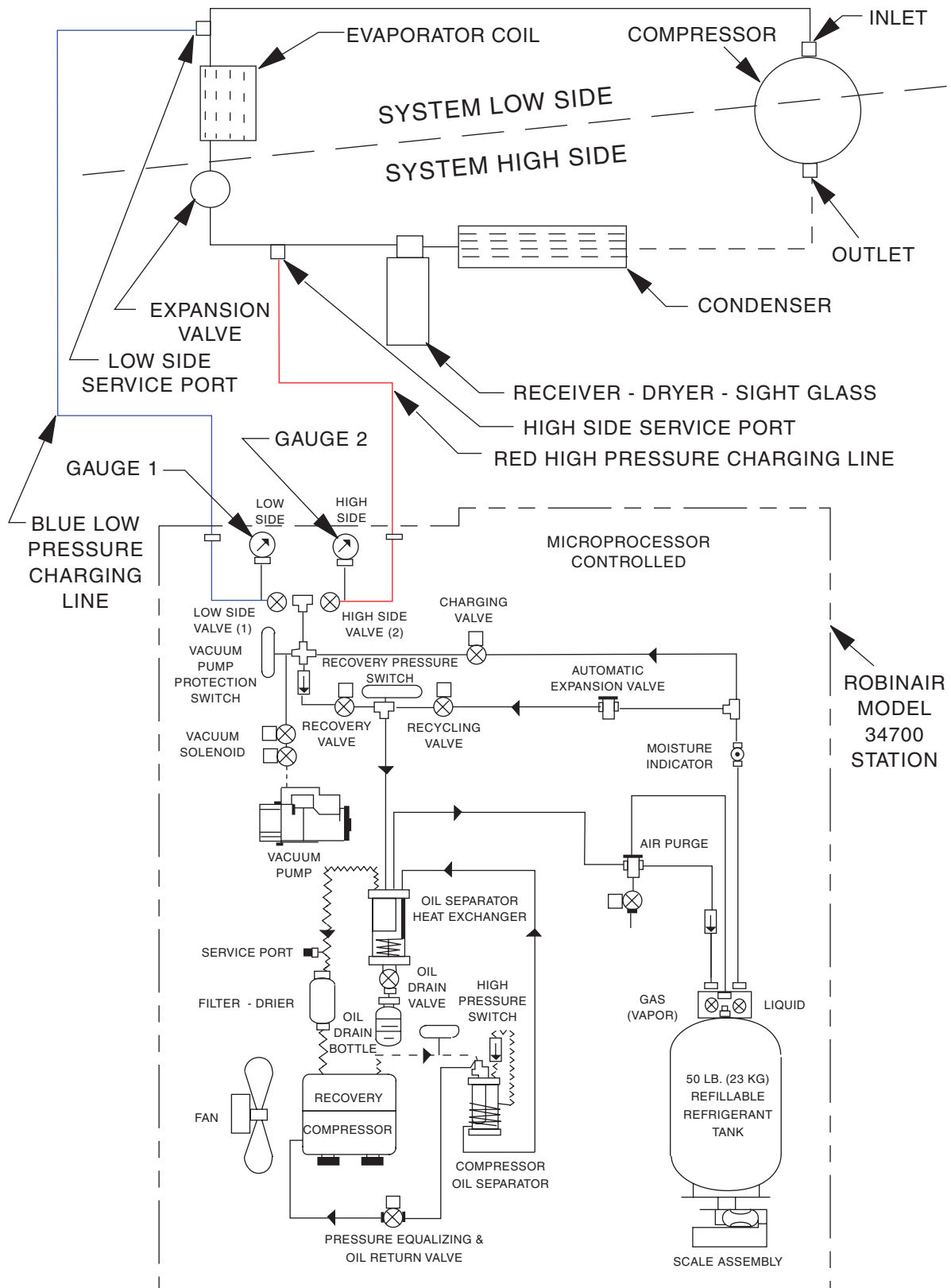
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- 7 Enter amount of refrigerant required to charge the system by pressing the appropriate number keys and ENTER on keypad.

NOTE: You may enter the amount of refrigerant to be charged when the unit is turned ON. The unit will store the amount in memory until it is turned off.

- 8 To begin charging process, press CHG key on keypad.
- a The digital display will read AUTOMATIC and show the amount of refrigerant programmed for the charge.
 - b As the solenoid opens, it will make an audible sound.
 - c The display will count down to zero, and display message CPL, when charging is complete.
- 9 Close low side (blue) valve. Check that the high (red) valve is also closed. Also close coupler valves.
- 10 Perform Post Charging Operational Check, see below.

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Robinair 34700 Charging Station Hose Hookup
Figure 6

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- (5) Post Charging Operational Check (see Figures 3, 4, and 6 - for numbers in parentheses see Figure 4; for numbers in brackets see Figure 6)
- (a) Ensure that the low pressure control valve (3) [1] and the high pressure control valve (10) [2] are closed. Hook up the charging stand to the system as shown in Figures 5 and 6.
 - (b) With Robinair 34700 style stands equipped with quick disconnect couplings only, ensure coupler valves are open.

CAUTION: ASCERTAIN THAT THE AREA AROUND THE AIRPLANE IS CLEAR AND THAT A QUALIFIED PERSON IS AT THE CONTROLS OF THE AIRPLANE.

CAUTION: ENSURE THE AIRPLANE IS HEADED INTO THE WIND.

- (c) Activate the system and operate the engine at 1,000 rpm for 2 minutes. Then operate the engine at 2,000 rpm for 2 minutes.
- (d) Check the sight gauge on the receiver-dehydrator during the engine operation at 1,000 and 2,000 rpm. Any indication of bubbles passing the sight gauge indicates that additional refrigerant is required.
- (e) If additional refrigerant is required, add it slowly through the refrigerant control valve (11) (Kent Moore J23500 style stands only) and the low pressure control valve (3) [1] until the sight glass remains free of bubbles. Regulate the flow of refrigerant with the low pressure control valve. Do not allow the compound gauge (2) or the low side gauge [1] to exceed a reading of 40 psi.
- (f) With the engine operating at 1,000-1,500 rpm, the low and high side gauges should indicate as shown in Chart 5.
- (g) With the charge properly established, stop the engine and, with Robinair 34700 style stands equipped with quick disconnect couplings only, close the coupler valves.
- (h) Close the low pressure control valve (3) [1] and, with Kent Moore J23500 style stands only, the refrigerant control valve (11).
- (i) Remove the charging stand. Replace all protective caps and covers.

**CHART 5
AMBIENT TEMPERATURE INDICATION**

GAUGE (PRESSURE)	AMBIENT TEMPERATURE	GAUGE INDICATION
Low Side	All	10 to 35 psig
High Side	Up thru 75° F	125 psig minimum to 175 psig maximum
High Side	Over 75° F	150 psig minimum to 300 psig maximum

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F. Servicing the System with a Manifold Set

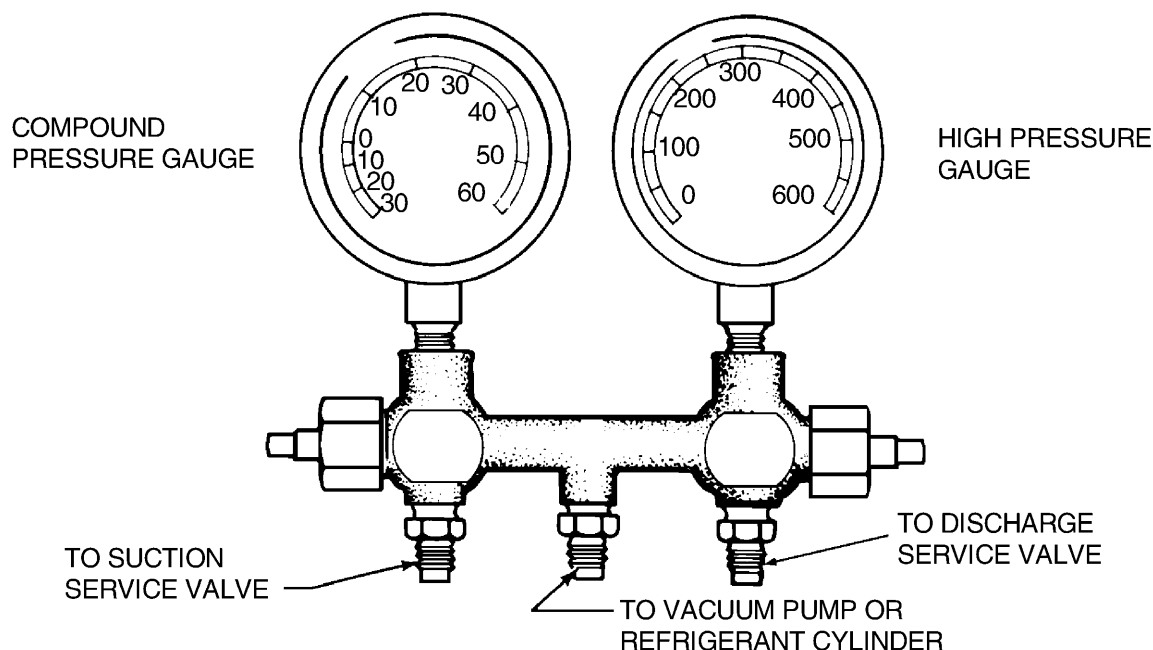
(1) Test Gauge and Manifold Set

The proper testing and diagnosis of the air conditioning system requires that a manifold gauge set (or a charging stand) be attached to the system. This set consists of two gauges mounted to a manifold. One gauge is a high pressure gauge used in the discharge side of the system. The other is a low pressure gauge used in the suction side of the system. The manifold is a device having fittings for both gauges and connection hoses with provisions for controlling the flow of refrigerant through the manifold. (See Figures 7 and 8.)

The center port of the manifold set is used for charging or evacuation procedures, or any other service that may be necessary.

Both the high or low side of the manifold have hand shut-off valves. When the hand valve is turned all the way in, in a clockwise direction, the manifold is closed. The pressures on that side of the system will, however, be recorded on the gauge above the hose.

Cracking the hand valve, in the counterclockwise direction, opens the systems to the middle service port of the manifold set. This is desirable only when it is necessary to let refrigerant out of or into the system. (See Figures 7 and 8.)



Test Gauge and Manifold Set
Figure 7

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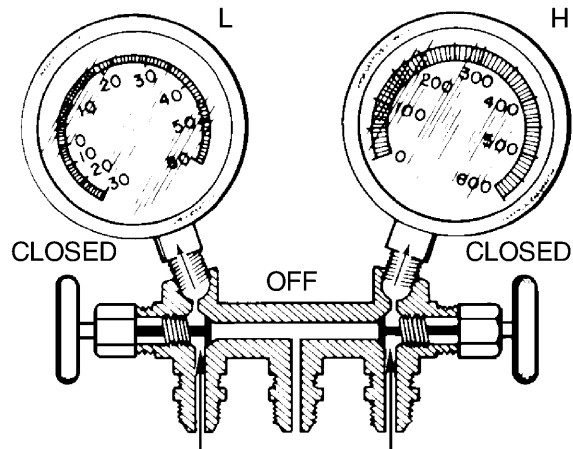


DIAGRAM A

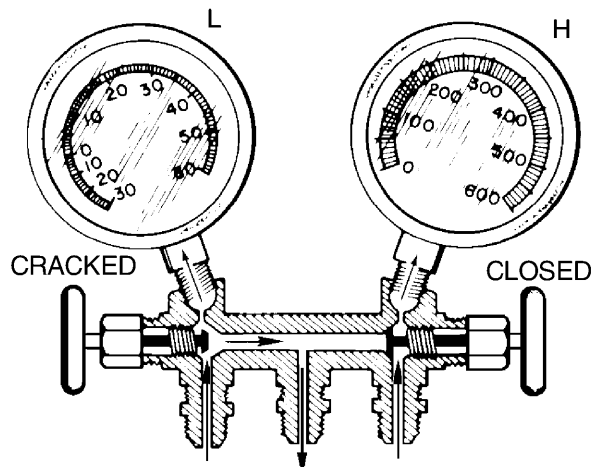


DIAGRAM B

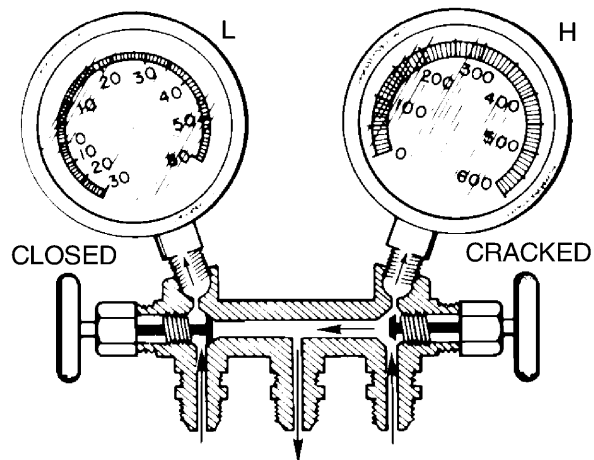


DIAGRAM C

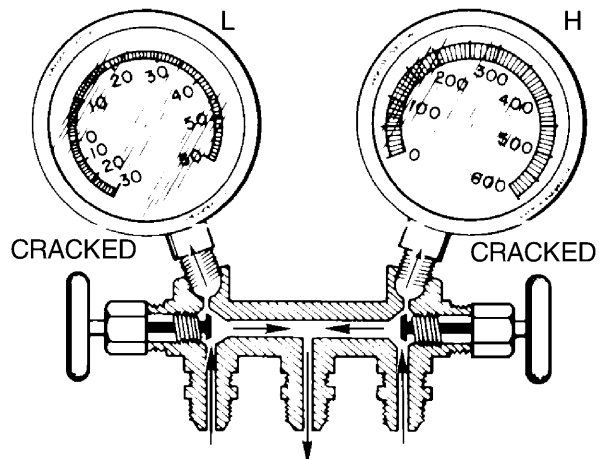


DIAGRAM D

Manifold Set Operation
Figure 8

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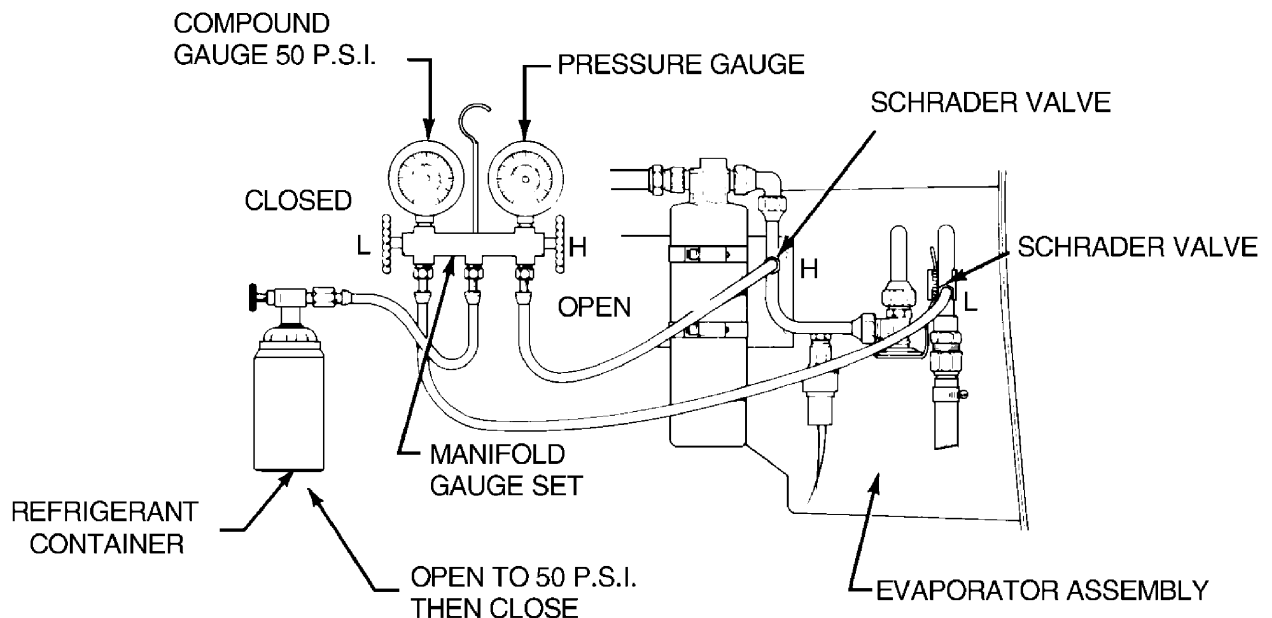
(2) Leak Detection (See Figure 9.)

- (a) Close both the low side and high side valves on manifold hand set.
- (b) Connect manifold hand set middle port (yellow) hose to a regulated (0-300 psig) gaseous dry nitrogen source or a container of HFC-134a refrigerant.

NOTE: Do Not use HFC-134a refrigerant in a Seneca IV.

- (c) Open nitrogen source or refrigerant container service valve.
- (d) Open the manifold hand set high side valve until a pressure of 50 psig is reached on low side gauge. Close high side valve.
- (e) Locate leak(s) using soap and water in a thick solution; or, if using HFC-134a, an electronic leak detector designed to detect HFC134a refrigerant can also be used.
- (f) Tighten/re-tighten fittings as necessary to stop leak(s). If leaks are due to damaged or worn components, proceed with refrigerant recovery/system discharge, perform repairs or component replacement and repeat leak detection procedure.
- (g) Check that both the high side and low side valves on the manifold hand set are closed.
- (h) Close service valve on nitrogen source or refrigerant container. Disconnect yellow manifold hand set center hose from nitrogen source or refrigerant container.
- (i) On systems equipped with quick disconnect connections, close coupler valves. Disconnect manifold hand set red and blue hoses from airplane service ports. Remove manifold hand set.
- (j) If HFC-134a refrigerant was used, recover remaining refrigerant from system using the Robinair 34700 (or other approved) charging station (see Servicing the System, Charging, above). Any quantity of oil recovered from aircraft must be measured and an equal amount of new oil (i.e. - PAG with HFC134a) must be added to system before recharging.
- (k) When refrigerant recovery is complete, on systems equipped with quick disconnect connections, close coupler valves. Disconnect charging/test station from service ports.

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Leak Test Hookup
Figure 9

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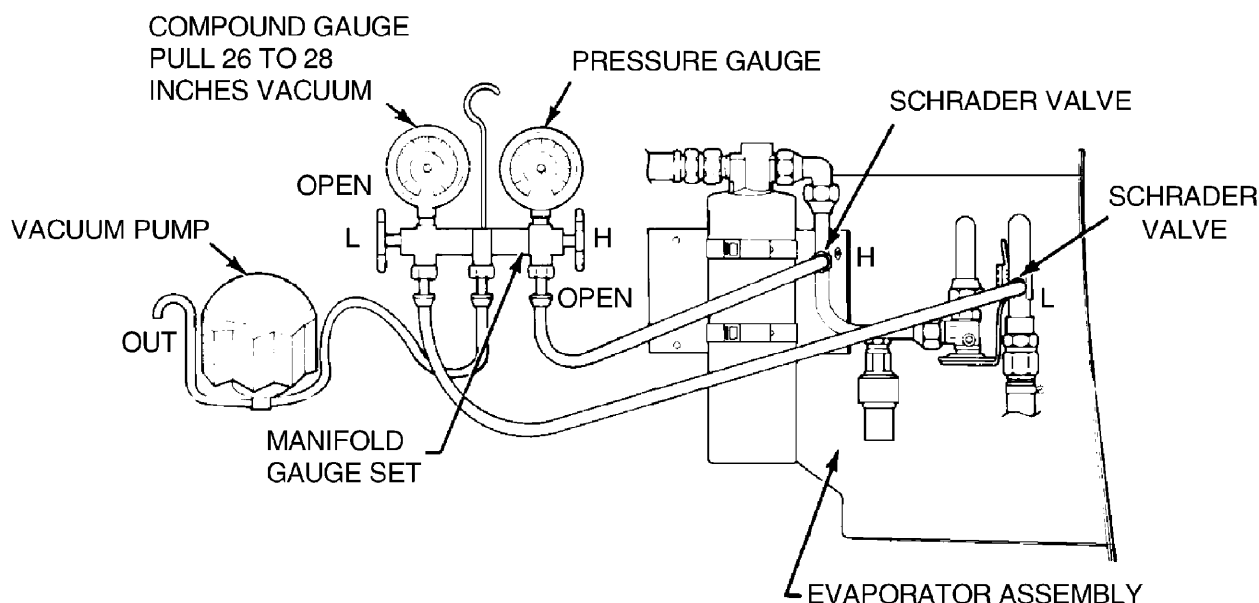
- (l) Evacuate the system, see below or Servicing the System, Evacuating, above.
- (m) Immediately charge the system, see below or Servicing the System, Charging, above.
- (3) Evacuating the System (See Figure 10.)

NOTE: Perform a Leak Detection check, above, before evacuating the system.

If the system has been operated in a discharged condition or anytime the system has been open to atmospheric pressure, the receiver-dehydrator must be replaced and the system evacuated to remove any trapped air and moisture which has entered it. A vacuum pump capable of pulling 29 inches of mercury or better should be used. As the pressure in the air conditioning system is lowered, the boiling temperature of the water (moisture) that may be present is also lowered. This then forces any moisture, in the form of water vapor, out of the system. Chart 4 demonstrates the effectiveness of moisture removal under a given vacuum.

- (a) Ascertain that all system pressure is released.
- (b) Connect the manifold set hoses to the service ports and vacuum pump as shown in Figure 10.
- (c) Close the high side (pressure) and low side (suction) hand valves on the manifold set.
- (d) Start the vacuum pump.
- (e) Open the low side manifold set hand valve. The low side gauge should show a vacuum.
- (f) After five minutes of pump operation the high side gauge should indicate slightly below zero. If it does not, stop the pump and eliminate the blockage in the system by replacing the faulty component, then repeat the previous evacuation steps.
- (g) Operate the vacuum pump for fifteen minutes or until the low side gauge indicates 24 to 26 in. Hg. whichever occurs first.

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Evacuation Hookup
Figure 10

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- (h) Close the low side hand valve, stop the vacuum pump and observe the low side gauge. If the gauge rises at a rate faster than 1 in. Hg. in 5 minutes, there is a leak in the system. Locate and repair the leak, then repeat the previous evacuation steps.
- (i) With both the low and high side valves open, continue the pumping and hold the system below 26 in. Hg. for a minimum of 30 minutes. All the previous pumping time may be included in the 30 minutes provided that no leaks or blockages are noted, and provided that the system is not opened by removal or disconnection of components.
- (j) Close the low and high side hand valves, stop the vacuum pump and perform the charging procedure immediately.

(4) Charging the System Using the Airplane Compressor

This method is the least desirable due to the requirement of operating the airplane's engine to run the compressor.

CAUTION: ASCERTAIN THAT THE AREA AROUND THE AIRPLANE IS CLEAR AND THAT A QUALIFIED PERSON IS AT THE CONTROLS OF THE AIRPLANE.

- (a) Keep the system under the vacuum established during the evacuating procedure with both hand valves in the closed position.
 - (b) Attach a container of the appropriate refrigerant to the manifold set and open the container service valve.
 - (c) Loosen the center hose at the manifold set until a hiss can be heard. Allow the gas to escape for 2 to 3 seconds, then tighten the connection.
 - (d) Open the high side manifold set hand valve, observe the low side gauge, then close the high side hand valve. The low side gauge should immediately change from an indication of a vacuum to an indication of pressure. If it does not, the system is blocked, and the blockage must be corrected before proceeding.
 - (e) Start the engine and operate it at 1000 rpm.
 - (f) Adjust the airplane air conditioning controls for maximum cooling, high blower speed.
 - (g) Keep the refrigerant cylinder in an upright position. A slug of liquid refrigerant entering the system would damage the compressor.
 - (h) Open the low side manifold set hand valve and allow two pounds of refrigerant in the gas state to enter the system.
 - (i) Close the low side manifold set hand valve.
 - (j) Proceed with the Post Charging Operational Check, below.
- (5) Post Charging Operational Check

CAUTION: ASCERTAIN THAT THE AREA AROUND THE AIRPLANE IS CLEAR AND THAT A QUALIFIED PERSON IS AT THE CONTROLS OF THE AIRPLANE.

NOTE: Head the airplane into the wind during these checks.

- (a) With the manifold set installed, and both hand valves closed, actuate the system and operate the engine at 1,000 rpm for 2 minutes, then operate the system at 2,000 rpm for 2 minutes.
- (b) Check the system sight gauge (on the receiver-dehydrator) during operation at 1,000 and 2,000 rpm. Any indication of bubbles passing through the sight gauge indicates that additional refrigerant is required.
- (c) Add additional refrigerant slowly through the low side manifold set hand valve until the sight glass remains free of bubbles.
- (d) Close the low side hand valve and refrigerant container valve.

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**CHART 6
AMBIENT TEMPERATURE INDICATION**

GAUGE	AMBIENT TEMPERATURE	GAUGE INDICATION
Low Pressure	All	10 to 35 psig
High Pressure	Up thru 75°F	125 psig min to 175 psig max
High Pressure	Over 75°F	150 psig min to 275 psig max

- (e) With the engine operating at 1,000 to 1,500 rpm, the gauges should indicate as shown in Chart 6.
 - (f) Once the charge is properly established, stop the engine, close the refrigerant container service valve. Remove the manifold set and replace all protective caps and covers.
- (6) Adding Partial Charge to System

The system can be topped off with refrigerant by the following method:

- (a) Remove the closeout panel at the rear of the cabin.
- (b) Connect a charging hose to a refrigerant cylinder and also to the low pressure Schrader valve fitting on the manifold assembly.
- (c) Purge the charging hose by allowing a small amount of refrigerant gas to escape at the Schrader valve fitting.

CAUTION: ASCERTAIN THAT THE AREA AROUND THE AIRPLANE IS CLEAR AND THAT A QUALIFIED PERSON IS AT THE CONTROLS OF THE AIRPLANE.

NOTE: Head the airplane into the wind during this procedure.

- (d) Start the engine, operate at 1000 rpm and turn the air conditioner on maximum cool.
- (e) Remove the plastic plug (if installed) from the sight glass in top of the receiver-dehydrator.
- (f) With a low refrigerant charge in the system, bubbles will be seen passing through the sight glass when the system is operating.
- (g) Open the valve on the refrigerant cylinder.
- (h) Allow refrigerant to flow into the system until the bubbles disappear from the sight glass.
- (i) Close the refrigerant valve and check to see that the sight glass remains clear during system operation.
- (j) When the sight glass stays clear of bubbles, add an additional pound of refrigerant to the system. (Engine should be operating at 1,000 rpm.)

NOTE: This is done with OAT at 70°F, or higher, with the air conditioner operating.

- (k) Shut off the air conditioner and engine. Remove the charging hose from the Schrader valve with care due to refrigerant remaining in the line.
- (l) Reinstall closeout panel.

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G. Compressor (See Figure 13.)

The engine driven compressor is mounted on the rear of the left engine. A V-belt connected to the accessory drive adapter pulley drives the compressor through a magnetic clutch.

(1) Servicing

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

CAUTION: AN IMPORTANT FACTOR IN AIR CONDITIONING SERVICING IS CLEANLINESS. TAKE CARE TO PREVENT DIRT OR FOREIGN MATERIAL FROM ENTERING THE SYSTEM. ALL HOSE AND TUBING ENDS SHOULD BE CAPPED IMMEDIATELY. ANY LUBRICATION REQUIRED IN THE ASSEMBLY OF THE COMPONENTS SHOULD BE REFRIGERANT OIL OF THE TYPE USED IN THE COMPRESSOR.

Servicing the compressor in the field is not recommended. Compressor service should be done by a qualified shop which has the special equipment and trained personnel required to properly service the unit.

Field maintenance of the Sanden compressor is limited to removal and installation, checking the compressor oil level, and replacement of worn drive belts. Contact Sanden International, for special tools and instructions for detailed compressor maintenance.

(2) Removal

- (a) Be sure the air conditioning circuit protector is in the off position.
- (b) Remove engine cowling.
- (c) Disconnect the electrical leads to the magnetic clutch on the compressor.
- (d) Discharge the air conditioning system to an appropriate environmentally approved refrigerant recovery station. See Servicing the System, Discharging, above.
- (e) Remove the suction and discharge lines from the connections on the compressor.

NOTE: All open lines should be capped immediately to prevent dirt and moisture from entering the system.

- (f) Loosen compressor mounting bolts (4) to release belt tension and remove belt from pulley. (Do not force belt over pulleys.)
- (g) Support compressor and remove bolts, washers, and nuts securing compressor to forward and rear mounting brackets.
- (h) Remove compressor.

(3) Installation

- (a) Align compressor mounting lugs with forward and rear mounting brackets and install bolts, washers, and nuts hand tight.
- (b) Place drive belt over compressor clutch and accessory drive adapter pulleys. Ensuring drive belt is properly seated in both pulleys, rotate compressor in mounting brackets slots to obtain a drive belt tension of 45 to 50 lbs. Torque the four (4) mounting bolts 240 to 260 in.-lbs.
- (c) Check oil level in compressor as described in Checking Compressor Oil, below.
- (d) Connect discharge and suction lines to their respective fittings on the compressor.
- (e) Evacuate the system per Servicing the System, Evacuating, above.
- (f) Charge the system per Servicing the System, Charging, above.
- (g) Install engine cowling.

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**CHART 7
SANDEN COMPRESSOR OIL LEVEL VS. MOUNTING ANGLE**

Mounting Angle	0°	10°	20°	30°	40°	50°	60°	90°
Oil Level (in notches)	3-5	5-7	6-8	7-9	8-10	8-10	9-11	9-11

(4) Checking Compressor Oil Level

Whenever a system component has been replaced or there is an obvious leak, use the following procedure to check the compressor oil level (after making necessary repairs):

WARNING: ENSURE THE AREA AROUND THE AIRCRAFT IS CLEAN AND FREE OF LOOSE OBJECTS, BEFORE OPERATING THE ENGINE AND AIR CONDITIONER ON THE GROUND.

- (a) Run compressor for 10 minutes at engine idle rpm.
- (b) Recover all refrigerant from the system. Be careful not to lose oil.
- (c) Determine the compressor mounting angle by positioning the angle gauge (Sanden P/N 32448) or a propeller protractor across the flat surfaces of the two front mounting ears.
- (d) Center the bubble and read the mounting angle to the closest degree.

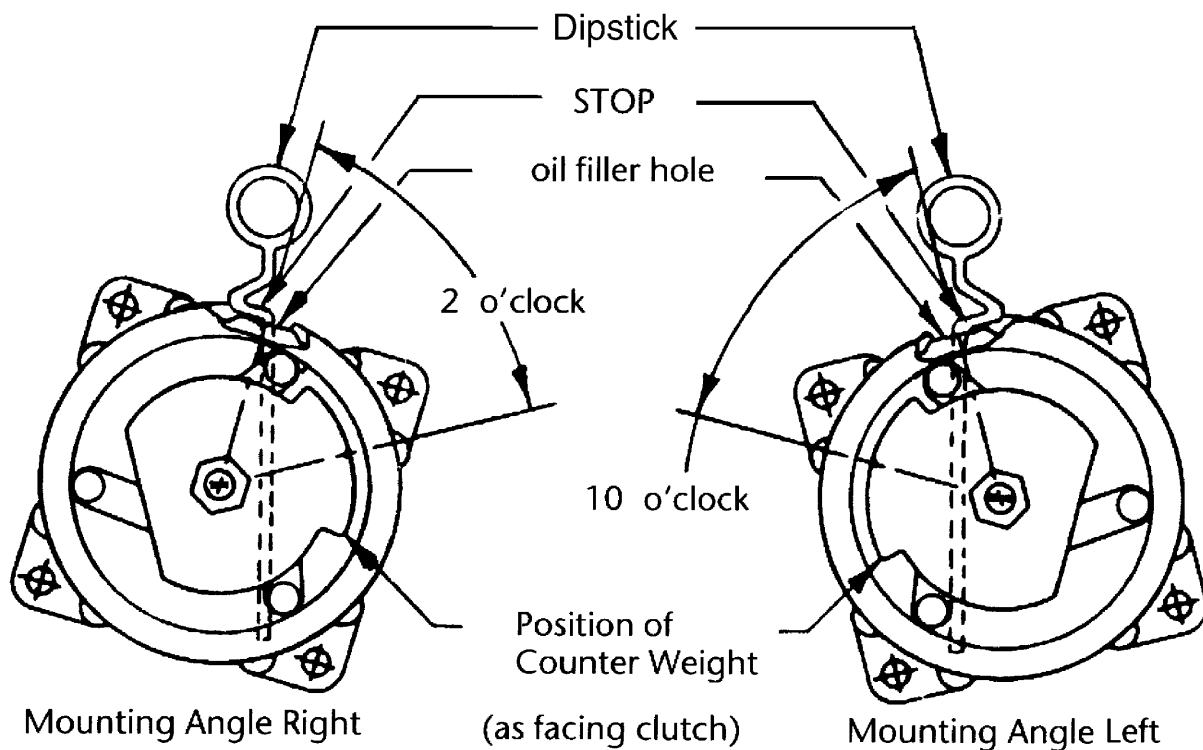
CAUTION: DO NOT REMOVE THE OIL FILLER PLUG WITH PRESSURE IN THE SYSTEM.

- (e) Remove the oil filler plug.
- (f) Look through the oil filler plug hole (Figure 11) and rotate the clutch front plate to position the internal parts as shown in Figure 11. Center the parts as they are moving to the rear of the compressor (discharge stroke).

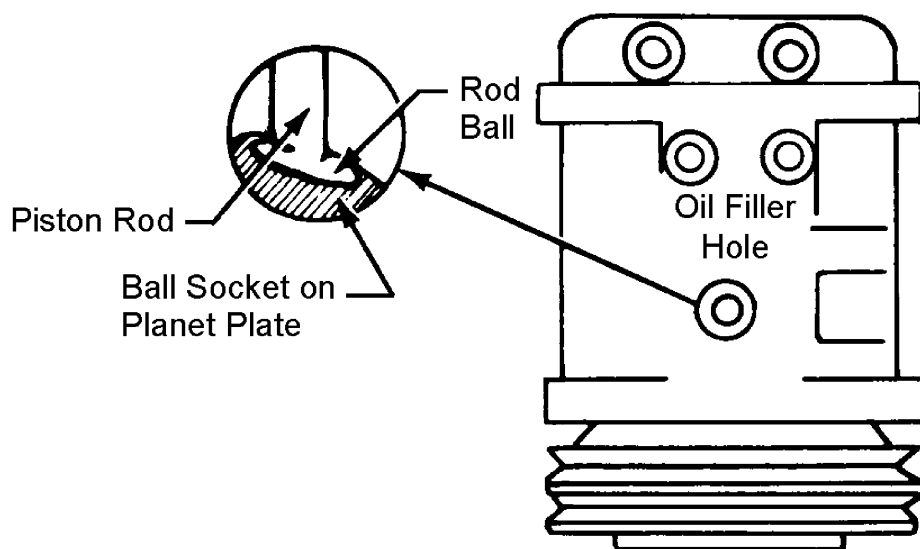
NOTE: This step is necessary to clear the dipstick of internal parts and to allow its insertion to full depth.

- (g) Insert the dipstick (Figure 12) to its stop position (See Figure 11). The stop is the angle near the top of the dipstick.
 - 1 The point of the angle must be to the left if the mounting angle is to the right, or to the right if the mounting angle is to the left.
 - 2 The bottom surface of the angle must be flush with the surface of the oil filler hole.
- (h) Remove the dipstick and count the increments of oil.
- (i) Use Chart 7 to determine the correct oil level for the mounting angle of the compressor.
- (j) If the increments read on the dipstick do not match the table, add or subtract the appropriate oil to the mid-range value - i.e. - if the angle is 20°, the desired oil level is 7.
- (k) Install the oil filler plug, first checking that the sealing O-ring is not twisted. Ensure that the seat and O-ring are clean.
- (l) Torque the plug from 6 to 9 foot-pounds (0.8 to 1.2 kg-m). Do not over tighten the plug to stop a leak. If plug leaks, remove it, and install a new O-ring.
- (m) Evacuate and charge the system as described above.

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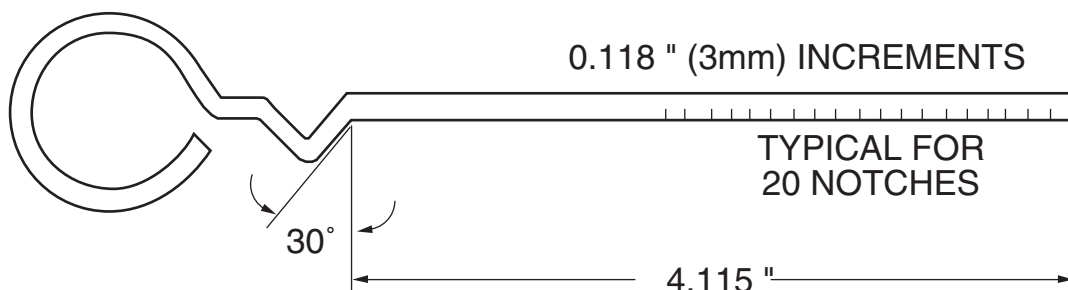


TOP VIEW



Checking Compressor Oil Level
Figure 11

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Fabricated Dipstick
Figure 12

(5) Adjusting Drive Belt Tension

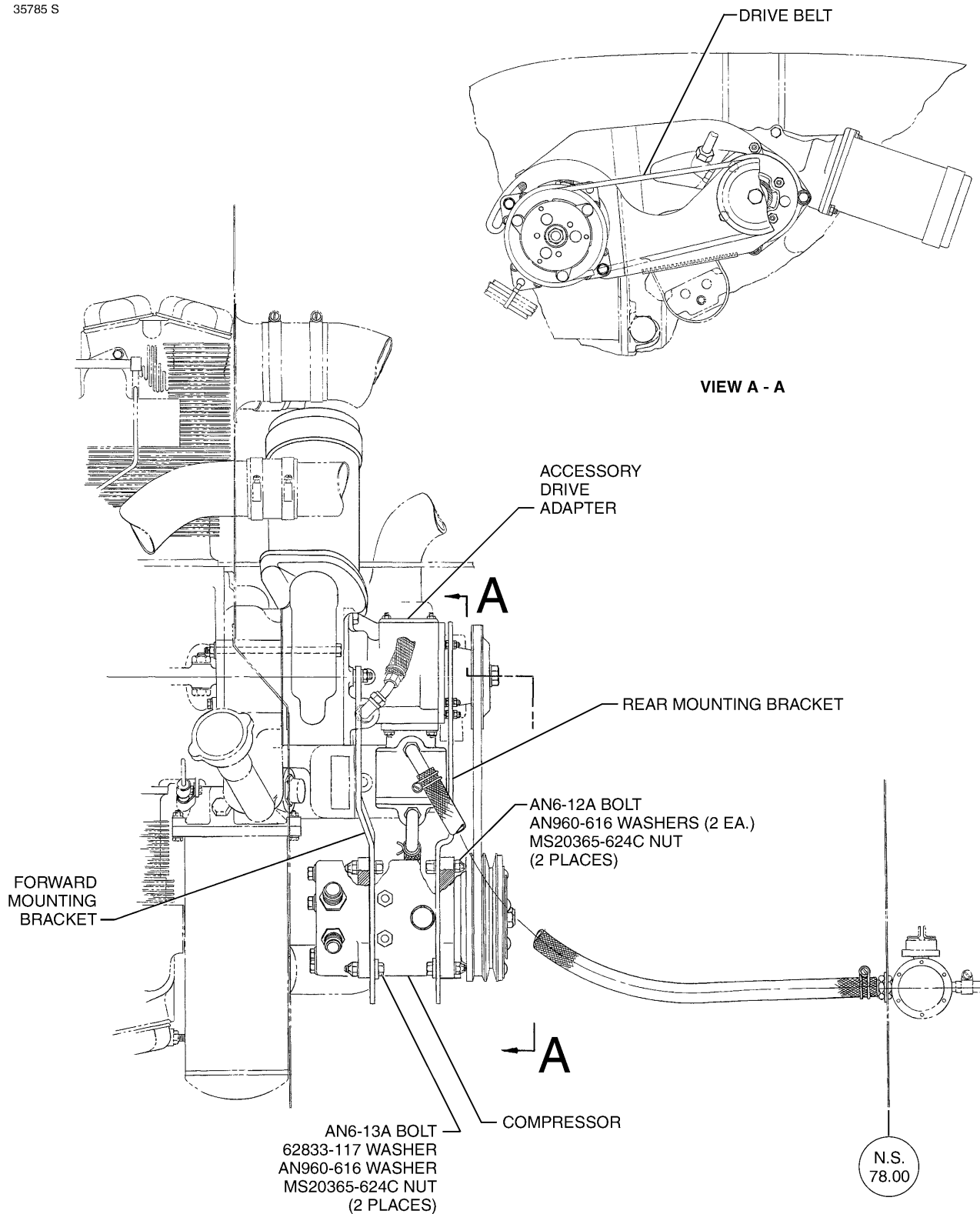
- (a) Remove left engine cowling.
- (b) Loosen compressor mounting bolts (4) rotate compressor in mounting brackets slots to obtain a drive belt tension of 45 to 50 lbs. Torque the four (4) mounting bolts 240 to 260 in.-lbs.

WARNING: ENSURE THE AREA AROUND THE AIRCRAFT IS CLEAN AND FREE OF LOOSE OBJECTS, BEFORE OPERATING THE ENGINE AND AIR CONDITIONER ON THE GROUND.

- (c) Run the engine for 20 minutes at 1900 rpm with the compressor engaged.
- (d) Shut down engine and recheck belt tension. Tension should hold at 45 to 50 lbs.
- (e) Check tension every 100 hours or annual inspection, whichever comes first.
- (f) Install engine cowling.

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Compressor Installation
Figure 13

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H. Refrigerant Lines And Routing

CAUTION: DISCHARGE SYSTEM COMPLETELY BEFORE HOSE COUPLINGS ARE UNCOUPLED. (SEE SERVICING THE SYSTEM, DISCHARGING, ABOVE.)

CAUTION: UNITED STATES ENVIRONMENTAL REGULATIONS PROHIBIT THE RELEASE OF REFRIGERANT INTO THE ATMOSPHERE. SPECIAL EQUIPMENT IS REQUIRED WHEN DISCHARGING OR RECHARGING SYSTEM.

Handle refrigerant lines carefully. Refrigerant lines are flexible high pressure hoses. Hoses in power plant area are routed for maximum protection from heat and abrasion. They couple at firewall to hoses routed through the two inboard, external hat sections on bottom of fuselage, up through floor to condenser and evaporator in tail cone. Discharge is in the right hand hat section. The suction is in the left hand hat section.

I. Receiver-Dehydrator

(1) Removal

CAUTION: IF RECEIVER-DEHYDRATOR IS NOT SERVICEABLE, IT MUST BE REPLACED. RECEIVER-DEHYDRATOR MUST BE REPLACED WHEN SYSTEM HAS OPERATED WITHOUT A CHARGE OR HAS BEEN LEFT OPEN.

The unit is mounted on inboard side of evaporator assembly housing.

- (a) Discharge system of all refrigerant. (See Servicing the System, Discharging, above.)
- (b) Uncouple refrigerant lines at receiver-dehydrator. (Follow all warnings and cautions under Special Servicing Procedures, above.)
- (c) Remove clamp attaching unit to evaporator housing.

(2) Installation

CAUTION: A NEW RECEIVER-DEHYDRATOR SHOULD BE OPENED AND CONNECTED TO THE SYSTEM ONLY WHEN READY TO CHARGE THE SYSTEM WITH REFRIGERANT.

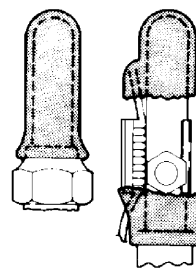
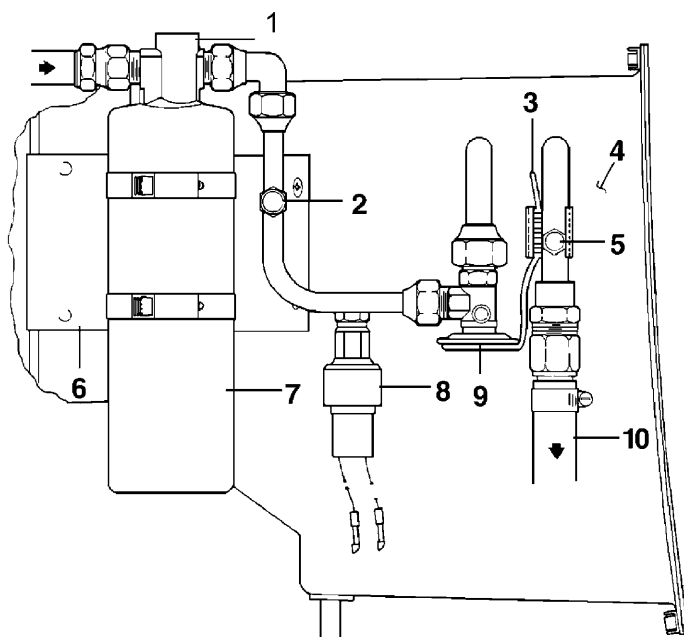
On systems utilizing HFC 134a refrigerant, use only receiver-dehydrators marked with a GREEN arrow.

- (a) Slip mounting bracket around receiver and put it in place on evaporator housing with tube fitting on top. Align fittings to proper line before securing mounting bracket.
- (b) Replace O-rings on HFC-134a systems.
- (c) Tighten fittings to torque listed in Chart 3.
- (d) Evacuate and charge system per Servicing the System, Evacuating and Charging, above.

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WRAP TAPE AROUND THERMOSTAT
CAPILLARY LEAVING SERVICE PORT
ACCESSIBLE.

1. SIGHT GLASS
2. SERVICE VALVE (SCHRADER) (HI)
3. CAPILLARY COIL
4. HOUSING ASSEMBLY
5. SERVICE VALVE (SCHRADER) (LOW)
6. RECEIVER DEHYDRATOR CLAMP
7. RECEIVER DEHYDRATOR
8. PRESSURE RELIEF SWITCH (RANCO)
9. EXPANSION VALVE
10. OUTLET HOSE

Components Installation
Figure 14

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CAUTION: SUCCESS OF APPLYING BOTH AN OUTSIDE AND INSIDE REPAIR PATCH SIMULTANEOUSLY IS DOUBTFUL AND NOT RECOMMENDED.

(13) Inside patch is applied same as above procedure except for size of repair patch (see limitations) after outside patch has been cured.

E. Patch Repair (Air Cure Method)

Follow procedure for heat cure method, except omit repair iron and cure each patch per air cure limitations (minimum 72 hours), undisturbed, at 75°F.

F. Defect Repair of Fuel Cell

- (1) Blisters: Remove loose material by trimming. Apply an outside and inside repair patch.
- (2) Holes, Punctures, Cuts, Tears and Deep Abraded Areas: Trim away any ragged material and apply an outside and inside repair patch.
- (3) Loose Seams: Buff loose edge and contact surface with emery cloth. Wash three times with Methyl Ethyl Ketone. Apply 80C27 mixed cement two coats as with repair patch. Clamp and cure. Either method may be used. See repair patch. Loose seams may be trimmed if minimum lap remains.

4. Testing Fuel Cells

Either of the following test procedures may be used to detect leaks in the bladder cells.

NOTE: The chemical test is the more sensitive and the preferred test.

A. Soap Suds Test

- (1) Attach test plates to all fittings.
- (2) Inflate the cell with air to a pressure of 1/4 psi MAXIMUM.
- (3) Apply a soap and water solution to all repaired areas and any areas suspected of leakage. Bubbles will appear at any point where leakage occurs.
- (4) After test, remove all plates and wipe soap residue from the exterior of the cell.

B. Chemical Test

- (1) Attach test plates to all fitting openings except one.
- (2) Make up a phenolphthalein solution as follows: Add 40 grams phenolphthalein crystals in 1/2 gallon of ethyl alcohol, mix, then add 1/2 gallon of water.
- (3) Pour ammonia on an absorbent cloth in the ratio of 3 ml per cubic foot of cell capacity. Place the saturated cloth inside the cell and install remaining test plate.
- (4) Inflate the cell with air to a pressure of 1/4 psi MAXIMUM, and maintain pressure for fifteen minutes.
- (5) Soak a large white cloth in the phenolphthalein solution, wring it out thoroughly, and spread it smoothly on the outer surface of the cell. Press the cloth down to ensure detection of minute leaks.
- (6) Check the cloth for red spots which will indicate a leak. Mark any leaks found and move the cloth to a new location. Repeat this procedure until the entire exterior surface of the cell has been covered. If red spots appear on the cloth, they may be removed by re-soaking the cloth in the solution.
- (7) The solution and test cloth are satisfactory only as long as they remain clean. Indicator solution that is not in immediate use should be stored in a closed rustproof container to prevent evaporation and deterioration.

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- (8) After the test, remove all plates and test equipment. Allow the cell to air out.
 - (9) In conducting either test outlined above, the cell need not be confined by a cage or jig, providing the 1/4 psi pressure is not exceeded.
5. Flush Fuel Cap Maintenance (See Figure 2.)

NOTE: These instructions do not apply to new style fuel caps (P/N 654-556 Locking, and 654-557 Non-Locking) installed in 2006 and later.

The flush fuel cap is designed to afford the aircraft a cleaner surface and a reduction in drag. Anytime the cap does not close tightly or gas leakage is evident the cap should either be replaced, or repaired. The cap consists of three basic assemblies; the handle/plate assembly, gasket spring assembly, and lock assembly.

A. Disassembly

The cap can be disassembled as follows:

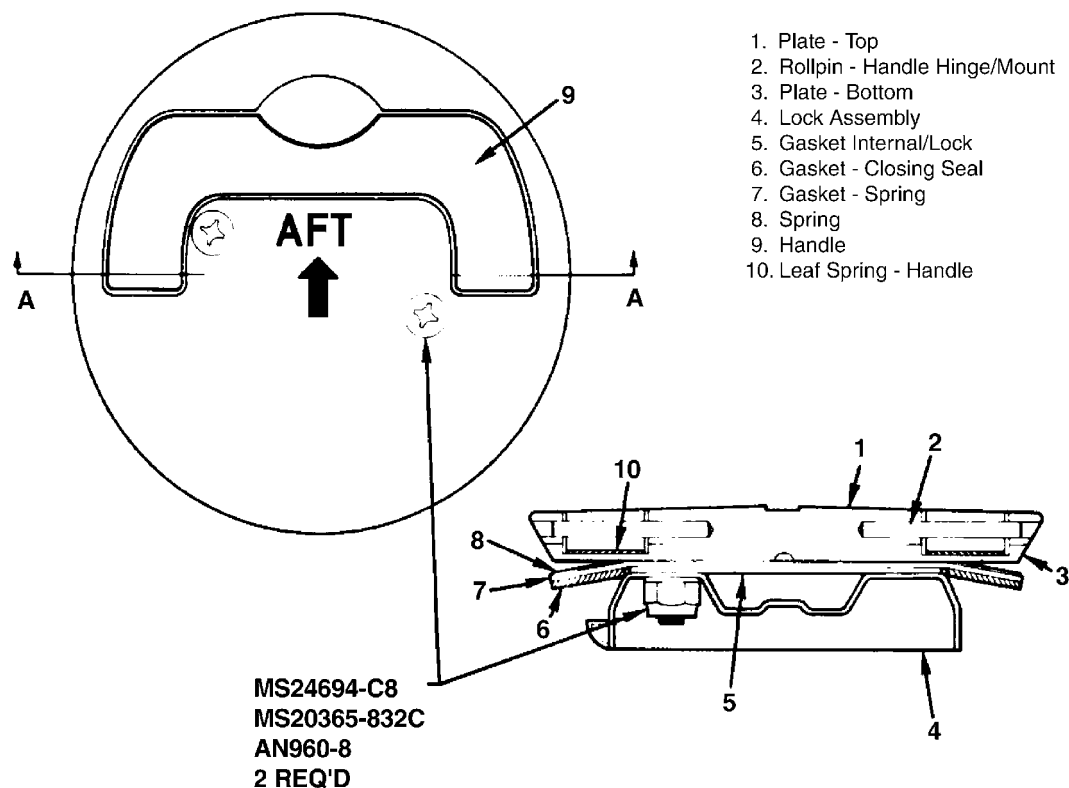
- (1) Remove the screws that hold the cap assembly together and make note of the relative position of the lock to the up plate.
- (2) Separate the assembly and replace the spring and gaskets as necessary.

B. Assembly

The cap should be assembled as follows:

- (1) Install the gaskets on the spring assembly if necessary and align the gasket and spring on the handle plate with the spring concave towards the lock.
- (2) Align the lock assembly against the gasket and spring assembly in the same position as noted at removal.
- (3) Coat the threads of the bolts with Tite-Seal Gasket and Joint Sealing Compound (medium weight).
- (4) Install bolts.

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Flush Fuel Cap Assembly
Figure 2

6. Locking Fuel Cap

NOTE: These instructions do not apply to “new style” fuel caps (P/N 654-556 Locking, and 654-557 Non-Locking) installed in 2006 and later.

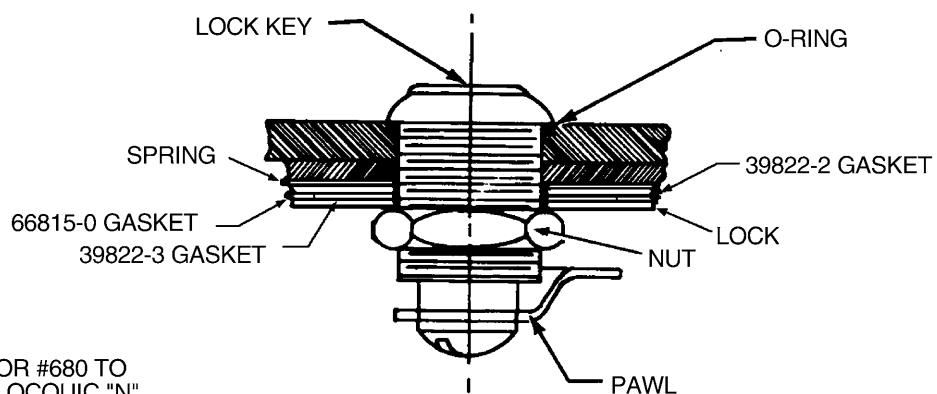
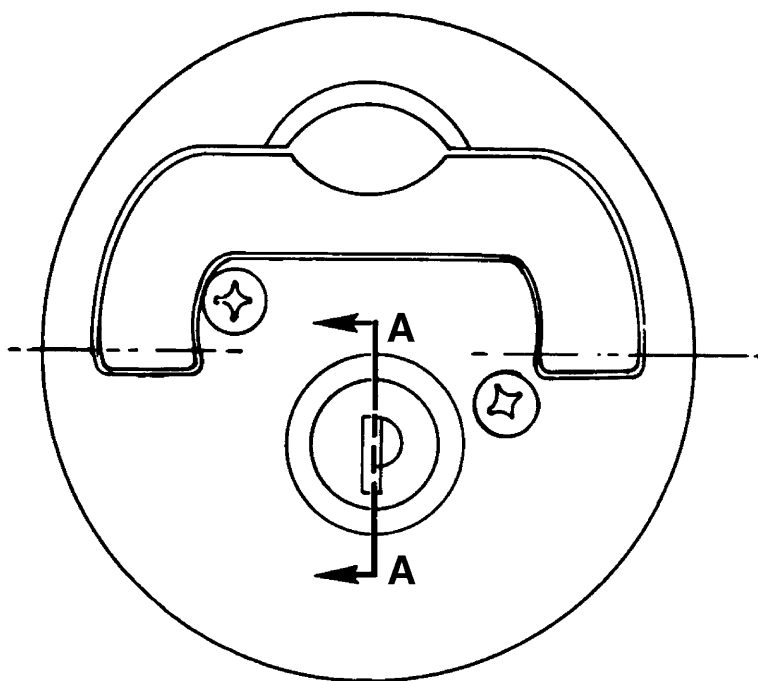
A. Disassembly (Refer to Figure 3.)

- (1) Remove the two screws from the top of the fuel cap.
- (2) Remove the screw and lock washer which secures the pawl to the bottom of the key lock. Remove pawl.
- (3) Remove the nut which secures the key lock to the cover.
- (4) Slide lock, gaskets and spring over the back of the key lock.
- (5) The key lock may be removed by removing the o-ring and pushing the key lock through the cover. Ensure that the teflon lock gasket is not lost.

B. Assembly

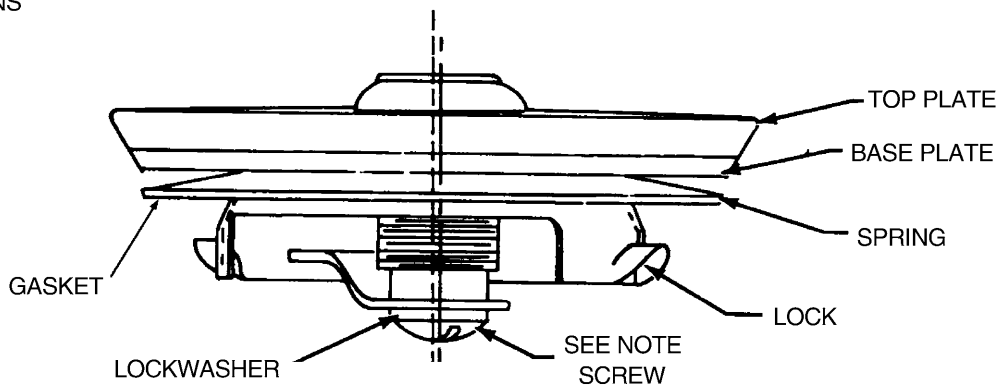
- (1) Insert the key lock through the cover; making sure that the teflon lock gasket is installed under the head of the key lock.
- (2) Insert the o-ring in the groove on top of the cover.
- (3) Slide spring, gaskets and lock over the back of the key lock.
- (4) Reinstall nut which secures the key lock to the cover.
- (5) Attach the pawl to the back of the lock assembly with the screw and lock washers.
- (6) Reinstall the two screws and lockwashers on top of the fuel cap.

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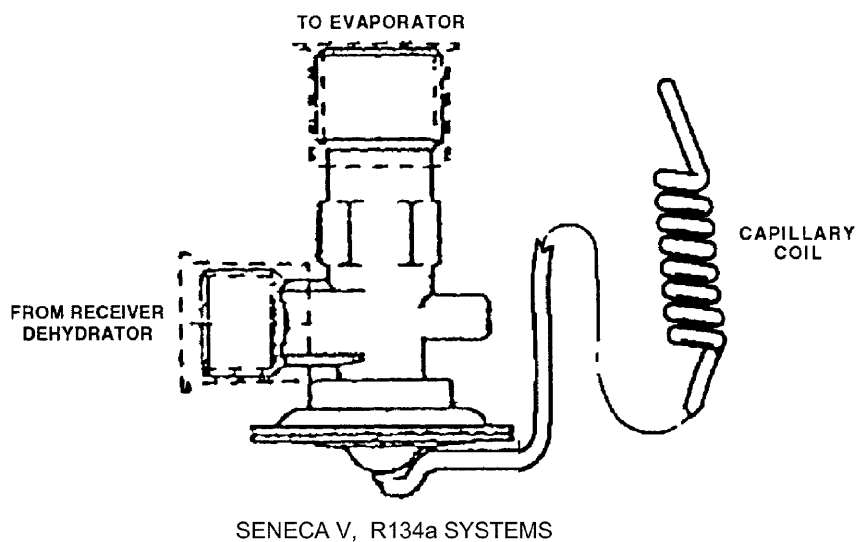
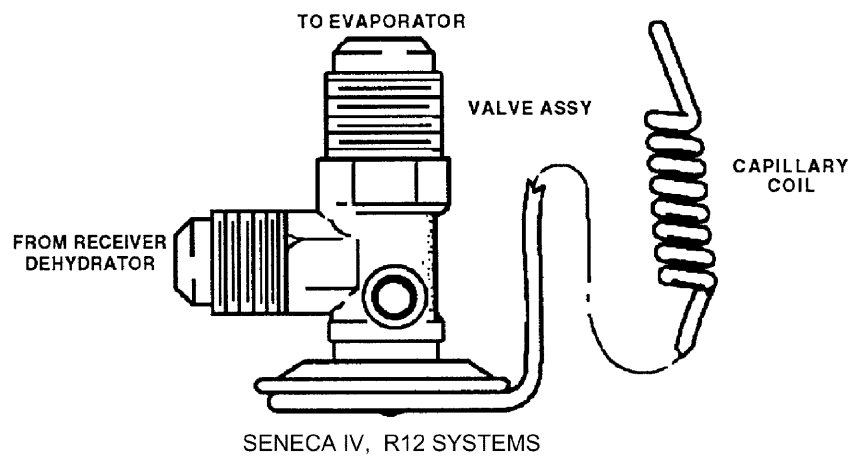
NOTE

APPLY LOCQUIC #271 OR #680 TO
THREADS PRIME WITH LOCQUIC "N"
OR "T" PER MANUFACTURERS
INSTRUCTIONS



Old Style Locking Fuel Cap
Figure 3

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Expansion Valve
Figure 17

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K. Expansion Valve

(1) Removal (See Figure 17.)

The expansion valve is in evaporator assembly between receiver dehydrator and evaporator inlet. The capillary coil is attached to evaporator outlet line.

NOTE: If expansion valve is not serviceable, it must be replaced with a new part.

- (a) Remove access panels, and discharge system. See Servicing the System, Discharging, above.
- (b) Remove capillary coil from outlet line. (Do not kink capillary tube.)
- (c) Uncouple all related tube fittings. (See Special Servicing Procedures, above.)

(2) Installation

- (a) Install expansion valve in inlet line of evaporator core. Apply appropriate lubricant on O-rings and replace O-rings on fittings, torque fittings per Chart 3.
- (b) Secure capillary coil to evaporator outlet line.
- (c) Evacuate and charge system per Servicing the System, Evacuating and Discharging, above.
- (d) Check for leaks. (See leak detection, above.)
- (e) Replace access panels.

L. Evaporator

(1) Removal

CAUTION: DISCHARGE THE SYSTEM BEFORE DISASSEMBLING ANY COMPONENTS FOR SERVICE.

CAUTION: UNITED STATES ENVIRONMENTAL REGULATIONS PROHIBIT THE RELEASE OF REFRIGERANT INTO THE ATMOSPHERE. SPECIAL EQUIPMENT IS REQUIRED WHEN DISCHARGING OR RECHARGING SYSTEM.

Evaporator assembly consists of evaporator core, receiver-dehydrator, expansion valve, circulating fan, pressure switch, necessary housing, and plumbing. The housing is made of thermoplastic material and the condensed moisture is dumped overboard through a hose clamped to fitting on bottom of evaporator housing.

Evaporator assembly is behind cabin rear closeout panel, attached to mounting panel with 12 screws, washers, and a bracket securing the back to mounting panel.

- (1) Remove air conditioning filter cover, filter, and rear access panels.
- (2) Uncouple the liquid line from inlet side of receiver-dehydrator and suction line from evaporator core outlet (see Special Servicing Procedures above).
- (3) Disconnect related electrical wires.
- (4) Remove flexible air duct from housing outlet and remove drain hose from housing.
- (5) Remove temperature probe from evaporator housing.
- (6) Remove screws attaching support bracket and evaporator housing to mounting panel.
- (7) Remove assembly through access hole in bulkhead.

(2) Installation

- (1) Cement gasket in place on flanges of evaporator housing and attach large end of mounting gasket to back of housing.
- (2) Install housing through access hole with air duct outlet on top and mate mounting flanges to surface of mounting panel and insert screws (Do not tighten at this time).

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- (3) Line mounting bracket with mating holes in mounting panel, insert screws and tighten. Tighten screws in flange and check that the gasket is in place, flange seal must be air tight.
- (4) Couple suction and discharge lines to their proper fittings (apply Loctite refrigerant sealant to tube flares only).
- (5) Evacuate and charge system per Servicing the System, Evacuating and Discharging, above.
- (6) Check for leaks (see Leak Detection, above). If no leaks are detected, seal, and install access panel on evaporator housing.
- (7) Couple flexible air duct and drain tube.
- (8) Make and check electrical connections (see 91-21-50, Figure 1).
- (9) Check blower operation and refrigerant systems.
- (10) Install rear closeout panel.

M. Pressure Relief Switch

CAUTION: BEFORE RELIEF SWITCH REMOVAL, AIR CONDITIONING SYSTEM MUST BE DISCHARGED. (SEE DISCHARGING.)

CAUTION: UNITED STATES ENVIRONMENTAL REGULATIONS PROHIBIT THE RELEASE OF REFRIGERANT INTO THE ATMOSPHERE. SPECIAL EQUIPMENT IS REQUIRED WHEN DISCHARGING OR RECHARGING SYSTEM.

- (1) Remove electrical connections from switch.
- (2) Remove switch assembly from service port on steel line.
- (3) Apply sealant sparingly to flare. When O-ring is present in HFC-134a systems, lube O-ring with PAG oil.
- (4) Install new switch.
- (5) Charge system per Servicing the System, Charging, above.

N. Electrical Installation

The wiring harness is connected to switches in the climate control center on the right side of the instrument panel. The harnesses cross the instrument panel to the left side where two wires are taken off for the compressor clutch. The harness then passes aft along the left side of fuselage connecting to the blower motor, the pressure relief switch, and the condenser actuating motor. Two fuses behind the air conditioning system control panel and a 10 amp circuit breaker mounted in circuit breaker panel protect the complete air conditioning electrical system.

(1) Adjustment of Throttle Switch

The throttle switch is mounted forward and below the throttle arm. The switch must be adjusted to actuate at the last quarter inch of full open throttle travel. Position the switch so that the throttle arm contacts the center of the switch actuator button.

(2) Fuse Replacement

Locate the fuse to be replaced behind the air conditioning system control panel.

- (a) Open the fuse holder by applying a slight pushing, counterclockwise twisting, pressure.
- (b) Remove blown fuse and insert a new 5 amp fuse.
- (c) Close the fuse holder by applying a slight pushing and clockwise twisting pressure.

(3) Electrical Schematic

See 91-21-50, Figure 1.

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CHAPTER

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AUTOFLIGHT

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C. Installation

- (1) Position the selector valve in the wing with the lever facing down and the center port facing forward. Secure to the mounting bracket with four screws and nuts.
- (2) Connect the fuel lines and control cable to the valve.
- (3) Refer to the following paragraph for rigging of the selector valve.
- (4) Install access panel.

D. Rigging

- (1) Remove the access panel located on the underside of the wing, forward of the main spar, outboard of the nacelle.
- (2) Ensure that the selector valve is connected to the control cable and the selector valve arm is in its center detent position.
- (3) Ensure that the control cable is disconnected where it attaches to the cockpit lever.
- (4) Place the fuel selector handle in the cockpit in its OFF position (the levers centered on the OFF position of the cover placard). Adjust and connect the cable end to the cockpit lever.
- (5) Actuate the selector to ascertain that the valve moves into its three detent positions and that the control levers have a positive clearance between the lever and cover assembly.
- (6) Reinstall the access panel.

4. Electric Fuel Pump

NOTE: Electric Fuel Pump replacement is on condition / as required.

A. Removal and Installation of Electric Fuel Pump

- (1) There is one electric rotary vane type fuel pump for each engine. The pump is mounted in a bracket on the aft side of the firewall. To remove pump, proceed as follows:
 - (a) Remove rectangular hatch assembly located on the top of the nacelle, aft of the firewall.
 - (b) Remove fuel lines from the pump and disconnect the electrical leads.
 - (c) Remove straps holding pump in position and withdraw pump through hatch opening.
 - (d) Do not attempt to disassemble or repair the fuel pump. If fuel pump proves to be defective, it should be replaced.
 - (e) Reinstall pump in reverse order of removal.

B. Auxiliary Fuel System Adjustment (*Seneca IV only*)

- (1) Adjustment of the auxiliary fuel system if installed is accomplished as follows for each engine:
 - (a) Remove the access panels from the top of each engine nacelle to gain access to the slider resistor mounted on the nacelle bulkhead.
 - (b) Install a calibrated pressure gauge (31 to 37 psi) in the fuel line forward of the firewall.
 - (c) Pull the circuit protector (for the auxiliary fuel pump which is to be adjusted) to the off position and ensure that the aircraft master switch is in the off position also.
 - (d) Connect the negative lead from an external DC power source to ground on the aircraft and the positive lead to the slider resistor high position. (Refer to Figure 3.)
 - (e) Using a calibrated voltmeter, adjust the external power source to indicate 12.0 to 12.5 volts DC at the auxiliary fuel pump. Note the voltage reading on the external power source voltmeter.
 - (f) The calibrated pressure gauge should indicate 31 to 37 psi.
 - (g) Connect the positive lead from the external power source to the slider resistor low position. (Refer to Figure 3.) Adjust the power supply voltage level to the same voltage obtained in Step (e).

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**GRIDS 2G18 THRU 2G24
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AUTOPILOT

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. SEE INTRODUCTION, SUPPLEMENTARY PUBLICATIONS.

1. General

An Autopilot/Flight Director (APFD) system is installed as standard equipment in these airplanes.

- A. 1995 - 1999: Seneca IV - S/N's 3447001 thru 3447029, and
Seneca V - S/N's 3449001 thru 3449151.

A King Autopilot/Flight Director (A.P.F.D.), manufactured by then Allied Signal (now Honeywell), was installed in these airplanes. Maintenance information for those systems is not included in this manual. Follow the service literature published by the A.P.F.D. equipment manufacturer. This includes mechanical service such as: adjusting bridle cable tension, servo removal and installation, servo clutch adjustments, etc.

King/Allied Signal technical support, parts support, and service literature can be obtained from:

Honeywell
One Technology Center
23500 W. 105th St., M/D #45
Olathe, Kansas 66061-1950
<http://www.bendixking.com/>

- B. 2000 and up: Seneca V, S/N's 3449152 and up:

The S-TEC System 55 / 55X is installed in these airplanes. Maintenance information for this system only is provided herein.

2. S-TEC System 55 / 55X (Seneca V only.)

- A. S-TEC System 55 (2000)

This system is installed as standard equipment in S/N's 3449152 thru 3449195, less 3449161.

- B. S-TEC System 55X (2001 & up)

This system is installed as standard equipment in S/N's 3449161 and, 3449196 & up,

- C. Description (See Figure 1.)

The Pitch Computer receives select input signals from the Altitude Pressure Transducer, Accelerometer, Glideslope Deviation Indicator and Altitude Selector/Alerter (if installed). It then computes pitch servo commands for vertical speed, altitude hold and glideslope intercept and tracking. Sensing for trim annunciation or automatic stabilator trim is provided by the pitch servo. Drive for the stabilator trim servo is provided by the pitch computer.

A typical S-TEC System 55/55X Autopilot installation includes the following:

- (1) Panel Mounted:

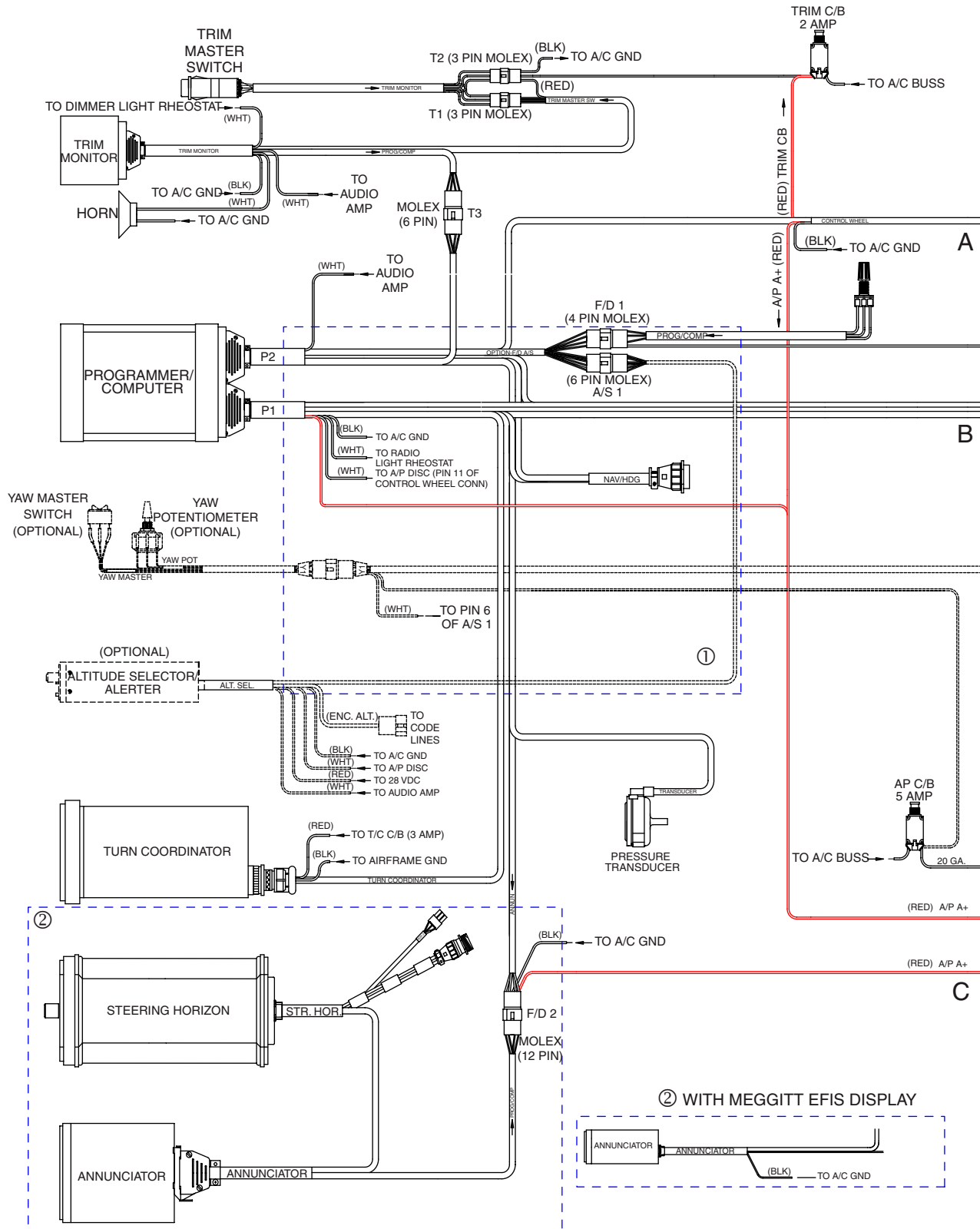
Programmer/Computer, Turn Coordinator, Annunciator, D.G. or HSI, and Steering Horizon.

- (2) Remote Mounted:

Roll Servo, Pitch Servo, Trim Servo, Trim Monitor, A/P Disconnect switch, and Altitude (Pressure) Transducer.

Servo installations use aluminum brackets to secure the servos to the airframe. Attachment to the airplane's primary flight control and trim systems is accomplished with bridle cables and extension attachments.

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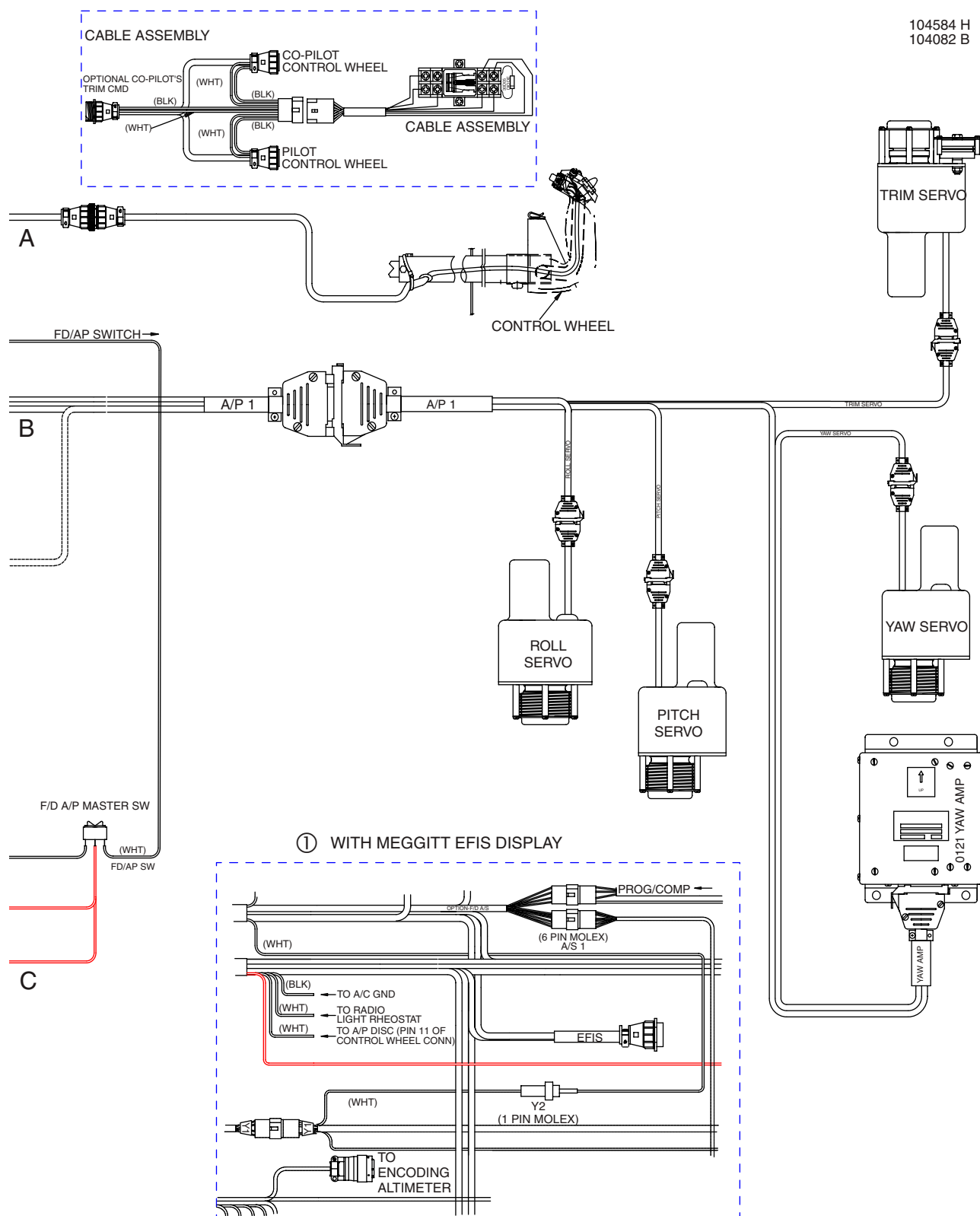


Effectivity
3449152 & up

System 55 / 55X Autopilot Installation
Figure 1 (Sheet 1 of 5)

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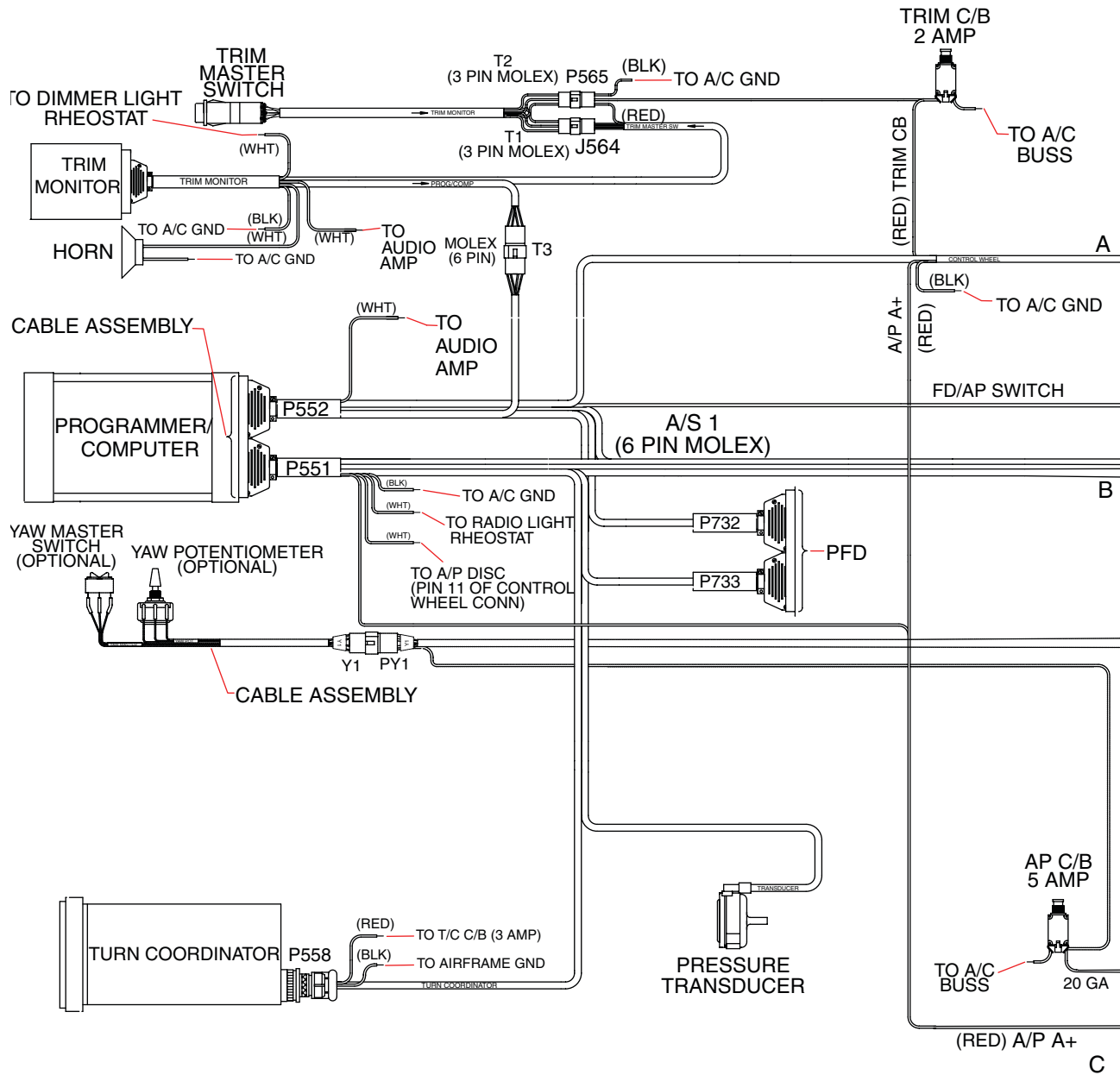


System 55 / 55X Autopilot Installation
Figure 1 (Sheet 2 of 5)

Effectivity
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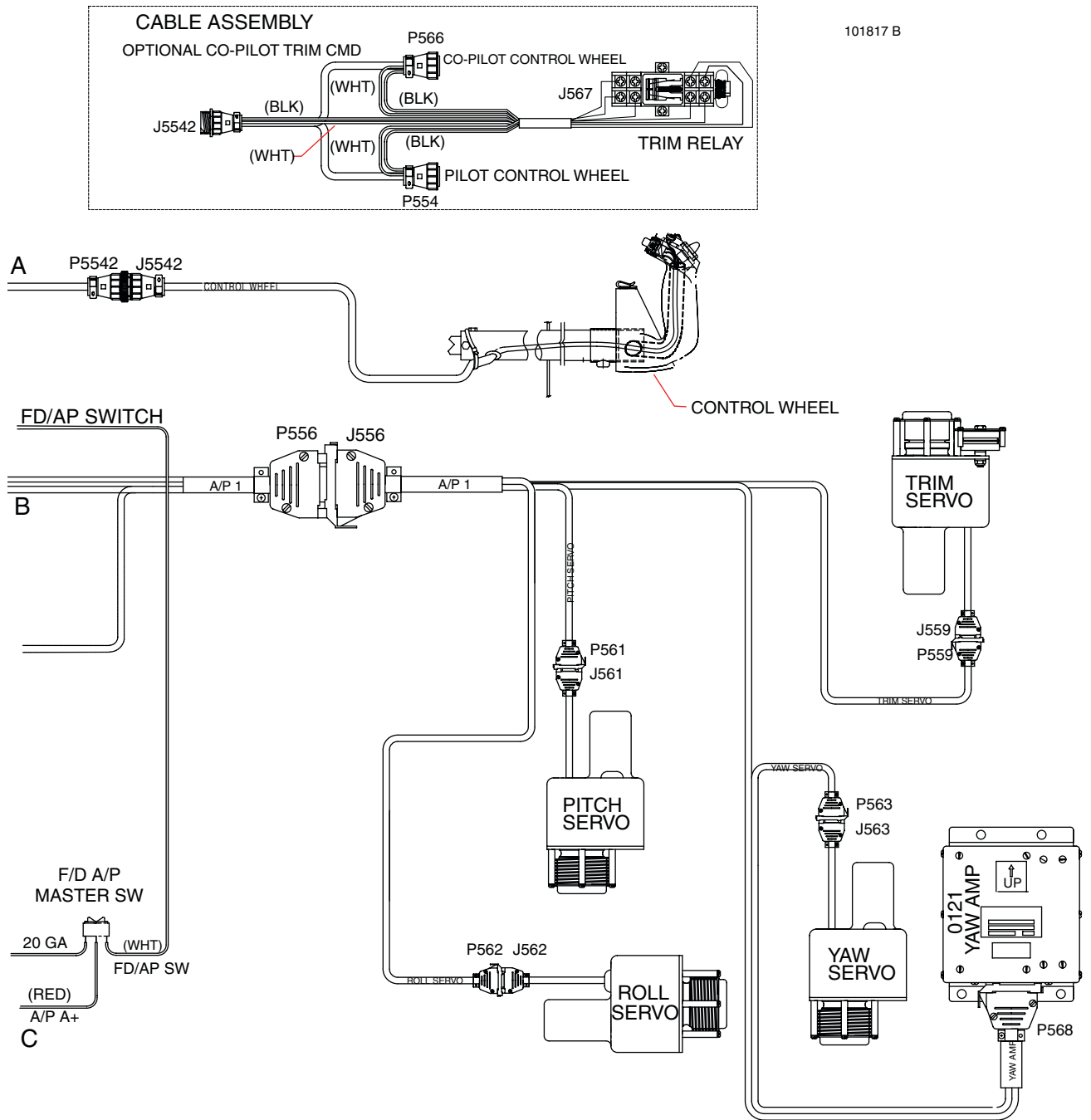
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Effectivity
Seneca V
With Avidyne Entegra

System 55 / 55X Autopilot Installation
Figure 1 (Sheet 3 of 5)

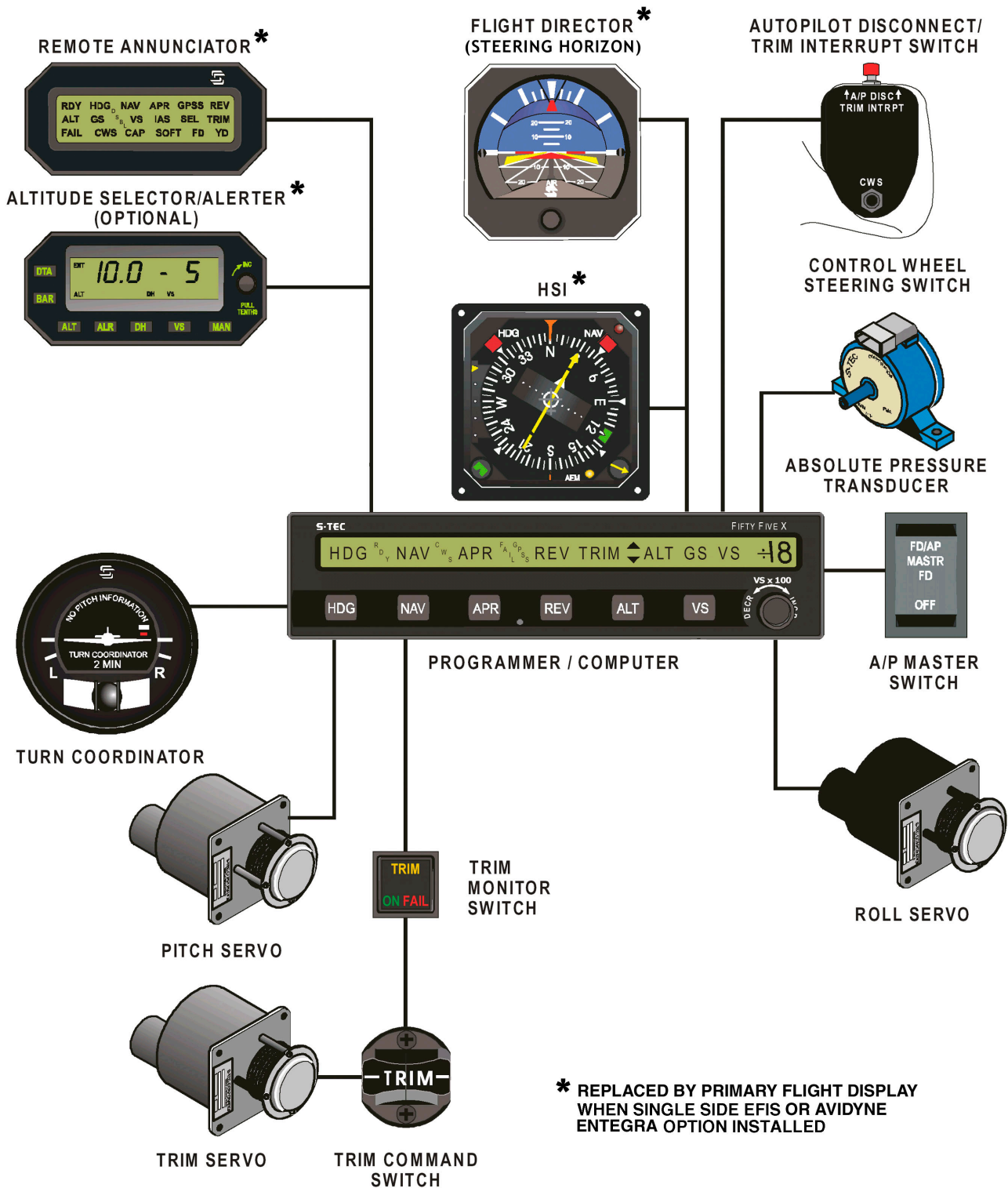
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System 55 / 55X Autopilot Installation
Figure 1 (Sheet 4 of 5)

Effectivity
Seneca V
With Avidyne Integra

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Effectivity
3449152 and up

System 55 / 55X Autopilot Installation
Figure 1 (Sheet 5 of 5)

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D. Troubleshooting

System functionality can be determined using functional checks described in the AFM Supplement and autopilot Pilot's Operating Handbook. More detailed troubleshooting should be accomplished by authorized S-TEC Dealers, holding the appropriate FAA certification, with required test equipment and service data.

E. GPSS (System 55X only.)

The Global Positioning System Steering (GPSS) is a function of the 55X autopilot only. In the GPSS mode, the converter receives ground speed and bank angle digital signals that are calculated and converted to a commanded turn rate. The turn rate is then scaled and converted to a DC heading error signal that is compatible with S-TEC autopilots. The end result is an autopilot that can be directly coupled to the roll steering commands produced by the GPS Navigator, eliminating the need for the pilot to make any further adjustments to the HSI course arrow or the DG's heading bug.

F. System Operation

Operation of the autopilot and other systems is described in the FAA-approved Airplane Flight Manual Supplement (AFMS) - see airplane Pilot's Operating Handbook (POH), Section 9. Specialized controls, annunciation, operation and interpretation are covered in this supplement and in the S-TEC Autopilot POH that supplements the approved AFMS.

G. Maintenance

Except as provided in 5-20-00, servicing and/or maintenance of the autopilot system is On-Condition.

NOTE: Servicing of S-TEC System 55/55X Autopilot installations is best accomplished by approved S-TEC dealers holding the appropriate FAA-certification. Locations of and access to the components installed are described and depicted individually below. Removal and replacement of components is generally indicated by functional checks provided in the AFM Supplement, S-TEC Autopilot POH and/or below.

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H. Post-Maintenance Operational Checkout

Complete the following checkout procedure after any maintenance to the system is performed.

NOTE: The Systems 55/55X incorporate a SELF-TEST that requires a 100% pass rate before the autopilot can be engaged.

NOTE: For airplanes equipped with the optional Avidyne Entegra Electronic Flight Information System, (see 34-20-00) references below to the remote annunciator, flight director and HSI are to those functions in the Primary Flight Display (PFD).

- (1) Apply aircraft power.
- (2) Avionics Master Switch ON
- (3) Autopilot Master Switch Set to FD / AP

NOTE: Observe that all segments of the Programmer / Computer display and annunciators illuminate for five (5) seconds during test. Satisfactory completion of the SELF-TEST is indicated when the Ready (RDY) annunciator remains on at the end of the five (5) second self-test. Should a fault be detected, the FAIL annunciator will remain on at the conclusion of the self-test and the autopilot will not operate.

- (4) Trim Master (ON / OFF) Switch ON
- (5) HDG and VS switches PRESS / RELEASE
Ensure that HDG and VS illuminate on the Fifty Five X annunciator.
- (6) VS Knob ROTATE CW
Pitch control (i.e. - the control yoke) should move slowly out (pilot may have to assist a heavy yoke).
- (7) VS Knob ROTATE CCW
Pitch control should move slowly in.
- (8) A/P DISC Trim Interrupt Switch (on control yoke) PRESS
Verify the autopilot disconnects.
- (9) HDG Mode ENGAGE
- (10) DG or HSI HDG bug MOVE LT / RT
Roll control should follow the HDG bug.

NOTE: If HSI equipped, center the course arrow under the lubber line and push the NAV button. Move the course arrow on the HSI left then right. Roll control should follow the course arrow. Channel a valid VOR signal and move course arrow just enough to deflect the left / right needle one (1) or two (2) dots. Roll control should follow the Course Deviation Indicator (CDI) left / right needle during the test. (This test is only valid if the left / right needle is centered with the course arrow under the lubber line.)

NOTE: If DG equipped, center the HDG bug under the lubber line. Channel a valid VOR signal. Move the OBS to cause left / right CDI needle deflection. The roll control should follow the left / right needle movement.

- (11) REV Mode button PUSH
Roll control should respond opposite to the course arrow and CDI left / right needle inputs.
- (12) Altitude Hold (ALT) button PUSH
Slowly pull out (nose up) on the pitch control (i.e. - control yoke). Autotrim should run nose down with TRIM flashing on the remote annunciator and the autopilot computer / programmer after approximately 3 seconds. Slowly move control yoke forward (nose down). After 3 seconds, autotrim should move nose up with TRIM flashing on the remote annunciator and the autopilot computer / programmer after approximately 3 seconds.

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- (13) Trim Master (ON / OFF) Switch OFF
- (14) Manual Electric Trim Test:
- (a) Trim Master (ON / OFF) switch ON
 - 1 Move each segment of the Manual Electric Trim Command Switch FWD and AFT.
Trim should not run.
 - 2 Move both segments of the Trim Command switch FWD.
Trim should run nose down.
 - 3 Move both segments of the Trim Command switch AFT.
Trim should run nose up.
 - (b) Re-trim aircraft for takeoff and check controls for freedom of movement. Be sure the autopilot and trim servos are dis-engaged.
- (15) Flight Director Test:
- (a) Autopilot Master Switch SELECT FD
Note the roll, pitch and trim servos are disengaged. The steering bar should be in view on the attitude indicator.
 - (b) HDG Mode ENGAGE
MOVE HDG bug 45 degrees left. The roll steering bar should slowly indicate a left steering command. Repeat the same test for the right side.
 - (c) VS Mode ENGAGE
SELECT 1500 FPM rate of climb. Note the pitch steering bar moves slowly up. Repeat the same test for the down direction.
 - (d) Autopilot Master Switch SELECT FD / AP
The servos should re-engage.
 - (e) Trim Master ON / OFF Switch ON
 - (f) Manual Electric Trim Command Switch MOVE FWD or AFT
The autopilot should disconnect.

NOTE: The Manual Electric Trim Command Switch will disconnect the autopilot only if there is a Pitch Mode engaged.

- I. Post-Installation Ground Checks for the Yaw Damper System, if installed.
- (a) With aircraft levelled laterally, and trim pot on instrument panel approximately centered, adjust the pot in the yaw damper amplifier (located under plug in top of amplifier) to provide a null (no servo action) at the yaw servo.
 - (b) Align the cap on the yaw trim pot knob (on instrument panel) so that the white line is centered vertically.
 - (c) Check operation of yaw trim pot by turning trim pot both left and right, and note rudder pedal movement in the same direction (i.e., a counterclockwise or left turn of the trim pot causes left rudder pedal depression, etc.).

I. Panel-Mounted Components

The flight director, HSI, autopilot programmer/computer, altitude selector/alerter (if installed), remote annunciator, and turn coordinator are either face-mounted or rack-mounted in the instrument panel. See 39-10-00 for removal and installation instructions.

J. Component Locator

See Figure 2.

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K. Trim Monitor (See Figure 2.)

The trim monitor is mounted to a bracket under the instrument panel on the left side.

(1) Removal

- (a) Disconnect autopilot harness.
- (b) Remove screws (4) holding trim monitor to mounting bracket and remove trim monitor.

(2) Installation

- (a) Place trim monitor in position on mounting bracket and secure with screws (4).
- (b) Connect autopilot harness.
- (c) Perform Post-Maintenance Operational Checkout, above.

L. Pressure Transducer (See Figure 2.)

The pressure transducer is located on the aft upper left side of the bulkhead at F.S. 191.00.

(1) Removal

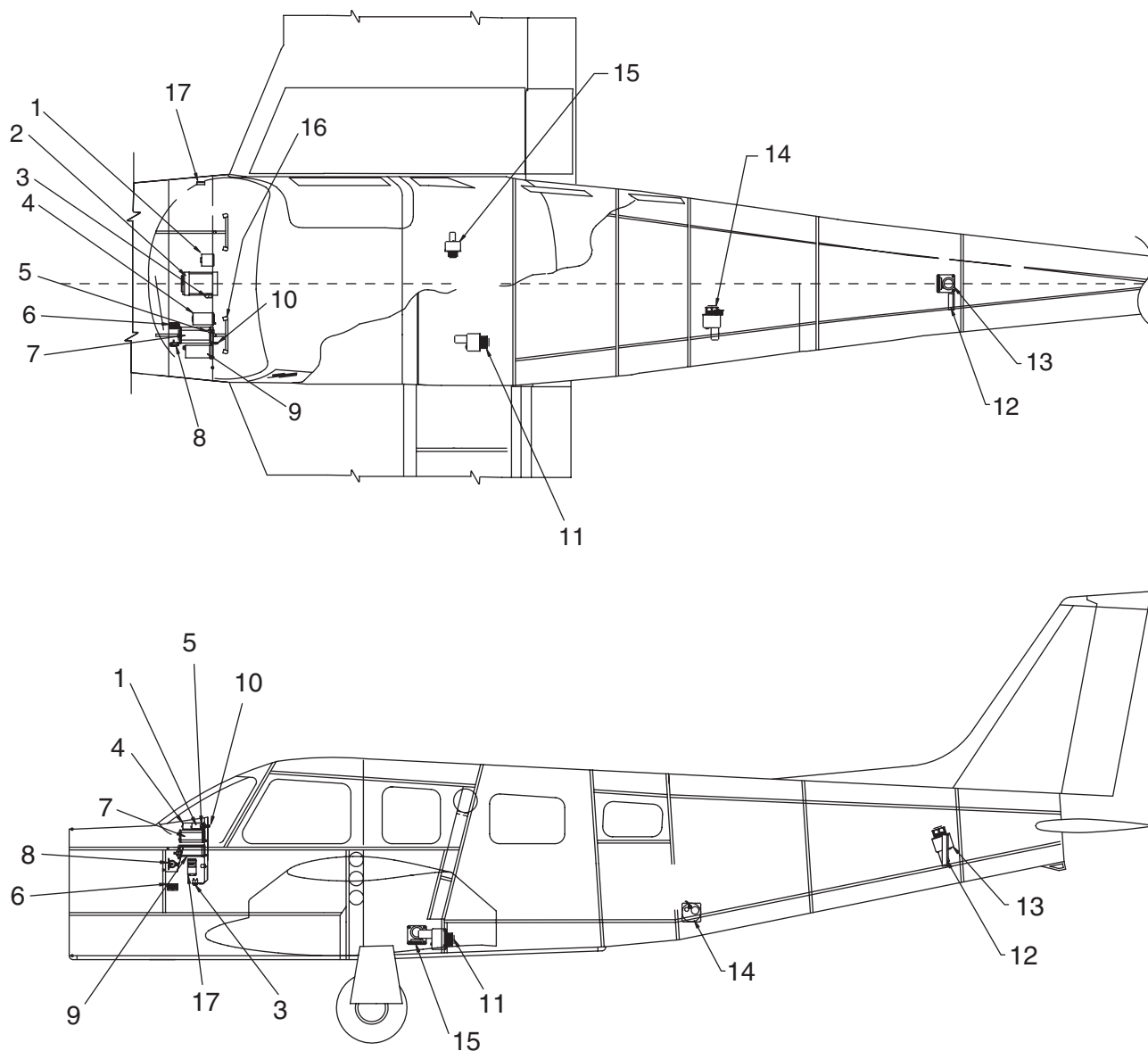
- (a) Remove the Ty-Rap and disconnect the transducer from the static-system by removing the flexible hose.
- (b) Disconnect the autopilot harness.
- (c) Remove screws and washers (2 ea.) and remove transducer.

(2) Installation

- (a) Place transducer in position. Secure transducer to instrument panel with screws and washers (2 ea.)
- (b) Connect the transducer to the static system by sliding the flexible hose over the hose barb. Then position and tighten Ty-Rap.
- (c) Connect the autopilot harness.
- (d) Perform Post-Maintenance Operational Checkout, above.

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1. ANNUNCIATOR
2. PROGRAMMER/COMPUTER
3. HORN
4. ALTITUDE SELECTOR
5. TRIM/MASTER ANNUNCIATOR SWITCH
6. TRIM RELAY
7. STEERING HORIZON
8. TRANSDUCER
9. TURN COORDINATOR

10. FD PARALLEX POTENTIOMETER
11. ROLL SERVO
12. YAW AMPLIFIER
13. YAW SERVO
14. TRIM SERVO
15. PITCH SERVO
16. CONTROL WHEEL ASSEMBLY
17. TRIM MONITOR

System 55 / 55X Component Locator
Figure 2

[Effectivity
3449152 & up](#)

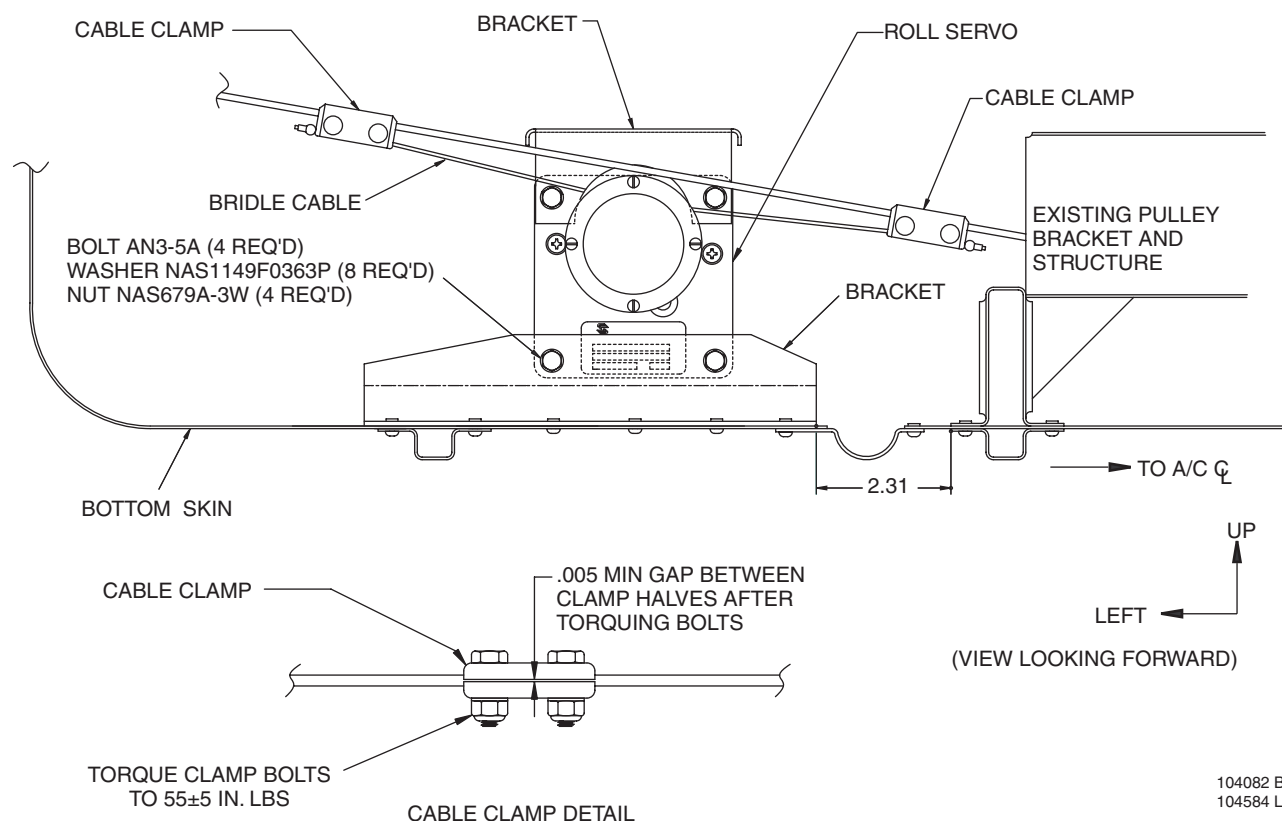
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M. Roll Servo (See Figures 2 and 3.)

The roll servo is mounted underneath the left rear seat. A bridle cable and clamps attach the servo capstan to the aileron balance cable.

(1) Removal

- (a) Remove the rear seats.
- (b) Remove adjacent carpet.
- (c) Remove screws securing floor panel and remove panel.
- (d) Disconnect autopilot harness.
- (e) Remove nuts and bolts (2 ea.) securing each cable clamp (2) and remove cable clamps from aileron balance cable and autopilot bridle cable.
- (f) Remove nuts and bolts (4 ea.) and washers (8 ea.) securing roll servo to mounting bracket and remove roll servo with attached bridle cable.



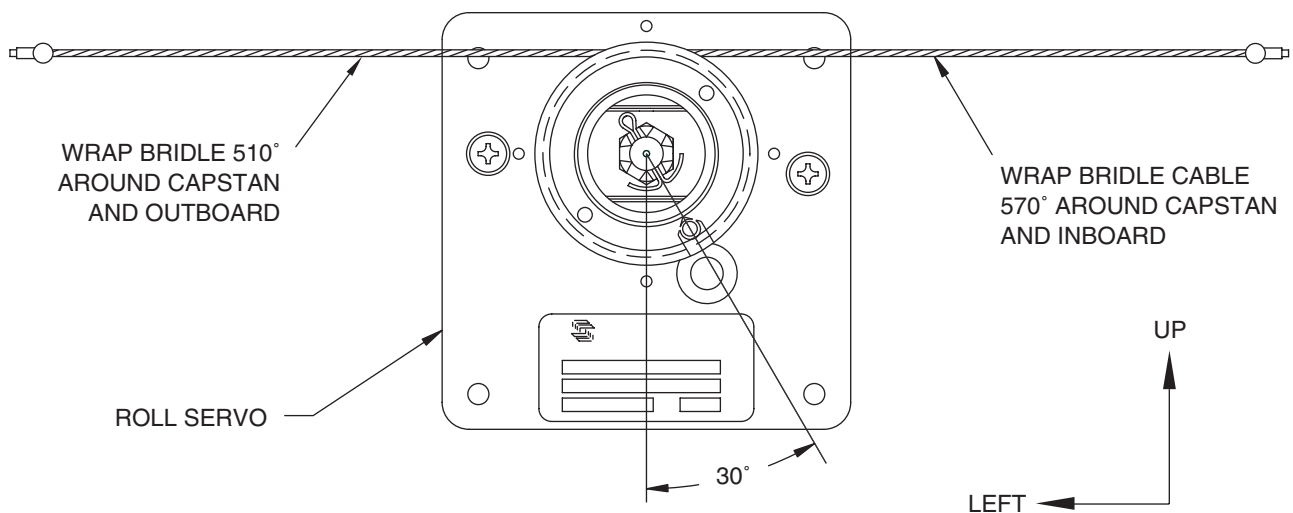
Roll Servo Installation
Figure 3

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(2) Installation

- (a) Rig ailerons per Aileron Control Rigging and Adjustment, 27-10-00.
- (b) Place the control column tee bar in full forward position and secure by use of a suitable tool or by placing weights on the aft side of the stabilator, if stabilator cables have been previously tensioned.
- (c) Lock the ailerons in neutral (i.e. - aligned with flaps) position using a suitable contour fixture at the inboard ends of the ailerons and the outboard ends of the flaps. Verify control wheels are centered and secure in that position.
- (d) Remove screws (4) and remove capstan cover and cable guards from servo.
- (e) Adjust roll servo clutch torque per Servo Clutch Torque Adjustment, below.
- (f) Wrap autopilot bridle cable, align capstan, and and tighten center-ball setscrew as shown in Figure 4.
- (g) Replace cable guards and capstan cover, secure with screws (4).
- (h) Position servo as shown in Figure 3 and install and secure nuts (4 ea.) , washers (8 ea.) , and bolts (4 ea.) holding servo to mounting bracket.
- (i) Position cable clamps (2) as shown in Figure 3 and tighten nuts and bolts (2 ea.). Adjust cable clamps in or out along the aileron balance cable to obtain a bridle cable tension of $15 + 10, -2$ lbs (System 55X) or 15 ± 2 lbs (System 55). Torque cable clamp bolts to 55 ± 5 in. lbs.
- (j) Remove the locking fixtures at the inboard ends of the ailerons. Aileron neutral (i.e. - aligned with flaps) position should be maintained with the control wheels in neutral. A droop of 1/8 inch is allowable.
- (k) Remove the control wheel/tee bar locks. Check to insure that the left aileron up and right aileron down stops are contacted simultaneously and vice versa. Adjust stops as required.



(CAPSTAN COVER AND CABLE GUARDS REMOVED FOR CLARITY)

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Roll Servo Capstan Wrapping
Figure 4

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- (l) Rotate the left (pilot's) control wheel in each direction until the bellcranks contact the stops. The sprocket stops on the tee bar shall not be contacted until additional "override" movement (cushion) of the wheel occurs. A "cushion" on 0.030 to 0.040 inches is to be maintained as measured between the sprocket pin and adjustable control wheel stop bolts.
- (m) Place the ailerons in the neutral (aligned with the flaps) position. For each aileron, from the neutral position, check that the "up" travel and the "down" travel are within the limits shown in 27-10-00, Figure 6.
 - (a) Center bubble of a protractor over surface of aileron at neutral position. Note reading.
 - (b) Move aileron full up and down. Check degree of travel in each direction. Degree of travel on protractor is determined by taking the difference between protractor reading at neutral and up, and neutral and down. Bubble must be centered at each reading.

When measuring "down" travel from the neutral position, a light "up" pressure shall be maintained at the center of the aft edge of the aileron. When measuring "up" travel from the neutral position, a light "down" pressure shall be maintained at the center of the aft edge of the aileron (at the "up" position only), just sufficient to remove the slack between the bellcrank and the aileron.
- (n) If steps (j) thru (m), above, reveal the aileron controls out of rig, repeat steps (a) thru (i).
- (o) Connect autopilot harness.
- (p) Check aileron controls for free and correct movement.
- (q) Perform Post-Maintenance Operational Checkout, above.
- (r) Replace floor panel and secure with screws.
- (s) Replace carpeting.
- (t) Replace the rear seats.

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N. Trim Servo (See Figures 2 and 5.)

The trim servo is located just left of the aircraft centerline, under the rear seats, just aft of the bulkhead at F.S. 108.17. The left stabilator trim cable wraps around the servo idler pulley and servo capstan.

(1) Removal

- (a) Remove rear seats. Remove carpet and floor panel.
- (b) Tie a pull rope to the left stabilator trim cable exposed beneath the floor panel and tie-off the pull rope to structure aft.
- (c) Tie a pull rope to the left stabilator trim cable aft of the turnbuckle in the rear fuselage aft of the trim servo and tie-off the pull rope to structure forward.

NOTE: The pull ropes apply tension to the trim cables to prevent the cables from unwrapping from the trim wheel drum or the trim barrel, and to prevent the cables from fouling at any of the pulleys.

- (d) Slack-off the turnbuckle in the left stabilator trim cable segment aft of the trim servo sufficient to relieve tension on the left stabilator trim cable as it wraps around the trim servo idler pulley and capstan.
- (e) Disconnect the autopilot harness.
- (f) Remove the capstan cover and cable guards (4) by removing the retaining screws (4).
- (g) Remove the bolt, nut, and washer securing the idler pulley to the trim servo baseplate and mounting bracket and remove the idler pulley components.

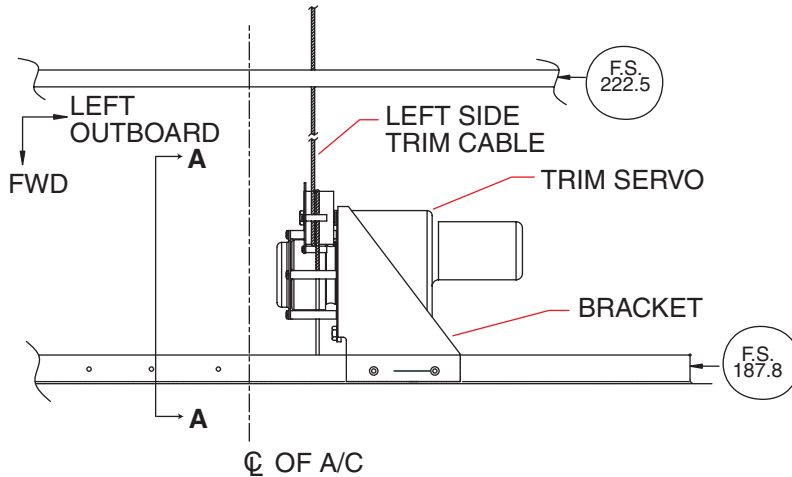
NOTE: The idler pulley breaks down into the following components upon removal of the bolt, above: mounting plate/cable guard assembly, idler pulley, and two washers.

- (h) Remove the remaining bolts, nuts, and washers (3 ea.) securing the trim servo to its mounting bracket and remove the trim servo.

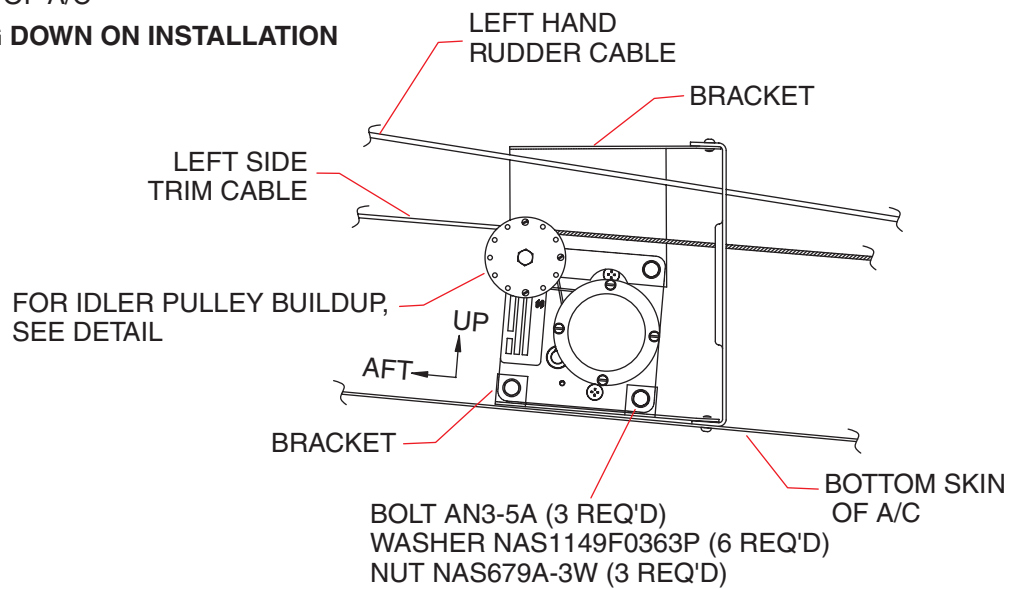
(2) Installation

- (a) Adjust trim servo clutch torque per Servo Clutch Torque Adjustment, below.
- (b) With the capstan cover and cable guards removed, position the trim servo as shown in Figure 5. Secure with bolts, nuts, and washers (3 ea. - i.e. - aft two and forward left).
- (c) Assemble the idler pulley cable guards (3) to the mounting plate with screws (1 ea.) and star washers (2 ea.). Place the center bolt through the mounting plate/cable guard assembly and slide a washer over the threaded end and up against the mounting plate. Set the mounting plate/cable guard/bolt assembly aside.
- (d) Drape the slack left stabilator trim cable over the servo capstan.

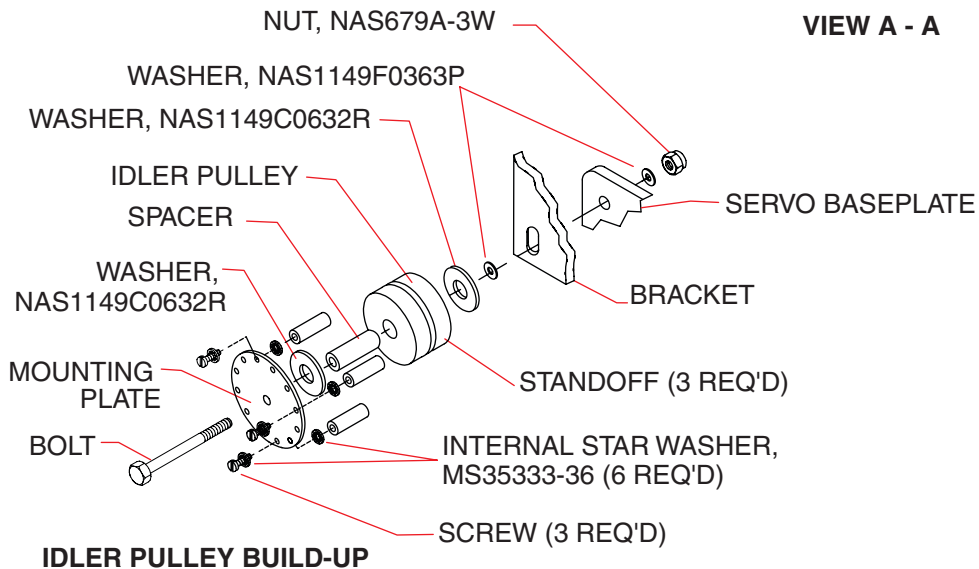
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VIEW LOOKING DOWN ON INSTALLATION



VIEW A - A



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Trim Servo Installation
Figure 5

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CAUTION: IN STEPS (E) THRU (I), BELOW, USAGE OF LEFT AND RIGHT IS RELATIVE TO THE VIEW OF THE TECHNICIAN IN THE CABIN BAGGAGE AREA LOOKING AFT, EXCEPT WHERE AIRPLANE COMPONENT PARTS ARE SPECIFICALLY NAMED.

- (e) Place thumb and forefinger on top of the capstan over the trim cable in its groove. Pressing the trim cable into its groove, slide thumb and forefinger down around opposite sides of the servo capstan and pull the trim cable slack towards you and to your left.
- (f) Holding the trim cable in that position, install the capstan cover and cable guards as shown in Figure 5.
- (g) Hold the idler pulley aft of the trim servo and to the right of the airplane's left stabilator trim cable. Move the idler pulley left to the left stabilator trim cable and capture the trim cable in the bottom cable groove on the left of the idler pulley.
- (h) Keeping the trim cable in the bottom groove, slide the idler pulley forward along the trim cable, left of the servo capstan, and bring it approximately to its installed position (See Figure 5). At this point, the aft portion of the trim cable should be routed left, around the front, and to the right of the idler pulley and to the left, around the rear, and to the right of the capstan.
- (i) Holding the idler pulley in this position, reach down and pull the forward portion of the trim cable over the idler pulley and seat it in the top cable groove on the idler pulley. The left trim cable should now be routed as shown in Figure 5.
- (j) Place the spacer inside the idler pulley.
- (k) Position the mounting plate/cable guard/bolt assembly as shown in Figure 5 and slide the bolt through the spacer inside the idler pulley.
- (l) Place a washer over the bolt end and put the bolt through the trim servo mounting bracket and baseplate. Secure with a nut and washer, taking care to ensure that the cable guards are positioned, and the left stabilator trim cable is routed, as shown in Figure 5.
- (m) Take up the slack in the left trim cable with the turnbuckle and remove the pull ropes.
- (n) Rig stabilator trim per Stabilator Trim Rigging and Adjustment, 27-30-00.
- (o) Connect the autopilot harness.
- (p) Perform Post-Maintenance Operational Checkout, above.
- (q) Check elevator trim controls for free and correct movement.
- (r) Reinstall floor panel and carpet.
- (s) Reinstall rear seats.

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O. Pitch Servo (See Figures 2 and 6.)

The pitch servo is located under the right rear seat. A bridle cable and clamps attach the servo capstan to the right (upper) stabilator cable.

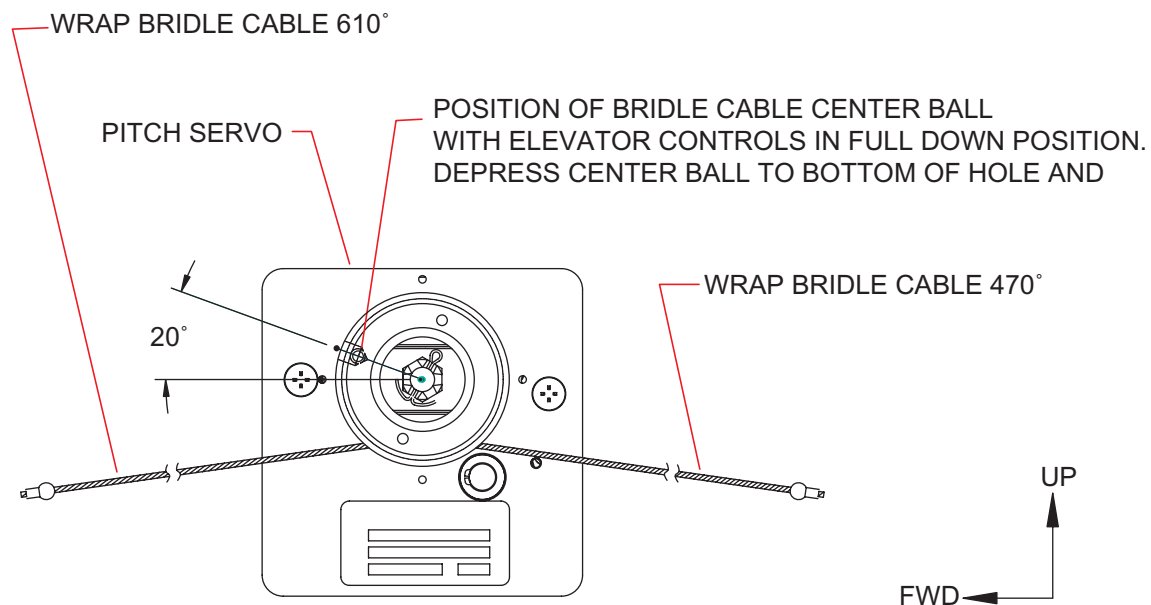
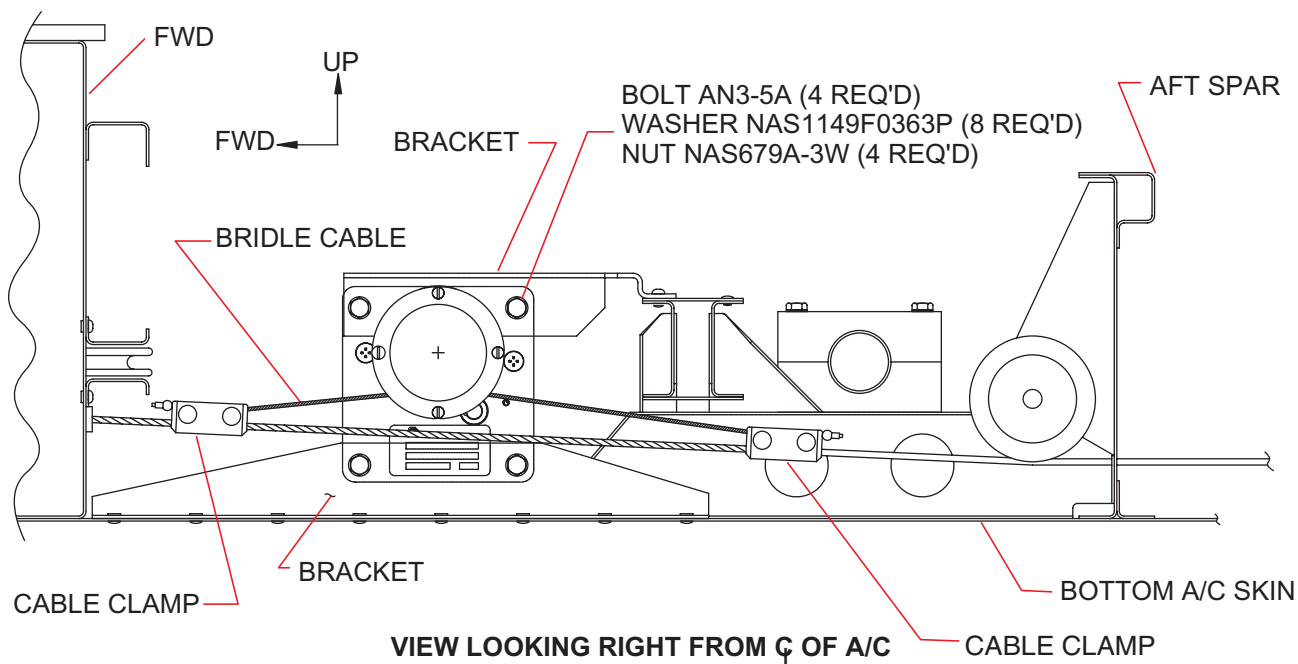
(1) Removal

- (a) Remove rear seats.
- (b) Remove carpet and floor panel.
- (c) Disconnect autopilot harness.
- (d) Remove nuts and bolts (2 ea.) securing each cable clamp (2) and remove cable clamps from right (upper) stabilator cable and autopilot bridle cable.
- (e) Remove nuts and bolts (4 ea.) and washers (8 ea.), securing pitch servo to mounting bracket and remove pitch servo with attached bridle cable.

(2) Installation

- (a) Rig stabilator controls per Stabilator Controls Rigging and Adjustment, 27-30-00.
- (b) Remove screws (4) and remove capstan cover and cable guards from servo.
- (c) Adjust pitch servo clutch torque per Servo Clutch Torque Adjustment, below.
- (d) Wrap autopilot bridle cable, align capstan, and tighten center-ball setscrew as shown in Figure 6.
- (e) Replace cable guards and capstan cover, secure with screws (4).
- (f) Position pitch servo as shown in Figure 6 and secure with bolts, nuts, and washers (4 ea.).
- (g) Position cable clamps (2) as shown in Figure 6 and tighten nuts and bolts (2 ea.). Adjust cable clamps in or out along the stabilator cables to obtain a bridle cable tension of 15 ± 2 lbs (System 55) or $15 + 10, -2$ lbs (System 55X). Torque cable clamp bolts to 55 ± 5 in. lbs.
- (h) Connect autopilot harness.
- (i) Perform Post-Maintenance Operational Checkout, above.
- (j) Check stabilator controls for free and correct movement.
- (k) Reinstall floor panel and carpet.
- (l) Reinstall rear seats.

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**BRIDLE CABLE WRAPPING DETAIL
(CAPSTAN COVER REMOVED)**

Pitch Servo Installation
Figure 6

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P. Servo Clutch Torque Adjustment (See Figure 7 and Chart 1.)

- (1) Remove servo per instructions under specific servo, above.
- (2) Place servo in a holding fixture (i.e. - vice) with capstan up.
- (3) Remove capstan cover, cable guards, and cable.
- (4) Check capstan torque by attaching the capstan adjusting tool (special tool - see parts catalog) to the capstan and using a currently calibrated torque wrench as shown in Figure 7.
 - (a) Acceptable torque is specified in Chart 1.
 - (b) If adjustment is required, proceed as follows.
- (5) Remove cotter pin from end of servo shaft and remove castle nut, shim washers, and tension washers.
- (6) Replace tension washers as required (see Chart 1).
- (7) Replace shim washers and castle nut.
- (8) Tension castle nut so that capstan torque is as specified in Chart 1.

Q. Flap Compensator

A flap compensator potentiometer (pot) is mounted underneath the right rear seat. The pot is mounted on a bracket attached to the forward side of the pitch servo mounting bracket. The arm of the pot is linked to the flap torque tube by a cable assembly.

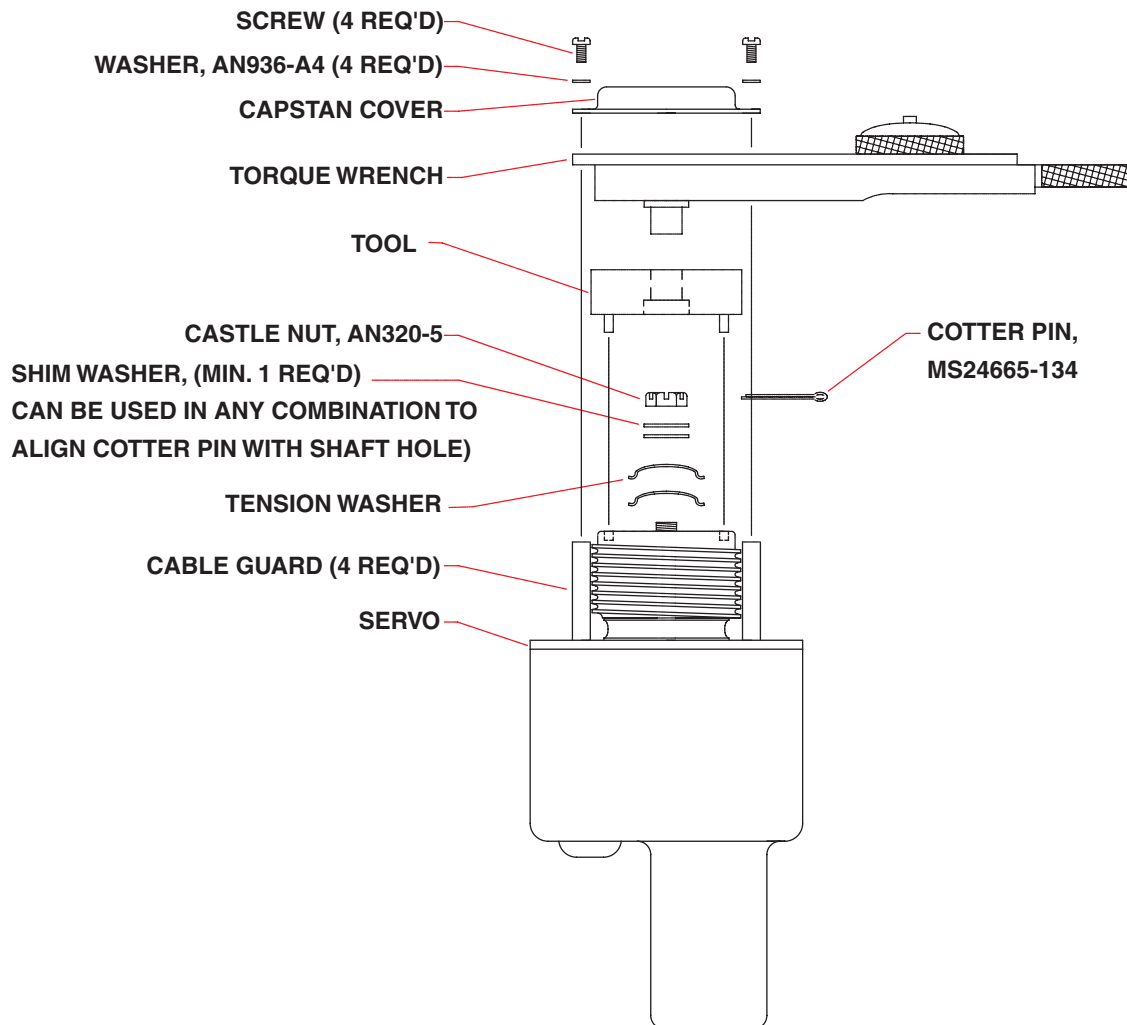
Adjustment

- (a) With flaps in the full up position and set screw loose, turn A/P master switch ON.
- (b) Connect a digital voltmeter (3 1/2 digit) between airframe ground and center terminal (wiper) of potentiometer (pot).
- (c) Turn pot shaft clockwise to stop. Voltmeter should read 5.00 vdc.
- (4) Turn pot shaft slowly counter-clockwise until voltage just starts to decrease from 5.00 volts.
- (5) Tighten set screw and recheck wiper voltage for 4.95 to 5.00 vdc.

CHART 1
SERVO CLUTCH TORQUE ADJUSTMENT

SERVO	TORQUE (In. Lbs.)	CLUTCH WASHERS	
	System 55/55X	System 55	System 55X
Roll	40 ± 2	(3) .040	(1) .032 (2) .040
Pitch	45 ± 2	(3) .032 (1) .040	(3) .040
Trim	20 ± 2	(2) .040	(2) .040
Yaw	50 ± 2	(3) .032 (1) .040	(3) .040

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Servo Clutch Torque Adjustment
Figure 7

[Effectivity](#)
3449152 & up

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**GRIDS 2H22 THRU 2H24
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CHAPTER

24

ELECTRICAL POWER

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CHAPTER 24 - ELECTRICAL POWER

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NOTE: For Electrical Schematics or Wiring Diagrams, refer to Chapter 91.

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GENERAL

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

This chapter contains instructions for correcting difficulties which may arise in the operation of the electrical system. It includes a general description and function of each part of the system along with test and adjustments of the various components.

1. Description and Operation

Electrical power is supplied by a 28-volt, direct current, negative ground electrical system. A 24-volt, 19 ampere hour Gill G-247 manifold type battery is incorporated in the system to furnish power for starting and as a reserve power source in case of alternator failure; On **Seneca IV** models, the battery is located in a compartment located on the right side of the nose section of the airplane. On **Seneca V** models, the battery is located under the floor in the aft baggage compartment.

The electrical generating system on **Seneca IV** models consists of two engine driven, 60 ampere alternators, that are individually protected by 70 amp circuit breakers. The electrical generating system on **Seneca V** models consists of two engine driven, 85 ampere alternators, that are individually protected by 90 amp circuit breakers.

Two solid state Lamar B 00382-1 alternator control units maintain effective alternator load sharing while regulating the system bus voltage at 28.8-volts. Also, incorporated in the alternator control units are overvoltage relays; one for each alternator circuit which prevents damage to electrical and avionic equipment in case the regulating function fails. Unregulated voltage that exceeds 32 volts automatically takes the malfunctioning alternator circuit off line. A warning light on the annunciator panel will illuminate if either alternator fails to produce current, accompanied by a zero indication on the individual ammeter. A low voltage warning light on the annunciator panel will illuminate when the electrical bus drops below $25 \pm .3$ volts. The loads from the electrical bus system are protected by manual reset type circuit breakers mounted on the lower right-hand instrument panel.

2. Troubleshooting

WARNING: ALL CHECKS AND ADJUSTMENTS OF THE ALTERNATOR AND/OR ITS COMPONENTS SHOULD BE MADE WITH THE ENGINE STOPPED. THEREFORE, TO COMPLETE SOME CHECKS OR ADJUSTMENTS, IT WILL BE NECESSARY TO REMOVE THESE UNITS FROM THE AIRPLANE AND PLACE THEM ON A TEST STAND.

Troubles peculiar to the electrical system and battery are listed in Charts 1 and 24-30-00, Chart 1 along with their probable causes and suggested remedies. The wiring diagrams included in Chapter 91 will give physical breakdown of the different electrical circuits used in this airplane.

After the trouble has been corrected, check the entire electrical system for security and operation of its components.

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**CHART 1 (Sheet 1 of 4)
TROUBLESHOOTING ALTERNATOR**

Trouble	Cause	Remedy
Zero output indicated on ammeter regardless of rpm (refer to alternator system test procedure).	Open field circuit.	<p>With battery switch turned on, check for battery voltage from airplane's main buss field circuit to alternator field terminal. Measure voltage from ground (-) to the following points (+) in sequence; bus bar, output circuit breaker, field circuit breaker (5A), field terminals of master switch voltage regulator and alternator field terminal.</p> <p>Interruption of voltage through any of these points isolates the faulty component or wire which must be replaced. (See wiring schematic, Chapter 91.)</p>
	Open output circuit.	<p>With battery switch turned on, check for battery voltage from airplane's main buss through entire output circuit to alternator battery post. Measure voltage from ground (-) to the following points (+) in sequence; buss bar, output circuit breaker, ammeter, and alternator battery post.</p> <p>Interruption of voltage through any of these points isolates the faulty component or wire which must be replaced. (See wiring schematic, Chapter 91.)</p>

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**CHART 1 (Sheet 2 of 4)
TROUBLESHOOTING ALTERNATOR**

Trouble	Cause	Remedy
Zero output indicated on ammeter regardless of rpm (refer to alternator system test procedure). (continued)	Open field winding in alternator.	Disconnect field terminal of alternator from field wiring and check for continuity from field terminal to ground with ohmmeter (20-100 ohms) depending on brush contact resistance. <u>WARNING:</u> TURN MAGNETO SWITCH TO OFF BEFORE TURNING PROPELLER. (Pull propeller slowly by hand turning alternator rotor through 360° of travel.) If resistance is high, check brushes for spring tension and excessive wear and replace if necessary. If brushes are okay and field reads open, replace alternator.
Output indicated on ammeter does not meet minimum values specified in alternator system test procedure.	Faulty voltage regulator. High resistance connections in field or output circuit.	Start engine, turn on load (ref: alternator test procedure), set throttle at 2300 rpm. Check voltage at buss bar. Voltage should be 27.5-volts minimum. If voltage is below this value, replace regulator. Check visually for loose binding posts at the various junction points in system, alternator battery post, lugs on ammeter, connections at voltage regulator, circuit breaker, etc. (See wiring schematic, Chapter 91.) Examine crimped terminal ends for signs of deterioration at crimp or strands of broken wire at crimp. Tighten any loose binding posts or replace bad wire terminals.

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**CHART 1 (Sheet 3 of 4)
TROUBLESHOOTING ALTERNATOR**

Trouble	Cause	Remedy
Output indicated on ammeter does not meet minimum values specified in alternator system test procedure. (continued)	Open rectifier.	If any of the six rectifiers pressed into the rear bell housing of the alternator open up internally, it will result in a definite limitation on the current that can be drawn from the alternator. After having checked the previous causes of low output it can be assumed that a faulty rectifier exists. See paragraph titled Inspection and Testing of Components.
Field circuit breaker trips.	Short circuit in field circuit.	Disconnect field wiring at terminal of alternator. Turn on master switch. If breaker continues to trip, proceed to disconnect each leg of field circuit, working from the alternator towards the circuit breaker until breaker can be reset and will hold. Replace component or wire which was isolated as defective. (See wiring schematic, Chapter 91.)
	Short circuit in field winding of alternator.	Disconnect field wiring at terminal of alternator. Turn on master switch. Reset breaker and if breaker fails to retrip, this isolates short circuit to field of alternator itself. Check brush holders for shorting against frame. If there are no obvious signs of a physical short circuit at field terminal or brush holder, replace alternator. (Note: intermittent short circuit.)

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**CHART 1 (Sheet 4 of 4)
TROUBLESHOOTING ALTERNATOR**

Trouble	Cause	Remedy
<u>WARNING:</u> TURN MAGNETO SWITCH TO OFF BEFORE TURNING PROPELLER.		
Field circuit breaker trips. (continued)		Internal short circuiting of the field can occur at various positions of the rotor, therefore, reconnect field, reset breaker, pull propeller slowly by hand turning alternator rotor through 360° of travel. Observe circuit breaker for signs of tripping.
Battery installed that was charged with reversed polarity.	Battery charged backwards.	Remove battery. Connect load such as landing light lamp or similar load and discharge battery. Recharge with correct polarity and test each cell for signs of damage due to reversed charging.
<u>NOTE:</u> This type of condition can only occur in a case where a discharged battery has been removed from the airplane and put on a charger with the polarity reversed. This reversal in polarity cannot occur in the airplane due to any fault in the alternator system.		
Excessive ammeter fluctuation.	Excessive resistance in field circuit.	Check all connections and wire terminals in field circuit for deterioration such as loose binding posts, broken wire strands at terminals, etc. Tighten all connections and replace faulty terminals.
	High field circuit resistance.	If problem persists, jump across terminals of the following components one at a time until the faulty unit is isolated. a. Field 5 amp (alternator circuit protector). b. Alternator switch.
	Defective voltage regulator.	Replace voltage regulator.

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D.C. GENERATION

1. Alternator System

The alternators are mounted on the accessory case on the rear of the engine ([Seneca IV](#)) or front of the engine with brackets ([Seneca V](#)) of each engine. Many advantages, both in operation and maintenance, are derived from this system.

The alternators have no armature or commutator and only a small pair of carbon brushes which make contact with a pair of copper slip rings. The rotating member of the alternator, known as the rotor, is actually the field windings. The rotor draws only 1/20th of the current output. Therefore, there is very little friction and negligible wear and heat in this area. The alternating current is converted to direct current by diodes pressed into the end bell housing of the alternator. The diodes are highly reliable solid state devices but are easily damaged if current flow is reversed through them.

The alternator system does not require a reverse current relay because of the high back resistance of the diodes and the inability of the alternator to draw current or motorize. A current regulator is unnecessary because the windings have been designed to limit the maximum current available. Therefore, the voltage control is the only control needed.

The circuit breaker panel contains two 5 ampere circuit breakers marked ALT FIELD left and right. If the field circuit breakers trip, it will result in a complete shutdown of power from the particular generating system. After a one or two minute cool-down period, the breakers can be reset manually. If tripping reoccurs, then a short exists in the alternator field.

Unlike previous systems, the ammeters do not indicate battery discharge but displays the load in amperes placed on the particular generating system. With all electrical equipment off (except master), the ammeters will indicate the amount of charging current demanded by the battery. This amount will vary, depending on the percentage of charge in the battery at the time. As the battery becomes charged, the amount of current displayed on the ammeters will reduce to approximately two amperes. The amount of current shown on the ammeters will tell immediately whether or not the alternator systems are operating normally if the following principles are kept in mind.

NOTE: The amount of current shown on the ammeter is the load in amperes that is demanded by the electrical system from the alternator. As a check, take for example a condition where the battery is demanding 10 amperes charging current; then switch on the anti-collision light.

NOTE: The value in amperes placarded on the panel for the anti-collision light circuit breaker (10 amps) and multiply this by 80 percent; you will arrive at a current of 8 amperes. This is the approximate current drawn by the anti-collision light. Therefore, when the anti-collision light is switched on, there will be an increase of current from 10 to 18 amperes displayed on the ammeter. As each unit of electrical equipment is switched on, the currents will add up and the total, including the battery, will appear on the ammeter.

2. Troubleshooting

See 24-00-00, Chart 1.

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A. Description of Alternator

The principal components of the alternator are the brush holder assembly, front housing assembly, rectifier assembly, stator and coil assembly, rotor assembly, and the rear housing assembly. Since the alternator is a part of the power plant assembly, maintenance and inspection procedures can be obtained from the manufacturer of the engine or that particular alternator. In addition, on [Seneca IV](#) models, a shroud designed to aid in cooling covers the alternator.

B. Checking Alternator System

An ammeter is installed to enable independent output checks of each alternator, as well as electrical output/input of the battery. Should the ammeters show zero output from both alternators, check the alternators' electrical system. (Refer to Power Distribution Schematic in 91-24-30.)

- (1) Ensure that the ammeter is operating properly.
- (2) Disconnect the battery lead (+) at the alternator.
- (3) Disconnect the field leads at the alternator.
- (4) Ensure that all electrical units are off and battery is full charged.
- (5) Turn on the battery switch.
- (6) To check the alternator output circuit, connect a voltmeter or 24-volt test light to the battery lead and to ground. If a reading of approximately 24-volts registers on the voltmeter or the test lights, the battery circuit is operational.
- (7) Should there be no indication of voltage, trace back through the output circuit until voltage is indicated. A component that allows no voltage to pass through it should be replaced.

C. Checking Alternator Belt Tension

If properly installed, tensioned, and checked periodically, the alternator drive belt will give very satisfactory service. An improperly tensioned belt, on the other hand, will wear rapidly and may slip and reduce alternator output. Accordingly, a belt should be checked for proper tension when installed, after the initial 25 hours of operation, and each 100 hours thereafter.

Using a calibrated torque wrench at the alternator nut, tension the alternator drive belt as follows:

- (1) New belt (at initial installation) - 135 to 145 in.-lbs.
- (2) Existing belt (after run-in) - 110 to 120 in.-lbs.

D. Precautions

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

CAUTION: DISCONNECT THE BATTERY BEFORE REMOVING OR REPLACING ANY UNIT OR WIRING. ACCIDENTAL GROUNDING WILL CAUSE SEVERE DAMAGE TO THE UNITS AND/OR WIRING.

CAUTION: THE ALTERNATOR MUST NOT BE OPERATED ON AN OPEN CIRCUIT WITH THE ROTOR WINDING ENERGIZED.

CAUTION: NO POLARIZATION OF THE ALTERNATOR IS REQUIRED. ANY ATTEMPT TO DO SO MAY RESULT IN DAMAGE TO THE ALTERNATOR, REGULATOR OR CIRCUITS.

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CAUTION: GROUNDING OF THE ALTERNATOR OUTPUT TERMINAL WILL CAUSE POSSIBLE DAMAGE TO THE ALTERNATOR AND/OR ITS CIRCUIT AND COMPONENTS.

CAUTION: REVERSED BATTERY CONNECTIONS WILL DAMAGE THE RECTIFIERS, WIRING OR OTHER COMPONENTS OF THE CHARGING SYSTEM. BATTERY POLARITY SHOULD BE CHECKED WITH A VOLTMETER BEFORE CONNECTING THE BATTERY. THIS AIRCRAFT IS NEGATIVE GROUND.

CAUTION: IF A BOOSTER BATTERY OR FAST CHARGER IS USED, ITS POLARITY MUST BE CONNECTED CORRECTLY TO PREVENT DAMAGE TO THE ELECTRICAL SYSTEM COMPONENTS.

E. Overhaul of Alternator

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

When repairing the alternator, complete disassembly may not be required. In some cases, it will only be necessary to perform those operations which are required to effect the repair. However, when servicing or inspecting vendor equipment installed in Piper airplanes, it is the user's responsibility to refer to the applicable vendor publication.

NOTE: (Seneca IV only) The drive assembly used on these alternators are not manufactured or serviced by the vendor, but are available from the engine manufacturer.

3. Battery

WARNING: WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRPLANES, IT IS THE USER'S RESPONSIBILITY TO REFER TO THE APPLICABLE VENDOR PUBLICATIONS.

**CHART 1 (Sheet 1 of 2)
TROUBLESHOOTING BATTERY**

Trouble	Cause	Remedy
Discharged battery.	Battery worn out.	Replace battery.
	Standing too long.	Remove and recharge battery if left in unused airplane three weeks or more.
	Equipment left on accidentally.	Remove and recharge.
	Impurities in electrolyte.	Replace.
	Short circuit (ground) in wiring.	Check wiring.
	Broken cell partitions.	Replace.

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**CHART 1 (Sheet 2 of 2.)
TROUBLESHOOTING BATTERY**

Battery life is short.	Overcharge due to level	Maintain electrolyte. of electrolyte being below top of plates.
	Sulfation due to disuse.	Replace.
	Impurities in electrolyte.	Replace battery.
	Low voltage	Adjust voltage regulator.
Cracked cell jars.	Hold-down bracket loose.	Replace battery and tighten.
	Frozen battery.	Replace.
Compound on top of battery melts.	Charging rate too high.	Reduce charging rate by adjusting voltage regulator or replace regulator.
Electrolyte runs out of vent plug and/or into acid recovery jar. Excessive corrosion inside container.	Too much water added to battery and charging rate too high.	Drain and keep at proper level and adjust voltage regulator.
	Spillage from overfilling.	Use care in adding water.
	Vent lines leaking or clogged.	Repair or clean.
Battery freezes.	Charging rate too high.	Adjust voltage regulator.
	Discharged battery.	Replace.
	Water added and battery not charged immediately.	Always recharge battery for 1/2 hour following addition of water in freezing weather.
Battery polarity reversed.	Connected backwards on charger.	Battery should be slowly discharged completely and then charged correctly and tested.
Battery consumes excessive water.	Charging rate too high (if in all cells).	Correct charging rate.

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A. Servicing Battery

The battery is a Gill-247 19 amp hour, lead acid, manifold type. On the [Seneca IV](#), it is mounted on a shelf in a compartment located in the right portion of the nose cone, and can be gained access to by a removable access panel located on the right exterior side. On the [Seneca V](#), it is mounted under the floor on the left side of the aft baggage compartment, and can be gained access to by a removable access cover located over the floor. Fumes accumulated from the natural charging process are vented to the outside of the aircraft, through the recovery jar, requiring the vents be checked for any adverse corrosion. A positive and negative drain extends from the battery manifold and acid recovery jar that exit through vent tubes located on the bottom of the nose cone ([Seneca IV](#) See Figure 1) or bottom of aft fuselage ([Seneca V](#)). Servicing of the battery should be completed every 50 operating hours or 60 days, whichever occurs first, and at every 100 hour inspection. The water level in the battery should be checked at every inspection. A check with a hydrometer should also be made. Make sure all connections are clean and tight.

B. Removal of Battery

- (1) Gain access to battery compartment.

CAUTION: ALWAYS REMOVE THE GROUND CABLE FIRST AND INSTALL LAST TO PREVENT AN ACCIDENTAL SHORT CIRCUIT OR ARCING.

- (2) Disconnect the battery ground cable first; then the positive cable.
- (3) Disconnect manifold overflow tube.
- (4) Disconnect positive vent line.
- (5) Remove battery hold down bolts.
- (6) Remove battery.

C. Installation of Battery

- (1) Ensure that all vent lines are free of kinks, cracks, and loose connections. Replace only with special hoses specified in Parts Catalog. (Do not replace with ordinary rubber hose.)
- (2) Install battery in proper location.
- (3) Connect positive vent line.
- (4) Connect manifold overflow tube.
- (5) Connect positive cable to battery first and secure. Connect ground cable to battery and secure.
- (6) Install battery hold down bolts.
- (7) Install and secure all access plates, panels, and covers.
- (8) Close and secure baggage compartment door.

D. Cleaning Battery

- (1) Remove all accumulated contamination from the battery exterior with a stiff bristle brush. (Do not use a metal brush or abrasive materials.) Wipe exterior of battery and interior of manifold, including manifold top cover, with a cloth saturated with a solution of bicarbonate of soda mixed - one part soda to twenty parts of water. (Check that cell plugs are tight - do not allow soda solution to enter any cells.)
- (2) Wash entire battery with clear water and dry thoroughly.
- (3) Wash down the battery support and floor area, hold down supports, connectors and cable ends with a soda solution followed by clear water. Dry entire area and component parts thoroughly. Apply fresh acid resistant paint if required.

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E. Removal of Battery Acid Recovery Jar

- (1) Remove battery.
- (2) Keeping the jar upright in a vertical position, remove the acid recovery jar by removing the 2 bracket screws that secure jar to bracket.

F. Cleaning Acid Recovery Jar and Vent Lines

- (1) Visually inspect all vent lines for kinks, cracks, flexibility, and loose connections. Replace only with special hoses from parts manual. (DO NOT REPLACE WITH ORDINARY RUBBER HOSE.)
- (2) (Seneca IV) Slowly pour the soda solution into the vent hoses, still attached to the bottom of the nose cone surface, using a small funnel. The solution will flow out the bottom nose cone vents.
- (2a) (Seneca V) Slowly pour the soda solution into the vent hoses, still attached to the bottom of the aft fuselage surface, using a small funnel. The solution will flow out the bottom vents.
- (3) Follow with a final purge of clear water to flush the vent lines and then blow dry with low pressure air. This ensures that the vent line is not kinked or restricted and that it is neutralized.
- (4) (Seneca IV) Wipe down the lower right nose cone area surrounding the vents with soda solution and clear water. Apply a fresh coat of high quality wax to entire area.
- (4a) (Seneca V) Wipe down the bottom aft fuselage area surrounding the vents with soda solution and clear water. Apply a fresh coat of high quality wax to entire area.
- (5) Unscrew the bottom of the recovery jar and separate from the top. Remove jar pad. Observing environmental regulations, empty jar contents into a suitable container for safe disposal.
- (6) Thoroughly wash and neutralize the jar, pad, top (including bracket), and the short length of vent hose still attached to the jar top with soda solution and clear water rinse.
- (7) Thoroughly dry all components and recharge the jar with 0.75 bicarbonate of soda. Place dry jar pad in the jar on top of the soda charge.
- (8) Screw jar back together and keep it in a vertical position.
- (9) Install jar in aircraft.
- (10) Install battery.

G. Battery Charging - (Gill G-247)

CAUTION: NEVER ALLOW LEAD ACID BATTERIES, OR TOOLS USED ON THEM, TO COME IN CONTACT WITH, OR BE NEAR NI-CAD BATTERIES AND NI-CAD BATTERY TOOLS.

CAUTION: IF CHARGING IS NECESSARY, WEAR EYE PROTECTION. ENSURE THE CHARGING AREA IS WELL VENTILATED. IF CENTRAL AIR CONDITIONING IS USED, THE BATTERY CHARGING AREA SHOULD BE VENTED TO THE OUTSIDE AIR TO PREVENT HYDROGEN GASSES FROM BEING CIRCULATED THROUGHOUT THE BUILDING.

The National Electric Code forbids charging batteries installed in aircraft or within 10 feet of fuel tank areas. The battery must be removed from the aircraft for charging. Further, an aircraft battery should not be allowed to deteriorate to a point where safety of flight is jeopardized. The battery's emergency capacity should be sufficient to power the bus for thirty minutes.

- (1) Remove cell plugs and ensure that vents in plugs are open and that vent valves operate freely.
- (2) Check that the electrolyte level in each cell is at the bottom of the split ring.
- (3) A hydrometer check of each cell should be accomplished. (Refer to Hydrometer Reading and Battery Charge in this chapter.)

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- (4) It is recommended that vent caps be left on the battery while charging. In addition, a wet cloth should be placed over the vent caps within the manifold.
- (5) The battery may be charged at any rate, in amperes, not to exceed that point which would produce bubbling and gassing of the electrolyte or a cell temperature of 115°F in any case.

NOTE: If a cell temperature reaches the 115°F limit, the charging rate shall be reduced and the charge completed at 3 amperes or less. **DO NOT CHARGE AT A HIGHER RATE WHEN CELLS ARE GASSING.** Refer to Gill Service Manual G.S.M. - 682 for alternate charging methods and service procedures.

- (6) If a constant current (recommended) charge is available, the charge should be started at 3 amperes and reduced in half if and when cells start gassing until fully charged.
- (7) As charging occurs, if any cells sputter or flood, the electrolyte level is too high and the excess must be removed. In any case, the electrolyte level shall be adjusted at the end of the charge. The level will rise due to acid returning to the electrolyte mix, normal gassing, and expansion due to temperature rise.
- (8) Thoroughly clean battery after charging to prevent remaining acid bridges which can form during charging.

CHART 2
HYDROMETER READING AND BATTERY CHARGE PERCENT

Hydrometer Reading	Percent of Charge
1280	100
1250	75
1220	50
1190	25
1160	Very little useful capacity
1130 or below	discharged

H. Hydrometer Reading and Battery Charge

Whenever checking the battery, ensure that all connections are clean and tight and that the fluid level is above the baffle plates. If necessary to add fluid, full cell with distilled water to the bottom of the split ring. After adding water, charge the battery until gassing before taking a hydrometer reading. Otherwise, the water and electrolyte will not be mixed, giving a false reading. Temperatures different from the established norm will effect the hydrometer readings. See Chart 4 for the temperature corrections. Specific gravity values for a fully charged battery are shown in Chart 3.

CHART 3
SPECIFIC GRAVITY AT FULL CHARGE VS TEMPERATURE

Electrolyte Temperature	Specific Gravity
47°F (8°C)	1,280 to 1,300
77°F (24°C)	1,280 to 1,290
107°F (42°C)	1,260 to 1,280
Temperature change of 30°F changes the reading 0.010.	

To adjust low specific gravity, charge the battery (see Battery Charging) until it is gassing and until the specific gravity rises to no higher over a 3-hour period, then remove some electrolyte and replace with 1.300 specific gravity electrolyte. Repeat this step if, after one hour of charging, the specific gravity is still too low. **DO NOT ADJUST A CELL THAT DOES NOT GAS.**

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To adjust high specific gravity, charge the battery (see Battery Charging) until it is gassing and until the specific gravity rises no higher over a 3-hour period. Remove some electrolyte and replace with distilled water. Repeat this step if, after one hour of charging, the specific gravity is still too high.

**CHART 4
SPECIFIC GRAVITY TEMPERATURE CORRECTION**

Electrolyte Temperature			
°C	°F	Corrections	
60	140	+1.024	
55	130	+1.020	
49	120	+1.016	Add to
43	110	+0.012	Reading
38	100	+0.008	Add to
33	90	+0.002	Reading
27	80	.000	
23	70	-.004	
15	60	-.008	
10	50	-.012	
5	40	-.016	Subtract
-2	30	-.020	From
-7	20	-.024	Reading
-13	10	-.028	
-18	0	-.032	
-28	-10	-.036	
-20	-20	-.040	
-30	-30	-.044	

I. Battery Discharge

The capacity of a storage battery is measured in units of ampere hours, which is the product of the electrical current in amperes multiplied by the time in hours. Although current may be obtained after the end of the time, the voltage of the battery has dropped to a point beyond which is not very useful. The ampere hours which may be obtained from a battery are greater for a long low-rate or intermittent rate discharge than for a short high-rate discharge because the voltage will drop faster at the higher discharge rate. The maximum permissible rate of discharge is limited only by the current-carrying ability of the wiring, motor, or other apparatus to which the battery is connected or by the current-carrying ability of the cell terminals and connectors and not by the plates themselves. Chart 5 lists recommended discharge rates:

**CHART 5
DISCHARGE RATES**

TELEDYNE Battery Type	Volts	Ampere Hours
GILL-G-247	24	19.0

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J. Battery Temperature Considerations

Operation of storage batteries beyond their ambient temperature or charging voltage limits will result in excessive cell temperatures leading to electrolyte boiling, rapid deterioration of the cell and finally battery failure. The relationship between the maximum charging voltage and the number of cells in the battery is also significant, since this will determine (for a given ambient temperature and state of charge) the rate at which energy is absorbed as heat within the battery. The maximum voltage per cell should not exceed 2.35-volts and the maximum temperature should not exceed 115°F (46°C).

Low electrolyte temperatures temporarily reduce the battery capacity and the freezing point depends on the specific gravity. To prevent freeze damage, maintain the specific gravity at a reasonably high level as indicated by Chart 6.

NOTE: Lead-acid batteries are subject to a constant discharge due to the internal chemical action.

K. Battery Repairs, Storage and Service Tips

The internal parts of the battery have been designed to wear at approximately the same rate, making it uneconomical to replace any of the parts with new ones. Replacing the entire battery is simpler and cheaper.

CHART 6
ELECTROLYTE FREEZING POINTS

Specific Gravity	Freezing Point	
	°C	°F
1.300	-70	-95
1.275	-62	-80
1.250	-52	-62
1.225	-37	-35
1.200	-26	-16
1.175	-20	-4
1.150	-15	+5
1.125	-10	+13
1.100	-8	+19

Before storing the battery, it should be properly charged, the vent plugs put tightly in place, and the leads disconnected to prevent use during idle periods. The battery should be charged at intervals during the idle period. Before returning the battery to service, it should be thoroughly charged. The battery will be sufficiently charged when, after a 3-hour period, the specific gravity does not rise any higher with the electrolyte gassing and a charging rate of 1-1/2 amperes.

Long battery life and trouble-free service is obtained from the battery if the following simple tips are observed:

- (1) Keep it clean.
- (2) Keep it charged.
- (3) Maintain proper electrolyte levels.
- (4) Keep specific gravity equal among all cells.

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L. Preparing New Dry Charged Battery for Installation

CAUTION: PRIOR TO INSTALLING A NEW DRY-CHARGED BATTERY, FOLLOW THE PREPARATION AND INSTALLATION INSTRUCTIONS FURNISHED WITH THE BATTERY BY TELEDYNE.

NOTE: The aircraft battery must be removed from the airplane if it is to be charged with a ground dc supply.

The dry-charged, Model GILL G-247 Battery shall be stored as received from the vendor. Do not remove vents seals, add acid, nor attempt to charge a dry-charged battery until the time arrives to install the battery into the airplane.

M. Corrosion Prevention

The battery should be checked for spilled electrolyte or corrosion at least each 50 hour inspection or at least every 60 days, whichever comes first. Should this be found in the box, on the terminals or around the battery, the battery should be removed and both the shelf area and battery cleaned by the following procedure:

CAUTION: DO NOT ALLOW SODA SOLUTION TO ENTER BATTERY.

- (1) Clean the battery and the shelf. Corrosion effect may be neutralized by applying a solution of baking soda and water mixed to a consistency of thin cream. The application of this mixture should be applied until all bubbling action has ceased.
- (2) Rinse the battery and shelf area with clean water and dry thoroughly.
- (3) As necessary, paint the battery shelf area with an acid resistant paint. Allow paint to dry thoroughly.
- (4) Install battery.

4. Alternator Control Unit — Lamar B-00382-1

A. Adjustment of Alternator Control Unit

The only adjustment necessary to maintain the alternator system is the adjustment of the voltage control on the alternator control unit. A voltage of 28.8 Vdc is automatically maintained. All other adjustments are made at the time of manufacture at the factory and need not be reset.

B. Bench Test of Alternator Control Unit — Lamar B-00382-1

CAUTION: IN-AIRCRAFT TESTING WITH ALTERNATOR RUNNING IS NOT RECOMMENDED. DO NOT BYPASS REGULATOR BUS TO FIELD AS A MEANS OF CHECKING ALTERNATOR OR OVERVOLTAGE PROTECTION WITH ALTERNATOR RUNNING.

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C. Setting Up Test Equipment

- (1) Remove unit from aircraft.
- (2) Set up the following equipment as shown in Figure 2:

Power:	Pure dc regulated power supply (A) 28.8V @ 5A		
	Adjustable 6-12V power supply (B) @ 0.05A		
Resistors:	R1	1	
	R2	650	fine adjustment
	R3	7.2	dummy load 4A
Ammeter:	0-5A dc		
Voltmeters:	Precision meter between pins#1 and #8; between pin #3 and power (B) ground: 50 MV precision meter between shunts at pins #6 and #7.		
Switch:	Between R1 and R2		
Indicator:	28V light (Mazda #1829 or equivalent)		
- (3) Set up load resistance as follows:
 - (a) Jumper pins #1 and #2.
 - (b) Set dummy load resistance for 4A @ 28.8V (approximately 7.2).
 - (c) Remove jumper.
- (4) Proceed to Voltage Control Unit Test.

D. Voltage Control Unit Test

- (1) Turn power off.
- (2) Mate unit with test connector.
- (3) Open switch 1.
- (4) Apply regulated power supply (A). Hold constant @ 28.8V \pm 0.025V.

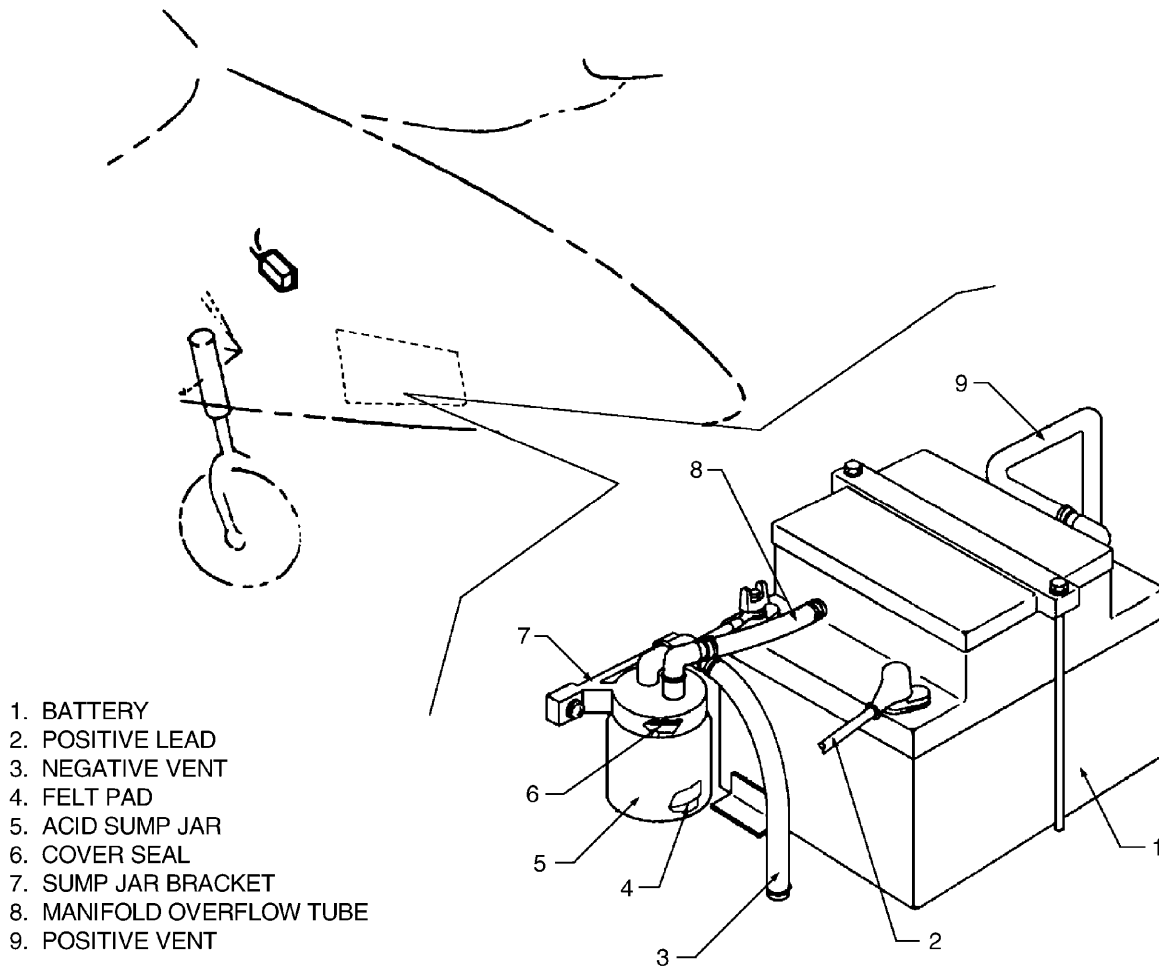
NOTE: Power supply should be adequate for load. If fluctuation occurs, assist with 28V battery to stabilize current.
- (5) Allow unit 2-minute warm-up.
- (6) Reset adjustment on alternator control unit for 1.0A field current.
- (7) Decrease power supply (A) to approximately 28.6V until ammeter shows 3A field current.
- (8) Check alternator inoperative indicator by varying power supply (B) to 10.25V \pm 0.75V.

E. Equalizer Test

- (1) Apply voltmeter at pins #5 and #8 (equalizer and ground). Equalizer voltage should read 5.75V \pm 0.1V.

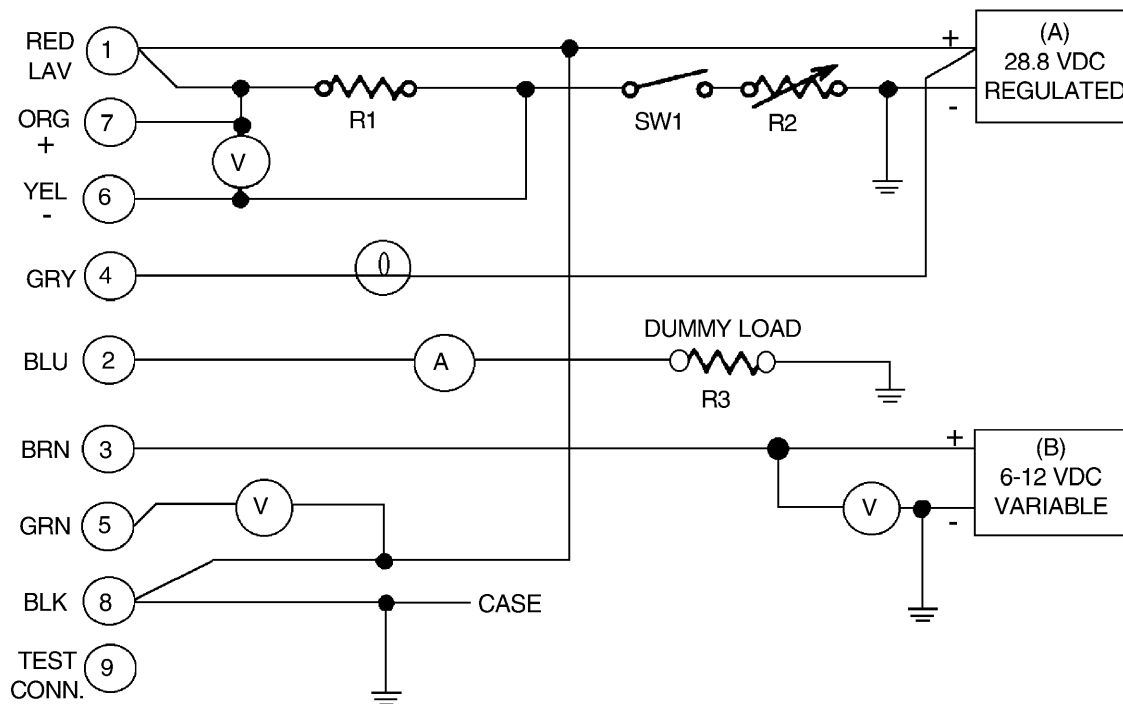
NOTE: Equalizer voltage outside 5.65 - 5.85V limits may still be acceptable because of meter calibration differences and temperature. If error is several times the stated 0.1V tolerance, have the unit rechecked by a fully equipped test facility.
- (2) Set R2 for maximum resistance (650).
- (3) Close switch 1.
- (4) Adjust R2 for 50 MV across R1.
- (5) Read equalizer voltage.
- (6) Subtract from reading in step 1. Difference should be 10.0V \pm 0.25V

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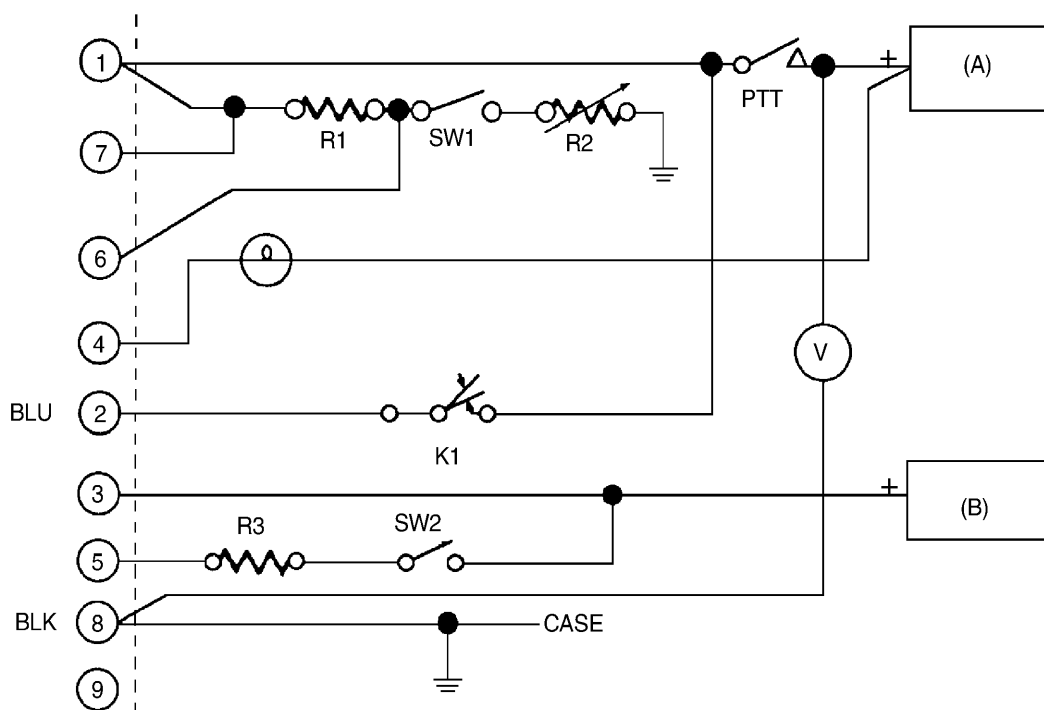


Battery Installation ([Seneca IV](#))
Figure 1

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Bench Test of Alternator Control Unit — Lamar #B-00382-1
Figure 2



Overvoltage Test of ACU
Figure 3

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F. Overvoltage Protection Test (Refer to Figure 3)

- (1) Revise connection as follows:
 - (a) Disconnect dummy load.
 - (b) Add 28V relay (K1). No other connections should be on pin #2.
 - (c) Add a press-to-test (PTT) switch between power supply (A) and pin #2.
 - (d) Add resistor R3 and switch 2.
- (2) Open switches 1 and 2. Set power supply (B) at 11V.
- (3) Set power supply (A) to 31.8V. Depress PTT and hold for 5 seconds. No activation should occur.
- (4) Increase power (A) to 32.2V. Depress PTT for 5 seconds. No activation should occur.
- (5) Close switch 2. Increase power to 33.8V. Depress PTT for 5 seconds. No activation should occur.
- (6) Increase power to 34.5V. Depress PTT. Relay should activate almost instantly.

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EXTERNAL POWER

Starting Through External Power Receptacle

On Seneca IV models, the external power receptacle is located on the left side of the nose. On Seneca V models, the external power receptacle is located on the side of the fuselage below the aft cargo door.

CAUTION: BEFORE USING ANY EXTERNAL POWER, A HYDROMETER READING SHOULD BE TAKEN. IF THE READING INDICATES LESS THAN 1190, THE BATTERY SHOULD BE RECHARGED OR REPLACED BEFORE CONTINUING.

NOTE: For all normal operations using the external power jumper cables, the master switch should be OFF. However, it is possible to use the ship's battery in parallel with the battery switch ON, which will not increase amperage at that point but will give longer cranking capabilities.

- A. If the airplane's battery is nearly depleted, the following procedure should be used when using a 24 volt battery for external power:
 - (1) If the battery switch is being left in the OFF position, the battery need not be disconnected. If the battery switch is switched ON, it is recommended that the airplane's battery be disconnected at the negative terminal to prevent excessive loading of the external battery.
 - (2) Check to ensure that all electrical equipment is turned off.
 - (3) With the external battery connected to the receptacle, start the RIGHT engine only with normal starting procedures.
 - (4) Disconnect the external battery and, if applicable, reconnect the ship's battery.
 - (5) Switch on the battery switch and check ammeter for battery charging current.
- B. A power cart can be used instead of a battery in which case all but step a of the above procedure is applicable. The power cart (or APU) should be able to start the system even through a dead battery.

WARNING: ENSURE THAT THE PROPELLER AREA IS CLEAR AND THAT THE INDIVIDUAL MONITORING THE START FROM THE GROUND POWER UNIT REMAINS CLEAR AS THE ENGINE STARTS.

CAUTION: EXERCISE GREAT CARE DISCONNECTING GROUND POWER PLUG. DISCONNECT THE PLUG ONLY FROM THE PILOT'S SIDE OF THE AIRPLANE.

- C. Start engine and move ground power unit well away from aircraft.
- D. Turn ON Battery Master Switch.
- E. Observe ammeter indicates alternator electrical current to ammeter on both left and right systems.
- F. With the alternator(s) on line, observe charging current on ammeter.

CAUTION: IF AIRCRAFT BATTERY IS WEAK, CHARGING CURRENT WILL BE HIGH. DO NOT TAKEOFF UNTIL CHARGING CURRENT FALLS BELOW 20 AMPS.

- G. Do not takeoff until charging current falls below 20 amps.

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ELECTRICAL LOAD DISTRIBUTION

**CHART 1
ELECTRICAL SYSTEM COMPONENT LOADS (SENECA IV)**

Duty Cycle		Equipment	Circuit Breaker	Load (Amps)	Optional
Cont.	Inter.				
X	X	Alternator Field (2)	5	1.57	
		Anti-Collision (Strobe)	10	2.0	
	X	Cabin Lights (4)	5	2.0	
	X	Cigar Lighter	10	4.0	
	X	Combustion Heater	15	11.0	
	X	Defroster Blower	10	3.0	
	X	Fuel Pump (2)	7.5	5.0	
	X	Heated Windshield	15	7.0	X
	X	Hydraulic Pump	25	7.5	
X		Instrument Lights	7.5	3.66	
	X	Landing Lights (2)	10	8.4	
X		Master Contactor	—	0.6	
	X	Pitot Heat	15	6.0	
X		Position Lights	10	1.5	
	X	Prop Deice		18.0	X
		Red Flood Lights	5	2.0	
	X	Stall Warning Cluster	5	1.0	
	X	Stall Warning Heat		7.5	X
	X	Starter		175.0	
	X	Starter Solenoid	10	10.0	
X		Turn & Bank	5	0.3	
	X	Electric Flaps	15	6.0	
X	X	Alternators	70		

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**CHART 2
ELECTRICAL SYSTEM COMPONENT LOADS (SENECA V)**

Duty Cycle		Equipment	Circuit Breaker	Load (Amps)	Optional
Cont.	Inter.				
X	X	Alternator Field (2)	5 ea.	1.57 ea.	
		Anti-Collision (Strobe)	10	2.0	
	X	Cabin Lights (4)	5	2.0	
	X	Combustion Heater	15	11.0	
	X	Fresh Air Blower	15	7.0	
	X	Fuel Pump (2)	7.5 ea.	5.0 ea.	
	X	Heated Windshield	15	7.0	X
	X	Hydraulic Pump	25	7.5	
X		Panel & Switch Lights	7.5	3.66	
	X	Landing Lights	10	8.4	
X		Master Contactor	—	0.6	
	X	Pitot Heat	15	6.0	
X		Position Lights	10	1.5	
	X	Prop Deice	20	18.0	X
		Cockpit Flood Lights	5	2.0	
	X	Stall Warning Heat	15	8.0	X
	X	Starter		175.0	
X		Turn & Bank	5	0.3	
	X	Electric Flaps	15	6.0	
X	X	Alternators	90		
X		Entertainment Console	10		X

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CHAPTER

25

EQUIPMENT / FURNISHINGS

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CHAPTER 25 - EQUIPMENT / FURNISHINGS

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FLIGHT/PASSENGER COMPARTMENT

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

The **Seneca IV** has the capacity of seating up to six passengers. The **Seneca V** has the capacity to seat up to six passengers, or five passengers with the addition of an entertainment/executive console, in place of the right hand aft facing seat.

Information on seat installations and other options are included in this chapter.

1. Removal and Installation of Seats (See Figure 1.)

A. The pilot's and copilot's seats are on rails and can be removed as follows. Reverse this procedure for installation.

- (1) Lift up on handle just under the front of the seat and move the seat to the center of its travel.
- (2) Remove the screws from the clips (fore and aft) on the rails and move the control column full forward.
- (3) Pull the release and move the seat forward until the forward seat legs are aligned with the holes in the rails. Rotate the seat backward just until the legs clear the rails.
- (4) With the front legs clear, move the seat aft until the rear legs can also be moved clear.

CAUTION: UPON INSTALLATION, WITH SEAT OCCUPIED AND AT LOWEST VERTICAL POSITION, CHECK SEAT FOR PROPER ENGAGEMENT OF PINS TO SEAT TRACK.

B. Remove the forward facing passenger seats as follows:

On the floor attachment plates where the rear legs are retained, a spring pin retains the seat by keeping them forward under the lips of the retainers. Push down on the pin with a drift, or other suitable tool, and slide the seats back until the legs can clear their retaining plates.

C. Remove the aft facing passenger seats as follows:

- (1) Disconnect safety belt.
- (2) Remove the two mounting bolts from the seat's front legs.
- (3) With the front legs of the seats disconnected, slide the seat aft until its back legs are clear of the retainers.

NOTE: Make sure the plates are clean of dirt that might prevent the leg foot from entering its retaining plate.

- (4) Install the forward facing passenger seats by aligning the four legs of the chair with the openings in their retainers, pushing down on the part of the chair where the legs are over the keeper pin, and pushing the chair forward into the retaining plate.
- (5) Install the aft facing passenger seats by aligning the seats' legs in the retaining plates and installing the mounting bolts.

D. Rigging Instructions - Seat Back Lock and Release (Refer to Figure 3.)

- (1) Loosen screws and ascertain that clamps are in a relaxed condition. (Push-pull cable is able to move within the clamps.)
- (2) Place a straightedge along the lower surface of bushing of the seat back release.
- (3) Adjust the push-pull cable by raising or lowering it until the lower surface of the stop assembly is parallel to the straightedge.

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- (4) Secure the push-pull cable in this position by tightening screws on clamps. The stop should be lubricated and free to swivel without excessive play.
- (5) Push on seat back with stop assembly in an engaged position to check engagement. Rotate the seat back release handle and check for disengagement of seat back.

2. Center Console Removal and Installation (See Figure 1.)

The center console, if installed, is mounted to the center floor in the same manner as the club seats. Remove and install as follows:

- A. Remove the bolts from the aft legs of the console that are held to the stud plates.
- B. Slide the unit aft and lift up on the forward part of the console until the legs clear the retainers.
- C. Install in the reverse order.

NOTE: If the console is not going to be installed any time soon, it is recommended that the retaining and stud plates be taped over to prevent dirt from fouling the assemblies.

3. Entertainment/Executive Console (Seneca V only) (See Figure 2.)

The Entertainment/Executive Console is available on [Seneca V](#) models in place of the right hand aft facing seat.

Some of the features of the console are: a horizontally sliding, pull out table, which when in the extended position, reveals a storage compartment; a cabinet designed to house a multimedia entertainment system, which is hidden away by a vertically sliding tambour door (controls for the entertainment system are located in this compartment); a fore and aft sliding beverage cooler drawer with a removable stainless steel container; a pilot's reference material compartment; and a three-cup cup holder that hides away into the side of the console when not in use.

Removal and Installation ([Seneca V only](#)) (See Figure 2.)

- (1) Remove the Entertainment/Executive Console as follows:

WARNING: REMOVE ALL ELECTRICAL POWER FROM THE AIRPLANE BEFORE REMOVING CONSOLE.

- (a) Remove fire extinguisher from front of console (behind copilot seat).
- (b) Disconnect electrical connections from console. (Electrical connections are standard connections, no special tools are necessary.)
- (c) Remove four mounting bolts from aft side, bottom of console (the side facing the forward facing passenger seats). (Bolts may be hidden behind carpet.)

CAUTION: DO NOT LIFT CONSOLE BY PULLING UP ON TABLE. DAMAGE TO CONSOLE COULD RESULT.

CAUTION: WHEN MOVING CONSOLE, BE SURE TO SECURE ALL DOORS AND DRAWERS TO PREVENT THEM FROM SLAMMING OPEN AND CLOSED. DAMAGE TO CONSOLE COULD RESULT.

- (d) Slide console aft until back legs are clear of retainers.

CAUTION: SET CONSOLE DOWN ON TO SURFACE GENTLY TO PREVENT BENDING ANGLE BRACKET.

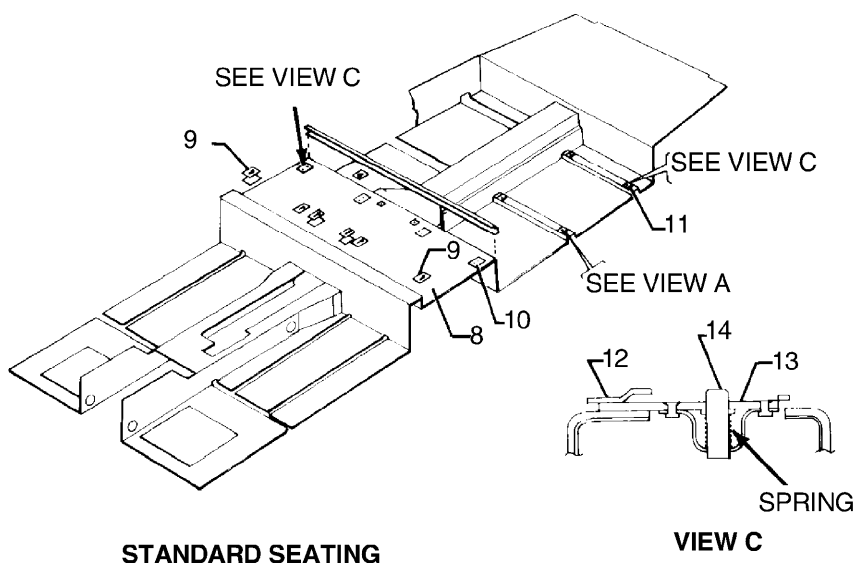
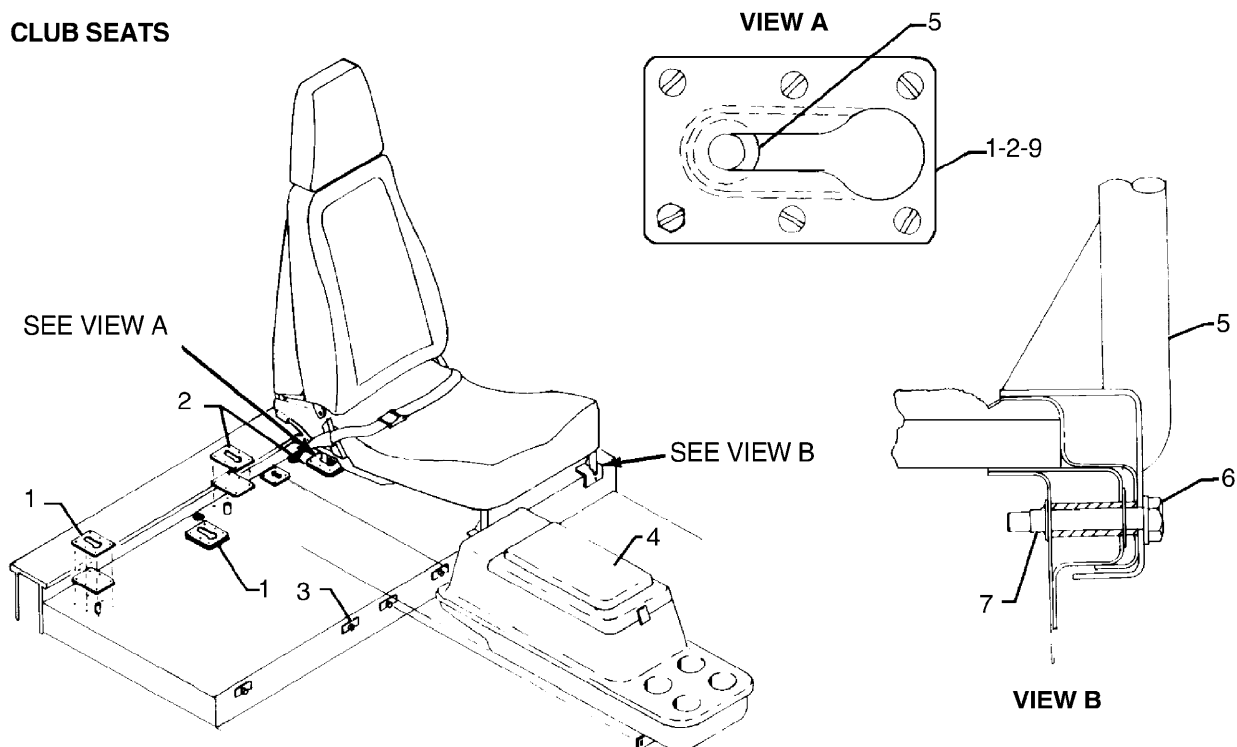
- (e) Carefully remove console from airplane.

NOTE: If the console is not going to be installed, it is recommended that the retaining and stud plates be taped over to prevent dirt from fouling the assemblies. Also enclose electrical connectors and secure harnesses.

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3042
78087 / 37825

CLUB SEATS



1. SEAT LEG RETAINING PLATE (BACK LEG OF CLUB SEATS)
2. RETAINING PLATES FOR CONSOLE OR OXYGEN INSTALLATION
3. STUD PLATES FOR CLUB SEATS (SEE VIEW B)
4. CONSOLE
5. FORWARD LEG CLUB SEAT
6. AN4-14A MOUNTING BOLT(S)
7. NUT PLATE (NAS 680A4)
8. CENTER FLOOR
9. RETAINING PLATE (FRONT LEG RETAINER FOR STANDARD SEATING)
10. ATTACHMENT PLATE FOR CENTER SEATS (SEE VIEW C) ON STANDARD SEATING
11. ATTACHMENT PLATE, REAR SEATS
12. RETAINING PLATE
13. KEEPER PLATE
14. KEEPER PIN

Seats and Center Console Installation
Figure 1

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MOUNTING
BOLTS

Entertainment/Executive Console ([Seneca V only](#))
Figure 2

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- (2) Install the Entertainment/Executive Console as follows:

CAUTION: DO NOT LIFT CONSOLE BY PULLING UP ON TABLE. DAMAGE TO CONSOLE COULD RESULT.

CAUTION: WHEN MOVING CONSOLE, BE SURE TO SECURE ALL DOORS AND DRAWERS TO PREVENT THEM FROM SLAMMING OPEN AND CLOSED. DAMAGE TO CONSOLE COULD RESULT.

- (a) Align console into position, engaging back legs into retainers.
- (b) Install four mounting bolts to aft side, bottom of console (the side facing the forward facing passenger seats).

WARNING: REMOVE ALL ELECTRICAL POWER FROM THE AIRPLANE BEFORE CONNECTING ELECTRICAL CONNECTIONS TO CONSOLE.

- (c) Connect electrical connections to console. (Electrical connections are standard connections, no special tools are necessary.)
- (d) Install fire extinguisher to front of console (behind copilot seat).

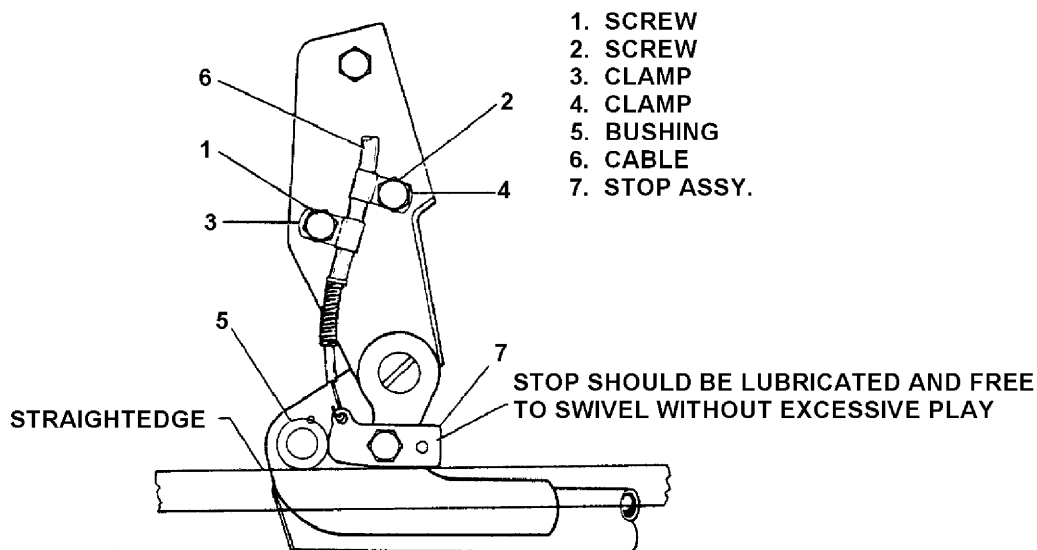
4. Restraint System

A. Inspection.

- (1) Shoulder Harness

In [Seneca IV's](#) and in [Seneca V S/N's 3449001 thru 3449164](#) only:

- (a) Inspect ends and attachment points for condition and security.
- (b) Inspect harness web material for condition and wear over its entire length. Particularly look for wear and fraying where harness web passes in and out of inertial reel. If excessively worn, replace.
- (c) Check inertia reel mechanism by pulling sharply on strap. Verify reel will lock in place under sudden stress.



Seat Back Lock
Figure 3

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(2) Lap Belt

In Seneca IV's and in Seneca V S/N's 3449001 thru 3449164 only:

- (a) Inspect ends and attachment points for condition and security.
- (b) Inspect harness web material for condition and wear over its entire length. Particularly look for wear and fraying where harness web passes in and out of adjustable buckle end. If excessively worn, replace.
- (c) Inspect shoulder harness keeper nylon bushing. If excessively worn or missing, replacement of that half of the lap belt is required.

(3) Integrated Shoulder Harness / Lap Belt (Schroth)

In Seneca V S/N's 3449165 & up:

- (a) Inspect ends and attachment points for condition and security.
- (b) Inspect harness web material for condition and wear over its entire length. Particularly look for wear and fraying where harness web passes in and out of inertial reel and in and out of the adjusting buckle. If excessively worn, replace.
- (c) Check inertia reel mechanism by pulling sharply on strap. Verify reel will lock in place under sudden stress.

B. Inertial Reel Adjustment

The inertial reel locking feature prevents the shoulder strap from extending and holds occupant in place. For normal movement strap will extend and retract as required. If required, adjust inertial reel as follows:

- (1) Allow harness to wind up on reel as much as possible.
- (2) On end of reel, pry off plastic cover over spring. Make sure spring does not come out of plastic cover. Set aside plastic cover.
- (3) Unwind the harness completely. Measure and mark the harness 24 inches from the reel center.
- (4) Wind harness onto reel until the 24 inch mark is reached. Hold reel and place cap with spring over reel shaft end.
- (5) Align slot in shaft with spring tang. Wind spring 6 1/2 turns and snap plastic cover into holes in reel end shaft.
- (6) Release harness and allow harness to wind up. Extend harness several times to check reel for smooth operation.
- (7) Hold inertia reel with reel completely wound and inertia mechanism end up. Pry off plastic cover over mechanism and set reel aside.
- (8) Install nut in plastic cover so that stud in cover is flush with nut surface. Position cover over reel and snap cover into place. Extend harness several times to ensure reel operates smoothly.

5. Lumbar Support (See Figure 4.)

A. Description

In the optional interior, the pilot and co-pilot seats incorporate a Lumbar support feature. The installation consists of an inflatable bladder attached to the seat back filler and an inflation bulb located under and on the inboard side of each pilot and co-pilot seat.

B. Removal

- (1) Remove seat from airplane.
- (2) Loosen velcro securing seat back filler cover.
- (3) Remove only enough of seat back filler cover to expose lumbar bladder.

NOTE: Inflation tube may be removed before or after bladder is removed from seat back filler. Tube is not glued to nipple attachment; it can be removed by carefully pulling on tube.

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- (4) Remove inflation tube from bladder.

CAUTION: DO NOT USE A CHEMICAL SOLVENT TO REMOVE BLADDER. SOLVENT MAY DAMAGE SEAT BACK FILLER

CAUTION: TO AVOID OR MINIMIZE DAMAGE TO SEAT BACK FILLER DURING REMOVAL, USE ONE HAND TO RETAIN SEAT BACK FILLER IN PLACE, WHILE GENTLY REMOVING BLADDER WITH OTHER HAND.

- (5) Starting at either right or left edge of bladder, carefully and slowly pull bladder and pad assembly from seat back filler.

C. Assembly

- (1) Apply a layer of 3M 847 cement to smooth side of bladder pad.
- (2) Apply a layer of 3M 847 cement to back side of bladder (side away from inflation tube nipple).
- (3) Attach bladder pad to bladder.

NOTE: While cement does not set immediately, there is no need to wait before attaching bladder and pad to seat back filler.

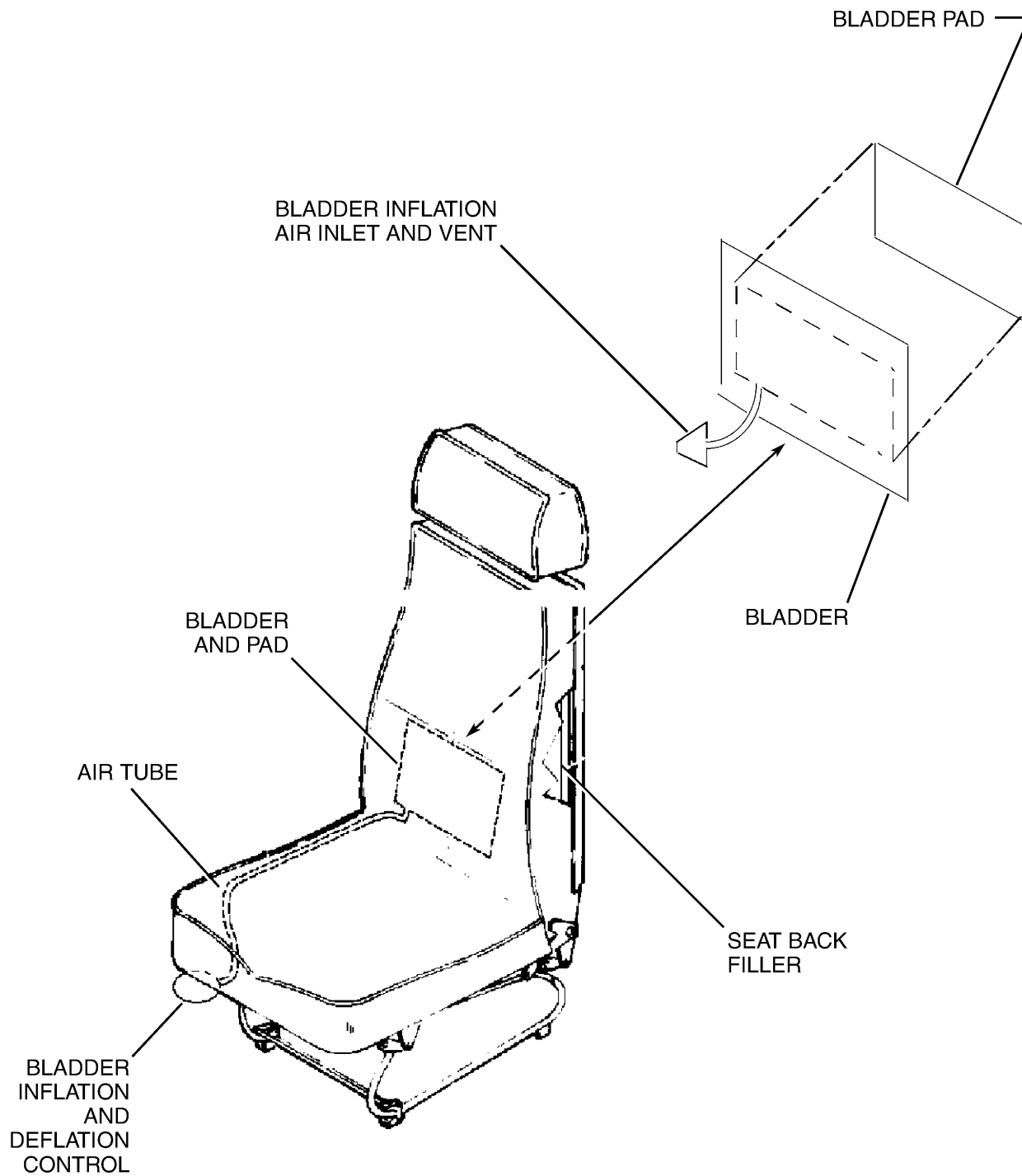
D. Installation

- (1) Apply a layer of 3M 847 cement to rough side of bladder pad.
- (2) Apply a layer of 3M 847 cement to seat back filler where bladder is to be located.
- (3) Attach bladder and pad assembly to seat back filler. Depending on temperature and humidity, allow 0:30 minutes to 1:00 hour for cement to set.
- (4) Install seat back filler cover and secure velcro fastenings.
- (5) Install seat in airplane.

6. Carpets

The carpets are individually fastened to the floor with Velcro fasteners and adhesive (Hysol EA9309 NA).

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Lumbar Seat Bladder Installation
Figure 4

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EMERGENCY

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

This section contains information necessary to perform operational checks of the Emergency Locator Transmitter (ELT), with and without a pilot's remote switch. Included are the appropriate removal and installation instructions to facilitate battery replacement.

1. Artex ELT 110-4 Emergency Locator Transmitter (ELT)

A. Description

The Artex ELT 110-4 transmits on 121.5 MHz and 243.0 MHz, and is designed to meet or exceed the requirements of TSO C91a and FAR Part 91. Electrical power for the ELT transmissions is totally supplied by its own self-contained battery. The battery must be replaced if the transmitter has been used in an emergency situation or if accumulated test time exceeds one hour, or no later than the replacement date marked on the transmitter label, whichever comes first.

The Artex 110 cannot be accidentally activated by dropping the unit, handling it roughly, or during shipping. However, when properly mounted, and locked into its mounting tray, the ELT will activate in a crash, regardless of the cockpit remote switch and ELT switch position. The normal position of the ELT switch is in the down or OFF position. The normal position of the remote cockpit switch is in down or ARM position.

Whenever the ELT is activated, a red light located just above the remote cockpit switch will blink to alert the pilot or maintenance personnel. Should the ELT be activated accidentally, it must be reset. To reset:

- (1) Position the remote cockpit switch to ON, then immediately reposition it to ARM, or;
- (2) Position the switch on the ELT to ON, then immediately reposition it to OFF.

B. Battery (See Figure 1.)

(1) Removal

- (a) In cabin, remove rear closeout panel.
- (b) Disconnect and remove positive cable from battery.
- (c) At right side of empennage, remove four (4) screws and remove ELT access panel.
- (d) Remove ELT from the airplane by:
 - 1 Loosening the two screws on the front of the mounting tray and pull mounting tray cap off.
 - 2 Disconnecting coax (antenna) cable.
 - 3 Disconnecting the Molex cable from the ELT unit.
 - 4 Remove unit from airplane.
- (e) Remove the four screws on the bottom of the ELT securing the battery pack.
- (f) Disconnect battery pack connector from main unit.
- (g) Remove battery pack from unit.

(2) Installation

- (a) Securely plug in new battery pack connector to main unit.
- (b) Immediately reset unit by positioning unit switch to ON, then to OFF.
- (c) Fit new battery pack into place. Ensure all gaskets are properly aligned.

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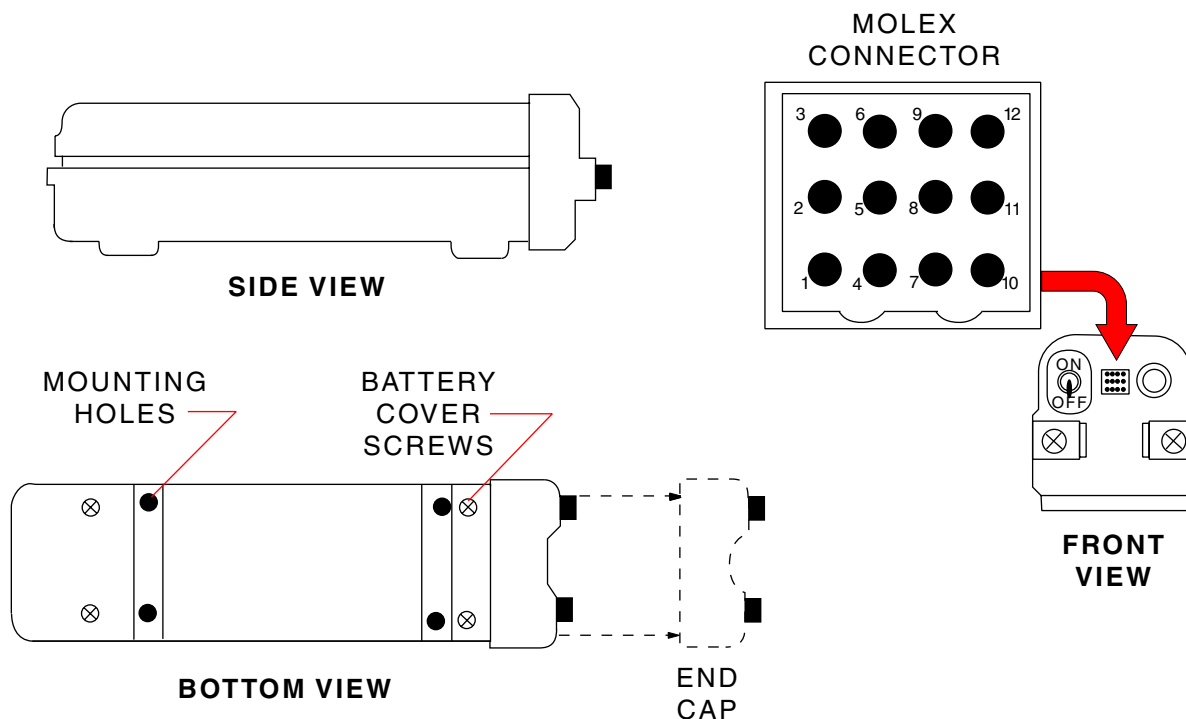
- (d) Replace the four screws. Dress wires away from standoffs to avoid pinching wires between standoffs and the battery pack.
- (e) Install unit into mounting tray:
 - 1 Connect molex and coax cables to ELT unit.
 - 2 Install mounting tray cap and secure to front of mounting tray with the two screws.
- (f) Replace ELT access panel and secure with four (4) screws.
- (g) In cabin, install positive cable to battery.
- (h) Replace cabin rear closeout panel.
- (i) Test transmitter.

C. Testing

The transmitter operates on the emergency frequencies of 121.5 and 243.0 MHz; both of these frequencies are monitored by the various FAA installations. Before performing any operational test of the ELT, the following precautions should be observed:

CAUTION: TESTING OF AN ELT SHOULD BE CONDUCTED IN A SCREEN ROOM OR METAL ENCLOSURE TO ENSURE THAT ELECTROMAGNETIC ENERGY IS NOT RADIATED DURING TESTING. IF A SHIELDED ENCLOSURE IS NOT AVAILABLE, TESTING MAY BE PERFORMED IN ACCORDANCE WITH THE FOLLOWING PROCEDURES:

- (1) Test should be no longer than three audio sweeps.
- (2) Test should be conducted only within the time period made up of the first five minutes after any hour.



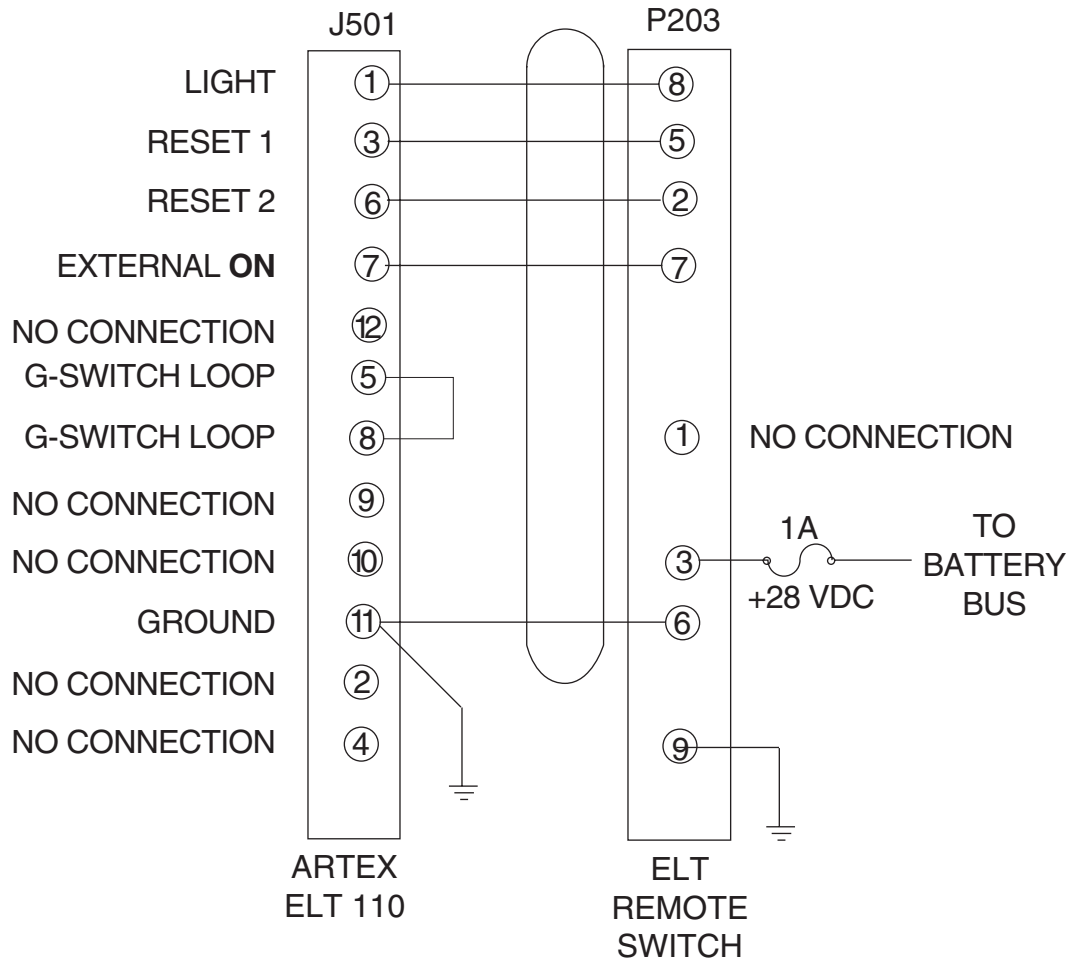
Artex ELT 110-4
Figure 1

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PA-34-220T, SENECA IV / V
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- (3) If the operational tests must be made at a time not included within the first five minutes after the hour, the test should be coordinated with the closest FAA Tower or Flight Service Station.

CAUTION: CONSULT FAA ADVISORY CIRCULAR AC 20-81 FOR DETAILED INFORMATION CONCERNING UNSHIELDED TESTING.

- (4) Turn both the airplane master switch and the radio master switch ON.
- (5) Tune airplane communications receiver to 121.5 MHz and select SPKR on the audio panel.
- (6) Position ELT cockpit switch to ON. The ELT should immediately begin signaling and the panel light should immediately come ON. Although the light may illuminate after a few seconds, failure of the light to immediately come ON indicates trouble with the G-Switch circuit, pins 5 and 8 on tray connector, and that the unit is not working properly. Repairs should be done only by a licensed aviation radio repair shop.



Artex ELT 110-4 Wiring Schematic
Figure 2

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2. Narco 910 (See Figures 3 and 4.)

CAUTION: ALTHOUGH THE ELT IS INDEPENDENT OF THE AIRPLANE'S ELECTRICAL SYSTEM, REMOVE POSITIVE CABLE FROM AIRPLANE'S BATTERY ANYTIME WORK IS TO BE DONE ON ANY ELECTRICAL OR ELECTRONIC EQUIPMENT.

CAUTION: INSPECT THE EXTERNAL WHIP ANTENNA FOR ANY DAMAGE. AVOID BENDING THE WHIP. ANY SHARPLY BENT OR KINKED WHIP SHOULD BE REPLACED. ANTENNA DAMAGE MAY CAUSE STRUCTURAL FAILURE OF WHIP IN FLIGHT.

A. Battery Removal and Installation

- (1) Remove access panel on aft fuselage, right hand side.
- (2) Set ON/OFF/ARM switch on transmitter to OFF.
- (3) Disconnect antenna coaxial cable from ELT.
- (4) Disconnect wiring harness connector from ELT.
- (5) Remove ELT from its mounting tray.
- (6) Remove 8 flat head screws from unit.
- (7) Carefully separate unit into two sections.
- (8) Unsnap battery connector (connector toward back end of circuit board).
- (9) Carefully remove battery pack (contained in white foam jacket) from the ELT.
- (10) Cut tape holding the two halves of foam together and remove old battery pack.
- (11) Install new battery pack in foam jacket. Tape foam halves together with a good quality glass filament tape.
- (12) Install battery pack assembly into ELT. Plug connector into circuit board.
- (13) Slide the two unit section together. Ensure red gasket in header is sitting flat.
- (14) Secure with 8 new screws provided with replacement battery. Ensure all 8 screws are snugged up.
- (15) Install ELT into tray in airplane. Perform test of ELT.

B. Testing

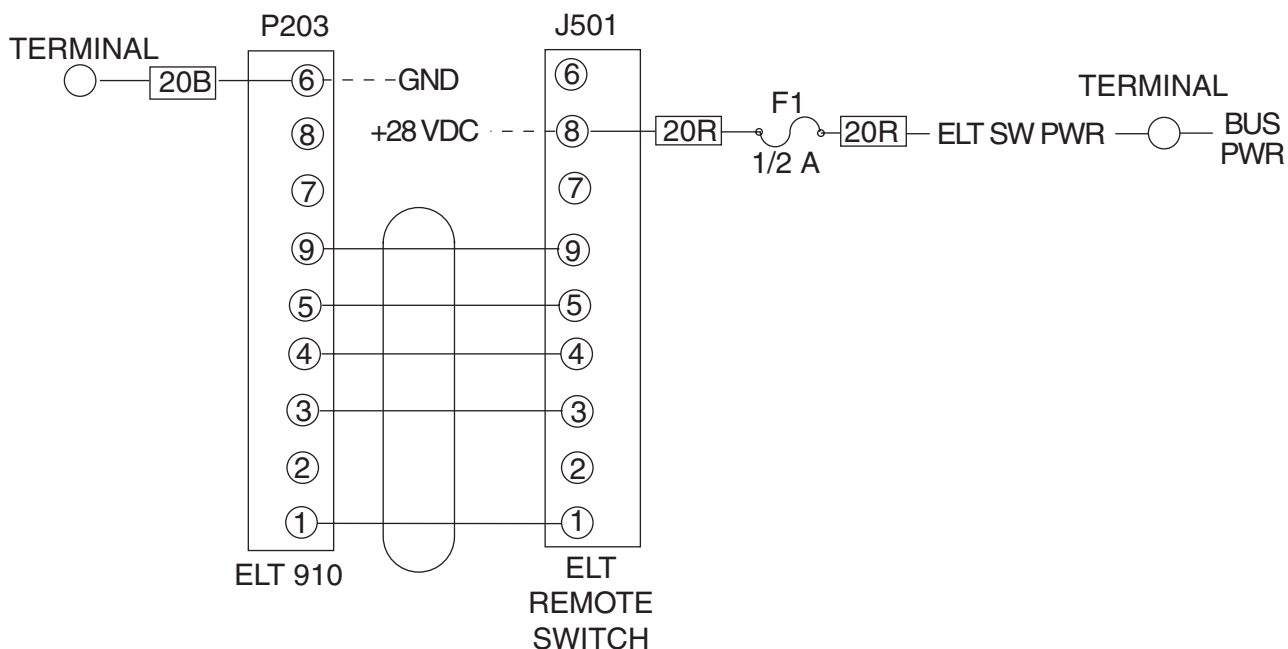
CAUTION: REPAIRS SHOULD BE DONE ONLY BY A LICENSED AVIATION RADIO REPAIR SHOP.

NOTE: Consult FAA Advisory Circular AC 20-81 for detailed testing information and precautions

- (1) Conduct test only during the first five minutes after any hour.
- (2) If operational test must be made at any time other than the first five minutes after the hour, notify the nearest FAA traffic Control Tower or Flight Service Station prior to the test.
- (3) Test should be no longer than three audio sweeps.
- (4) If the antenna is removed, a dummy load should be substituted during the test.
 - (a) Remove access panel or cover to gain access to transmitter.
 - (b) Turn aircraft master switch ON. Turn the aircraft communications receiver ON and tune to 121.5 mhz.
 - (c) Turn receiver volume up until a slight background noise is heard. If equipped, automatic squelch must be overridden.
 - (d) If aircraft is not fitted with a communications receiver, request the nearest FAA facility to listen for E.L.T. signal.
 - (e) Set ON/ARM/OFF switch on the transmitter to the ON position for approximately 2 seconds. Return to OFF, then ARM position.

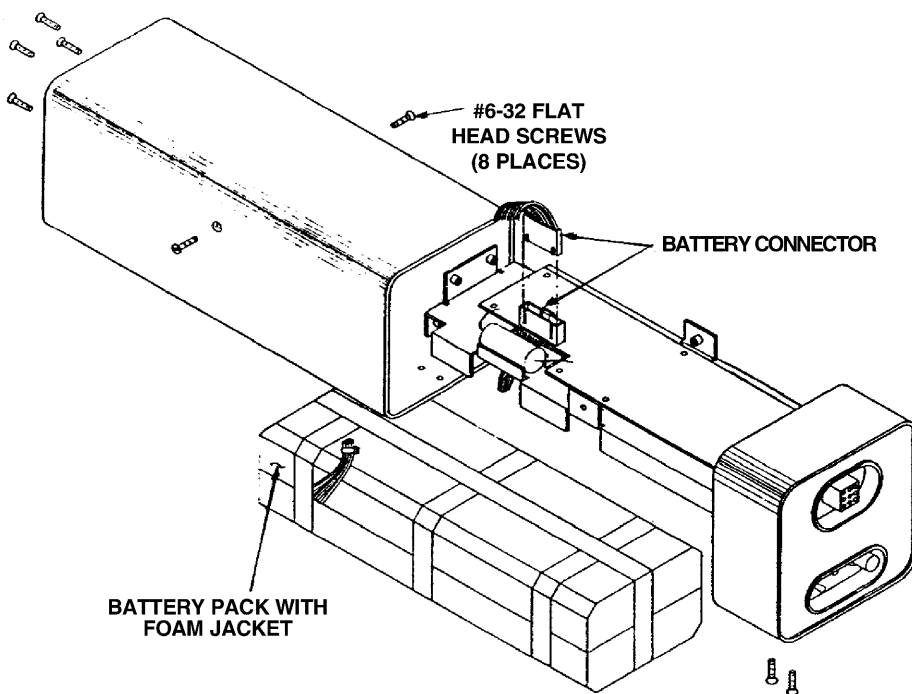
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- (f) Test transmission should be received by aircraft communications receiver and/or FAA facility. During cold weather, there may be a slight delay before transmission occurs.
 - (g) A properly functioning transmitter emits a characteristic downward swept tone.
 - (h) When test is completed, ensure transmitter ON/ARM/OFF is in the ARM position. Whenever unit is checked by moving transmitter ON/ARM/OFF switch from ARM to ON position, it must first be moved to OFF position before resetting to ARM position.
- (5) Install access panel on dorsal fin aft of fuselage station 259.30 and secure with the appropriate screws.



Narco 910 Wiring Schematic
Figure 3

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Narco 910 Battery Pack
Figure 4

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CHAPTER

26

FIRE PROTECTION

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CHAPTER 26

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EXTINGUISHING

WARNING: AFTER DISCHARGE OF EXTINGUISHER AVOID EXPOSURE TO SMOKE, VAPORS AND OTHER BY-PRODUCTS OF FIRE. DO NOT INCINERATE EXTINGUISHER.

CAUTION: EXTINGUISHER IS A PRESSURE VESSEL. PROTECT FROM CORROSIVE CONDITIONS. IF THERE IS ANY CORROSION OR DAMAGE, EXTINGUISHER SHOULD BE CAREFULLY EMPTIED AND DISCARDED. USE ONLY AS DIRECTED.

Portable Fire Extinguisher

A. Description

A portable, disposable, Class 2B:C fire extinguisher (Model No. A600) is installed as standard equipment. Containing 1.2 lbs. (550 grams) of Halon 1211/1301 blend, the extinguisher is located either on the back of the right-hand rear facing seat behind the co-pilot's seat. When the Executive/Entertainment console option installed the extinguisher is mounted on the back of it also right behind the co-pilots seat (see Figure 1). The extinguisher is secured by a quick release bracket..

To operate the extinguisher, remove it from the quick-release bracket, hold it upright in either hand by the handgrip, with the spray nozzle pointing forward. Remove the safety pin, direct the nozzle towards the base of the fire source, depress the lever. Maximum extinguishing effect is obtained if the fire fighter uses side to side motion and keeps moving in towards the base of the fire source as it is extinguished. Releasing the lever closes a secondary seal inside the operating head. This interrupts the flow of extinguishant, thus retaining part of the charge, for dealing with a flash back or re-ignition should they occur, without waste or leakage. A partly or totally discharged extinguisher should be replaced immediately after use.

B. Inspection

Disposable type fire extinguishers should be maintained and inspected in accordance with the nameplate instructions.

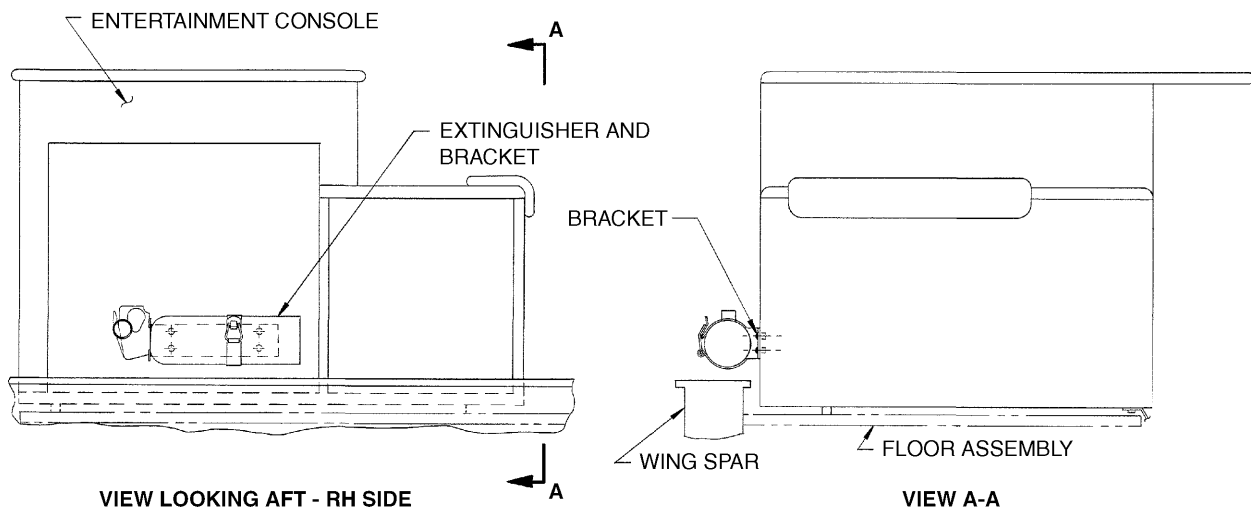
(1) Monthly

Inspect monthly or more frequently. Ensure nozzle is not obstructed and safety seal is intact. Inspection is a "quick check" that an extinguisher is available and will operate. It is intended to give reasonable assurance that the extinguisher is fully charged and operable. This is done by seeing that it is in its designated place, that it has not been actuated (discharged) or tampered with, and that there is no obvious physical damage or condition to prevent operation. Determine fullness by weighing or "hefting."

(2) 100 Hour / Annual

Each 100 hours or annually, whichever comes first, weigh the extinguisher. Replace and return to manufacturer if gross weight is below the minimum specified on the nameplate.

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[Effectivity](#)
[Seneca V with Entertain.Console](#)

Fire Extinguisher Locator
Figure 1

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**GRIDS 2L10 THRU 2L24
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AIRPLANE MAINTENANCE MANUAL

CARD 3 OF 7

PA-34-220T

Seneca IV

(SN's 3447001 THRU 3447029)

SENECA

(SN's 3449001 AND UP)

THE NEW PIPER AIRCRAFT, INC.

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AEROFICHE REVISION STATUS

Revisions to Maintenance Manual (P/N 761-888) issued July 12, 1995, are as follows:

<u>Revision</u>	<u>Publication Date</u>	<u>Aerofiche Card Effectivity</u>
ORG950712	November 7, 1996	1, 2, 3, 4 and 5
PR980415	April 15, 1998	1, 2, 3, 4 and 5
PR981115	November 15, 1998	1, 2, 3, 4 and 5
PR020531	May 31, 2002	1
CR050819	August 19, 2005	1, 2, 3, 4, 5, 6 and 7
PR051107	November 7, 2005	1, 2, 4 and 5
PR060428*	April 28, 2006	1, 2, 3, 4, 5, 6 and 7

*** PARTIAL REVISION OF MAINTENANCE MANUAL 761-888**

Revisions appear in Aerofiche Cards 1, 2, 3, 4, 5, 6, and 7. Accordingly, discard your existing Aerofiche Cards and replace them with the cards dated April 28, 2006.

Consult the Customer Service Information Aerofiche (P/N 1753-755) for current revision dates for this manual.

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INTRODUCTION

1. Instructions for Continued Airworthiness

WARNING: INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA) FOR ALL NON-PIPER APPROVED STC INSTALLATIONS ARE NOT INCLUDED IN THIS MANUAL. 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 ICA 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, THE PIPER PROVIDED ICA MAY NOT BE VALID FOR AIRPLANES SO MODIFIED.

The PIPER PA-34-220T Seneca IV / V Maintenance Manual constitutes the Instructions for Continued Airworthiness (ICA) as required by Federal Aviation Regulations (FAR) Part 23, Appendix G. Chapter 4 contains the Airworthiness Limitations section (4-00-00) and the Inspection Program is in Chapter 5 (5-20-00).

2. General

This publication is prepared in accordance with the General Aviation Manufacturers Association (GAMA) Specification No. 2, with respect to the arrangement and content of the System/Chapters within the designated Chapter/Section-numbering system.

WARNING: USE ONLY GENUINE PIPER AIRCRAFT PARTS OR PIPER AIRCRAFT APPROVED PARTS OBTAINED FROM PIPER APPROVED SOURCES, IN CONNECTION WITH THE MAINTENANCE AND REPAIR OF PIPER AIRPLANES.

This manual generally does not contain hardware callouts for installation. Hardware callouts are only indicated where a special application is required. To confirm the correct hardware used, refer to the PA-34-220T Parts Catalog, P/N 761-887, and FAR 43 for proper use.

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.

THE NEW PIPER AIRCRAFT, INC. expressly disclaims any responsibility for malfunctions, failures, damage or injury caused by use of non-PIPER approved parts.

NOTE: THE NEW PIPER AIRCRAFT, INC. expressly reserves the right to supersede, cancel and/or declare obsolete any part, part numbers, kits or publication that may be referenced in this manual without prior notice.

In any question concerning the care of your airplane, be sure to include the airplane serial number in any correspondence.

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3. Effectivity

This maintenance manual is effective for PA-34-220T Seneca IV airplanes, serial numbers 3447001 thru 3447029, and Seneca V airplanes, serial numbers 3449001 and up.

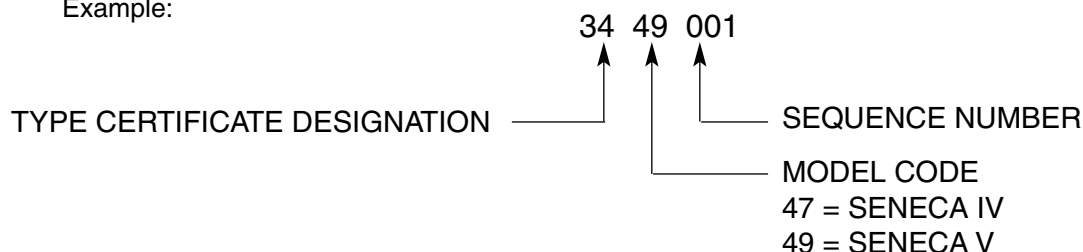
This encompasses the following model years:

NOTE: The following is provided as a general reference only.

<u>Model</u>	<u>Serial Numbers</u>	<u>Model Year</u>
Seneca IV	3447001 thru 3447012	1995
	3447013 thru 3447029	1996
Seneca V	3449001	Prototype
	3449002 thru 3449041	1997
	3449042 thru 3449096	1998
	3449097 thru 3449151	1999
	3449152 thru 3449195	2000
	3449196 thru 3449231	2001
	3449232,	2002
	3449237 thru 3449239, and	
	3449241 thru 3449268	
	3449269, 3449273, and	2003
	3449275 thru 3449300	
	3449301 thru 3449310	2004
	3449311 thru 3449322	2005
	3449323 and Up	2006

4. Serial Number Explanation

Example:



5. Assignment of Subject Material

This publication is divided into industry standard, three element, numeric subject groupings as follows:

- A. System/Chapter - The various groups are broken down into major systems such as Environmental Systems, Electrical Power, Landing Gear, etc. They are assigned a number, which becomes the first element of the standardized numbering system. Thus, the element "28" of the number 28-40-01 refers to the chapter "Fuel". Everything concerning the fuel system will be covered in this chapter.
- B. Sub-System/Section - The major systems/chapters of an airplane are broken down into subsystems. These sub-systems are identified by the second element of the standard numbering system. The element "40" of the number 28-40-01 concerns itself with the indicating section of the fuel system.

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- C. Unit/Subject - The individual units within a sub-system/section may be identified by the third element of the standard numbering system. The element "01" of the number 28-40-01 is a subject designator. This element is assigned at the option of the manufacturer and is normally zeroed out by PIPER.

Refer to paragraph 14, Chapter/Section Index Guide, for a complete breakdown and list. The material is arranged in ascending numerical sequence.

6. Pagination

The Chapter - Section (i.e. - 28-40-00) numbering system (explained above) forms the primary page numbering system for this manual. Within each Section, pages are numbered consecutively beginning with Page 1 (i.e. - 28-40-00, Page 1). Additionally, the aerofiche grid numbering system (explained below) is also used to indicate location within the manual.

7. Aerofiche Effectivity

- A. The General Aviation Manufacturers Association (GAMA) has developed specifications for microfiche reproduction of aircraft publications. The information compiled in this Aerofiche Maintenance Manual will be kept current by revisions distributed periodically. These revisions will supersede all previous revisions and will be complete Aerofiche card replacements and shall supersede Aerofiche cards of the same number in the set. The "Aerofiche Effectivity" page at the front of this manual lists the current revision for each card in this set.

- B. Conversion of Aerofiche alpha/numeric grid code numbers:

First number is the Aerofiche card number.

Letter is the horizontal row reference per card.

Second number is the vertical column reference per card.

Example: 2J16 = Aerofiche card number two, row J, column 16.

- C. To aid in locating information, the following is provided at the beginning of each aerofiche card:

- (1) A complete Introduction containing the Chapter/Section Index Guide for all fiche in this set.
(2) A complete subject Index for all fiche in this set.

8. Identifying Revised Material

A revision to a page is defined as any change to the printed matter that existed previously. Revisions, additions and deletions are identified by a vertical line (i.e. - change bar) along the left-hand margin of the page opposite only that portion of the printed matter that was changed.

A change bar in the left-hand margin opposite the footer (i.e. - chapter/section/subject, page number and date), indicates that the text was unchanged but the material was relocated to a different page.

Example.

NOTE: Change bars are not used in the title pages, list of effective pages, or index.

9. Indexing

An alphabetically arranged subject Index follows this introduction to assist the user in locating desired information. In addition, each System/Chapter begins with an individual Table of Contents.

10. List of Effective Pages

Each System/Chapter has a List of Effective Pages preceding the Table of Contents to identify the effective revision date for each page in that chapter.

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11. Warnings, Cautions and Notes

These adjuncts to the text are used to highlight or emphasize important points when necessary. **Warnings** call attention to use of materials, processes, methods, procedures or limits which must be followed precisely to avoid injury or death to persons. **Cautions** call attention to methods and procedures which must be followed to avoid damage to equipment. **Notes** call attention to methods which make the job easier. Warnings and Cautions shall be located directly above and Notes directly beneath the text and be in line with the paragraphs to which they apply.

12. Accident/Incident Reporting

To improve our Service and Reliability system and aid in our compliance with FAR 21.3, knowledge of all incidents and/or accidents must be reported to Piper immediately. To expedite and assist in reporting all incidents and accidents, Piper Form 420-01 has been created. See Service Letter 1041 for latest revision. This procedure is to be used by all Dealers, Service Centers and Repair Facilities.

13. Supplementary Publications

The following publications/sources provide servicing, overhaul and parts information for the PA-34-220T Seneca IV / V airplanes and their various components. Use them to supplement this manual.

A. Piper Publications: (by Part Number)	Seneca IV	Seneca V
(1) Parts Catalog:	761-887	761-887
(2) Periodic Inspection Report:	230-1061	767-012
(3) Progressive Inspection Manual (50 Hour):	761-753	767-006

B. Vendor Publications:

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY.

(1) AIR CONDITIONING COMPRESSOR:

Vendor:	Sanden International (USA), Inc. 601 South Sanden Blvd. Wylie, TX 75098-4999 http://www.sanden.com	PH: - (972) 442-8400
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(2) AUTOFLIGHT:

Vendor(s):	Honeywell One Technology Center 23500 W. 105th St., M/D #45 Olathe, Kansas 66061-1950 http://www.bendixking.com/	(or)	S-TEC Corporation One S-TEC Way Mineral Wells, Tx 76067 PH: - (940) 325-9406 www.s-tec.com
Flight Control:	Bendix/King		
System Flight Line	KFC 150		
Installation Manual:	P/N 006-0287-00		

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(3) BATTERY:

Vendor:	GILL Batteries	PH: - (800) 456-0070
	A Division of Teledyne Continental Motors	
	http://www.gillbatteries.com	

(4) BRAKES AND WHEELS:

Vendor:	Parker Hannifin Corp.	PH: - (800) 272-5464
	Aircraft Wheel and Brake Division	
	1160 Center Road	
	Avon, Ohio 44011	
	http://www.parker.com/cleveland/Universe/book.pdf	

(5) ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS):

Vendor:	Meggitt Avionics, Inc.	PH: - (603) 669-0940
	10 Ammon Drive	FAX: - (603) 669-0931
	Manchester, NH 03103-7406	
	http://www.meggittavi.com/	

Vendor:	Avidyne Corporation	PH - (800) 284-3963
	55 Old Bedford Road	
	Lincoln, MA 01773	
	http://www.avidyne.com/index.htm	

Instructions for Continued Airworthiness

Primary Flight Display and Magnetometer/OAT:	Document No. AVPFD-174
Multifunction Display:	Document No. AVMFD-167
Data Acquisition Unit:	Document No. AVSIU-011

(6) EMERGENCY LOCATOR TRANSMITTER:

Vendor:	Artex Aircraft Supplies	PH: - (800) 547-8901
	14405 Keil Road NE	
	Aurora, Oregon 97002	
	http://www.artex.net/	

(7) ENGINE:

Vendor:	Teledyne Continental Motors	PH: - (800) 718-3411
	Attn: Aircraft Products Division	FAX: - (251) 432-7352
	Mobile, Alabama 36601	

[SENECA IV](#)

Overhaul Manual =	CONTINENTAL - Form No. X-30030A
Parts Catalog =	CONTINENTAL - Form No. X-30031A
Operators Handbook =	CONTINENTAL - Form No. X-30553

[SENECA V](#)

Maintenance Manual =	CONTINENTAL - Form No. X-30645A
Overhaul Manual =	CONTINENTAL - Form No. X-30596A

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(8) FIRE EXTINGUISHER (PORTABLE):

Vendor:	H3R Inc. 43 Magnolia Ave # 4 San Francisco, California 94123-2911 http://www.h3r.com/index.htm	PH: - (800) 249-4289
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(9) FUEL CELLS:

Vendor:	Engineered Fabrics Corporation 669 Goodyear Street Rockmart, Georgia 30153-0548 http://www.kfefc.com/index.htm	PH: - (770) 684-7855 FAX: - (770) 684-7438
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(10) FUEL PUMP:

Vendor:	Weldon Pumps P.O. Box 46579 640 Golden Oak Parkway Oakwood Village, Ohio 44146 http://www.weldonpumps.com/index.html	PH: - (440) 232-2282 FAX: - (440) 232-0606
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(11) GEAR LOCKING ACTUATORS, HYDRAULIC PUMP, AND ALL HYDRAULIC COMPONENTS:

Vendor:	Parker Hannifin Corporation 6035 Parkland Boulevard Cleveland, OH 44124-4141 USA email: c-parker@parker.com	PH: - (800) C-PARKER (800) 272-7537 FAX: - (440) 266-7400
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(12) KEVLAR:

Vendor:	KEVLAR Special Products E.I. DuPont De Nemours & Co. Inc. Textile Fibers Department Centre Road Building Wilmington, Delaware 19898
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A Guide to Cutting and Machining Kevlar Aramid

(13) LIGHTS - NAVIGATION, STROBE, AND MAP LIGHTS:

Vendor:	Whelen Engineering Co. Inc. Route 145, Winthrop Rd. Chester, Connecticut 06412 http://www.whelen.com/	PH: - (860) 526-9504 FAX: - (860) 526-2009
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(14) MAGNETOS:

Vendor: TCM Aircraft Products PH: - (800) 718-3411
P. O. Box 90 FAX: - (251) 432-7352
Mobile, AL 36601
<http://www.tcmlink.com/>

Installation, Operation and Maintenance Teledyne Continental Motors (TCM)
Service Support Manual, P/N x42002

Instructions = S-20 / S-200 Series High Tension Magnets

or,

Vendor: Slick Aircraft Products PH: - (904) 739-4000
Unison Industries FAX: - (904) 739-4006
Attn: Subscription Service
7575 Baymeadows Way
Jacksonville, FL 32256
http://www.unisonindustries.com/news/service_documents.html

Installation, Operation and Maintenance F1100 MASTER SERVICE MANUAL,
4300/6300 SERIES MAGNETO MAINTENANCE AND
Instructions: OVERHAUL MANUAL - L-1363

(15) NAVIGATION, COMMUNICATIONS, AND GPS (NAV/COM/GPS):

Vendor: Garmin International PH: - (913) 397-8200
1200 East 151ST Street
Olathe, KS 66062
<http://www.garmin.com>

(16) OXYGEN SYSTEM:

Vendor: Scott Aviation PH: - (716) 683-5100
2225 Erie Street
Lancaster, New York 14086
<http://www.scottaviation.com/>

(17) PROPELLER:

Vendor: Hartzell Propeller Inc. PH: - (937) 778-4379
One Propeller Place FAX: - (937) 778-4321
Piqua, OH 45356-2634
<http://www.hartzellprop.com/index2.htm>

Overhaul Instructions: Manual No. 117

or,

Vendor: McCauley Accessory Division
3535 McCauley Drive
P.O. Drawer 5053
Vandalia, Ohio 45377-5053

McCAULEY C500 SERIES SERVICE MANUAL - P/N 810915

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(18) STANDBY ATTITUDE INDICATOR:

Vendor Address: Mid-Continent Instruments Co., Inc. PH - (316) 630-0101
9400 E. 34 TH Street N. FAX - (316) 630-0723
Wichita, KS 67226
<http://www.mcico.com/index.html>

Installation Manual and
Operating Instructions: Manual No. 9015762

(19) STARTER:

Electro Systems, Inc.
(see "Voltage Regulator," below)

(20) VACUUM PUMP:

Vendor: Aero Accessories, Inc. PH: - (800) 822-3200
1240 Springwood Avenue
Gibsonville, NC 27249
<http://www.aeroaccessories.com/index.html>

(21) VACUUM REGULATOR:

Vendor: Parker Hannifin Corp. PH: - (800) 382-8422
Airborne Division
711 Taylor Street
Elyria, Ohio 44035
<http://www.parker.com/cleveland/Universe/book.pdf>

(22) VOLTAGE REGULATOR:

Vendor: Electro Systems, Inc. PH: - (888) 461-6077
Airport Complex
P. O. Box 273
Fort Deposit, Alabama 36032
<http://www.kellyaerospace.com/index.htm/>

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14. Chapter/Section Index Guide

NOTE: The following GAMA Specification No. 2 standard chapters are not included in this Maintenance Manual: 23, 36, 38, 49, 53, 54, 60, 72, 75, and 83. These chapters are omitted because the subject system is either: not installed in these airplanes; adequately covered in vendor or other manuals; or, for ease of use, has been combined with another chapter.

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		00 Airworthiness Limitations	
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		00 General	
		10 Time Limits	
		20 Scheduled Maintenance	
		30 Special Inspections	
		50 Unscheduled Maintenance Checks	
6	DIMENSIONS AND AREAS		1E11
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7	LIFTING AND SHORING		1F5
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		20 Leveling	
9	TOWING AND TAXIING		1G1
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		20 Taxiing	
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		20 Mooring	
11	PLACARDS AND MARKINGS		1G21
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		30 Interior Placards	
12	SERVICING		1H15
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		10 Replenishing	
		20 Scheduled Servicing	

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		20 Painting	
21	ENVIRONMENTAL SYSTEMS		2C1
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		20 Distribution	
		40 Heating	
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		30 Stabilator Controls	
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		40 Windows and Windshield	
		60 Propellers	
		80 Detection	
31	INDICATING / RECORDING SYSTEMS		4C1
		50 Central Warning Systems	
32	LANDING GEAR		4C17
		00 General	
		10 Main Gear and Doors	
		20 Nose Gear and Doors	
		30 Extension and Retraction	
		40 Wheels and Brakes	
		60 Position and Warning	
33	LIGHTS		4G5
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39	ELECTRICAL/ELECTRONIC PANELS		5E5
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70	STANDARD PRACTICES - ENGINE		6D9
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71	POWER PLANT		6D17
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**GRIDS 3A22 THRU 3A24
INTENTIONALLY BLANK**

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CHAPTER 27 - FLIGHT CONTROLS

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GENERAL

1. Description and Operation

The airplane is controlled in flight by the use of three primary control surfaces, consisting of ailerons, stabilator, and rudder. Operation of these controls is through the movement of the control column-tee bar assembly and rudder pedals. On the forward end of each control column is a sprocket assembly. A chain is wrapped around the sprockets to connect the right and left controls and then back to idler sprockets on the column's tee bar, which in turn connect to the aileron primary control cables. The cables operate the aileron bellcrank and push-pull rods. The stabilator is controlled by a cable connected to the bottom of the tee bar assembly and operates an aft fuselage bellcrank which controls a push rod connected to the balance arm of the stabilator. Cables also connect the rudder pedals with the rudder horn. Provisions for directional and longitudinal trim control is provided by an adjustable trim mechanism for the stabilator and rudder. The stabilator trim is controlled by a wheel and drum mounted on the floor tunnel between the front seats. Cables routed aft from the drum to a screw assembly mounted above the stabilator attachment point. This screw assembly in turn moves the push rod which controls the stabilator trim tab. The rudder trim is controlled by a knob and screw assembly attached to the rudder pedal assembly. The flaps are electrically operated.

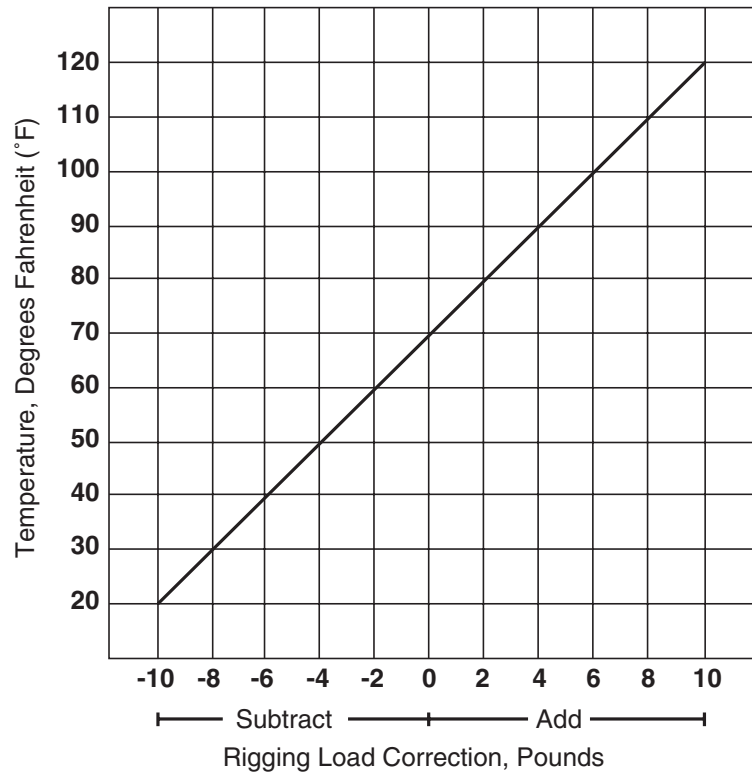
2. Standard Practices and Procedures

The following tips may be helpful where applicable in the individual control system procedures.

- A. Turnbuckles must be assembled and adjusted in a manner that each terminal end is screwed an approximately equal distance into the barrel. During adjustment, the terminals must not be turned in a manner which would put a permanent twist in the cable.
- B. After adjustment is complete, each turnbuckle must be checked. Not more than three terminal threads shall be visible outside the barrel. Locking clips must be installed and checked for proper installation by trying to remove the clips using fingers only. Both locking clips may be inserted in the same holes of the turnbuckle barrel, or they may be installed in opposite holes. Locking clips which have been installed and removed must be scrapped and new clips used.
- C. Torque all nuts in the flight control surface rigging system in accordance with AC 43.13-1, latest revision, or to torques specified within this manual.
- D. After completion of adjustment, each jam nut must be tightened securely and inspected 100%.
- E. On push rods or rod ends provided with an inspection hole, the screw must be screwed in sufficiently far to pass the hole. This can be determined visually or by feel, by inserting a piece of wire into the inspection hole. If no inspection hole is provided, a minimum of .375 of an inch thread engagement must be maintained.
- F. All cable rigging tensions given must be corrected to ambient temperature in the area where the tension is being checked by using Chart 1.
- G. See Figure 2, 20-00-00, for the proper method of adjusting rod ends to prevent possible damage and binding of bearing surface in rod end.
- H. All pulley guard pins should be properly installed.

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CHART 1
CABLE TENSION vs. AMBIENT TEMPERATURE



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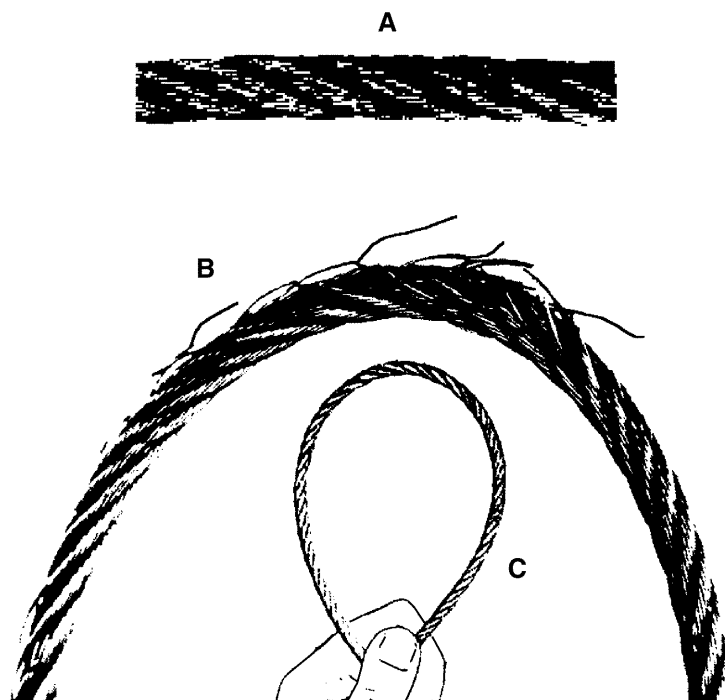
3. Control Cable Inspection

Aircraft control cable systems are subject to a variety of environmental conditions and forms of deterioration that, with time, may be easy to recognize as wire/strand breakage or the not-so-readily visible types of wear, corrosion, and/or distortion. The following data may help in detecting the presence of these conditions:

A. Cable Damage

Critical areas for wire breakage are sections of the cable which pass through fairleads and around pulleys. To inspect each section which passes over a pulley or through a fairlead, remove cable from aircraft to the extent necessary to expose that particular section. Examine cables for broken wires by passing a cloth along length of cable. This will clean the cable for a visual inspection, and detect broken wires, if the cloth snags on cable. When snags are found, closely examine cable to determine full extent of damage.

The absence of snags is not positive evidence that broken wires do not exist. Figure 1 (A) shows a cable with broken wires that were not detected by wiping, but were found during a visual inspection. The damage became readily apparent (Figure 1 (B)) when the cable was removed and bent using the techniques depicted in Figure 1 (C).

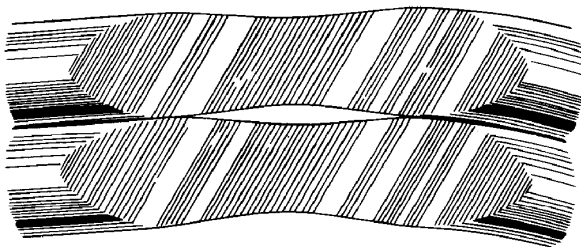


Control Cable Inspection Technique
Figure 1

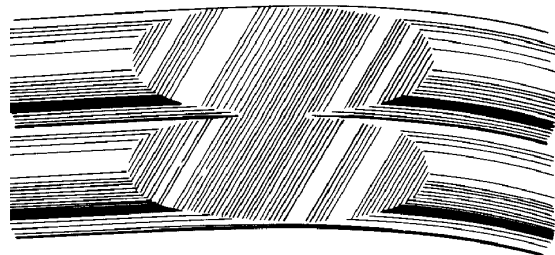
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B. External Wear Patterns

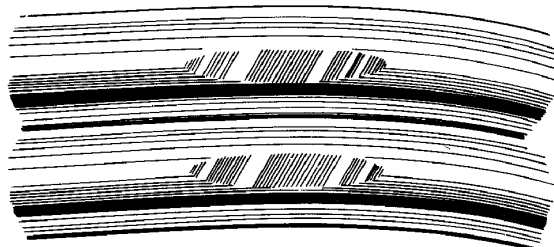
Wear will normally extend along cable equal to the distance cable moves at that location. Wear may occur on one side of the cable only or on its entire circumference. Replace flexible and non-flexible cables when individual wires in each strand appear to blend together (outer wires worn 40-50 percent) as depicted in Figure 2.



**INDIVIDUAL OUTER WIRES
WORN MORE THAN 50%**



**INDIVIDUAL OUTER WIRES WORN
MORE THAN 40 - 50 %
(NOTE BLENDING OF WORN AREAS)**



**INDIVIDUAL OUTER WIRES WORN LESS THAN 40%
(WORN AREAS INDIVIDUALLY DISTINGUISHABLE)**

**Cable Wear Patterns
Figure 2**

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C. Internal Cable Wear

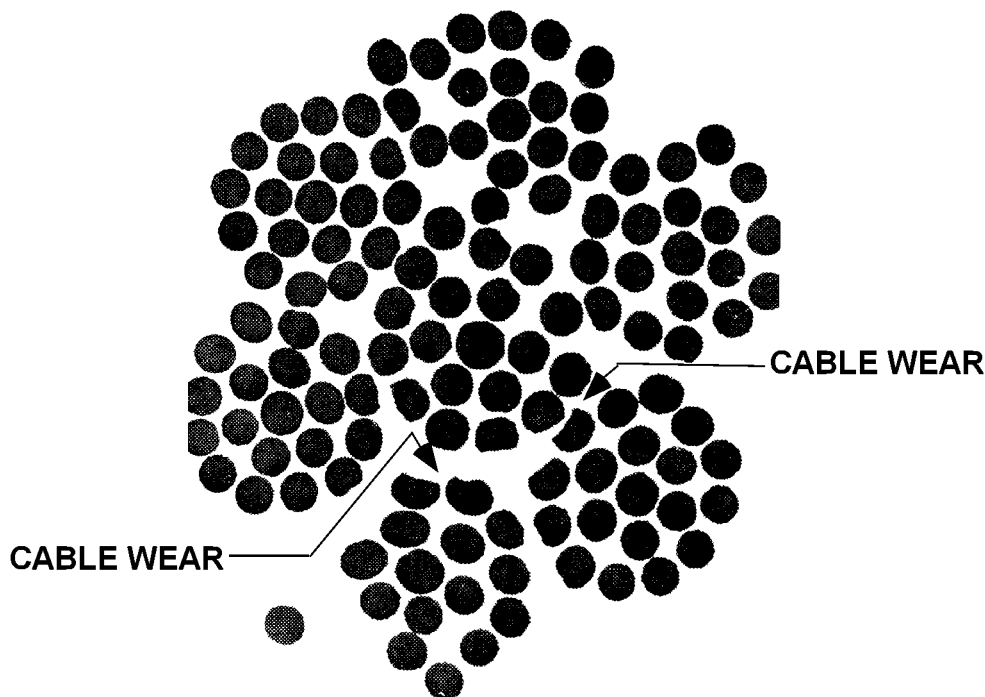
As wear is taking place on the exterior surface of a cable, the same condition is taking place internally, particularly in the sections of the cable which pass over pulleys and quadrants. This condition, shown in Figure 3, is not easily detected unless the strands of the cable are separated. Wear of this type is a result of the relative motion between inner wire surfaces. Under certain conditions the rate of this type wear can be greater than that occurring on the surface.

D. Corrosion

Carefully examine any cable for corrosion that has a broken wire in a section not in contact with wear producing airframe components such as pulleys, fairleads, etc. It may be necessary to remove and bend the cable to properly inspect it for internal strand corrosion as this condition is usually not evident on the outer surface of the cable. Replace cable segments if internal strand rust or corrosion is found.

Areas especially conducive to cable corrosion are battery compartments, lavatories, wheel wells, etc., where concentrations of corrosive fumes, vapors, and liquids can accumulate.

NOTE: Check all exposed sections of cable for corrosion after a cleaning and/or metal-brightening operation has been accomplished in that area.



Internal Cable Wear
Figure 3

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E. Cable Maintenance

CAUTION: TO AVOID REMOVAL OF CORROSION-PREVENTATIVE COMPOUNDS AND CABLE INTERNAL LUBRICANT, DO NOT USE VAPOR DEGREASING, STEAM CLEANING, METHYLETHYLKETONE (MEK) OR OTHER SOLVENTS.

CAUTION: DO NOT OIL CONTROL CABLES.

Frequent inspections and preservation measures such as rust prevention treatments for bare cable areas will help to extend cable service life. Where cables pass through fairleads, pressure seals, or over pulleys, remove accumulated heavy coatings of corrosion prevention compound. Provide corrosion protection for these cable sections by lubricating as specified in the Lubrication Chart, 12-20-00.

F. Cable Fittings

(1) 100 Hour Standard Inspection

Check swaged terminal reference marks for any indication of cable slippage within fitting. Inspect fitting assembly for distortion and/or broken strands at the terminal. Check that all bearings and swivel fittings (bolted or pinned) pivot freely to prevent binding and subsequent failure. Check turnbuckles for proper thread exposure and broken or missing safety wires/clips.

Pay particular attention to corrosion and "pitting" on cable terminals, turnbuckles and cable fittings. Any corrosion or pitting found requires replacement of the corroded fitting and/or cable.

(2) 100 Hour Special Inspection

For airplanes 15 years old or older, using a 10X magnifier, visually inspect the entire surface of each cable terminal, turnbuckle, or other cable fitting for corrosion or cracking. Inspect under safety wire or clips wrapped around the cable or fitting. Any evidence of corrosion or cracking, however minute, is cause for replacement. A logbook entry documenting the replacement of a cable terminal, turnbuckle, or other cable fitting relieves the inspection requirement for that fitting only, until such time as that fitting has been in service for 15 years.

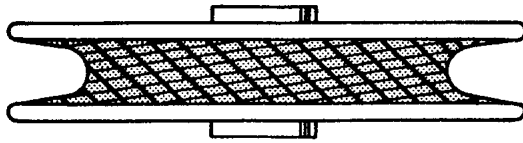
G. Pulleys

Inspect pulleys for roughness, sharp edges, and presence of foreign material embedded in the grooves. Examine pulley bearings to assure proper lubrication, smooth rotation, freedom from flat spots, dirt, and paint spray. Periodically rotate pulleys, which turn through a small arc, to provide a new bearing surface for the cable. Maintain pulley alignment to prevent the cable from riding on flanges and chafing against guards, covers, or adjacent structure. Check all pulley brackets and guards for damage, alignment, and security.

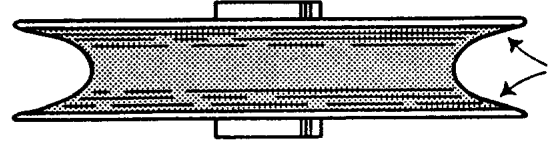
Pulley Wear Patterns

Various cable system malfunctions may be detected by analyzing pulley conditions. These include such discrepancies as too much tension, misalignment, pulley bearing problems, and size mismatches between cables and pulleys. Examples of these conditions are shown in Figure 4.

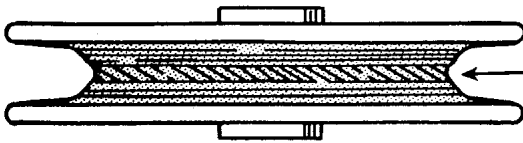
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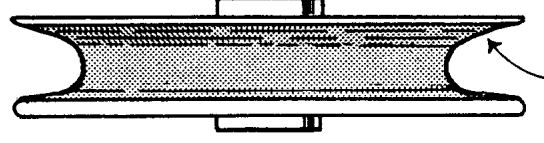
EXCESSIVE CABLE WEAR



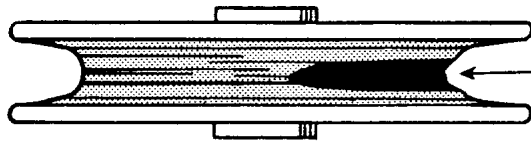
PULLEY MISALIGNMENT



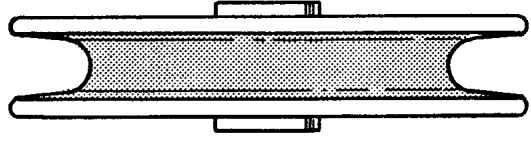
PULLEY TOO LARGE FOR CABLE



CABLE MISALIGNMENT



FROZEN BEARING



NORMAL CONDITION

Pulley Wear Patterns
Figure 4

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AILERON CONTROLS

1. Troubleshooting

Chart 1 lists troubles peculiar to aileron flight controls along with their probable causes and suggested remedies. When troubleshooting the aileron flight controls, additional reference may be obtained from Chapter 57 on control surface balancing, if required. After the trouble has been corrected, check the entire aileron flight control system for security and operation.

**CHART 1 (Sheet 1 of 2)
TROUBLESHOOTING AILERON CONTROL SYSTEM**

Trouble	Cause	Remedy
Lost motion between control wheel and aileron.	Cable tension too low.	Adjust cable tension.
	Linkage loose or worn.	Check linkage and tighten or replace.
	Broken pulley.	Replace pulley.
	Cables not in place on pulleys.	Install cables correctly. Check cable guards.
Resistance to control wheel rotation.	System not lubricated properly.	Lubricate system.
	Cable tension too high.	Adjust cable tension.
	Control column horizontal cable improperly adjusted.	Adjust cable tension.
	Pulleys binding or rubbing.	Replace binding pulleys and/or provide clearance between pulleys and brackets.
	Cables not in place on pulleys.	Install cables correctly. Check cable guards.
	Bent aileron and/or hinge.	Repair or replace aileron and/or hinge.
	Cables crossed or routed incorrectly.	Check routing of control cables.
Control wheels not synchronized.	Incorrect control column rigging.	Re-rig control column.
Control wheels not horizontal when ailerons are neutral.	Incorrect rigging of aileron system.	Re-rig aileron system.

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CHART 1 (Sheet 1 of 2)
TROUBLESHOOTING AILERON CONTROL SYSTEM

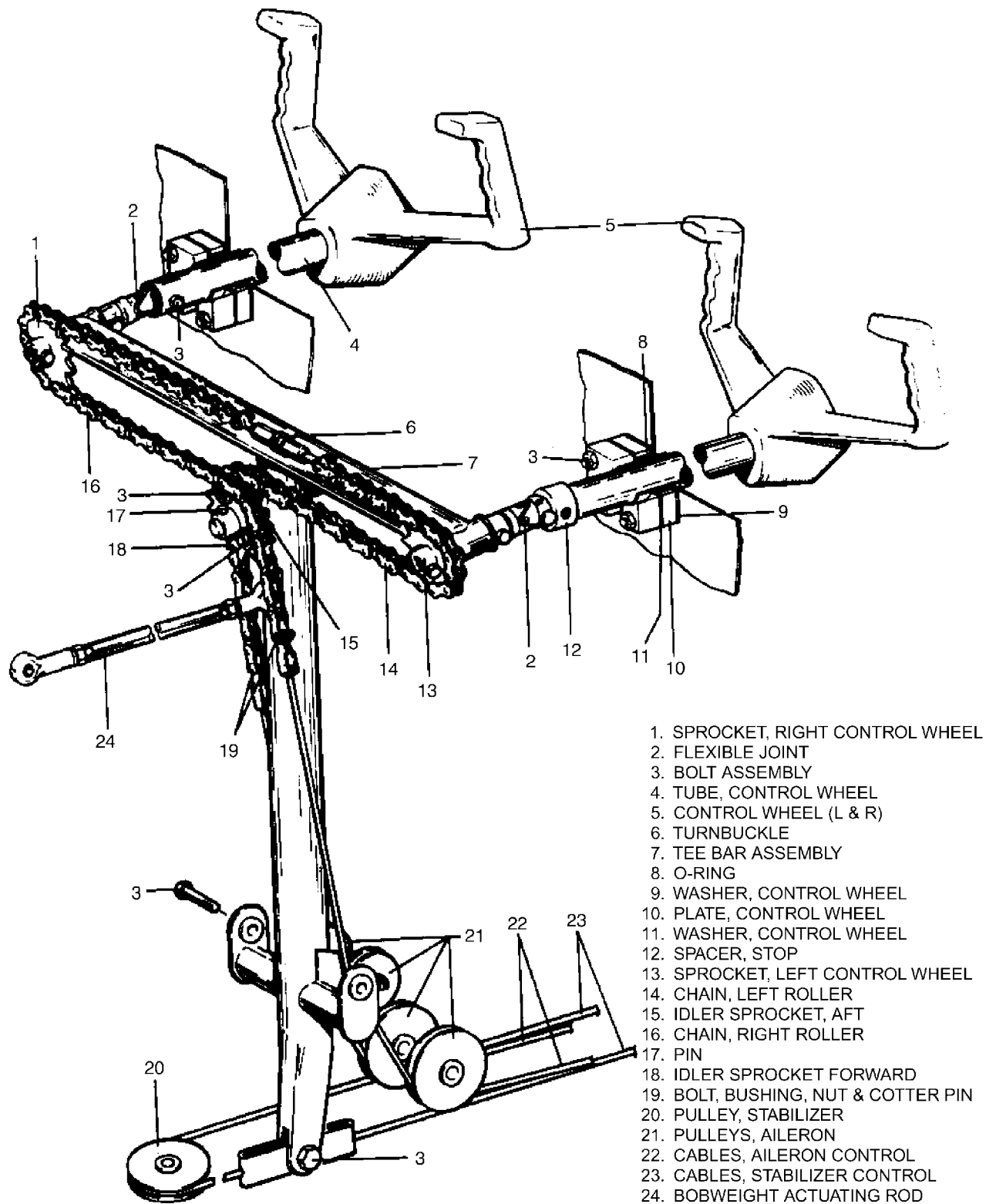
Trouble	Cause	Remedy
Incorrect aileron travel.	Aileron control rods not adjusted properly.	Adjust control rods.
	Aileron bellcrank stops not adjusted properly.	Adjust bellcrank stops.
Correct aileron travel cannot be obtained by adjusting stops.	Incorrect rigging of aileron cables, and/or control wheel.	Re-rig controls.
Control wheel stops before control surfaces reach full travel.	Incorrect rigging between control wheel and control cables.	Re-rig controls.

2. Control Column Assembly

A. Removal (See Figure 1.)

- (1) To remove either control wheel with tube, the following procedure may be used:
 - (a) Separate the control wheel tube from the flexible joint that is located on either side of the tee bar assembly by removing the nut, washer and bolt. Pull the tube from the flexible joint.
 - (b) If removing the left control tube, slide the stop from the tube.
 - (c) Should wires for the various Autopilot systems be installed in the control tube, disconnect them at the quick disconnect terminals behind the instrument panel. Draw the wires back into the tube and back out through the forward end of the tube.
 - (d) Remove the control wheel assembly from the instrument panel.
- (2) The tee bar with assembled parts may be removed from the airplane by the following procedure:
 - (a) Remove the access panel to the aft section of the fuselage.
 - (b) Relieve cable tension from the stabilator control cables at one of the stabilator cable turnbuckles in the aft section of the fuselage.
 - (c) Relieve tension from the aileron control cables and chains at the turnbuckle that connects the chains at the top of the tee bar.
 - (d) Disconnect the control chains from the control cables where the chains and cables join by removing the cotter pins, nuts, bolts and bushings.
 - (e) If the control wheel assemblies have not been previously disconnected from the tee bar assembly, separate the control wheel tubes at the flexible joints by removing the nuts, washers and bolts.
 - (f) Disconnect the bobweight actuating rod at the tee bar.
 - (g) Remove the tunnel plate just aft of the tee bar by laying back enough tunnel carpet to remove the plate attachment screws.
 - (h) Remove the two aileron control cable pulleys attached to the lower section of the tee bar by removing the pulley attachment bolt.
 - (i) Disconnect the stabilator control cables from the lower end of the tee bar assembly.

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Control Column Installation
Figure 1

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- (j) Disconnect the necessary control cables, such as the propeller pitch control, mixture control, etc., that will allow the tee bar assembly to be removed.
- (k) Remove the tee bar assembly by removing the attachment bolts with washers and nuts which are through each side of the floor tunnel. and lifting it up and out through the right side of the cabin.

B. Installation (See Figure 1.)

- (1) The tee bar assembly may be installed in the airplane by the following procedure:
 - (a) Swing the tee bar assembly into place from the right side of the cabin and secure with attachment bolts, washers, and nuts inserted in through each side of the floor tunnel.
 - (b) Connect the bobweight actuating rod to the tee bar. (See Figure 3 for proper rigging of bobweight.)
 - (c) Connect the stabilator control cables to the lower end of the tee bar with bolt, washer, nut and cotter pin. Allow the cable ends free to rotate.
 - (d) Place the aileron control cables around the pulleys that attach to the lower section of the tee bar: position pulleys and secure with bolt, washers and nut.
 - (e) Install the control wheel.
 - (f) Place the control wheels in neutral (centered) position and install the aileron control chains on the control wheel sprockets and idler cross-over sprockets. The turnbuckle must be centered between the two control wheel sprockets.
 - (g) Loosen the connecting bolts of the idler sprockets to allow the chain to fit snug around the control wheel sprockets and over the idler sprockets.
 - (h) Connect the aileron control cables to the ends of the chains with bolts, bushings, nuts and cotter pins.
 - (i) Adjust the chain turnbuckle between the two control wheel sprockets to allow the control wheels to be neutral and obtain proper cable tension as given in Chart 1, 27-00-00. It may be necessary in order to have both control wheels neutral to set the chain turnbuckle to neutralize the wheels and then set cable tension with the turnbuckles located under the floor panel aft of the main spar as instructed in Rigging and Adjustment of Aileron Controls. Before safetying the turnbuckle, check that when the ailerons are neutral, the control wheels will be neutral and the chain turnbuckle centered. Also, the aileron bellcranks should contact their stops before the control wheel hits its stop. Models which have adjustable aileron tee bar stops must maintain .030 to .040 clearance between the sprocket pin and the adjustable stop bolts after the bellcranks contact their stops.
 - (j) Set stabilator cable tension with the turnbuckles in the aft section of the fuselage as described in the appropriate section of this chapter. Check safety of all turnbuckles upon completion of adjustments.
 - (k) Tighten the connecting bolts of the idler sprockets. (Torque 45 ± 5 in. lbs.)
 - (l) Install the floor tunnel plate and secure with screws. Fasten the tunnel carpet in place.
- (2) Either control wheel assembly may be installed by the following procedure:
 - (a) Insert the control wheel tube through the instrument panel.
 - (b) Should wires for the various Autopilot systems need to be installed in the control tube, route them through the hole in the forward side of the tube and out of the small hole in the side. Position the rubber grommet in the hole in the side of the tube.
 - (c) On the left control tube, install the stop.
 - (d) Connect the control wheel tube to the flexible joint of the tee bar assembly. If the control cables and or chains have not been removed or loosened, place the ailerons in neutral and install the control tube on the flexible joint to allow the control wheel to be neutral. Install bolt, washer and nut and tighten.

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(3) Control Wheel ([S/N's 3449042 and up.](#)) (See Figure 2.)

The retainer clip (P/N 104687-002) and MS24693-S40 screws (2 ea.) are factory installed in [S/N's 3449302 and up.](#) [S/N's 3449042 thru 3449301](#) must individually procure and retrofit the retainer clip and screws.

A. Removal

- (1) Remove two (2) screws and retainer clip.
- (2) Remove control wheel attachment screw and spacer.
- (3) Slide control wheel off of tube.

B. Installation

- (1) Degrease aft end of tube and inside of control wheel using acetone or naphtha. Allow to dry.
- (2) Degrease control wheel attachment screw, the spacer, and the nutplate (inside the tube) using acetone or naphtha. Allow to dry.
- (3) Prime inside of control wheel with Loctite 7649 (Piper P/N 279-073). Allow to dry.
- (4) Install control wheel onto tube using Loctite 271 (Piper P/N 279-128). Take care to ensure screw hole in control wheel aligns with screw hole in tube.

NOTE: This step must be accomplished promptly due to short cure time.

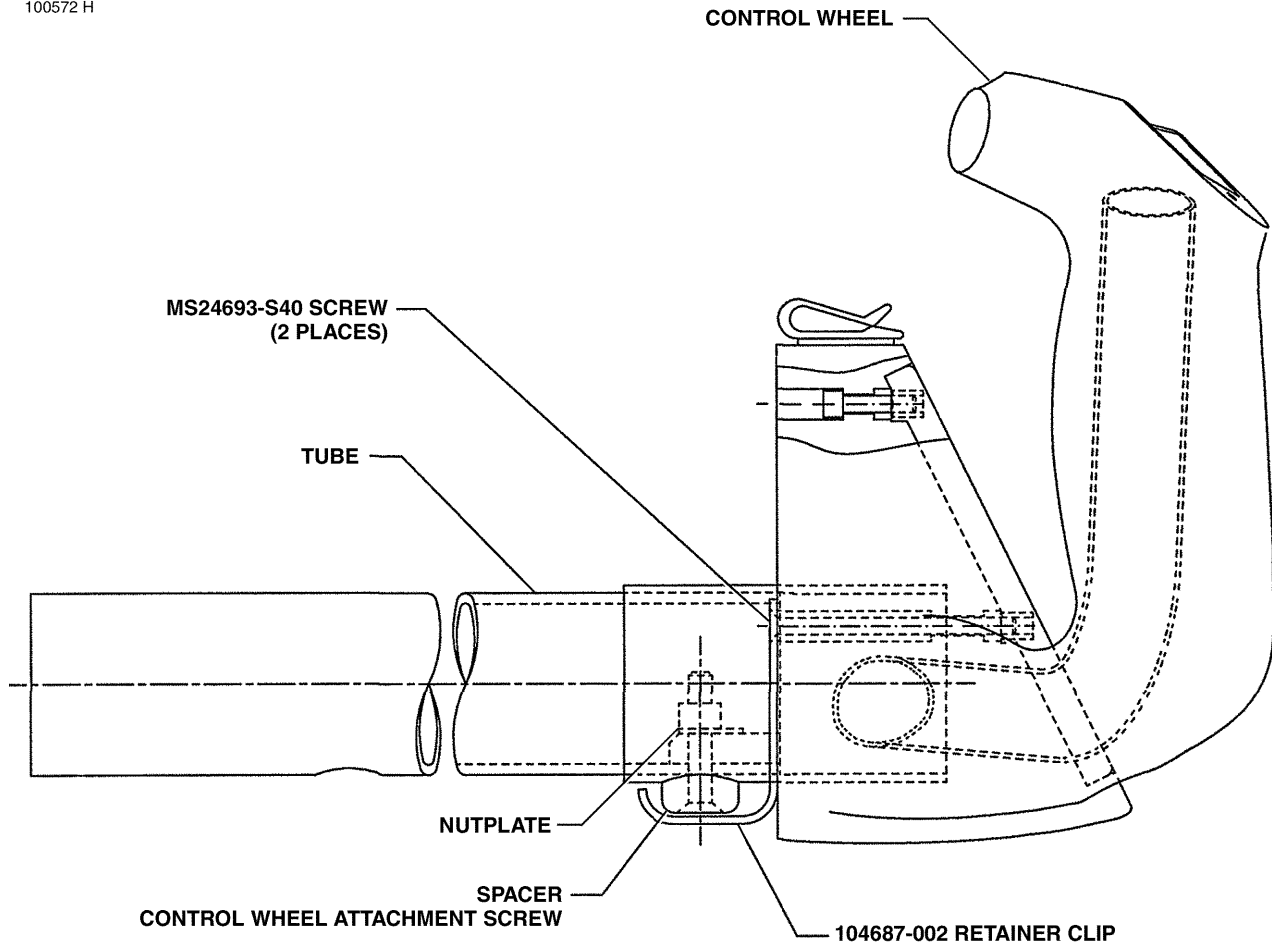
- (5) Prime threads of control wheel attachment screw with Loctite 7649 (Piper P/N 279-073). Allow to dry.
- (6) Install control wheel attachment screw (with spacer) into nutplate using Loctite 271 (Piper P/N 279-128).

NOTE: This step must be accomplished promptly due to short cure time.

- (7) Position retainer clip to capture spacer and control wheel attachment screw. Secure with screws (2), being careful not to over tighten the screws and damage the logo medallion.

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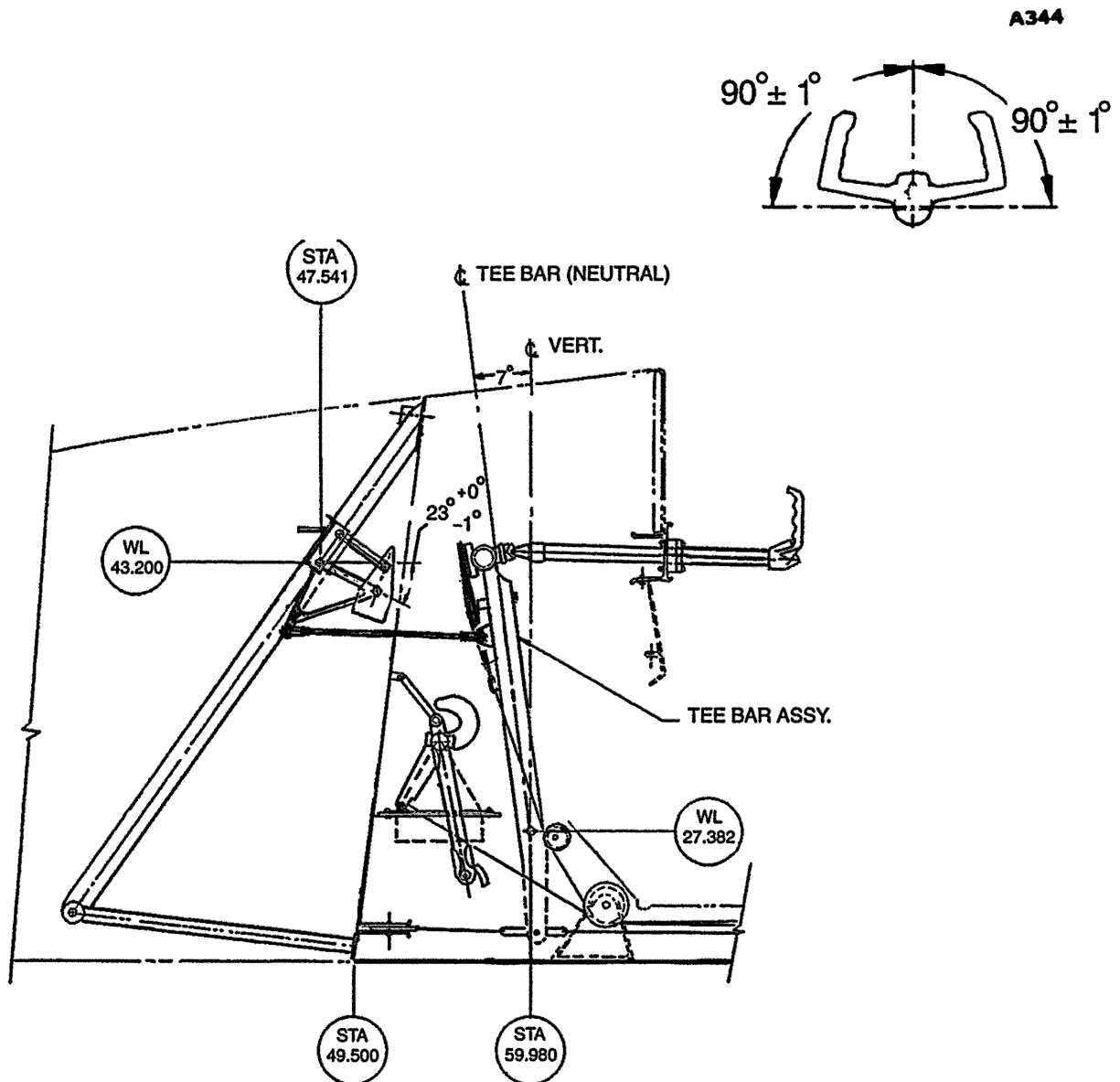
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Control Wheel Installation
Figure 2

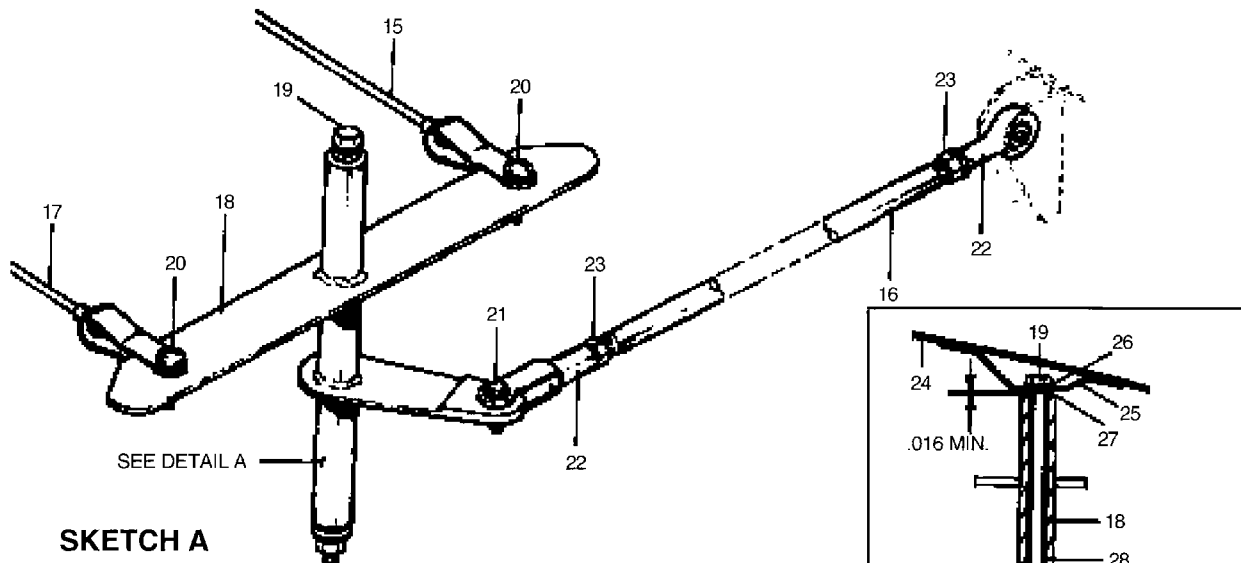
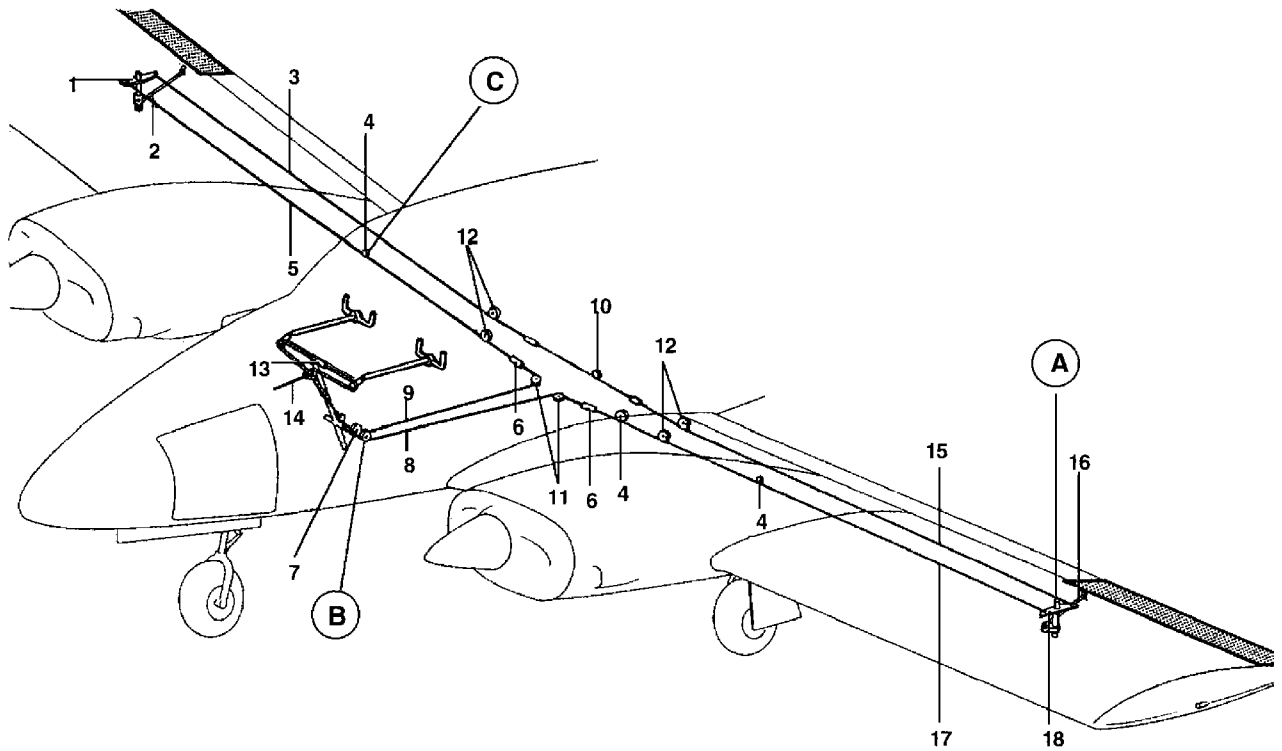
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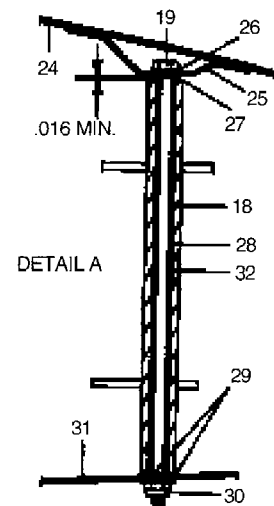
Control Column Rigging
Figure 3

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SKETCH A

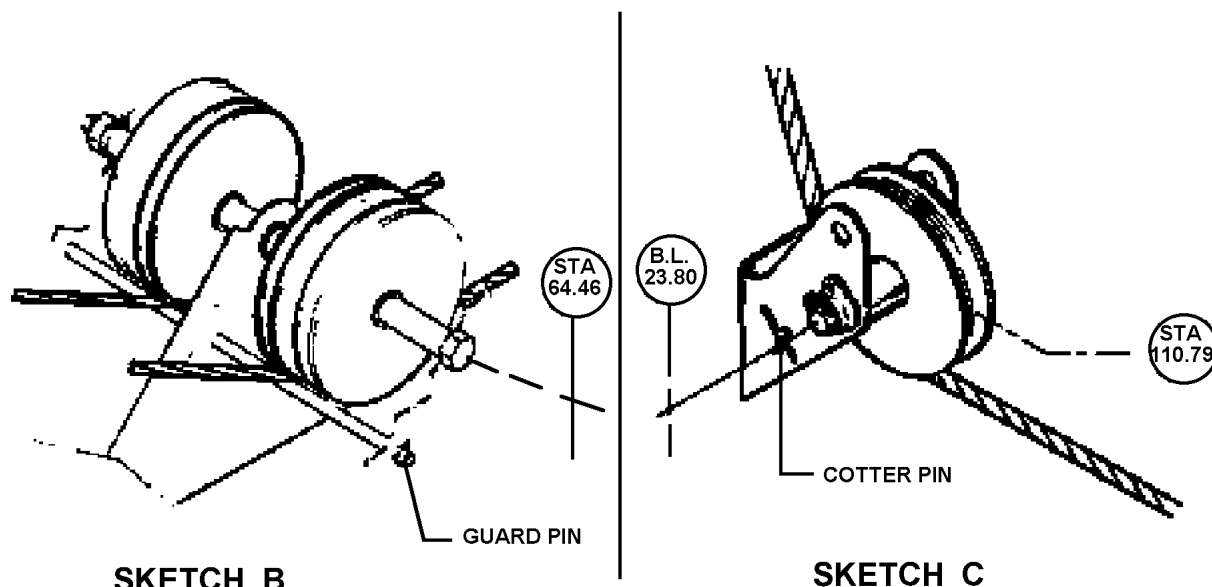
- | | | |
|------------------------------|--------------------------------|-----------------------|
| 1. BELLCRANK ASSY, RIGHT | 12. PULLEYS | 23. JAM NUT |
| 2. CONTROL ROD, RIGHT | 13. TURNBUCKLE, CONTROL CHAINS | 24. WING SKIN, TOP |
| 3. CABLE, BALANCE, RIGHT | 14. BOBWEIGHT ACTUATOR ROD | 25. BRACKET |
| 4. PULLEY | 15. CABLE, BALANCE, LEFT | 26. WASHER |
| 5. CABLE, CONTROL RIGHT | 16. CONTROL ROD, LEFT | 27. WASHER |
| 6. TURNBUCKLE, AILERON MAIN | 17. CABLE, CONTROL, LEFT | 28. SPACER |
| 7. PULLEY CLUSTER, STA 64.46 | 18. BELLCRANK ASSY., LEFT | 29. WASHER (2 REQ.) |
| 8. CABLE, CONTROL, LEFT | 19. BOLT ASSY. | 30. NUT |
| 9. CABLE, CONTROL, RIGHT | 20. BOLT ASSY. | 31. WING SKIN, BOTTOM |
| 10. PULLEY | 21. BOLT ASSY. | 32. TEFLON TUBE |
| 11. PULLEYS | 22. CONTROL ROD END | |



DETAIL A

Aileron Controls
Figure 5 (Sheet 1 of 2)

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Aileron Controls
Figure 5 (Sheet 2 of 2)

- (d) Move the cable guard (see Figure 5, Sketch B) located under the pulley cluster by removing the cotter pin from the exposed end of the guard and sliding it to the left or right as required.
- (e) Remove the cotter pins used as cable guards at the pulley in the forward area of the floor opening aft of the main spar.
- (f) Disconnect the cable from the control chain at the control column tee bar assembly by removing the cotter pin, nut, bolt, and bushing that connect the two together. Secure the chains in some manner to prevent them from unwrapping from around the sprockets.
- (g) Draw the cable back through the floor tunnel.
- (2) The primary control cable in either wing may be removed by the following procedure:
 - (a) Remove the access plate to the aileron bellcrank located on the underside of the wing forward of the aileron center hinge.
 - (b) If not previously disconnected, separate the cable at the turnbuckles located in the floor opening aft of the main spar.
 - (c) Disconnect the cable from the forward end of the aileron bellcrank by removing the cotter pin, nut, washer and bolt.
 - (d) Draw the cable from the wing.
- (3) Either balance cable may be removed by the following procedure:
 - (a) Separate the balance cable at the turnbuckle in the right side of the floor opening aft of the main spar.
 - (b) If the left balance cable is to be removed, remove the cotter pin used as a cable guard at the pulley (10) in the center of the floor opening.
 - (c) Remove the access plate to the aileron bellcrank located on the underside of the wing forward of the aileron center hinge.
 - (d) Disconnect the cable from the aft end of the aileron bellcrank by removing the cotter pin, nut, washer and bolt.
 - (e) Draw the cable from the wing.

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B. Installation (See Figure 5.)

- (1) The installation of either the right or left primary control cable, located in the fuselage, may be accomplished as follows:
 - (a) Draw the cable through the fuselage floor tunnel.
 - (b) Connect the cable to the end of the control chain and secure using bushing, bolt, nut and cotter pin.
 - (c) Place the cable around the pulley (see Sketch B) that is located in the tunnel. Install cable guard (see Figure 5, Sketch B) and secure with cotter pin.
 - (d) Position cables and install the cable pulleys that attach to the lower section of the tee bar assembly. Secure with bolt, washer and nut. (See Figure 5.)
 - (e) Place the cable around the pulley that is located in the floor opening just aft of the main spar and install cotter pin cable guards.
 - (f) If the primary control cable in the wing is installed, connect the control cable ends at the turnbuckle (6) located in the floor opening aft of the main spar.
 - (g) Check rigging and adjustment of aileron controls. Per Rigging and Adjustment below.
 - (h) Position the heat duct and secure with screws.
 - (i) Install the tunnel plate aft of tee bar assembly and secure with screws.
 - (j) Put the floor carpet in place and secure.
 - (k) Place the fuel selector lever on the selector torque tube and secure with pin and cotter pin.
 - (l) Install the lower and upper selector covers and secure with screws.
- (2) The primary control cable in either wing may be installed by the following procedure:
 - (a) Draw the control cable into the wing.
 - (b) Connect the cable to the forward end of the aileron bellcrank using a bolt, washer, nut and cotter pin. Allow the cable end to rotate freely on the bellcrank.
 - (c) If the primary control cable in the fuselage is installed, connect the ends at the turnbuckle located in the floor opening aft of the main spar.
 - (d) Check rigging and adjustment of aileron controls.
 - (e) Install the access plate on the underside of the wing.
- (3) Either balance cable may be installed by the following procedure:
 - (a) Draw the cable into the wing.
 - (b) Connect the cable to the aft end of the aileron bellcrank using a bolt, washer, nut and cotter pin. Allow the cable end to rotate freely on the bellcrank.
 - (c) Connect the balance cable ends at the turnbuckle in the floor opening aft of the main spar.
 - (d) If the left cable was removed, install the cotter pin cable guard at the pulley located in the center of the floor opening.
 - (e) Check rigging and adjustment.
 - (f) Install the access plate on the underside of the wing.
 - (g) Install the floor panel, seat belt attachments and seats.

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4. Aileron Bellcrank Assembly

A. Removal (See Figure 5.)

- (1) Remove the floor panel located directly aft of the main spar by removing the center seats, seat belt attachments, and the screws securing the floor panel. Lift the panel and remove from the airplane.
- (2) Remove the access plate to the aileron bellcrank located on the underside of the wing, forward of the aileron center hinge.
- (3) Relieve tension from the aileron control cables by loosening the balance cable turnbuckle located in the floor opening aft of the main spar.
- (4) Disconnect the primary and balance control cables from the bellcrank assembly by removing cotter pins, nuts, washers and bolts.
- (5) Disconnect the aileron control rod (See Figure 5, Sketch A) at the aft or forward end as desired.
- (6) Remove the nut, pivot bolt (See Figure 5, Sketch A) and washers that secure the bellcrank. The nut is visible from the underside of the wing.
- (7) Remove the bellcrank from within the wing.

B. Installation (See Figure 5.)

- (1) Install first the teflon tube then the spacer in the torque tube portion of the bellcrank. (See Figure 5, Sketch A.)
- (2) Place the bellcrank in position in the wing with a washer located between each end of the torque tube and the mounting brackets.
- (3) Install the bellcrank pivot bolt (See Figure 5, Sketch A) with the head up. Install a washer and nut on the bolt and torque nut 20 to 25 inch-pounds. Check that the bellcrank rotates freely with little up-down play. (See Figure 5, Sketch A, Detail A.)
- (4) Install and adjust control rod (See Figure 5, Sketch A) and check aileron travel per Rigging and Adjustment, below.
- (5) Connect the ends of the primary and balance control cables to the bellcrank using bolts, washers, nuts and cotter pins. Allow the cable ends to rotate freely on the bellcrank.
- (6) Tighten the control cables at the balance cable turnbuckle (6) in the floor opening aft of the main spar. Check cable tension as described in next paragraph.
- (7) Install the access plate on the underside of the wing, the floor panel aft of the main spar, seat belt attachments and seats.

5. Rigging and Adjustment (See Figures 6 and 7.)

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- A. Ensure that the control wheels are properly rigged as described previously under "Control Column Assembly Installation," above, and lock them in their center of travel.
- B. Move the tee bar (control column) to its full forward position, and place weights on the aft side of the stabilator to maintain its position. The stabilator cables must already be at their proper tension.
- C. With the aileron bellcrank in its neutral position, install the bellcrank rigging tool. The neutral position of the bellcrank occurs when the center of both of the cable connection holes are at an equal distance from the adjustment inboard wing ribs. (See Figure 7 for installation.)
- D. Adjust the turnbuckles on the primary and balance cables (located under the floor behind the spar carry through) to the tension specified in Figure 6. Make sure the bellcranks remain in their neutral positions.

NOTE: Tensions on drive (primary) cables may be slightly less than balance cable tension but must be within specified values. Move the controls after tensioning the cables and recheck as necessary.

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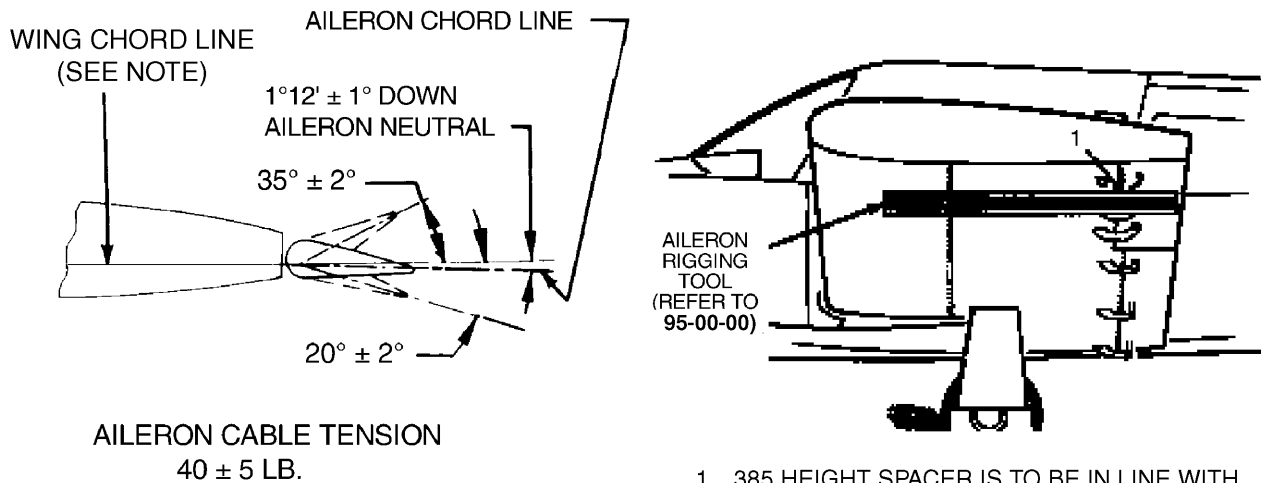
- E. The aileron's neutral position is designed to be at a point where the chord line of the aileron forms a $1^{\circ} 12' \pm 1^{\circ}$ down angle with the wing chord, viewed at the inboard end of the aileron. The tool to determine neutral position is shown in Figure 6 and can be fabricated from dimensions given in Chapter 95. The following procedure should be used for determining aileron neutral position.
- (1) Make sure the bellcrank rigging tools fit snug between the bellcranks and their respective ribs.
 - (2) Place the aileron rigging tool against the underside of the wing and aileron. Position it as close as possible to the center of the aileron without contacting any rivets. It must also be parallel with the wing rib(s). The aft end of the tool should be even with the trailing edge of the aileron.
 - (3) If not already done, connect the aileron/bellcrank push rod to its mounting points.
 - (4) Adjust the push rod as necessary such that with the forward surface of the aileron rigging tool and spacer against the wing, the trailing edge of the aileron contacts the aft end of the tool. A slight "up" pressure should be maintained at the center of the aileron trailing edge to remove the slack between the bellcrank and aileron. Be sure to retighten the jamb nuts after adjustment.
- F. Remove the bellcrank and control wheel locks.
- G. The aileron travel can now be checked. The following procedure is recommended using a bubble protractor and using the neutral position as a datum or reference line.
- (1) With one of the ailerons in its neutral position, center the bubble of the protractor over the aileron's surface and note the reading.
 - (2) Move the aileron to the extent of its travel and after centering the bubble when full up and full down, record the two readings. The difference of each individual reading from that at neutral, will give the degrees of travel up or down respectively.
 - (3) The bellcrank stops attached to the rib adjacent to the aileron bellcrank should be adjusted as necessary to allow the appropriate travels. Repeat the procedure with the other aileron.
- H. If the aileron bellcrank stops are bottomed before the control wheel is turned 90 ± 1 degree from the centered position, lengthen the drive cable and shorten the balance cable an equal amount. Recheck cable tension.
- I. Move the pilot's control wheel full travel to ensure freedom of movement. With the control wheel at full travel and the bellcranks on their stops, a "cushion" of .030 to .040 must be maintained between the sprocket stop pin (on the "T" bar) and adjustable stop bolts.
- J. Check control operation, bolts and turnbuckles for safety.

CAUTION: VERIFY FREE AND CORRECT MOVEMENT OF AILERONS. WHILE IT WOULD SEEM SELF-EVIDENT, FIELD EXPERIENCE HAS SHOWN THAT THIS CHECK IS FREQUENTLY MISINTERPRETED OR NOT PERFORMED AT ALL. ACCORDINGLY, UPON COMPLETION OF AILERON RIGGING AND ADJUSTMENT, VERIFY THAT THE RIGHT AILERON MOVES UP AND THE LEFT AILERON MOVES DOWN WHEN THE CONTROL WHEEL IS TURNED RIGHT; AND THAT THE LEFT AILERON MOVES UP AND THE RIGHT AILERON MOVES DOWN WHEN THE CONTROL WHEEL IS TURNED LEFT.

- K. Install access plates and panels.

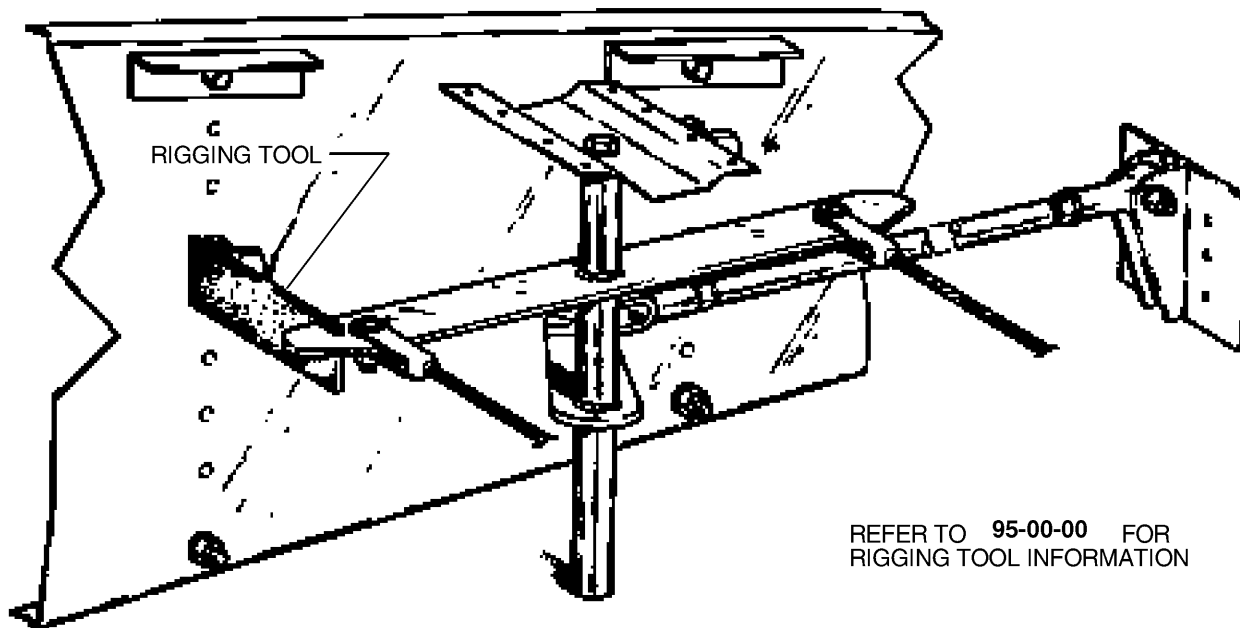
NOTE: When an out-of-trim condition persists, despite all the rigging corrections that can be made, there is a possibility that the trailing edge of the aileron has been used to move the aircraft forward. This can result in a slight bulging of the aileron contour at the trailing edge which will cause an out-of-trim condition that is very difficult to correct.

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NOTE
THE TRAVELS SHOWN ARE MEASURED FROM THE POSITION WHERE THE CHORD OF THE AILERON IS ALIGNED WITH THE CHORD OF THE WING.

Aileron Rigging
Figure 6



Aileron Bellcrank Rigging Tool
Figure 7

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RUDDER CONTROLS

1. Troubleshooting

Charts 1 lists troubles peculiar to rudder control system along with their probable causes and suggested remedies. When troubleshooting the rudder control system, additional reference may be obtained from Chapter 55 on control surface balancing, if required. After the trouble has been corrected, check the entire rudder control system for security and operation.

**CHART 1
TROUBLESHOOTING RUDDER CONTROL SYSTEM**

Trouble	Cause	Remedy
Lost motion between rudder pedals and rudder.	Cable tension too low.	Adjust cable tension.
	Linkage loose or worn.	Check linkage and tighten or replace.
	Broken pulley.	Replace pulley.
	Bolts attaching rudder to bellcrank are loose.	Tighten bellcrank bolts.
Excessive resistance to rudder pedal movement.	System not lubricated properly.	Lubricate system.
	Rudder pedal torque tube bearing in need of lubrication.	Lubricate torque tube bearings.
	Cable tension too high.	Adjust cable tension.
	Pulleys binding or rubbing.	Replace binding pulleys and/or provide clearance between pulleys and brackets.
	Cables not in place on pulleys.	Install cables correctly. Check cable guards.
	Cables crossed or routed incorrectly.	Check routing of control cables.
Rudder pedals not neutral	Rudder cables incorrectly when rudder is streamlined.	Rerig rudder cables.
Incorrect rudder travel.	Rudder bellcrank stop incorrectly adjusted.	Rerig bellcrank stops.
	Nose wheel contacts stops before rudder.	Rerig nose wheel stops.
Trim control knob moves	System not lubricated with excessive resistance.	Lubricate system properly.

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2. Rudder Pedal Assembly

A. Removal (See Figure 1.)

- (1) Remove the access panel to the aft section of the fuselage.
- (2) Relieve rudder and stabilator cable tension by loosening one of the rudder and stabilator cable turnbuckles in the aft section of the fuselage.
- (3) Remove the tunnel plate just aft of the tee bar by laying back enough tunnel carpet to remove the plate attachment screws.
- (4) Disconnect the stabilator control cable from the lower end of the tee bar assembly and disconnect the bobweight push rod from the tee bar.
- (5) Remove the tee bar attachment bolts with their washers and nuts which are through each side of the floor tunnel. Pull the lower end of the tee bar aft.
- (6) Disconnect the control cable ends from the arms on the torque tube by removing the cotter pins, washers, nuts and bolts.
- (7) Disconnect the bungee rods at the control arms by removing nuts and bolts.
- (8) Disconnect the brake cylinders at the lower end of each cylinder rod by removing the cotter pins and clevis pins.
- (9) Disconnect the vee brace(s) from the torque tube by removing nuts, washers and bolts that secure the strap bracket to the vee brace.
- (10) Disconnect the torque tube support bracket where it attaches to the floor tunnel by removing its attachment bolts.
- (11) Remove the two bolts that extend through the torque tube. They are located at the center of the tube assembly over the floor tunnel. Compress the tubes.
- (12) Disconnect the torque tube support blocks from the support brackets on each side of the fuselage by removing the attachment nuts, washers and bolts.
- (13) Remove the trim side panels if desired.
- (14) Remove the assembly from the airplane. Note the spacer washer on each end and between the support blocks.

B. Installation (See Figure 1.)

- (1) Assemble the torque tube assembly as shown in Figure 1. Do not at this time install the two bolts through the center of the tube assembly.
- (2) Place the upper support blocks on the ends of the torque tube assembly. Note that a washer is required on each end of the tube.
- (3) Position the support blocks on their mounting brackets at each side of the fuselage and secure with bolts, washers and nuts. Note that a bushing is required in the bolt holes of the upper support block, and a plate on top of the upper block, between the upper and lower blocks and under the block mounting bracket.
- (4) Align the bolt holes in the center area of the torque tube assembly; install bolts, washers and nuts. Then tighten nuts.
- (5) Position the torque tube support bracket on the floor tunnel and secure with bolts.
- (6) Position the vee brace(s) on the torque tube; install the strap bracket around the torque tube and brace. Secure with bolts, washers and nuts.
- (7) Connect the ends of the brake cylinder rods and clevis rods to the idler arms and secure with clevis and cotter pins.
- (8) Connect the bungee rods and secure with bolts and nuts. Check steering rod adjustment per Alignment of Nose Gear, 32-20-00.

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- (9) Connect the rudder trim to the arm of the torque tube and secure with bolt, washer, nut and cotter pin. A thin washer is installed under the nut which is tightened only finger tight.
- (10) Connect the ends of the rudder control cables to the arms provided on the torque tube and secure with bolts, washers, nuts and cotter pins. Allow the ends free to rotate.
- (11) Swing the tee bar into place and secure with attachment bolts, washers and nuts. Insert the bolts in through each side of the floor tunnel.
- (12) Connect the stabilator control cables to the lower end of the tee bar with bolt, washer and nut. Secure with cotter pin. Allow the cable ends to rotate freely. Connect bobweight push rod to tee bar.
- (13) Set rudder cable tension and check rigging and adjustment of rudder controls.
- (14) Set stabilator cable tension and check rigging and adjustment.
- (15) Check aileron cable tension.
- (16) Check safety of bolt and turnbuckles.
- (17) Install the floor tunnel plate and secure with screws. Fasten the tunnel carpet in place.
- (18) Install the access panel to the aft section of the fuselage.

3. Rudder Control Cables

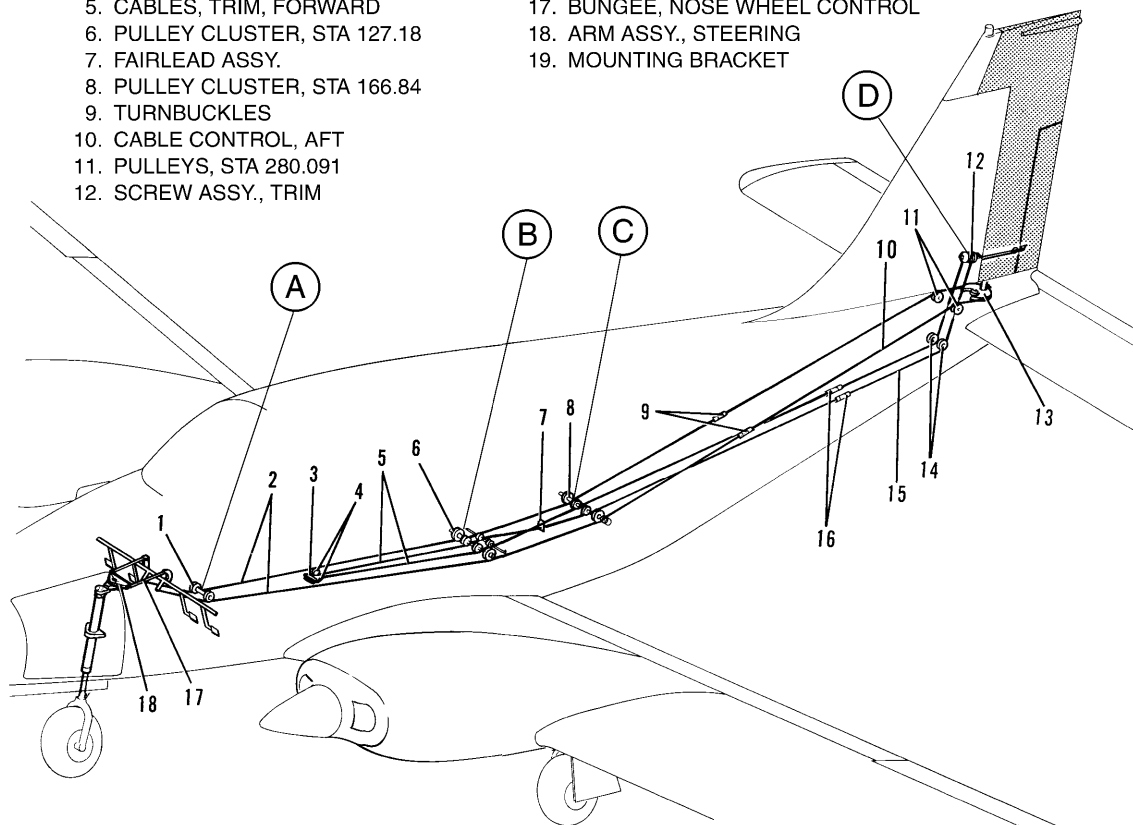
A. Removal (See Figure 1.)

- (1) To remove either the forward or aft rudder cables, first remove the access panel to the aft section of the fuselage.
- (2) Disconnect the desired cable at the turnbuckles in the aft section of the fuselage.
- (3) Either forward rudder cable may be removed by the following procedure:
 - (a) Remove the tunnel cover in the aft area of the cabin by removing the carpet, heat duct and the cover attachment screws.
 - (b) Remove the floor panel located directly aft of the main spar by removing the center seats, seat belt attachments and the screws securing the floor panel. Lift and remove the panel from the airplane.
 - (c) Remove the tunnel plate just aft of the tee bar by removing enough carpet from the tunnel to allow the plate attachment screws and the plate to be removed.
 - (d) Remove the cable guard plate (see Figure 1, Sketch C) from the underside of the pulley cluster that is located in the aft area of the floor tunnel, by removing the block attachment screws.
 - (e) From within the area of the floor opening, remove the cable rub blocks (see Figure 1, Sketch B) that are attached to the spar housing by removing the block attachment screws.
 - (f) Remove the cable guard pin (see Figure 1, Sketch A) located under the pulley cluster by removing the cotter pin from the exposed end and sliding the pin to the left or right as required.
 - (g) Disconnect the end of the cable from the arm on the rudder pedal torque tube by removing the cotter pin, nut, washer and bolt. (See Figure 1.)
 - (h) Draw the cable from the floor tunnel.
- (4) The aft rudder control cable may be removed by the following procedure:
 - (a) Remove the tail cone by removing its attachment screws.
 - (b) Disconnect the cable from the rudder sector by removing the two cotter pins at the aft center portion of the sector and moving the swaged ball and cable out of the recessed hole in the sector.
 - (c) Remove the cable guard pins from the pulley brackets at Fuselage Station 280.091.
 - (d) Draw the cable from the fuselage.

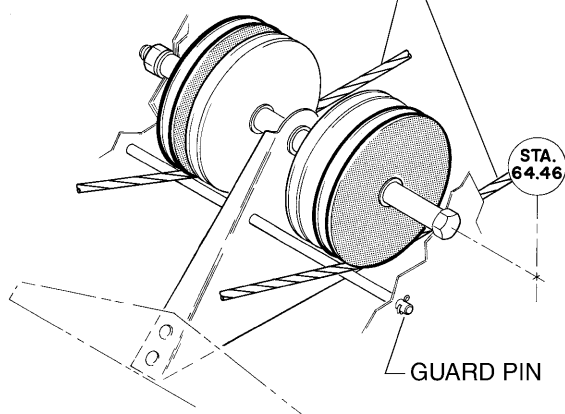
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- | | |
|-------------------------------|--------------------------------|
| 1. PULLEY CLUSTER, STA 64.46 | 13. SECTOR ASSY., TORQUE TUBE |
| 2. CABLES, CONTROL, FORWARD | 14. PULLEYS, STA 279.032 |
| 3. WHEEL ASSY., TRIM CONTROL | 15. CABLE, TRIM, AFT |
| 4. PULLEYS, TRIM | 16. TURNBUCKLES |
| 5. CABLES, TRIM, FORWARD | 17. BUNGEE, NOSE WHEEL CONTROL |
| 6. PULLEY CLUSTER, STA 127.18 | 18. ARM ASSY., STEERING |
| 7. FAIRLEAD ASSY. | 19. MOUNTING BRACKET |
| 8. PULLEY CLUSTER, STA 166.84 | |
| 9. TURNBUCKLES | |
| 10. CABLE CONTROL, AFT | |
| 11. PULLEYS, STA 280.091 | |
| 12. SCREW ASSY., TRIM | |



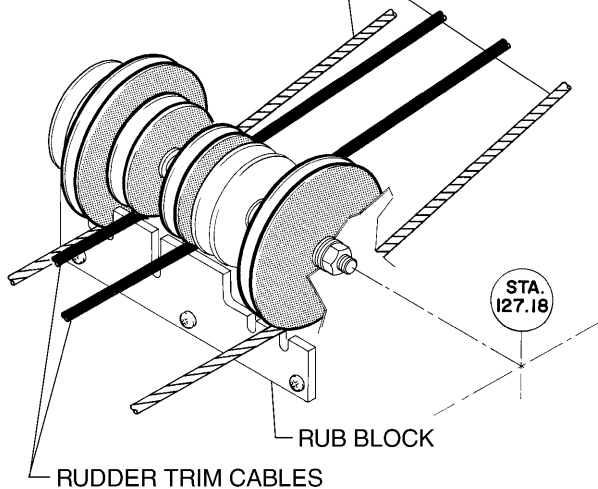
2037 RUDDER CONTROL CABLES



SKETCH A

RUDDER CONTROL CABLES

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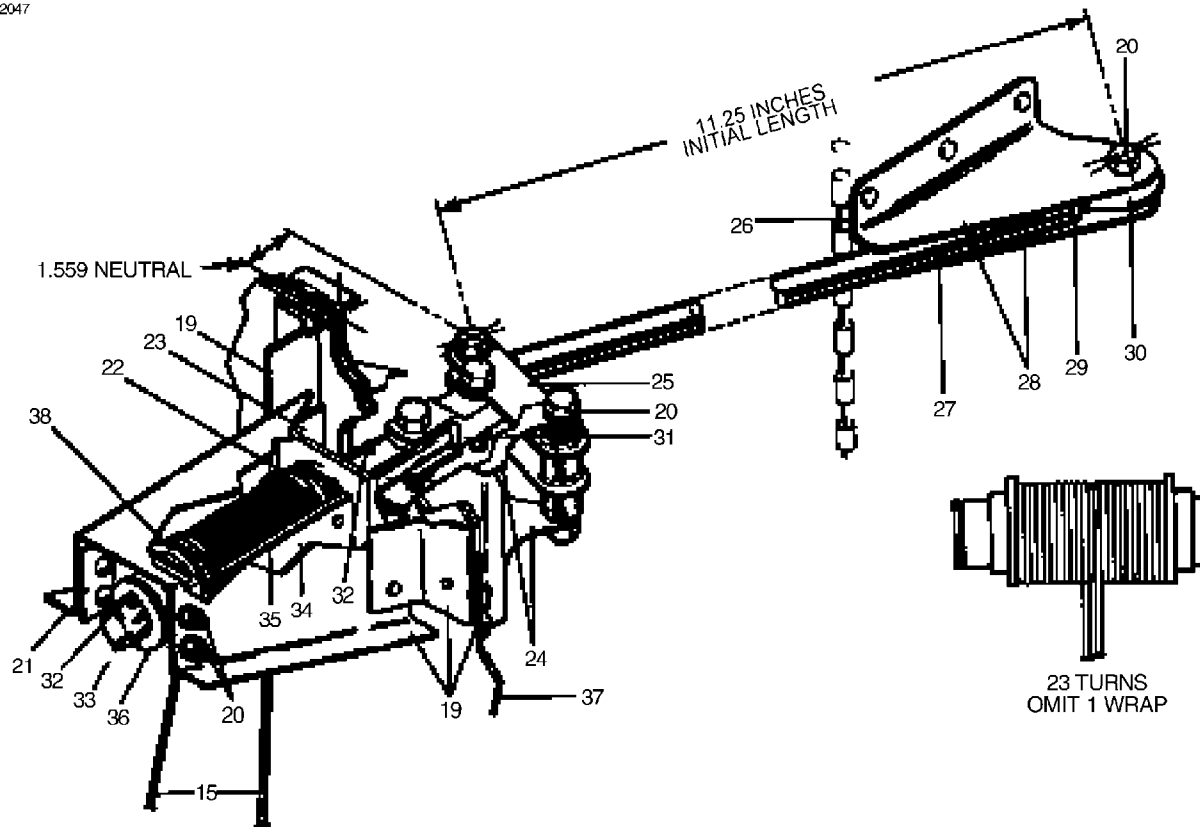


SKETCH B

Rudder Controls Installation
Figure 1 (Sheet 1 of 2)

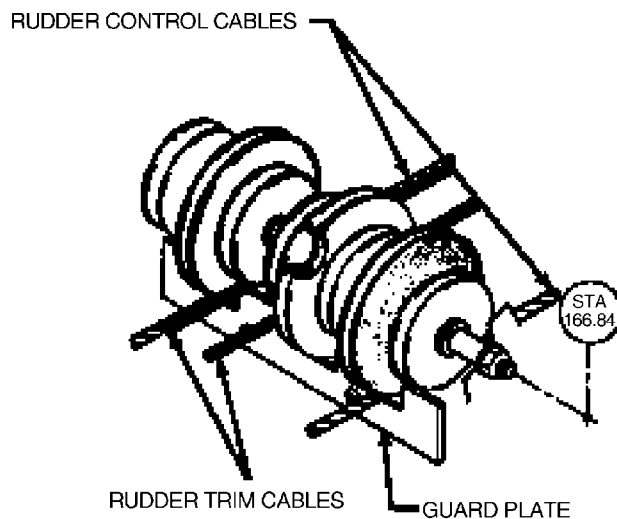
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SKETCH D

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SKETCH C

- 20. Bolt Assy.
- 21. Support Assy., Barrel Mount
- 22. Barrel Trim
- 23. Support Assy., Barrel Mount
- 24. Angle Trim
- 25. Arm Assy.
- 26. Rudder Trim Tab Assy.
- 27. Control Rod
- 28. Arm Assy., Trim Tab
- 29. Jam Nut
- 31. Link Assy.
- 32. Cotter Pin
- 33. Shaft Assy., Trim Screw
- 34. Shim
- 35. Cable Guard
- 36. Stop Washers (NAS1149F0863P, NAS1149F0832P in any combination up to 6 total)

Rudder Controls Installation
Figure 1 (Sheet 2 of 2)

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B. Installation (See Figure 1.)

- (1) The forward rudder control cables may be installed by the following procedure:
 - (a) Draw the control cable through the floor tunnel.
 - (b) Connect the end of the cable to the arm on the rudder pedal torque tube (Figure 2) by installing bolt, washer, nut and cotter pin, allowing the cable end to rotate freely.
 - (c) Connect the forward control cable to the aft control cable at the turnbuckles in the aft section of the fuselage. If the aft control cables are not installed, install them at this time per instructions in Step 2. Ascertain that each cable is in the proper pulley groove.
 - (d) Move the cable guard located in the forward tunnel, under the pulley cluster into position, and secure with cotter pin.
 - (e) Within the area of the floor opening aft of the main spar, install the cable rub blocks onto the spar housing and secure with screws at the pulley cluster.
 - (f) Install the cable guard plate under the pulley cluster located in the aft area of the floor tunnel and secure with screws.
 - (g) Set cable tension as given in Figure 3 and check rigging and adjustment. Safety the turnbuckle.
 - (h) Install the forward tunnel plate aft of the tee bar and secure with screws.
 - (i) Put the floor carpet in place and secure.
 - (j) Install the floor panel and seat belt attachment aft of the main spar, securing the panel with screws and install the seats.
 - (k) Install the cover and carpet of the aft floor tunnel.
- (2) The aft rudder control cable may be installed by the following procedure:
 - (a) Position the control cable in the fuselage with the swaged ball next to the rudder sector.
 - (b) Route the cable ends over the pulleys and install the guard pins in the pulley brackets.
 - (c) Position the swaged ball of the cable in the recessed hole in the sector and secure in place with two MS24665-283 cotter pins.
 - (d) Connect the cable ends to the forward control cables at the turnbuckles in the aft section of the fuselage.
 - (e) Set cable tension as given in Figure 3 and check rigging and adjustment of the rudder controls. Safety the turnbuckle.
 - (f) Install the tail cone and secure with screws.
- (3) Install the access panel to the aft section of the fuselage.

4. Rigging and Adjustment (See Figures 3 and 4, and 27-30-00, Figure 1.)

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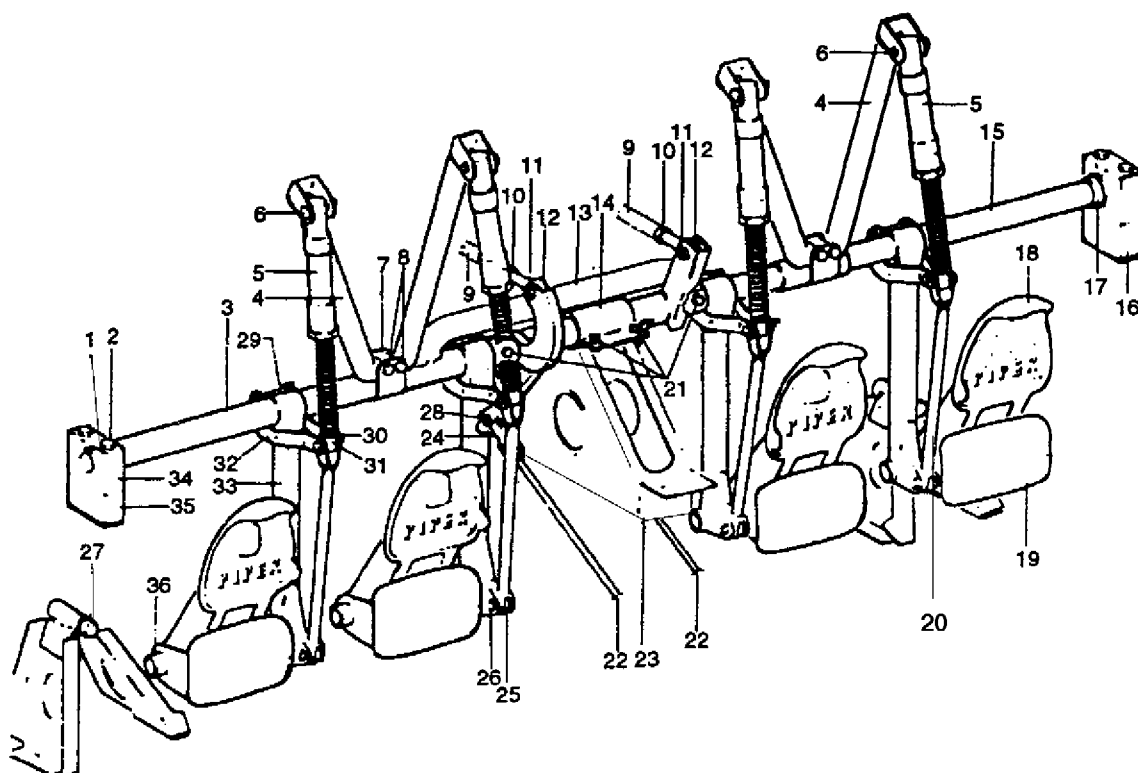
Measurements for determining rudder travel are initiated from the neutral position (i. e. when the rudder is streamlined with the vertical stabilizer).

CAUTION: VERIFY FREE AND CORRECT MOVEMENT OF RUDDER. WHILE IT WOULD SEEM SELF-EVIDENT, FIELD EXPERIENCE HAS SHOWN THAT THIS CHECK IS FREQUENTLY MISINTERPRETED OR NOT PERFORMED AT ALL. ACCORDINGLY, UPON COMPLETION OF RUDDER RIGGING AND ADJUSTMENT, VERIFY THAT THE RUDDER MOVES RIGHT WHEN THE RIGHT PEDAL IS DEPRESSED; AND, THAT THE RUDDER MOVES LEFT WHEN THE LEFT PEDAL IS DEPRESSED.

A. Using the rudder pedals as necessary, check and set the correct degree of rudder travel as follows:

- (1) Swing the rudder until it contacts the stop and hold it in that position. See Figure 3 for travels.
- (2) Using the rigging tool as shown in Figure 3, align the tool at the root against the side of the vertical stabilizer and rudder, making sure to keep it clear of rivets.

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1. PLATE
2. BOLT AND NUT
3. TUBE, LEFT, OUTER
4. VEE BRACE
5. BRAKE CYLINDER
6. CLEVIS PIN & COTTER PIN
7. BRACKET
8. BOLT, WASHER AND NUT
9. BUNGEE, NOSE WHEEL STEERING
10. JAM NUT
11. BOLT AND NUT
12. ROD END, STEERING

13. TUBE, LEFT, CENTER
14. BEARING SUPPORT
15. TUBE, RIGHT, CENTER
16. SUPPORT BLOCK, LOWER
17. WASHER, SPACER
18. BRAKE PEDAL
19. RUDDER PEDAL
20. CLEVIS ROD
21. BOLT, WASHER & NUT
22. CONTROL CABLE, RUDDER
23. BRACKET, TUBE END
24. CABLE END

25. ROD END
26. CLEVIS PIN & COTTER PIN
27. STOPS, RUDDER PEDAL
28. BOLT, WASHER, NUT & COTTER PIN
29. PIN, WASHER, & COTTER PIN
30. CLEVIS PIN & COTTER PIN
31. ROD, BRAKE CYLINDER
32. IDLER ARM
33. TUBE, RUDDER CONTROL
34. SUPPORT BLOCK, UPPER
35. SUPPORT BLOCK, LOWER
36. TUBE, RUDDER CONTROL

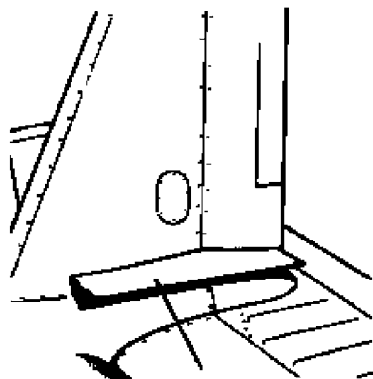
Rudder Pedals Installation
Figure 2

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- (c) The rigging tool should fit flush against the rudder and stabilizer. If a gap exists at these areas. remove the tail cone and adjust the stop. Use Figure 3 for reference.
- (d) Swing the rudder in the opposite direction and complete the same procedure.
- B. The cable tension may be set as follows:
 - (a) Remove the access panels in the rear baggage area to make access to the rear of the fuselage.
 - (b) Block the rudder and trim tab such that they are streamlined with the vertical fin.
 - (c) Secure the rudder pedals in their neutral position as shown in Figure 3. If the nose gear steering is found to be out of alignment see 32-20-00 for adjustment.
 - (d) If not already accomplished. the nose wheel must be raised clear of the ground for the remainder of this procedure.
 - (e) On the rudder cables in the aft of the fuselage. adjust the turnbuckles to obtain 40 ± 5 pounds tension. Make sure to tighten the cables evenly avoiding uneven strain on aircraft components.
 - (f) Unblock the rudder and trim tab.
- C. Apply just enough pressure on the pilot's left pedal for the rudder to meet the stop. The clearance between the pedal stop and the stop bolt should be .060 to .120 in.
- D. The same procedure and clearance applies to the copilot's right pedal.
- E. Install tail cone and the access panel.
- 5. Rudder Trim Controls (Forward)
 - A. Removal (See Figure 1.)
 - (1) To remove the trim control wheel assembly and/or trim control cables, first remove the panel to the aft section of the fuselage.
 - (2) If the aft trim cable is not being removed, block the cables aft to the turnbuckles to prevent the cables from unwrapping at the trim barrel in the fin. (See Figure 1.)
 - (3) If the trim control wheel is to be removed, loosen the cables at the turnbuckles and proceed with the following steps:
 - (a) Remove the trim cover assembly by removing the cover attaching screws.
 - (b) Remove the nut, washers and bolt that secures the trim wheel assembly between its mounting bracket. Draw the wheel from the brackets. Use caution not to damage the trim indicator wire.
 - (c) Unwrap the lower cable from the drum.
 - (d) The wheel and drum are joined by three screws. Remove screws and separate these two items and unwrap the upper cable.
 - (e) Tie the cables forward to prevent them from slipping back into the floor tunnel.
 - (4) If the trim control wheel and forward cables are to be removed, block the aft cables aft of the turnbuckles and proceed with the following steps:
 - (a) Remove the tunnel cover in the aft area of the cabin by removing the carpet and heater duct over the tunnel and the cover attachment screws.
 - (b) Remove the floor panel located directly aft of the main spar by removing the center seats, seat belt attachments and screws securing the panel. Remove the panel from the airplane.
 - (c) Remove the trim cover assembly to gain access to the trim wheel mounting hardware.
 - (d) Disconnect the turnbuckles and remove the guard plate (see Figure 1, Sketch C) at pulley cluster.

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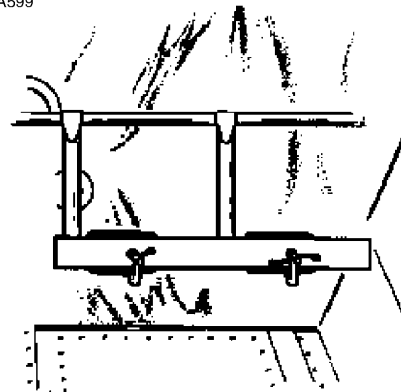
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RIGGING TOOL
REFER TO CHAPTER
91 FOR DIMENSIONS

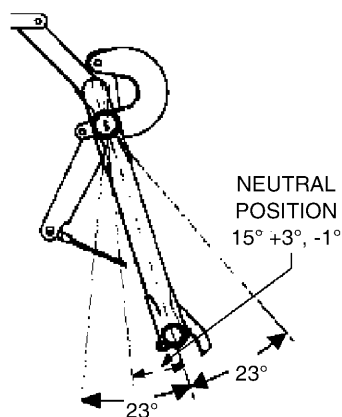
USING RIGGING TOOL

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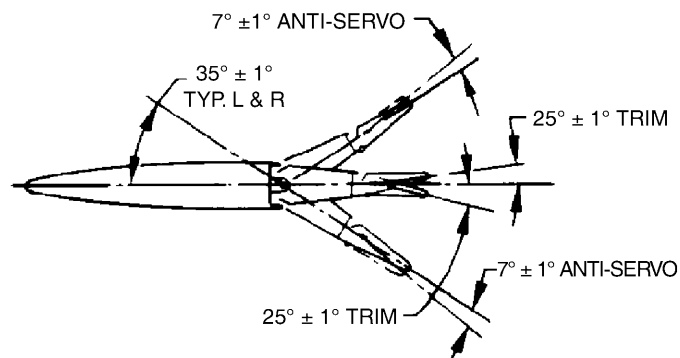


NEUTRALIZING PEDALS

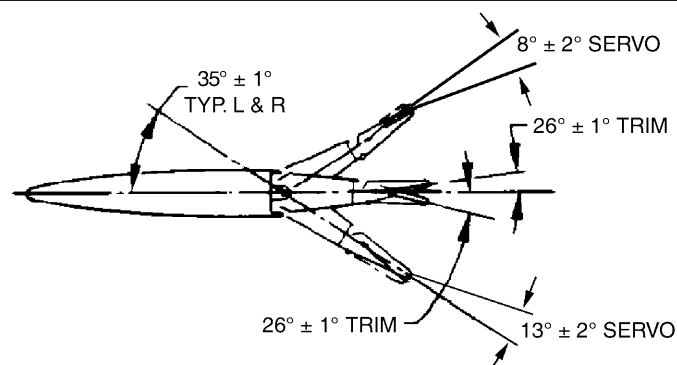
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PEDAL TRAVELS



RUDDER TRAVEL - ANTI-SERVO (SENECA IV)



RUDDER TRAVEL - SERVO (SENECA V)

CABLE TENSIONS	
RUDDER CABLES	40 ± 5 LB.
RUDDER TRIM CABLES	10 ± 2 LB.

Rigging Rudder and Controls
Figure 3

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- (e) Remove the rub block at the pulley cluster.
- (f) Remove the nut, washers, and bolt securing the rudder trim control wheel and drum assembly to its mounting bracket and remove the complete assembly with cables. Use caution not to damage the indicator wire.

B. Installation (See Figure 1.)

- (1) The trim control wheel with drum may be installed by the following procedure:
 - (a) Wrap the left cable on the trim drum by inserting the swaged ball of the cable in the slot provided in the upper side of the drum which mates with the control wheel. Looking at this side, proceed to wrap three and a half turns of cable in a clockwise direction.
 - (b) Attach the trim control wheel to the cable drum by aligning the long lug of the drum with the long slot of the wheel and securing the two pieces together with three screws.
 - (c) Wrap the right cable on the drum by inserting the swaged ball of the cable into the slot provided in the flanged lower side of the drum. Looking at this side, proceed to wrap three and a half turns of cable in a clockwise direction.
 - (d) Lubricate and install the bushing in the lower side of the drum and the bearing on the upper side of the trim control wheel assembly.
 - (e) Align the trim control cables and position the control wheel assembly between its mounting brackets. Ascertain that the trim indicator wire is positioned in the spiraled slot of the wheel with no binding on the end. Install the retainer bolt from the upper side, along with the washer and secure with washer and nut from below.
 - (f) Install the cover assembly over the trim control wheel and secure with screws unless the control cables have yet to be installed.
- (2) The trim control cables may be installed by the following procedure:
 - (a) Draw the cables through the floor tunnel and route them through the pulley clusters at station 127.17 and 166.84. Ascertain that the cables cross at the fairlead between the two pulley clusters.
 - (b) Wrap the cable drum and install the trim control wheel as given in Step 1.
 - (c) Position the cables over the proper pulleys (as shown in Sketches B and C of Figure 1).
 - (d) Connect the forward cables to the aft cables at the turnbuckles in the aft section of the fuselage. If the aft cable is not installed, proceed with instructions in this section.
 - (e) Remove the blocks securing the aft cables and check that the cables are seated on the pulleys. Install the rub block and guard plate at the appropriate pulley clusters. (See Sketches B and C of Figure 1.)
 - (f) Set trim cable tension in accordance with specifications given in Figure 3 and check rigging and adjustment of rudder trim controls. Safety both turnbuckles.
 - (g) Install the tunnel cover on the forward tunnel and secure with screws.
 - (h) Install the carpet over the floor tunnel.
 - (i) Install the cover over the trim control wheels and flap handle and secure with screws.
 - (j) Install the seat belts removed from the top of the floor tunnel and secure with bolt, washer and nut.
 - (k) Install the aft floor tunnel cover, heater duct and carpet.
 - (l) Install the carpet over the aft floor plate.
- (3) Install the panel to the aft section of the fuselage and the seats.

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6. Rudder Trim Controls (Aft)

A. Removal (See Figure 1.)

- (1) Remove the access panel from the lower side of the fin and the tail cone fairing.
- (2) If the forward trim mechanism is not being removed at this time, block the cables forward of the turnbuckles to prevent the cables from unwrapping at the forward trim drum. (See 27-30-00, Figure 2.)
- (3) Secure the trim cables at the aft trim drum barrel.
- (4) Disconnect the trim cable turnbuckles in the aft section of the fuselage.
- (5) Remove the cable guards from the pulley bracket located at station 279.032.
- (6) Disconnect the trim screw link assembly from the screw.
- (7) Remove the cotter pin from the aft end of the screw.
- (8) Remove the four bolt assemblies securing the forward support to the mounting bracket.
- (9) Remove the screw and barrel assembly along with the aft cables from the airplane.

B. Installation (See Figure 1.)

- (1) Insert the complete trim screw and barrel assembly into the fin. Route the trim cable ends around the pulleys at station 279.032.
- (2) Insert the trim screw and barrel assembly into the mounting bracket. Place the washer on the forward end of the barrel and install the support assembly in the mounting bracket.

NOTE: Total allowable end play of the barrel in the mounting bracket is .006 to .008 inches. Use 62833-18 laminated shim stock washer as required to achieve the correct end play.

- (3) Install the AN960-8 16 and AN-960-816L washers over the forward end of the screw shaft and install the cotter pin. Install the cotter pin in the aft end of the shaft.
- (4) Adjust the screw assembly to obtain the neutral position. (See Sketch D of Figure 1.)
- (5) Connect the link assembly to the trim screw.
- (6) Connect the aft trim cables to the forward cables with turnbuckles. Check to ensure the cables are properly routed around the pulleys.
- (7) Install the cable guards at the pulley bracket in the fuselage at station 279.032.
- (8) Remove the clamp securing the forward trim cables and proceed to rig the system.
- (9) Lubricate the assembly per instructions in 12-20-00.
- (10) Install the access panel and tail cone fairing.

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C. Rigging and Adjustment (See Figures 1 and 3.)

CAUTION: VERIFY FREE AND CORRECT MOVEMENT OF RUDDER TAB. WHILE IT WOULD SEEM SELF-EVIDENT, FIELD EXPERIENCE HAS SHOWN THAT THIS CHECK IS FREQUENTLY MISINTERPRETED OR NOT PERFORMED AT ALL. ACCORDINGLY, UPON COMPLETION OF RUDDER TRIM RIGGING AND ADJUSTMENT, VERIFY THAT THE RUDDER TAB MOVES RIGHT WHEN THE RUDDER TRIM WHEEL IS TRIMMED LEFT; AND, THAT THE RUDDER TAB MOVES LEFT WHEN THE RUDDER TRIM WHEEL IS TRIMMED RIGHT.

The rudder and its tab are considered to be in neutral when streamlined with each other and the vertical stabilizer. Travel measurements are taken from the neutral position. To rig the trim controls the following procedure is recommended:

- (1) If the assemblies have just been installed the following procedure is recommended. Disregard these instructions if previously accomplished.
 - (a) Check the trim drum in the stabilizer and make sure when at neutral there are 23 cable turns on the drum with one omitted in the center.
 - (b) Check the tab actuating push rod for its optimum length of 11.25 inches.
 - (c) Make sure the nose gear is clear of the ground.
- (2) If the cables have been disconnected proceed as follows:
 - (a) Make sure the rudder and tab are blocked in the neutral position.
 - (b) Center the cockpit rudder trim control, and connect the rudder trim cables. Tighten the cables to 10 ± 2 pounds making sure the system is evenly tensioned to prevent uneven loads on the structure and assemblies.
 - (c) Unblock the tab.
- (3) With the rudder centered, rotate the trim control wheel in the cockpit to full right trim and then full left trim.
- (4) Check that each tab travel is 25 ± 1 degrees (Seneca IV) or 26 ± 1 degrees (Seneca V). Adjust the actuating rod as necessary to obtain correct travel.
- (5) If symmetrical travels cannot be reached by adjusting the actuating rod, add or remove stop washers on the trim screw. At least two but no more than five AN-960-8 16 or AN-960-8 16L washers of any combination are allowed.

NOTE: If the tab cannot be adjusted to the correct travels with the removal or addition of washers along with adjustment of the actuating rod, the cable trim barrel must be repositioned on the actuating trim screw. See the previous subject paragraphs for appropriate instructions.

- (6) Remove the blocks securing the rudder in its neutral position.
- (7) On Seneca IV models, rudder tab servo travel is determined as follows:
 - (a) Ascertain that the rudder trim control wheel in the cockpit is in its neutral position.
 - (b) Push on one of the left rudder pedals until the rudder stop is contacted.
 - (c) With a bevel protractor or other suitable tool, measure the degree of deflection. Tab travel should be 7 ± 1 degrees left of center line of rudder.
 - (d) Repeat steps (a) and (b) with the right rudder pedal, checking for 7 ± 1 degrees right of center line of rudder.
 - (e) If either or both of these readings are off, the trim barrel must be repositioned on the actuating screw along with a readjustment of the actuating rod length. If either of these is adjusted, all rudder and rudder trim rigging and adjustments must be repeated.

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- (7a) On **Seneca V** models, rudder tab servo travel is determined as follows:
- (a) Ascertain that the rudder trim control wheel in the cockpit is in its neutral position.
 - (b) Push on one of the left rudder pedals until the rudder stop is contacted.
 - (c) With a bevel protractor or other suitable tool, measure the degree of deflection. Tab travel should be 13 ± 2 degrees right of center line of rudder.
 - (d) Repeat steps (a) and (b) with the right rudder pedal, checking for 8 ± 2 degrees left of center line of rudder.
 - (e) If either or both of these readings are off, the trim barrel must be repositioned on the actuating screw along with a readjustment of the actuating rod length. If either of these is adjusted, all rudder and rudder trim rigging and adjustments must be repeated.
- (8) Secure the rudder against either stop and measure, if any, the amount of trim tab free play. Measuring at the tab trailing edge, free play must not exceed 0.060 inch.

Alternate Method: Place rudder and rudder tab in neutral position. Utilizing a dial indicator and related holding fixture, determine the amount of free play motion between the rudder trailing edge and rudder tab trailing edge .06 max.

CAUTION: WHILE IT WOULD SEEM SELF-EVIDENT, EXPERIENCE HAS SHOWN THAT CHECKS FOR FREE AND CORRECT MOVEMENT OF CONTROL SURFACES ARE OCCASIONALLY MISINTERPRETED OR NOT PERFORMED AT ALL. ACCORDINGLY, VERIFY THAT THE RUDDER MOVES RIGHT WHEN THE RIGHT RUDDER PEDAL IS STEPPED ON. AND, THAT THE RUDDER MOVES LEFT WHEN THE LEFT RUDDER PEDAL IS STEPPED ON.

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STABILATOR CONTROLS

1. Troubleshooting

Charts 1 and 2 lists troubles peculiar to stabilator control system along with their probable causes and suggested remedies. When troubleshooting the stabilator control system, additional reference may be obtained on control surface balancing from Chapter 55. After the trouble has been corrected, check the entire rudder control system for security and operation.

**CHART 1
TROUBLESHOOTING STABILATOR CONTROL SYSTEM**

Trouble	Cause	Remedy
Lost motion between control wheel and stabilator.	Cable tension too low.	Adjust cable tension.
	Linkage loose or worn.	Check linkage and tighten or replace.
	Broken pulley.	Replace pulley.
	Cables not in place on pulleys.	Install cables correctly.
Resistance to stabilator control movement.	System not lubricated properly.	Lubricate system.
	Cable tension too high.	Adjust cable tension.
	Binding control column.	Adjust and lubricate.
	Pulleys binding or rubbing.	Replace binding pulleys and/or provide clearance between pulleys and brackets.
	Cables not in place on pulleys.	Install cables correctly.
	Cables crossed or routed incorrectly.	Check routing of control cables.
Incorrect stabilator travel. Correct stabilator travel cannot be obtained by adjusting stops.	Bent stabilator hinge.	Repair or replace stabilator hinge.
	Stabilator stops incorrectly adjusted.	Adjust stop screws.
	Stabilator cables incorrectly rigged.	Rerig stabilator cables.

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**CHART 2
TROUBLESHOOTING STABILATOR MANUAL TRIM CONTROL SYSTEM**

Trouble	Cause	Remedy
Lost motion between trim control wheel and trim tab.	Cable tension too low.	Adjust cable tension.
	Cables not in place on pulleys.	Install cables properly.
	Broken pulley.	Replace pulley.
	Linkage loose or worn.	Check linkage and tighten or replace.
Trim control wheel moves with excessive resistance.	System not lubricated properly.	Lubricate system.
	Cable tension too high.	Adjust cable tension.
	Pulleys binding or rubbing.	Replace binding pulleys. Provide clearance between pulleys and brackets.
	Cables not in place on pulleys.	Install cables properly.
	Trim tab hinge binding.	Lubricate hinge. If necessary, replace.
	Cables crossed or routed incorrectly.	Check routing of control cables.
Trim tab fails to reach full travel.	System incorrectly rigged.	Check and / or adjust rigging.
	Trim drum incorrectly wrapped .	Check and/or adjust rigging.
Trim indicator fails to indicate correct trim position.	Trim indicator unit not adjusted properly.	Adjust trim indicator.

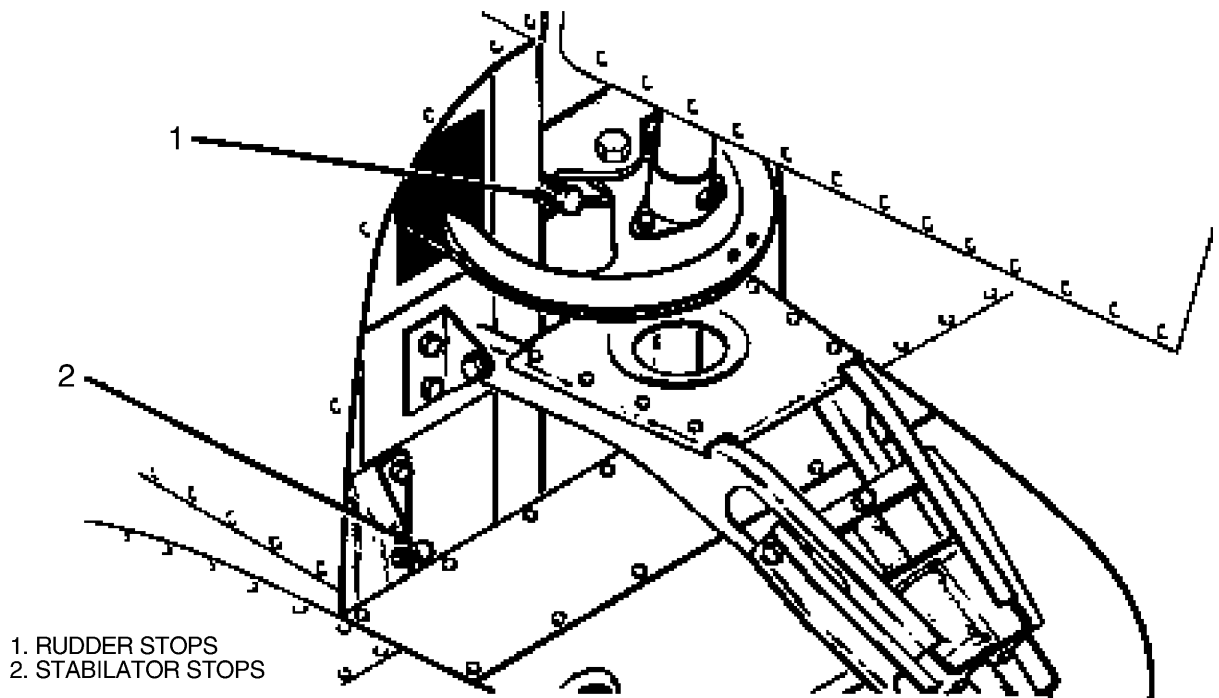
2. Stabilator Control Cables

A. Removal (See Figure 3.)

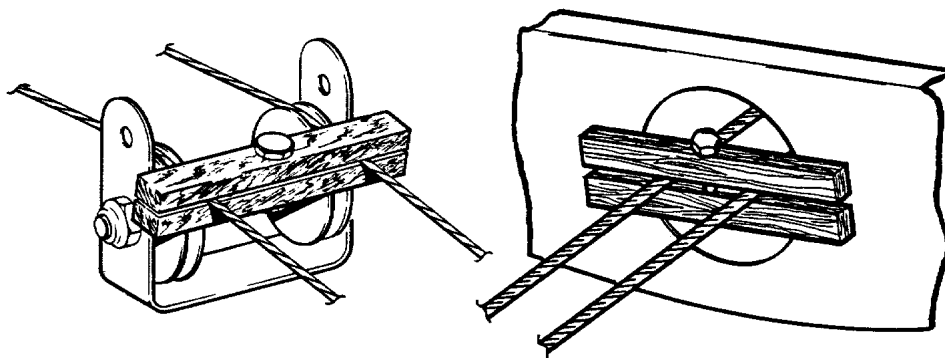
- (1) To remove either the forward or aft stabilator cables, first remove the access panel to the aft section of the fuselage.
- (2) Relieve cable tension from control system by loosening one of the cable turnbuckles in the aft section of the fuselage.
- (3) Disconnect the stabilator down springs and clamps from the upper stabilator control cable in the aft section of the fuselage.
- (4) Either forward stabilator cable may be removed by the following procedure:
 - (a) Remove the floor tunnel cover in the aft area of the cabin by removing the carpet and the heater duct over the tunnel and the cover attachment screws.
 - (b) Remove the cable guard plate from the underside of the pulley cluster in the aft area of the tunnel opening by removing the guard attachment screws.

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Rudder and Stabilator Adjustments
Figure 1

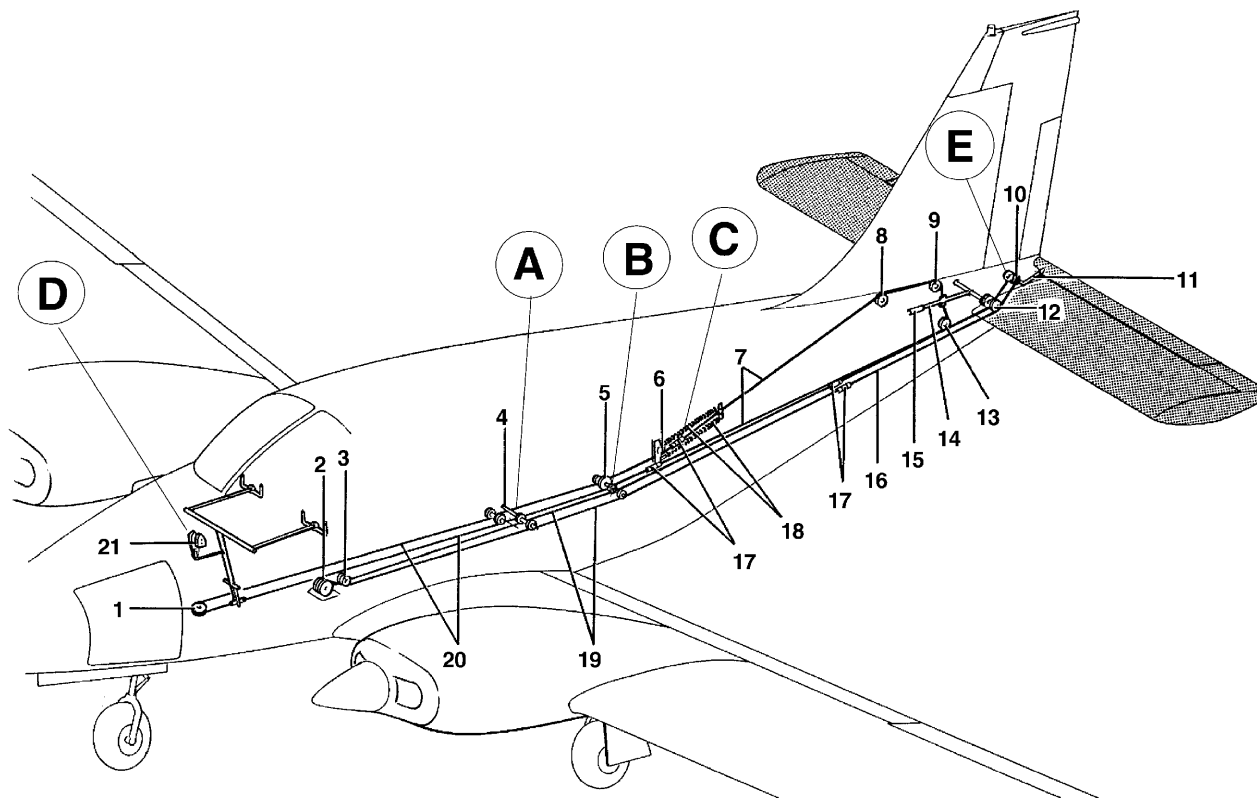


Method of Securing Trim Cables
Figure 2

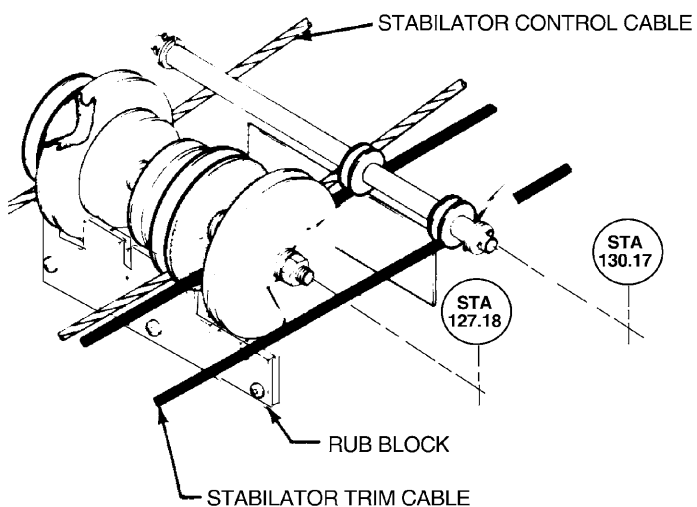
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- (c) Remove the floor and located directly aft of the main spar by removing the center seats, seat belt attachments, and the screws securing the panel. Lift the panel and remove from the airplane.
 - (d) Within the floor opening, remove the cable rub blocks that are attached to the spar housing by removing the block attachment screws. Also, remove the cotter pin cable guard at the pulley cluster in the aft area of the opening.
 - (e) Remove the tunnel plate just aft of the tee bar by removing enough carpet from the tunnel to allow the plate attachment screws and plate to be removed.
 - (f) If the right (upper) stabilator control cable is to be removed, remove the cotter pin cable guards at the pulley located in the forward area of the tunnel.
 - (g) Disconnect the cables from the lower end of the tee bar by removing cotter pin, nut, washer and bolt.
 - (h) Draw the cable aft through the floor tunnel.
 - (5) Either aft stabilator control cable may be removed by the following procedure:
 - (a) Disconnect the cable end at the balance arm of the stabilator by removing the cotter pin, nut, washer and bolt.
 - (b) Remove the cotter pin cable guard at the pulleys located either above or below the balance arm.
 - (c) Remove the cable from the airplane.
- B. Installation (See Figures 3 and 4.)
- (1) The forward stabilator cables may be installed by the following procedure:
 - (a) Draw the control cable through the floor tunnel. Ascertain that the right (upper) cable is routed around the pulley that is in the forward area of the forward floor tunnel.
 - (b) Connect the cables to the lower end of the control column tee bar with bolt, washer, nut and cotter pin. Allow the cable to be free to rotate.
 - (c) If the aft control cable is not installed, install as described in the next step.
 - (d) Connect the forward control cable to the aft cable at the turnbuckles in the aft section of the fuselage.
 - (e) For the right control cable, install the cotter pin cable guard at the pulley in the forward area of the tunnel.
 - (f) Within the forward area of the floor opening aft of the main spar, install the cable rub blocks to the spar housing and secure with screws.
 - (g) In the area of the floor opening, install the cotter pin cable at the pulley cluster.
 - (h) Install the cable guard plate under the pulley cluster located in the aft area of the aft floor tunnel and secure with screws.
 - (i) Set cable tension per Figure 4 and check rigging and adjustment.
 - (j) Connect stabilator down springs and clamps to upper aft stabilator control cable. (See Figure 3, Sketch C).
 - (k) Install the tunnel plate directly aft of the tee bar assembly and secure with screws.
 - (l) Put the floor carpet in place and secure.
 - (m) Install the floor panel aft of the main spar and secure with screws. Install the seat belt attachments and seats.
 - (n) Install the cover, heat duct and carpet over the aft floor tunnel.

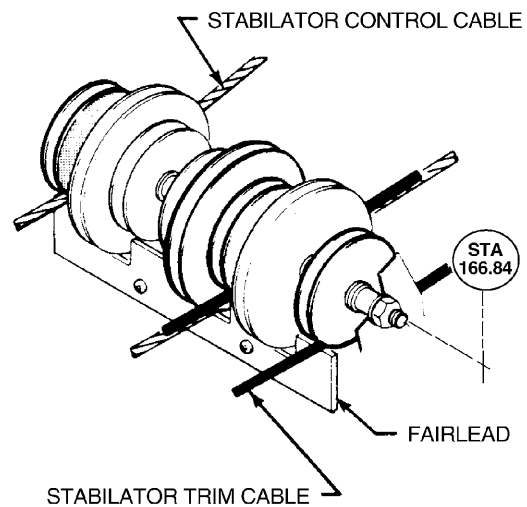
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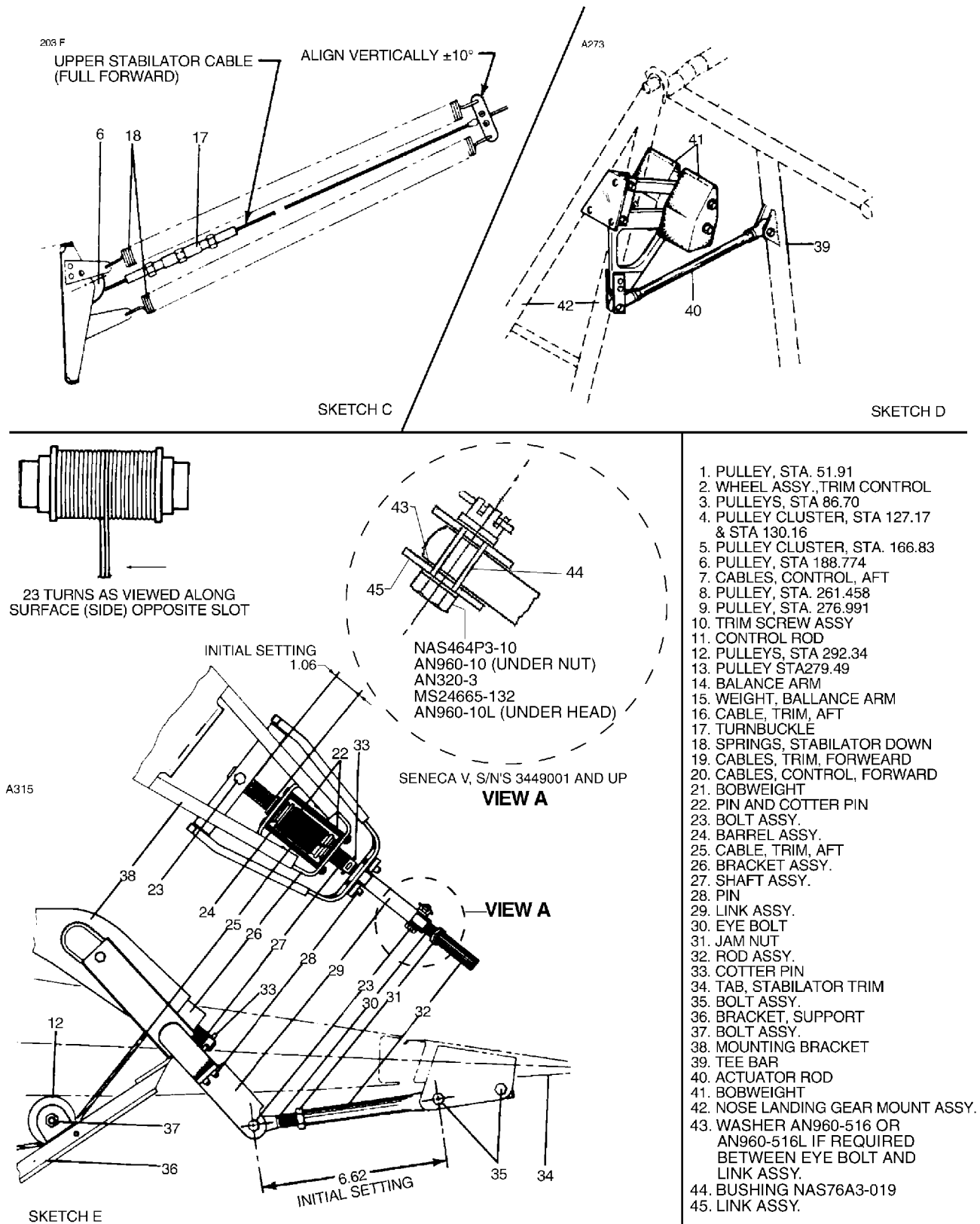
SKETCH A



SKETCH B

Stabilator Controls Installation
Figure 3 (Sheet 1 of 2)

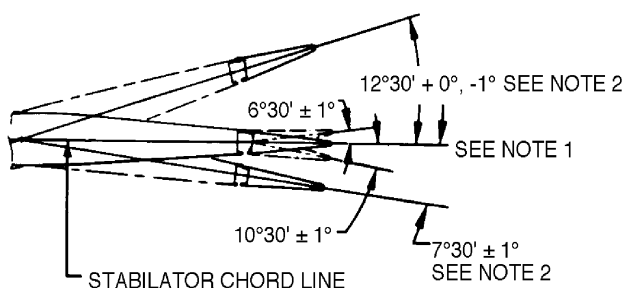
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Stabilator Controls Installation
Figure 3 (Sheet 2 of 2)

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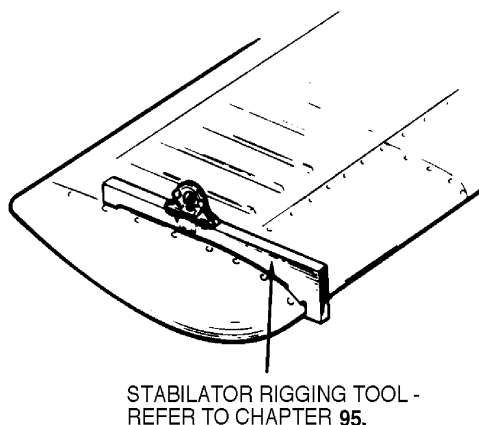
- (2) Either aft stabilator control cable may be installed by the following procedure:
 - (a) Route the cable around its pulley located either over or under the balance arm of the stabilator.
 - (b) Connect the cable to the stabilator balance arm and secure with bolt, washer, nut and cotter pin. (Ensure bushing is installed with bolt.)
 - (c) Connect the aft cable to the forward cable at the turnbuckle in the aft section of the fuselage. The upper aft cable connects to the right forward cable and the lower cable to the left cable.
 - (d) Install the cotter pin cable guard at the pulley where required.
 - (e) Connect the stabilator down spring to the upper aft control cable. (See Figure 3, Sketch C).
 - (f) Set cable tension and check rigging and adjustment.
- (3) Install the access panel to the aft section of the fuselage.



CABLE TENSIONS	
STABILATOR	40 ± 5 LB
STABILATOR TAB	10 ± 1 LB

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NOTES
1. THE NEUTRAL POSITION OF THE STABILATOR IS WHEN THE STABILATOR CHORD LINE IS PARALLEL WITH THE TOP OF THE SEAT TRACK
2. TOTAL TAB FREE PLAY IS NOT TO EXCEED 0.06 INCH



Stabilator Rigging
Figure 4

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C. Rigging and Adjustment (See Figures 3 and 4.)

The stabilator control system is designed to have the stabilator in neutral when the stabilator chord line is parallel to that of the front seat tracks. Travels as specified in Figure 4, are measured from the neutral point.

CAUTION: VERIFY FREE AND CORRECT MOVEMENT OF STABILATOR. WHILE IT WOULD SEEM SELF-EVIDENT, FIELD EXPERIENCE HAS SHOWN THAT THIS CHECK IS FREQUENTLY MISINTERPRETED OR NOT PERFORMED AT ALL. ACCORDINGLY, UPON COMPLETION OF STABILATOR RIGGING AND ADJUSTMENT, VERIFY THAT THE REAR EDGE OF THE STABILATOR MOVES UP WHEN THE WHEEL IS PULLED BACK; AND, THAT THE REAR EDGE OF THE STABILATOR MOVES DOWN WHEN THE WHEEL IS PUSHED FORWARD.

- (1) Before proceeding with any of the following instructions, level the airplane as described in 8-20-00.

NOTE: When adjusting cables, make sure they are evenly tensioned to prevent uneven strain on aircraft components. After any cable adjustments ensure that there is no interference between turn buckles and pulleys, and that all cables are aligned on their pulleys.

- (2) Remove the tail cone, and adjust the stabilator stops to obtain the travels specified in Figure 4. The stabilator travel can be determined using the rigging tool as shown and is described in 95-00-00. To check stabilator travel proceed as follows:

NOTE: Ensure the stabilator contacts both its stops(see figure 1) before the control column (tee bar) contacts its stops.

- (a) Align the stabilator rigging tool on the upper surface of the stabilator as shown in Figure 4.
 - (b) Position the stabilator in neutral and, using a bubble protractor, set the number of degrees up travel as specified in Figure 4.
 - (c) Raise the trailing edge of the stabilator until the elevator reaches its stop. If the bubble is not centered, adjust the elevator stops to obtain the correct travel.
 - (d) Again place the stabilator in neutral and using the values from Figure 4, proceed with measuring the down angle.
 - (e) Make sure the lock nuts of the elevator stop bolts are secure.
- (3) The control column, or tee bar, is designed to be in the neutral position when at a forward angle of 7° from the neutral position (see Figure 2, 27-00-00). Rig the bobweight and control column to the stabilator as follows:
- (a) Move the control column to its neutral position and with cable clamps (Figure 2) or other suitable tool, block the column in this position.
 - (b) Ascertain that the stabilator is in neutral, and disconnect the feel springs in the rear of the fuselage.
 - (c) Evenly adjust the cable tensions to those specified in Figure 4.
 - (d) Adjust the control column-to-bobweight pushrod as necessary to achieve an angle of 23° + 0, -1° from a line projected from the lower bobweight link below a projected parallel line with the top of the front seat tracks. Use Figure 2, 27-10-00 for reference.
 - (e) Remove the control column blocking mechanisms.

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- (4) With the stabilator in neutral and the feel springs still detached proceed as follows to adjust the stabilator tab:
 - (a) Position the tab control in its neutral position.
 - (b) As necessary adjust the tab push rod to streamline the tab with the stabilator. This is the neutral position of the tab.
 - (c) Rotate the trim wheel and cross check the travels with those in Figure 4.
 - (d) If adjustments need to be made to alter the tab travels, only adjustment of the rod end fitting on the tab actuating arm and the repositioning of the trim barrel screw are recommended.
 - (5) Check to ensure the stabilator travel stops are contacted before those of the control column (tee bar).
 - (6) Connect the stabilator feel springs.
 - (7) Secure the stabilator against one of its stops and ascertain that total tab free play does not exceed 0.06 inches.
 - (8) Make sure all cables are aligned in their pulleys and there is no interference throughout the entire stabilator control system.
3. Stabilator Trim Assembly (Forward)
- A. Removal (See Figure 3.)
- (1) To remove the trim control wheel assembly and / or the trim control cables, first remove the panel to the aft section of the airplane.
 - (2) If the aft trim cable is not to be removed, block the cables at the pulleys in the tail cone to prevent them from unwrapping from the trim drum. (See Figure 2.)
 - (3) Loosen the cables if the trim control wheel is to be removed or disconnected if the cables are also to be removed. Do this at the trim cable turnbuckles in the aft section of the fuselage.
 - (4) The control wheel with drum may be removed by the following procedure:
 - (a) Remove the control wheel cover by removing the cover attaching screws.
 - (b) The wheel assembly may be removed from its mounting brackets by removing nut, washer, and bolt that secures the wheel between the brackets. Draw the wheel from the brackets. Use caution not to damage trim indicator wire.
 - (c) Unwrap the left cable from the drum.
 - (d) The wheel and drum are joined by three screws. Remove screws and separate these two items with their center bushing and unwrap the right cable.
 - (e) Tie the cables forward to prevent them from slipping back into the floor tunnel.
 - (5) The trim control cables may be removed by the following procedure:
 - (a) Remove the center seats and the pilot and rear seats if desired.
 - (b) Remove the seat belts attached to the forward floor tunnel by removing attachment nuts, washers and bolts.
 - (c) Unfasten the carpet from the aft portion of the forward floor tunnel and lay it forward.
 - (d) Remove the tunnel cover located between the trim control wheel and the spar cover by removing attachment screws.
 - (e) Remove the cable pulleys located in the forward tunnel by removing the cotter pin, washer and clevis pin.
 - (f) Remove the floor panel aft of the main spar by removing the panel attachment screws and seat belt attachments. Lift the panel and remove from airplane.

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- (g) Remove the cable rub blocks located in the floor opening on the aft side of the main spar by removing the block attachment screws.
- (h) Remove the carpet and the heater duct over the aft floor tunnel.
- (i) Remove the cover plate from the top of the aft floor tunnel by removing attachment screws.
- (j) Remove the cable guard (see Figure 3, Sketch A) from the underside of the trim cable pulleys located at station 130.167 by removing the cotter pin and withdrawing the roll pin.
- (k) Remove the cable fairlead (see Figure 3, Sketch B) from the underside of the pulley cluster located at station 166.837 by removing the plate attachment screws.
- (l) With the cables disconnected from the trim control wheel, draw the cable(s) through the floor tunnel.

B. Installation (See Figure 3.)

- (1) The trim control wheel with drum may be installed by the following procedure:
 - (a) Wrap the right trim cable on the trim drum by inserting the swaged ball of the cable in the slot provided in the side (right side) of the drum that mates with the control wheel, and looking at this side, wrap the drum with three and a half wraps of the cable in a clockwise direction.
 - (b) Attach the control wheel to the cable drum by aligning the long lug of the drum with the long slot of the wheel and securing the two pieces together with three screws.
 - (c) Wrap the left trim cable on the drum by inserting the swaged ball of the cable in the slot provided in the flanged side (left side) of the drum and looking at this side, wrap the drum with three and a half wraps of the cable in a clockwise direction.
 - (d) Lubricate and install the bushing in the control wheel and drum.
 - (e) Align the control cables and position the control wheel assembly between its mounting brackets. Ascertain that the end of the trim indicator wire is positioned in the spiraled slot of the drum with no bind on the end. Install the retainer bolt and washer from the left side and install washer and nut.
 - (f) Install the cover over the control wheel and secure with screws, unless the control cables have yet to be installed.
- (2) The trim control cables may be installed by the following procedure:
 - (a) Draw the cable(s) through the floor tunnel.
 - (b) Wrap the cable drum and install the trim control wheel as given in Step 1.
 - (c) Position the cable pulleys on the mounting bracket and install the clevis pin, washer and cotter pin.
 - (d) Connect the cable to the aft cable at the turnbuckle in the aft section of the fuselage. Install aft cable if not installed.
 - (e) Install the cable fairlead (see Figure 3, Sketch B) at the underside of the pulley cluster located at station 166.837 and secure with screws.
 - (f) Install the roll pin type cable guard (see Figure 3, Sketch A) at the underside of the pulleys located in the forward area of the aft floor tunnel and secure it with a cotter pin.
 - (g) Install the cable rub blocks located on the aft side of the main spar housing and secure with screws.
 - (h) Remove the blocks that secure the aft trim cable and check that the cables are seated on the pulleys.
 - (i) Set cable tension and check rigging and adjustment of stabilator trim. Safety all turnbuckles.
 - (j) Install the tunnel cover on the forward tunnel and secure with screws.

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- (k) Install the carpet over the floor tunnel.
 - (l) Install the cover over the trim control wheel and secure with screws and special washers.
 - (m) Install the seat belts removed from the top of the floor tunnel and secure with bolt, washer and nut.
 - (n) Install the floor panel and seat belt attachments aft of the main spar and secure panel with screws.
 - (o) Install the aft floor tunnel and secure with screws.
 - (p) Install the heater duct and carpet over the aft floor tunnel.
 - (3) Install the panel to the aft section of the airplane and the seats.
4. Stabilator Trim Controls (Aft)
- A. Removal (See Figure 3.)
- (1) Remove the access panel to the aft section of the fuselage.
 - (2) Block the trim cables at the first set of pulleys forward of the cable turnbuckles in the aft section of the fuselage.
 - (3) Remove the tail cone attachment screws and tail cone from the airplane.
 - (4) Block the cable at the trim barrel to prevent it from unwrapping at the barrel.
 - (5) Disconnect the cables at the turnbuckles.
 - (6) Remove the cable guard pins at the trim screw and also at the pulleys located below the trim mechanism at station 292.34.
 - (7) Remove the bolt assembly which connects the forward end of the trim screw with the link assembly.
 - (8) Unscrew the screw from the trim barrel.
 - (9) Remove the four machine screws securing the two parts of the bracket assembly to the mounting bracket.
 - (10) Separate the two parts of the bracket assembly and remove the trim barrel and cable. Note the amount and placement of washers at each end of the barrel to simplify reassembly.
 - (11) Remove the barrel and cables from the airplane.
- B. Installation (See Figure 3.)
- (1) Wrap the trim barrel by first laying the center of the aft trim cable (as measured equally from each end to the center of the cable) in the slot of the barrel. Bring the upper cable through the diagonal slot in the flange at the upper end of the barrel and wrap down in a counterclockwise direction. Bring the lower cable through the diagonal slot in the lower end of the barrel and wrap up in a clockwise direction. Wrap the cable as evenly as possible to obtain 23 wraps on the barrel as viewed from the side opposite the slot and with the cables extending out from the slotted side.
 - (2) Block both cables by clamping them between two pieces of wood laid next to the wraps to prevent them from unwrapping.
 - (3) Install the barrel between the two parts of the bracket assembly. Be sure to install the washers at both ends of the barrel before installing it in the brackets.
 - (4) Secure the barrel and bracket assembly to the mounting bracket with the four machine screws.
 - (5) Install the screw into the barrel with the drilled bolt hole facing towards the front of the airplane.
 - (6) Position the stabilator and trim tab in a neutral position as described in the next paragraph, and adjust the trim screw until the bolt hole in the end aligns with the bolt hole in the yoke of the link assembly; then install and secure the bolt assembly.

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- (7) Route the cable around the pulleys at station 292.34 and forward to the turnbuckles in the fuselage.
- (8) Ascertain that the cables are in the pulley grooves; then install the guard pins at the pulleys.
- (9) Connect the cables to the turnbuckles and remove the blocking from both the forward and aft cables.
- (10) Set cable tension in accordance with Figure 4 and check rigging and adjustment.
- (11) Install the tail cone and secure with screws.
- (12) Install the access panel to the aft section of the fuselage.

C. Rigging and Adjustment (See Figures 3 and 4.)

- (1) Level the airplane.
- (2) Remove the tail cone fairing from the fuselage by removing the attaching screws.
- (3) Remove the access panel to the aft section of the fuselage.
- (4) Secure the stabilator in its neutral position. To find neutral, place a rigging tool on the upper surface of the stabilator as shown in Figure 4. Zero a bubble protractor on the top of the front seat tracks; then set it on the rigging tool and tilt the stabilator until the bubble is centered.
- (5) The following items should be accomplished as a preadjustment check before proceeding with the rigging of the trim tab. If these items were accomplished during the installation, proceed with Step 6.
 - (a) Ascertain that the cable is wrapped 23 times around the barrel as shown in Figure 3.
 - (b) The trim screw is adjusted to an initial length of 1.06 inches as shown in Figure 3.
 - (c) The actuating rod is initially adjusted to 6.62 inches in length as shown in Figure 3.
 - (d) Set the trim cable tension in accordance with Figure 4. If the cables were disconnected and replaced, rotate the control wheel several times to allow the cables to seat and then recheck the tension.
- (6) Turn the trim control wheel until the trim tab streamlines with the neutral stabilator.
- (7) Check the bubble of the protractor over the neutral tab and then check the tab travels as given in Figure 4. The degree of travel on the protractor is determined by taking the difference between the protractor reading at neutral and up, and neutral and down. The bubble must be centered at each reading with the airplane level.
- (8) If correct travels are not obtained, disconnect the actuating push rod from the trim screw and turn the rod end in or out as required.
- (9) Reconnect the rod end and secure the jamb nut.
- (10) With the trim tab operating at its proper extremes ascertain that there is no cable or turnbuckle interference, as well as binding or chafing.
- (11) With the stabilator held at one of its stops ensure that the trim tab free play does not exceed 0.06 inch measured at the trailing edge.

CAUTION: VERIFY FREE AND CORRECT MOVEMENT OF STABILATOR TAB. WHILE IT WOULD SEEM SELF-EVIDENT, FIELD EXPERIENCE HAS SHOWN THAT THIS CHECK IS FREQUENTLY MISINTERPRETED OR NOT PERFORMED AT ALL. ACCORDINGLY, UPON COMPLETION OF STABILATOR TRIM RIGGING AND ADJUSTMENT, VERIFY THAT THE STABILATOR TAB MOVES UP WHEN THE TRIM WHEEL IS TRIMMED DOWN; AND, THAT THE STABILATOR TAB MOVES DOWN WHEN THE TRIM WHEEL IS TRIMMED UP.

- (12) Reinstall tail cone.

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5. Stall Warning System

The stall warning system for this aircraft is designed to detect stall conditions through two modes of flight operation. These conditions involve flight of the aircraft with flaps at 0° and 24°, or 25° and 40°. To accomplish this, the system utilizes two lift detectors, two micro switches, a horn, and a 5 amp circuit breaker. (A 15 amp circuit breaker is used when stall heat is installed.)

The two lift detectors are mounted in the left wing outboard of the left nacelle. The detectors are mounted such that as stalling conditions are approached with the flaps at 0° or 24°, the outboard detector gives the indication of stall, while the inboard detector gives the indication with flaps at 25° and 40°.

For the system to function, the lift detectors are interconnected to a micro switch which is operated by a cam on the flap torque tube. The mechanism is located inside the fuselage at the left wing root (see Figure 5). As the flap torque tube turns, positioning the flap, the cam activates the switch locking out the particular lift detector tab.

To prevent operation of the stall warning system while on the ground, a squat switch, mounted on the left gear trunnion, opens the circuit as the gear is compressed. This switch is in line between the horn and the flap switch.

The electrical circuit is protected by a 5 amp circuit breaker mounted in the circuit breaker panel on the lower right side of the instrument panel. (A 15 amp circuit breaker is used when stall heat is installed.)

A. Troubleshooting

- (1) Insert a wedge or other tool under the leaf of the micro switch (squat switch) on the left main gear. Check wiring for identification. See Chapter 91 for wiring diagrams.
- (2) Ensure the flaps are in the full up position and switch on the master switch.
- (3) Using light finger pressure, gently raise the sensor blade of the outboard lift detector until the horn comes on. Gently lower the blade and the horn should be deactivated. Move the flap to 10° and check with the same procedure. In the same manner, ensure the inboard detector is also deactivated.
- (4) Extend the flaps to 25° and 40° and as previously described, check that the outboard lift detector is deactivated and the inboard lift detector activated.
- (5) If the stall system fails to operate properly make sure the master switch is off and check the system as follows:
 - (a) Using the wiring diagram in Chapter 91, check for proper continuities.
 - (b) If it is felt the flap micro switch is out of adjustment refer to the FLAPS section of this chapter to make access to the torque tube. With the flaps full up determine that the micro switch actuator bearing is in contact with the fitting on the torque tube, and move the flaps to the 25° down position. Listen for switch activation and adjust the switch as necessary.
- (6) Repeat Steps (3) and (4). If system still does not function properly, check continuity at flap switch terminals and throughout system.

B. Lift Detector

- (1) Removal
 - (a) Remove four screws holding the unit in place and remove the unit from the wing.
 - (b) Identify the electrical leads to facilitate reinstallation. Disconnect the electrical leads.
- (2) Installation
 - (a) Attach electrical leads to the appropriate terminals of the lift detector.
 - (b) Position the unit on the wing, determining that the sensor blade of the unit drops down freely, and secure in position with four screws previously removed.

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C. Flight Test Procedure

(PIR-FTP2001-12, Rev. E)

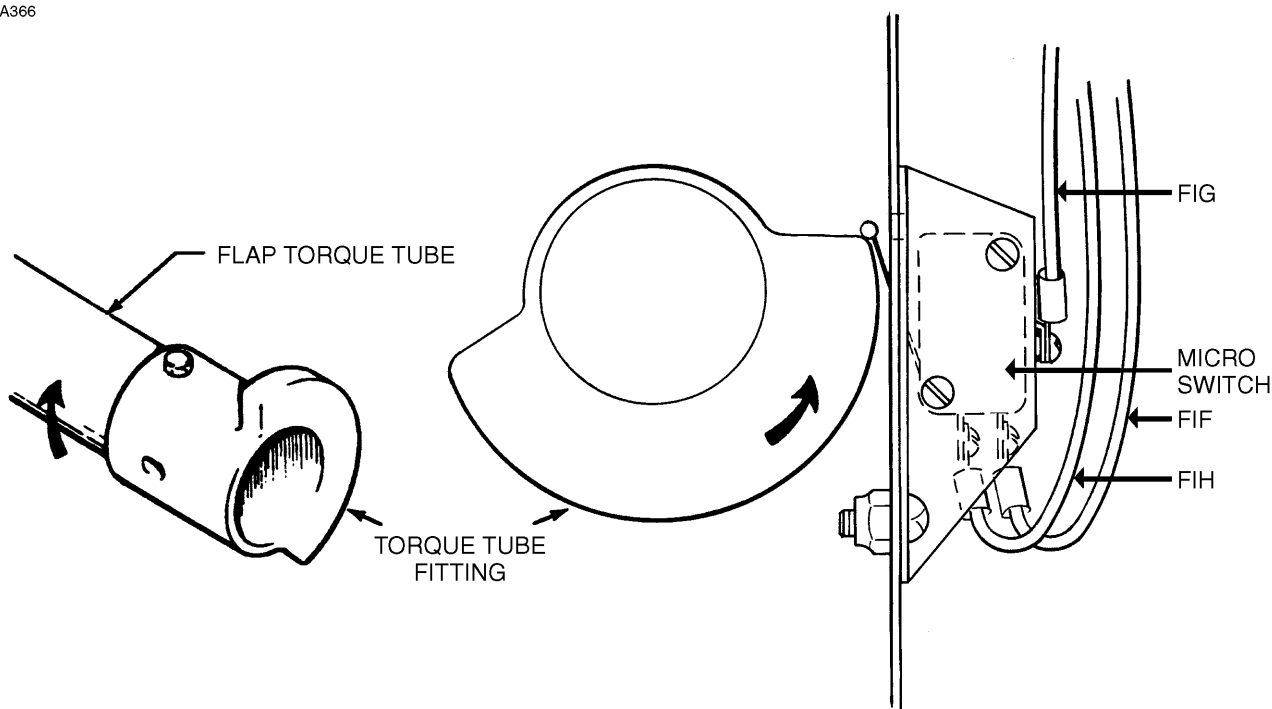
NOTE: Required whenever a "replacement" wing is installed.

Fly airplane, and at a rate of 1 KT/SEC maximum, record the following warning and stall speeds:

	<u>TRIM KIAS</u>	RECORD:	<u>WARNING KIAS</u>	<u>STALL KIAS</u>
0° FLAPS =	100		_____	_____
FULL FLAPS =	94		_____	_____

- A. Verify that the stall warning system performs within the following limits:
 - (1) Maximum: stall warning begins at 5 to 10 KIAS prior to stall and continues until stall occurs.
 - (2) Desired: stall warning begins at 7 to 9 KIAS prior to stall and continues until stall occurs.
- B. If the stall warning system fails to perform within the limits above, adjust the system and refly the test.
- C. If not able to adjust the stall warning system sufficient to achieve the limits above, recheck the "replacement" wing installation to ensure it is installed and rigged correctly.

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Stall Warning Flap Microswitch Adjustment
 Figure 5

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FLAP CONTROLS

1. Troubleshooting

Chart 1 lists troubles peculiar to flap control system along with their probable causes and suggested remedies. When troubleshooting the flap control system, additional reference may be obtained from Chapter 57 on control surface balancing, if required. After the trouble has been corrected, check the entire flap control system for security and operation.

2. Wing Flaps

A. Removal (See Figure 1.)

(1) To remove flap torque tube assembly:

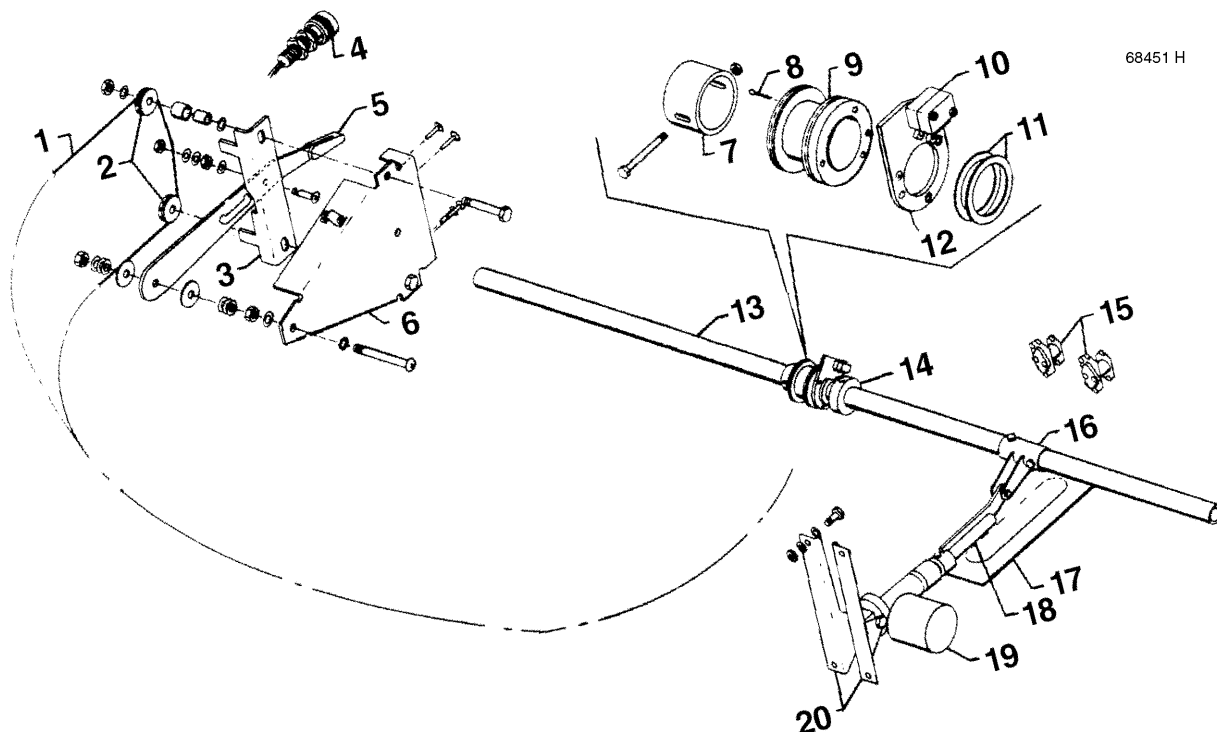
- (a) Extend flaps to 40° position
- (b) Remove floor panel located aft of main spar by removing center seats, seat belt attachments and screws securing panel. Lift panel and remove from airplane.
- (c) Remove access plate located between underside of aft section of each wing and fuselage by removing attaching screws.
- (d) Disconnect left and right flap control tubes (rods) either:
 - 1 At the flaps by removing nuts, washers and bolts at the torque tube cranks (arms) or by;
 - 2 Removing bolts and washers from inner side of each crank. Remove bolt through a hole in the fuselage side skin located over torque tube .
- (e) Disconnect electrical connections from limit switches mounted to torque tube switch plate.
- (f) Disconnect cable ends from torque tube pulley assembly by removing the cotter pins.
- (g) Disconnect jack screw actuator from torque tube bellcrank by removing nut, washers and bolt.
- (h) Remove tube support bearing blocks by removing block attachment bolts.
- (i) Remove nuts, washers and bolts securing right and left cranks, and stop fittings on torque tube.
- (j) From between each wing and fuselage, remove cranks from torque tube.
- (k) Disconnect one bearing block from its mounting brackets by removing nuts, washers and bolts.
- (l) Slide tube from bearing block still attached to its brackets. Raise end and lift it from floor opening.

CHART 1
TROUBLESHOOTING FLAP CONTROL SYSTEM

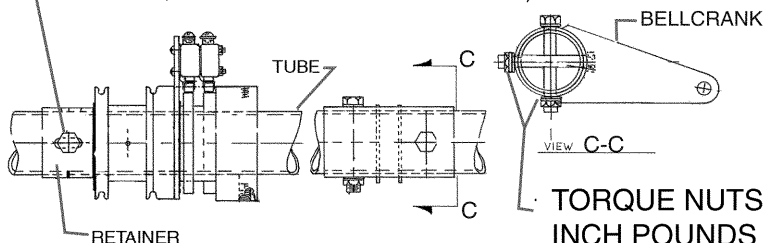
Trouble	Cause	Remedy
Flaps fail to extend or retract.	Motor or actuator inoperative	No electrical power to motor. Check circuit breaker.
Flaps not synchronized or fail to move evenly when retracted.	Incorrect rigging of system.	Adjust flaps.

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68451 H



TORQUE MS21042-3 NUT TO
20 TO 25 INCH POUNDS. (INCLUDES FRICTION
DRAG, NO LUBRICANT ON THREADS.)



TORQUE NUTS TO 40 TO 45
INCH POUNDS (INCLUDES FRICTION
DRAG, NO LUBRICANT ON THREADS.)

1. CABLE ASSEMBLY
2. PULLEYS
3. FLAP SELECTOR DETENT BRACKET
4. FLAP INDICATOR LIGHT ASSEMBLY
5. FLAP SELECTOR LEVER ASSEMBLY
6. BRACKET
7. TORQUE TUBE RETAINER
8. COTTER PIN
9. FLAP TORQUE TUBE PULLEY

10. SWITCHES
11. WASHERS
12. SWITCH MOUNTING LEVER
13. TORQUE TUBE ASSEMBLY
14. FLAP TORQUE TUBE CAM
15. FLAP ACTUATOR RELAYS
16. BELLCRANK ASSEMBLY
17. FLAP ACTUATOR COVER
18. FLAP ACTUATOR
19. FLAP ACTUATOR MOTOR
20. ACTUATOR MOUNTING BRACKET

Flap Control System Installation
Figure 1

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- (2) The flap control cable may be removed by the following procedure:
 - (a) If the center seats and floor panel have not been removed, remove the seats and the screws securing the floor panel.
 - (b) Remove the aft heat deflectors on each forward floor tunnel by sliding them far enough to release the spring fasteners.
 - (c) Lift the aft section of the tunnel carpet far enough to remove the screws securing the tunnel cover and remove the cover.
 - (d) If not previously accomplished, remove the cotter pins securing the cable ends to the pulley assembly on the torque tube; and the clamps securing the cable housings to the support bracket.
 - (e) Disconnect the selector lever and cable from the selector lever support bracket mounted on the aft side of the instrument panel.
 - (f) Remove the cable assembly from the tunnel.
 - (3) The jack screw and motor assembly may be removed by the following procedure.
 - (a) Remove the center seats and floor panels.
 - (b) Disconnect the electrical leads to the motor.
 - (c) If not previously accomplished, remove the nut, washers and bolt securing the screw jack actuator to the torque tube bellcrank.
 - (d) Remove the nut, washers and bolt securing the jack screw to its mounting bracket. Do not drop the bushing in the jack screw mounting end.
- B. Installation (See Figure 1.)
- (1) To install flap actuator jack screw and motor assembly:
 - (a) Position flap actuator jack screw and motor assembly through center floor opening. Do not drop bushing in jack screw mounting end.
 - (b) Install nut, washers and bolt securing flap actuator jack screw to its mounting bracket.
 - (c) Install nut, washers and bolt securing flap actuator jack screw to torque tube bellcrank.
 - (d) Connect electrical leads to flap actuator motor.
 - (2) To install flap control cable:
 - (a) Position cable assembly in tunnel.
 - (b) Connect cable to flap selector lever and flap selector lever support bracket mounted on aft side of instrument panel.
 - (c) Attach cable ends to pulley assembly on torque tube by installing cotter pins .
 - (d) Install clamps securing cable housings to support bracket.
 - (e) Install aft section tunnel cover and secure with screws.
 - (f) Install tunnel carpet and heat deflectors,
 - (g) Install center seats.
 - (3) To install flap torque tube assembly:
 - (a) Check that one end bearing block fitting is installed between its attachment brackets.
 - (b) Slide the other end bearing block over its respective end of torque tube.
 - (c) Position torque tube by placing end with bearing block attached between appropriate mounting bracket Slide other end into previously attached end bearing block. Secure with bolts, washers and nuts.
 - (d) Between each wing and fuselage, attach cranks to torque tube.
 - (e) Install nuts, washers and bolts securing right and left cranks, and stop fittings on torque tube.

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- (f) Install tube support bearing blocks . Secure by installing block attachment bolts.
- (g) Connect jack screw actuator to torque tube bellcrank and secure with nut, washers and bolt.
- (h) Connect cable ends to torque tube pulley assembly and secure with cotter pins.
- (i) Connect electrical connections to limit switches mounted to torque tube switch plate.
- (j) Connect left and right flap control tubes (rods) either:
 - 1 At flaps by installing nuts, washers and bolts at torque tube cranks (arms) or by;
 - 2 Installing bolts and washers to inner side of each crank. Install bolt through a hole in the fuselage side skin located over torque tube.
- (k) Install access plate located between underside of aft section of each wing and fuselage by installing attaching screws.
- (l) Install floor panel located aft of main spar and secure with screws
- (m) Install center seats and seat belt attachments.
- (n) Retract flaps.

C. Control Cable Rigging (See Figure 2.)

CAUTION: VERIFY FREE AND CORRECT MOVEMENT OF FLAPS. WHILE IT WOULD SEEM SELF-EVIDENT, FIELD EXPERIENCE HAS SHOWN THAT THIS CHECK IS FREQUENTLY MISINTERPRETED OR NOT PERFORMED AT ALL. ACCORDINGLY, UPON COMPLETION OF FLAP RIGGING AND ADJUSTMENT, VERIFY THAT THE FLAPS MOVE UP WHEN THE SELECTOR LEVER IS UP; AND, THAT THE FLAPS MOVE DOWN WHEN THE SELECTOR LEVER IS DOWN.

- (1) Loosen lever cable clamp nut so that cable can move freely through cable clamp. Secure lever in the full down position. (See Figure 2.)
- (2) Position the swash plate assembly on torque tube and secure in place. (See Figure 3.)
- (3) Loosen cable housing clamps at pulley support channel. Adjust cable tension so that a 5 ± 0.5 pound pull midway between cable housing clamps and swash plate assembly will deflect the cable 0.38 inch from relaxed position. Tighten cable housing clamp. (See Figure 3.)
- (4) Tighten lever cable lamp nut so that cable is compressed to 1/2 its full diameter. (See Figure 2.)

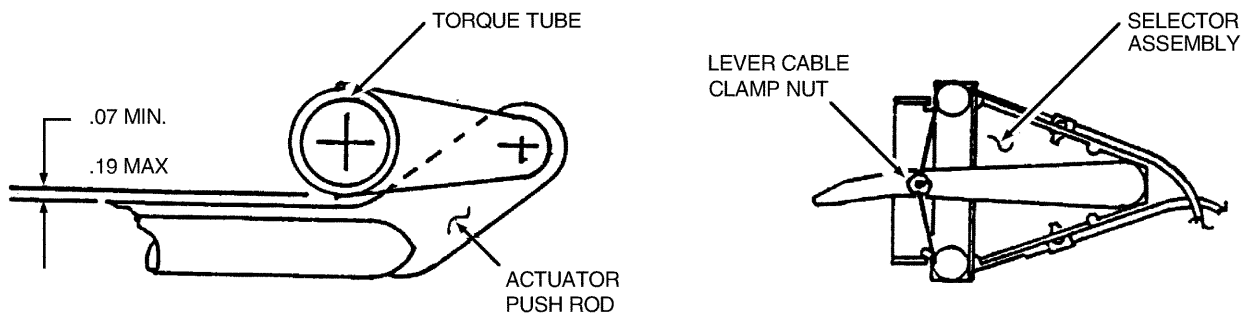
D. Cam Adjustment

- (1) Pull the electric flap circuit breaker.
- (2) Disconnect the actuator motor power leads and connect a reversible 24-volt dc power source.
- (3) Run the actuator out so that there is 0.10 inch clearance between the torque tube and the actuator pushrod. (See Figure 2.)
- (4) Reconnect the aircraft wires to the actuator motor and secure.
- (5) With the electric flap circuit breaker pulled, apply power to the aircraft buss.
- (6) Loosen the set screw in the cam and rotate until the flap in-transit light is out. (See Figure 3.)

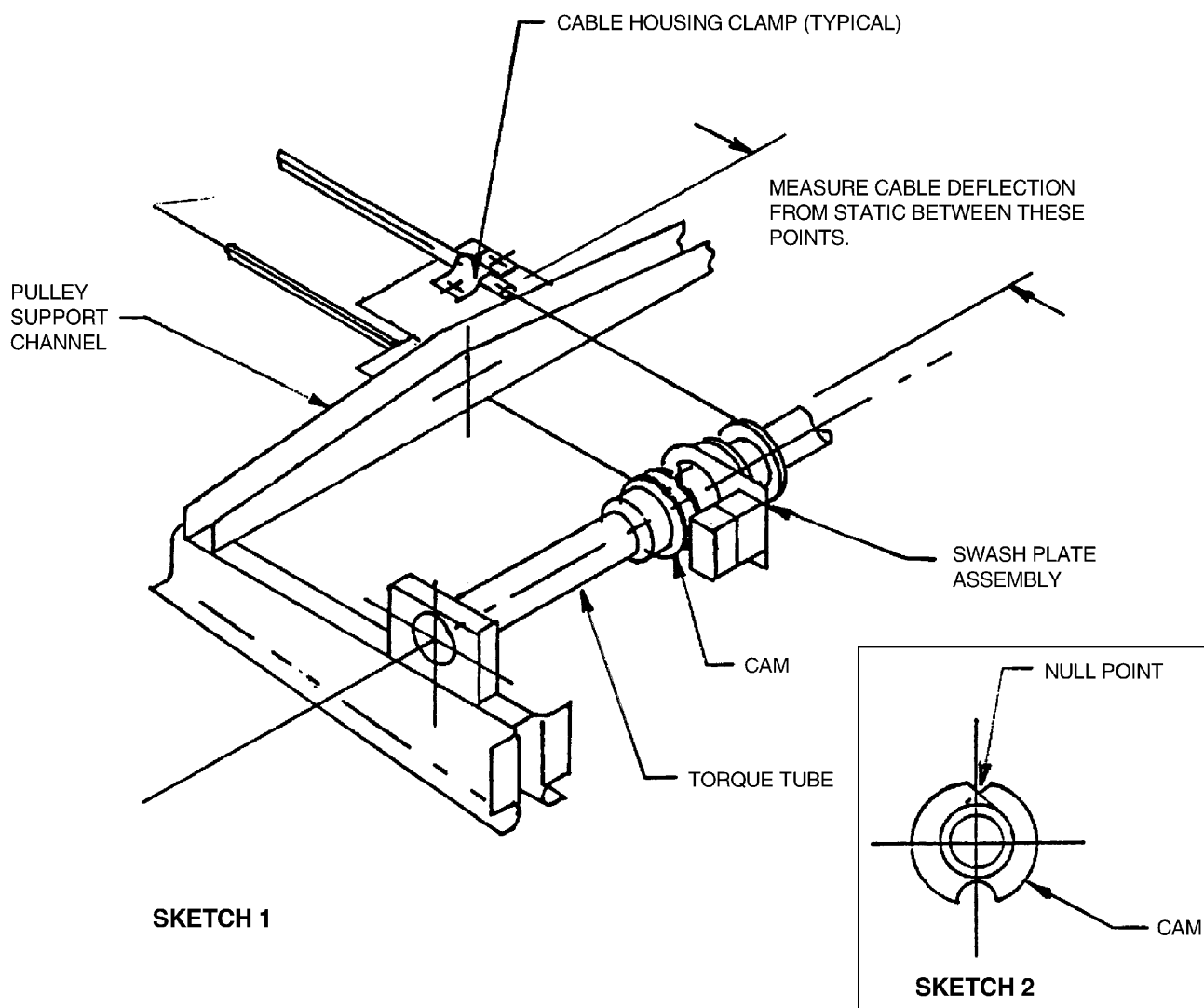
NOTE: Ensure that the switch rollers are in the cam “null point” as shown in Figure 3 and not 180 degrees off.

- (7) Tighten the cam set screws.
- (8) Push in the electric flap circuit breaker and verify that the flap motor does not run.
- (9) Move the selector lever to the full “down” position and verify that the actuator retracts and stops about 0.4 inch short of bottoming out.

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Rigging of Electric Flap Controls
Figure 2



Rigging of Flap Cam-Cable Assembly
Figure 3

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- (10) Move the selector lever to the full UP position and verify that clearance between the actuator pushrod and torque tube is 0.07 inches minimum, 0.19 inches maximum. (See Figure 2.)
- (11) Adjust the left and the right stop screws so that contact is just made with the stop. Tighten the jam nuts.

E. Flap Angle Setting

NOTE: While making this adjustment, maintain a slight “up” pressure on the underside of the flap sufficient to take the slack out of the linkage.

With the flap selected UP, adjust each flap pushrod so that the chord line of the flap forms a $0^\circ \pm 1^\circ$ angle with the wing chord at the outboard end of the flap.

Adjust the left and right stop screws so that contact is just made with the stop. Tighten the jamb nuts. (See Flap Stop, Figure 4.)

F. Flap Travel Check

While maintaining a light “up” pressure on the underside of the flap, check that the flap travel is:

- (a) $0^\circ \pm 1^\circ$ in full UP position.
- (b) $10^\circ \pm 2^\circ$ at the FIRST stop.
- (c) $25^\circ \pm 2^\circ$ at the SECOND stop.
- (d) $40^\circ \pm 2^\circ$ at the full DOWN position.

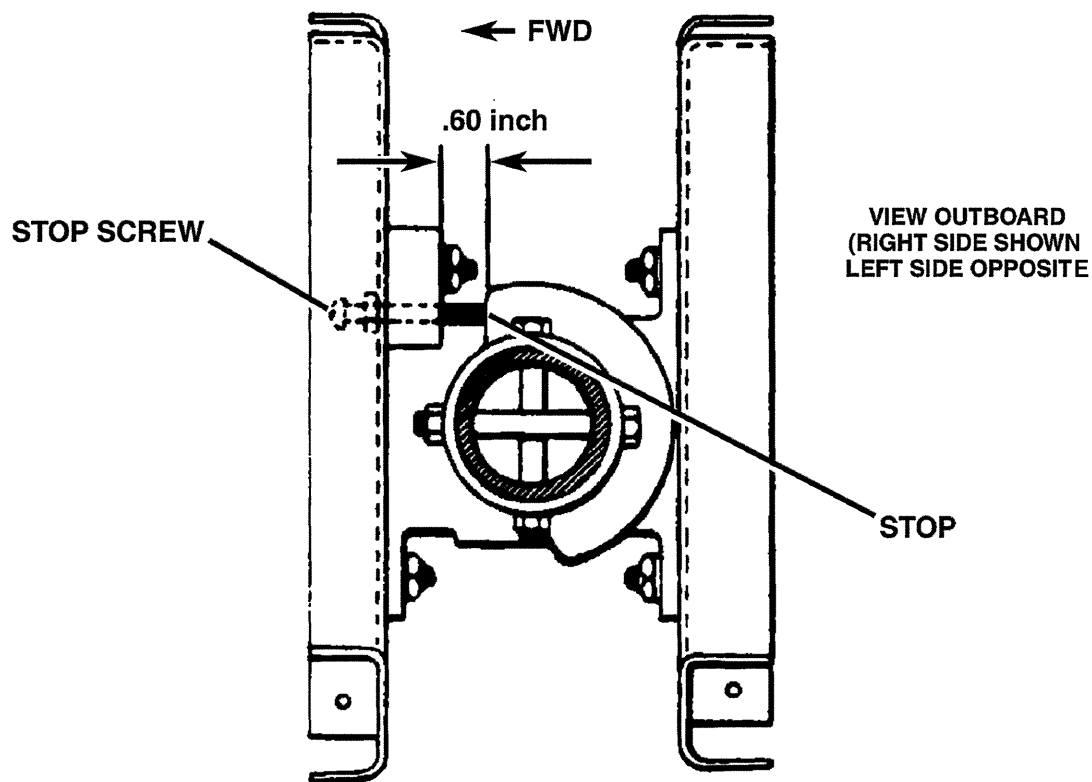
G. Flap Indicator Calibration (SENECA V only)

WARNING: EXCEEDING THE TRAVEL LIMIT WILL DESTROY THE POTENTIOMETER.

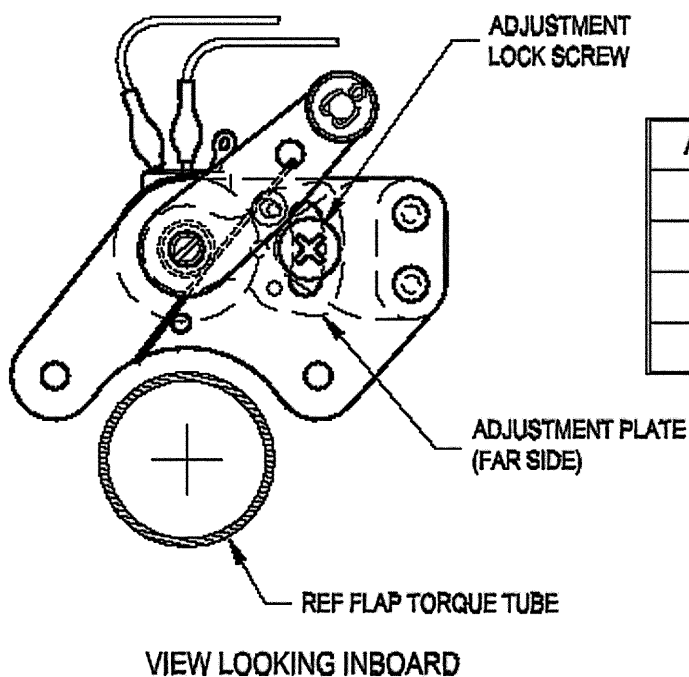
After the flaps have been rigged completely, ensure that external power is CONNECTED AND ONLINE. Indicator CANNOT be adjusted and WILL NOT indicate correctly without 28 volts on the system. A regulated external supply of 28 to 28.5 Volts must be used. Calibrate the flap indicator as follows:

- (a) With the aircraft power off, loosen the adjustment lock screw. Loosen the potentiometer mounting nut and tighten to finger tight. Ref. Figure 5
- (b) Unplug the flap pot assembly from the harness and connect a digital Ohmmeter to the leads. Ensure the 28-28.5 volt external power unit is connected and on line. Power up the aircraft and set the flaps to 40° . Read the resistance of the potentiometer. If it does not read 97.4 ohms, move the adjustment plate achieve 97.4 Ohms (maximum) and tighten the lock screw. Tighten the potentiometer mounting nut and verify reading. Repeat adjustment as necessary.
- (c) Move the flap lever to 25° , 10° , and 0° verify Ohm readings for each, see figure 5. If readings are NOT within limits, repeat steps (a) and (b). This will ensure that the pot travel limit is never exceeded. Exceeding the travel limit will destroy the potentiometer. Power down the aircraft.
- (d) Disconnect the Ohmmeter and plug the assembly into the harness. Power up the aircraft and verify that the indicator reads correctly for all positions.
- (e) The needle must be inside of the degree markings at 0° , 10° , 25° , and 40° . If the voltage is correct and the indicator is not within the marks and the resistances are to figure 5 the, the flap indicator is out of tolerance and should be replaced

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Stop Screws Adjustment
Figure 4



ANGLE	RESISTANCE
0°	11 ±2 OHMS
10°	49 ±2 OHMS
25°	75.6 ±2 OHMS
40°	97.4 ±2 OHMS

Flap Potentiometer Adjustment
Figure 5

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3. Torque Tube/Push Rod Distortion Inspection

If flaps have been extended at or above V_{FE} , inspect the flap torque tube arms and pushrods for evidence of distortion.

- A. If the paint is cracked or peeling anywhere along the torque tube arm or pushrod, torsional movement has occurred.
- B. Remove the paint and inspect for cracks:
 - (1) In the welds at the arm on the torque tube end.
 - (2) In the rod ends and pushrod tube.
 - (3) Use a dye penetrant method of inspection.
- C. If cracks are not found, repaint the part(s) and reinstall.
- D. If cracked, replace the affected part(s).

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CHAPTER

28

FUEL

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CAUTION: (SENECA IV MODELS) EXCESSIVE FUEL PRESSURE AND VERY RICH FUEL/AIR MIXTURES WILL OCCUR IF THE HI POSITION IS ENERGIZED WHEN THE ENGINE FUEL INJECTION SYSTEM IS FUNCTIONING NORMALLY.

On Seneca IV models, low auxiliary fuel pressure is available and may be used during normal engine operation both on the ground and in flight for vapor suppression should it be necessary as evidenced by unstable engine operation during idle or at high altitudes.

Primer operation is accomplished with two separate spring-loaded button type switches, located adjacent to the starter switches. These switches are used to select the HI auxiliary fuel pump operation for priming, irrespective of other switch positions. These primer buttons may be used for both hot or cold engine starts.

2. Troubleshooting

Troubles peculiar to the fuel system are listed in Chart 1 along with their probable causes and suggested remedies. When troubleshooting, check from the power supply to the items affected. If no trouble is found by this method, the trouble probably exists inside individual pieces of equipment: they may be removed from the airplane and an identical unit or units, tested and known to be good, installed in their place.

NOTE: Refer to Chart 1, 71-00-00, for additional Fuel System Troubleshooting.

3. Inspection of Fuel System

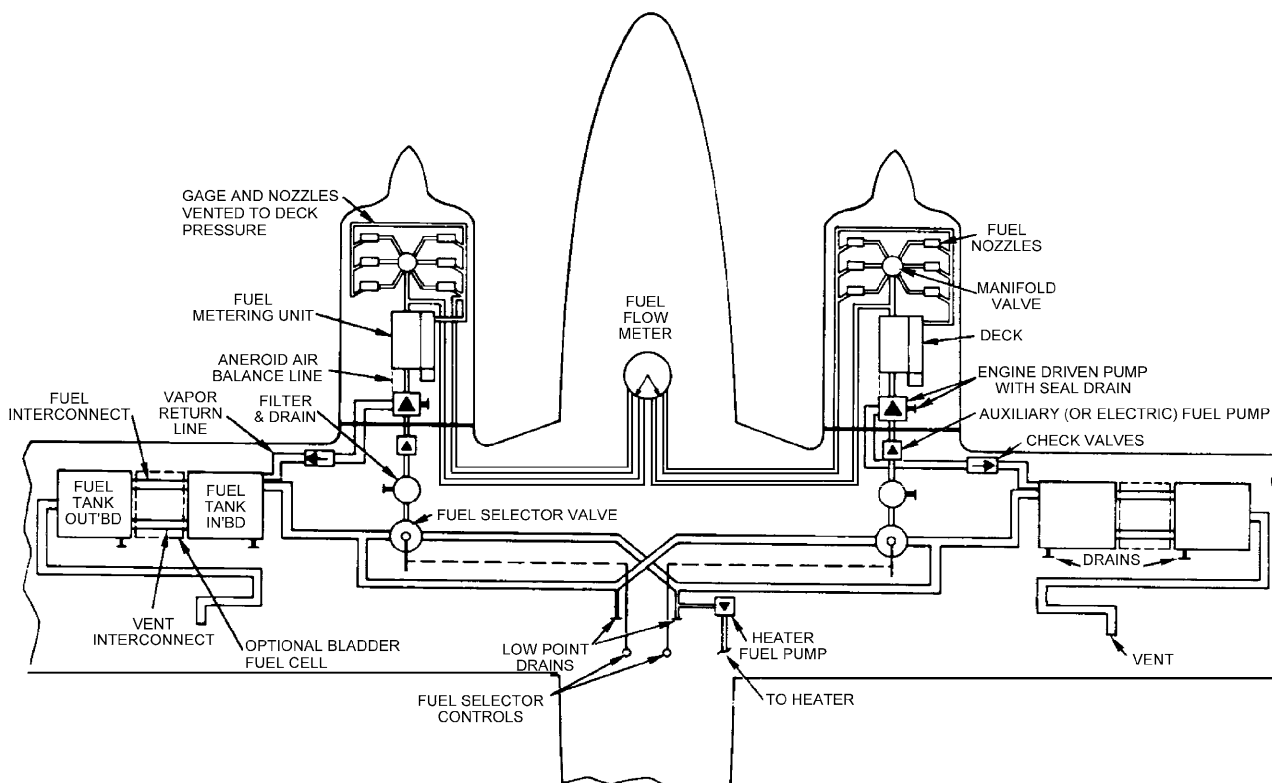
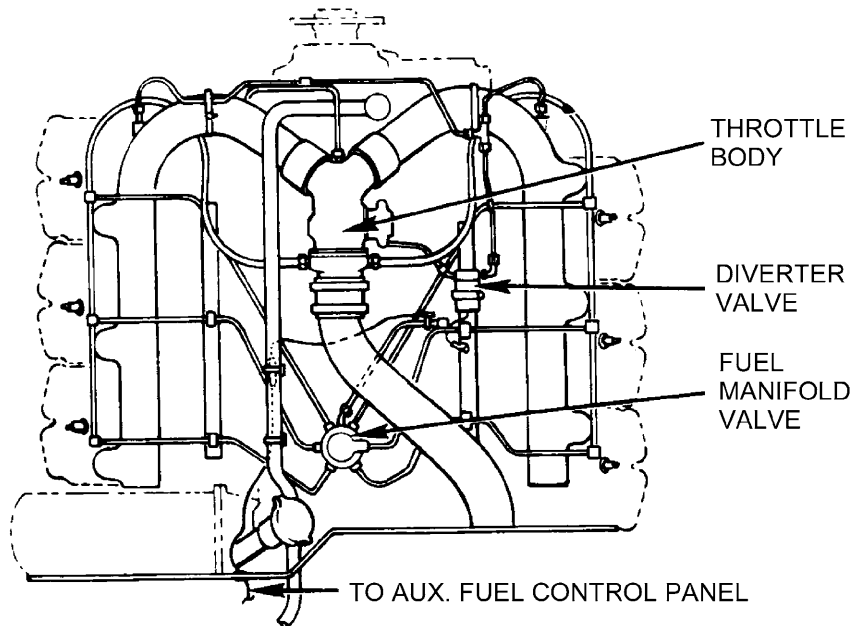
Fill tanks with fuel. Inspect tanks and fuel line connections for leaks. If fuel tanks leak, follow instructions given in "Inspection and Repair of Fuel Tanks". If fuel line connections leak, tighten clamps or replace hose connections after first draining tanks.

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**CHART 1
TROUBLESHOOTING FUEL SYSTEM**

Trouble	Cause	Remedy
Failure of fuel to flow.	Fuel line blocked.	Flush fuel system.
	Fuel vent cap blocked.	Check and clean vent hole in cap.
	Mechanical or electrical fuel pump failure.	Check and replace if necessary.
	Fuel selector valve in improper position.	Reposition as required.
		Check for obstructions in the fuel selector leverage mechanism. Check fuel selector cable for freedom of movement.
	Damaged fuel selector valve.	Replace fuel selector valve.
Fuel quantity gauge fails to operate.	Broken wire.	Check and repair.
	Gauge inoperative.	Replace gauge.
	Fuel sender float partially or completely filled with fuel.	Replace sender.
	Circuit breaker open.	Check and reset.
	Float and arm assembly of fuel sender sticking.	Check.
	Bad ground.	Check for good contact at ground lip or rear of gauge.
Low pressure or pressure surges.	Obstruction in inlet side of pump.	Trace lines and locate obstruction.
	Air in line to pressure gauge.	Bleed line.

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Fuel System Schematic
Figure 1 (Sheet 1 of 2)

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Figure 1 (Sheet 2 of 2)

Seneca V

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STORAGE

1. Inspection and Repair of Fuel Tanks

WARNING: OBSERVE ALL FUEL SYSTEM FIRE HAZARD PRECAUTIONS THROUGHOUT ALL REMOVAL AND INSPECTION PROCEDURES. USE VAPOR-PROOF LIGHT FOR INSPECTION.

WARNING: IF DRAIN VALVES ARE REMOVED TO DRAIN TANKS, APPLY PARKER HANNIFIN THREAD LUBE, PIPER P/N 913-224, TO MALE PIPE THREADS BEFORE INSTALLING. DO NOT ALLOW LUBRICANT TO ENTER FUEL SYSTEM.

Completely drain fuel tanks. (See Draining Fuel Systems, 12-10-00) Inspect each tank for signs of leaks as indicated by telltale stains. If a fuel leak is detected, remove fuel tank and repair as follows:

WARNING: SLOSHING OF FUEL TANKS IS PROHIBITED.

If tank has previously been sloshed, use a mirror and inspection light inserted through the filler neck to inspect tank interior for signs of peeling or chipping sealer. If peeling and/or chipping has occurred, and separated material is found, sloshing material must be completely removed or tank replaced.

Seal leaks with Products Research Corporation PR 1422A series or PR1433G series sealant. For example: PR1422A1.

A. Removal of Inboard Fuel Tank (See Figure 1, 28-00-00 and Figure 1, 28-10-00.)

- (1) Remove bladder type fuel cell before proceeding. (Refer to the appropriate paragraph.)
- (2) With fuel tank completely drained, loosen clamps at hose connections, and slide hose connections away from fuel tank.
- (3) Remove screws from around perimeter of the tank.
- (4) Carefully pull tank away from the wing far enough to gain access to remove sender wire and fuel line.
- (5) The tank is now free to be removed.

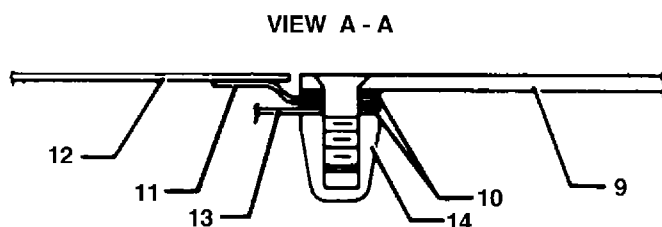
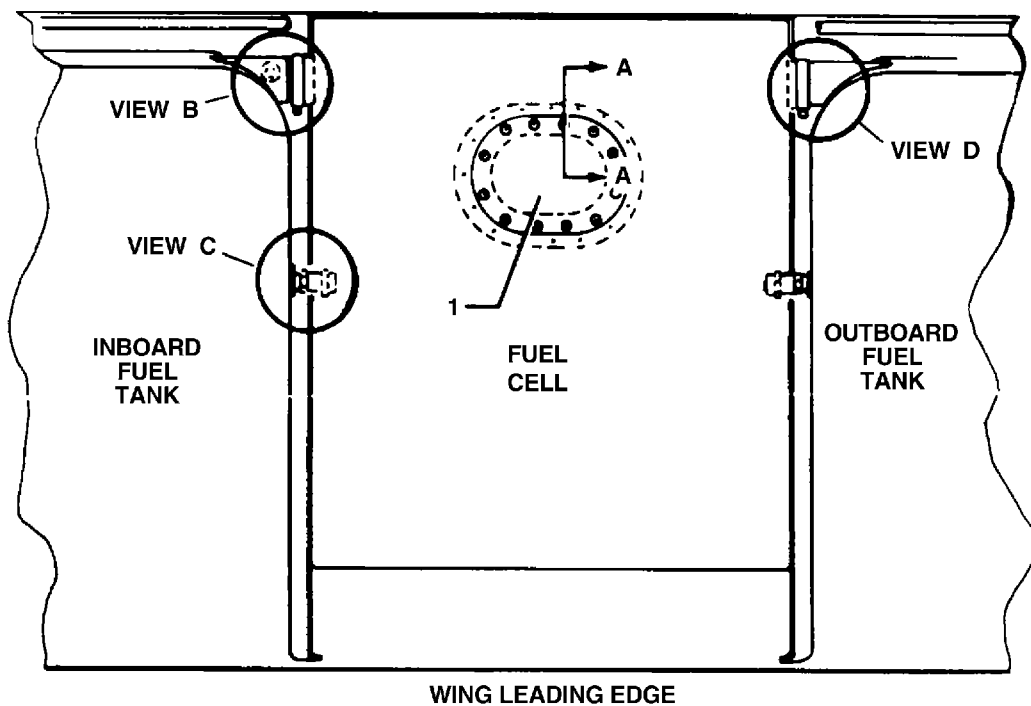
B. Installation of Inboard Fuel Tank (See Figure 1, 28-00-00 and Figure 1, 28-10-00.)

- (1) Position fuel tank in its recess in the wing.
- (2) Connect fuel line and fuel sender wires.
- (3) Slide tank completely into position and secure with screws around its perimeter.
- (4) Install bladder type fuel cell. (See the appropriate paragraph.)
- (5) Fill fuel tanks and check for leaks, unrestricted fuel flow, and accurate sender indications on fuel quantity gauge.

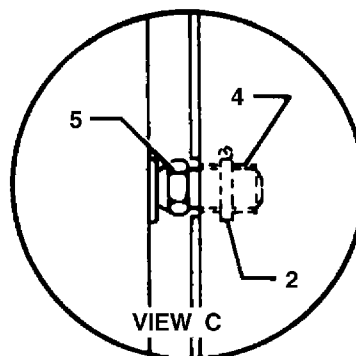
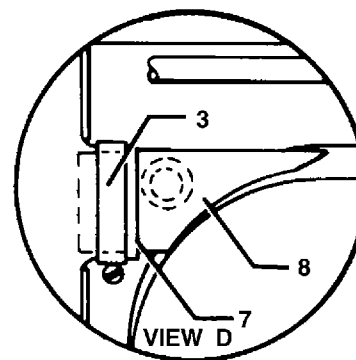
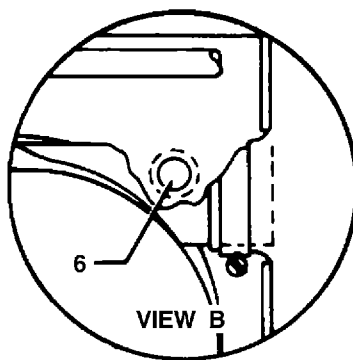
C. Removal of Outboard Fuel Tank (See Figure 1, 28-00-00 and Figure 1, 28-10-00.)

- (1) Remove bladder type fuel cell before proceeding. (See the appropriate paragraph.)
- (2) With fuel completely drained from the tank, loosen clamps at hose connections, and slide hose connections away from fuel tank.
- (3) Remove screws from around the perimeter of the tank.
- (4) Carefully pull tank away from the wing far enough to gain access to remove sender wire and fuel vent line.
- (5) The tank is now free to be removed.

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1. Access Panel
2. Hose Clamp
3. Hose Clamp
4. Fuel Vent Nipple
5. Fuel Vent Tube
6. Wing Plug
7. Fuel Interconnect Nipple
8. Interconnect Fitting
9. Access Panel
10. Gaskets
11. Doubler
12. Skin
13. Nut Flange
14. Fuel Cell



Fuel Cell Installation
Figure 1

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- D. Installation of Outboard Fuel Tank (See Figure 1, 28-00-00 and Figure 1, 28-10-00.)
- (1) Position fuel tank in its recess in the wing.
 - (2) Connect vent line on outboard side, and fuel sender wires.
 - (3) Slide tank completely into position and secure with screws around its perimeter.
 - (4) Install bladder type fuel cell. (See the appropriate paragraph.)
 - (5) Fill fuel tanks and check for leaks, unrestricted fuel flow, and accurate sender indications on fuel quantity gauge.
- E. Removal of Bladder Type Fuel Cell (See Figure 1, 28-00-00 and Figure 1, 28-10-00.)
- (1) Drain fuel tanks and remove fuel cell access panel located on top side of wing between Wing Station 138.00 and Wing Station 161.00.
 - (2) Reaching through fuel cell opening, remove hose clamp securing fuel cell vent nipple to vent tube of inboard and outboard fuel tanks.
 - (3) Remove wing plugs from underside of wing at Wing Stations 138.00 and 161.00 and, using a common screwdriver, loosen clamp securing fuel cell interconnect nipple to inboard and outboard fuel tanks.
 - (4) Reaching through fuel cell access hole, gently separate Velcro fasteners holding fuel cell to surrounding structure.
 - (5) Separate fuel cell vent nipple and fuel cell interconnect nipple from inboard and outboard fuel tanks.
- CAUTION:** PAD EDGES OF ACCESS HOLE TO PREVENT POSSIBLE DAMAGE TO FUEL CELL.
- (6) Carefully fold fuel cell and remove through fuel cell access hole.
- F. Installation of Bladder Type Fuel Cell (See Figure 1, 28-00-00 and Figure 1, 28-10-00.)
- (1) Before installing fuel cell, inspect airframe cavity for cleanliness.
- CAUTION:** PAD EDGES OF ACCESS HOLE TO PREVENT POSSIBLE DAMAGE TO FUEL CELL.
- (2) Place fuel cell into airframe cavity through access opening. Make sure no wrinkles exist in fuel cell upon installation.
 - (3) Install clamp on fuel cell interconnect nipple and tighten finger tight.
- NOTE:** Position so that screw on clamp will be facing plug hole in underside of wing.
- (4) Reaching into fuel cell, work fuel cell interconnect nipple onto interconnect fitting of inboard and outboard fuel tanks.
 - (5) Using a common screwdriver and working through plug hole in underside of wing, tighten clamps. Torque should be 30 to 35 inch-pounds.
 - (6) Press fuel cell vent nipple onto fuel tank vent fitting of inboard and outboard fuel tanks. Position clamp on nipple fitting so that when tightened the screw body does not contact top of fuel cell. Torque to 15 inch-pounds.
 - (7) Press outward firmly on sides and top of fuel cell to engage cell with Velcro tape.
 - (8) Position gaskets as shown in Figure 1. Place access panel over opening and secure with screws. Torque to 25 in.-lbs.
 - (9) Insert wing plugs in openings on underside of wing.
 - (10) Service fuel tanks and inspect for leaks.

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2. Maintenance of Fuel Cells

WARNING: OBSERVE ALL FUEL SYSTEM FIRE HAZARD PRECAUTIONS THROUGHOUT ALL REMOVAL AND INSPECTION PROCEDURES. USE VAPOR-PROOF LIGHT FOR INSPECTION.

A. Cleaning and Inspection of Fuel Cells

- (1) Fuel cells may be cleaned by the following procedure:
 - (a) New Cells: It should not be necessary to clean new cells upon removing them from their containers, if they are installed in the airframe cavities promptly. If for any reason the cells are not installed immediately, and become dirty, they should be cleaned with soap and warm water to remove foreign material prior to installation in a clean cavity.
 - (b) Used Cells: Prior to removal, the cells are to be drained of fuel, purged with fresh air and swabbed out to remove all traces of fuel. Following removal, the cells are to be cleaned inside and out with soap and warm water.
- (2) Fuel cells may be inspected by the following procedure:
 - (a) New Cells: Inspect the cell surface inside and outside for cuts, abraded (scuffed) areas and accessory damage. Also, inspect the fitting seals for nicks, scratches and foreign material.
 - (b) Used Cells: Cells removed from the airframe cavity for inspection and repair or cells being returned to service from storage. should be inspected as outlined above
Cells installed in the airframe cavity may be inspected for possible repairs by reaching through the fuel cell access plate and taking a section of cell between the thumb and forefinger. Wipe the ridge created by this action with MEK. If fine cracks are evident, the fuel cell is not repairable.

B. Fuel Cell Compartment

- (1) Thoroughly clear the cell compartment of all fittings, trimmings. Loose washers, bolts or nuts.
- (2) Round off all sharp edges of the fuel cell compartment.
- (3) Inspect the fuel cell compartment just prior to fuel cell installation.
- (4) Tape over all sharp edges and all rough rivets.

C. Handling and Storage of Fuel Cells

- (1) Prevent needless damage by exercising common sense care in all handling of the cells. Folding or collapsing of cells is necessary to place them in containers for storage, install in airframe cavities and carry from place to place. Protect cell from tools, hot lights, etc, when working around them. Avoid stepping on folds or creases of cells. Do not carry cells by fittings. Maintain original cell contours or folds when refolding for boxing, rolling to insert in airframe cavities or handling in the repair area. The cells to be repaired should be placed on a well-lighted table. Maintain natural contours, if possible while repairing. Prevent contact with sharp edges, corners, dirty floors or other surfaces. Repair area must be well-ventilated. Do not stack cells. Inspect cavities and ensure cleanliness prior to installing any cell.
- (2) When storing cells, observe the following rules:
 - (a) Fold cells smoothly and lightly as possible with a minimum number of folds. Place protective wadding between folds.
 - (b) Wrap cell in moisture-proof paper and place it in a suitable container. Do not crowd cell in container, use wadding to prevent movement.

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- (c) Stack boxed cells to allow access to oldest cells first. Do not allow stacks to crush bottom boxes. Leave cells in boxes until used.
- (d) Storage area must be dry, 70°F, and free of exposure to sunlight, dirt and damage.
- (e) Used cells must be cleaned with soap and warm water prior to storage. Dry, and box as outlined above.

3. Repair of Fuel Cells

The following is the repair procedure recommended for field repair of fuel cells constructed of Goodyear Vithane material. There are two methods by which these repairs may be accomplished. One method is by heat cure, the other is air cure. The end result of either repair is a neat, permanent repair. The heat repair allows the cell to be cured and ready for reinstallation in two hours while the air cure method required that the cell not be moved for 72 hours during the air cure period. See Chart 1 for a list of repair materials and equipment.

NOTE: Air cure repairs to be made at room temperature at approximately 75°F. For each 10° drop in temperature add 20 hours cure time. For instance if room temperature reads 65°F, air cure for 92 hours instead of 72 hours.

A. Handling of Repair Materials

- (1) All materials are to be protected from dirt contamination, sunlight, and excessive heat or cold while in storage. Containers are to be tightly capped and stored at a temperature of 70°F.

CAUTION: 80C27 REPAIR CEMENT REQUIRES THOROUGH MIXING TO OBTAIN FULL ADHESIVE VALUES.

- (2) The repair cement code 80C27 referred to in this text is prepared immediately prior to use by mixing repair cement 80C27 (pint can with 320 gms) with cross-linker 80C28 (4 oz. bottle with 81 cc).

CAUTION: ALL CONTAINERS FOR CEMENTS AND SOLVENTS SHOULD BE PROPERLY IDENTIFIED.

- (3) Repair cement has a pot life of 20 minutes after mixing. The unmixed 80C27 and 80C28 have a shelf life of six months from date of packaging.

B. Repair Procedures for Goodyear Vithane Fuel Cells

CAUTION: THE REPAIR OF GOODYEAR VITHANE FUEL CELLS IS RESTRICTED TO AUTHORIZED PERSONNEL. AUTHORIZED PERSONNEL ARE THOSE WHO HAVE BEEN CERTIFIED AND TRAINED BY GOODYEAR REPRESENTATIVES, OR THOSE WHO HAVE RECEIVED THEIR TRAINING FROM PERSONS WHO HAVE BEEN CERTIFIED AND TRAINED BY GOODYEAR REPRESENTATIVES.

C. Repair Limitations of Fuel Cells

Repair limitations are as follows:

- (1) FT-192 repair fabric is for repair of simple contours only. Patches referred to in this text are of this material.
- (2) Inside patches are to lap defect edges a minimum of 1.0 inch in each direction.
- (3) Outside patches are to lap defect edges .25 to .50 of an inch larger than inside patches.
- (4) Outside patches are to be applied and cured prior to applying an inside patch.
- (5) Blisters between inner liner and fabric, larger than .25 of an inch in diameter require an outside and an inside patch.

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**CHART 1
FUEL CELL REPAIR MATERIALS AND EQUIPMENT**

Repair Kit, Goodyear Drawing No. 2F1-3-37813

80C27 Repair Cement	8	Pint cans, 320 gms in each
80C28 Cross-Linker	8	4 oz. bottles, 81 cc in each
Methyl Ethyl Ketone	2	Pint cans
FT-192 Repair Fabric	2	Sheet 12" x 12"

Group I Materials

The following equipment is necessary to perform the repair.

Group II equipment will be furnished at additional cost, if ordered by customer.

Foam Rubber Cloth Back Sheet, 1/4" x 12" x 12"	2
Paint Brush, 1 inch wide	2
Aluminum Plates, 1/4" x 6" x 6'	4
Measuring Cup (250 ml)	1
Cellophane (Sheet 12" x 24")	2

Torques For Specific Nipple Fitting Sizes

Fitting Size (I.D.)	Clamp Torques (in.-lb.)
1/4" - 1/2"	12 - 16
3/4" - 1"	15 - 20
1 1/2"	25 - 30
2"	30 - 35
3"	35 - 40

NOTE: Accessories - order per individual cell equipment. Phenol plates, phenol plate assemblies and phenol test equipment can be ordered as required from cell manufacturer. Cure Iron (set 240°F) optional.

- (6) Separations between layers or plies larger than .50 of an inch in diameter require an outside and inside patch. Holes and punctures require an outside and inside patch.
- (7) Slits or tears up to 6.0 inches maximum length require an outside and inside patch.
- (8) External abraded or scuffed areas without fabric damage require an outside patch only.
- (9) A loose edge may be trimmed, provided that .50 of an inch minimum lap or seam is maintained.

CAUTION: FOR EACH 10°F (5.6°C) DROP IN TEMPERATURE FROM 75°F (24°C), ADD 20 HOURS CURE TIME. FOR EXAMPLE, AT 65°F (18°C), CURE FOR 92 HOURS.

- (10) Air cure repair patches are to remain clamped and undisturbed for 72 hours at room temperature of approximately 75°F (24°C).

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- (11) All heat cured patches are ready for use when cool.
- (12) Fitting repairs are confined to loose flange edges, seal surfaces rework and coat stock.

NOTE: Any damage not covered by the above should be returned to The Engineered Fabrics Corporation, Rockmart, Georgia, for repair.

D. Patch Repair (Heat Cure Method)

- (1) Prepare exterior cell wall and exterior patch first. Cut repair patch from FT-192 material to size required to ensure proper lap over injury in all directions. (See Limitations.) (Hold shears at an angle to produce a beveled edge (feather) on patch.) Round corners of patch. (Dull side or gum contact face of repair patch should be the largest surface after beveling.)
- (2) Wash one square foot of cell wall surrounding injury and repair patch contact side with a clean cloth soaked with Methyl Ethyl Ketone solvent.
- (3) Abrade cell wall surface about the injury and contact side of patch with fine emery cloth to remove shine.
- (4) Repeat Methyl Ethyl Ketone washings two more times. A total of three washings each surface.
- (5) Tape a 8" x 8" piece of cellophane inside cell over injury.
- (6) When all the above preparatory work has been done and cell has been positioned for patch application on repair table, mix the 80C27 cement (320 gms) with the crosslinker 80C28 (81cc), and stir mixture thoroughly for five minutes.

NOTE: Cement must be at a minimum of 70°F before mixing. Keep away from water and excessive heat.

- (7) Brush one even coat of mixed repair cement on the cell wall around injury and on the contact side of repair patch. Allow to dry for fifteen minutes.

CAUTION: DO NOT USE FIRST CAN OF MIXED CEMENT FOR THIS COAT.

- (8) Repeat a second mixing of repair cement and brush a second coat.

CAUTION: MAKE SURE CELLOPHANE INSIDE CELL OVER INJURY REMAINS IN PLACE AS ANY CEMENT WILL STICK CELL WALL TOGETHER WITHOUT THE CELLOPHANE AS A SEPARATOR.

- (9) Allow cement to dry approximately five minutes and then center patch over injury. Lay repair patch by rolling down on surface from center to edge without trapping air. Hold the unrolled portion of repair patch off the cemented surface until roller contact ensures an air-free union. At this time repair patch may be moved by hand on wet surface to improve lap. Do not lift repair patch, slide it.
- (10) Cover one smooth surface each of two aluminum plates (plates must be larger than patch), with fabric-backed airfoam fabric side out. Tape airfoam in place. Foam must cover edges of plate for protection. Use a cellophane separator to prevent the cement from sticking in the wrong place.

CAUTION: MAKE SURE THAT CELL FOLD IS NOT CLAMPED BETWEEN PLATES. THIS WOULD CAUSE A HARD PERMANENT CREASE. ALSO MAKE SURE THAT PATCH DOES NOT MOVE WHEN CLAMP IS TIGHTENED

- (11) Center a repair iron 2F1-3-25721-1 on the plate over the repair patch. Secure the assembly with a C-clamp. Tighten by hand. Check cement flow to determine pressure.
- (12) Connect repair iron into 110-volt electrical outlet and cure repair for two hours. After two hours cure, unplug electric and allow repair iron to cool to touch. Then remove C-clamp. Wet cellophane to remove from repair.

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CAUTION: SUCCESS OF APPLYING BOTH AN OUTSIDE AND INSIDE REPAIR PATCH SIMULTANEOUSLY IS DOUBTFUL AND NOT RECOMMENDED.

(13) Inside patch is applied same as above procedure except for size of repair patch (see limitations) after outside patch has been cured.

E. Patch Repair (Air Cure Method)

Follow procedure for heat cure method, except omit repair iron and cure each patch per air cure limitations (minimum 72 hours), undisturbed, at 75°F.

F. Defect Repair of Fuel Cell

- (1) Blisters: Remove loose material by trimming. Apply an outside and inside repair patch.
- (2) Holes, Punctures, Cuts, Tears and Deep Abraded Areas: Trim away any ragged material and apply an outside and inside repair patch.
- (3) Loose Seams: Buff loose edge and contact surface with emery cloth. Wash three times with Methyl Ethyl Ketone. Apply 80C27 mixed cement two coats as with repair patch. Clamp and cure. Either method may be used. See repair patch. Loose seams may be trimmed if minimum lap remains.

4. Testing Fuel Cells

Either of the following test procedures may be used to detect leaks in the bladder cells.

NOTE: The chemical test is the more sensitive and the preferred test.

A. Soap Suds Test

- (1) Attach test plates to all fittings.
- (2) Inflate the cell with air to a pressure of 1/4 psi MAXIMUM.
- (3) Apply a soap and water solution to all repaired areas and any areas suspected of leakage. Bubbles will appear at any point where leakage occurs.
- (4) After test, remove all plates and wipe soap residue from the exterior of the cell.

B. Chemical Test

- (1) Attach test plates to all fitting openings except one.
- (2) Make up a phenolphthalein solution as follows: Add 40 grams phenolphthalein crystals in 1/2 gallon of ethyl alcohol, mix, then add 1/2 gallon of water.
- (3) Pour ammonia on an absorbent cloth in the ratio of 3 ml per cubic foot of cell capacity. Place the saturated cloth inside the cell and install remaining test plate.
- (4) Inflate the cell with air to a pressure of 1/4 psi MAXIMUM, and maintain pressure for fifteen minutes.
- (5) Soak a large white cloth in the phenolphthalein solution, wring it out thoroughly, and spread it smoothly on the outer surface of the cell. Press the cloth down to ensure detection of minute leaks.
- (6) Check the cloth for red spots which will indicate a leak. Mark any leaks found and move the cloth to a new location. Repeat this procedure until the entire exterior surface of the cell has been covered. If red spots appear on the cloth, they may be removed by re-soaking the cloth in the solution.
- (7) The solution and test cloth are satisfactory only as long as they remain clean. Indicator solution that is not in immediate use should be stored in a closed rustproof container to prevent evaporation and deterioration.

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- (8) After the test, remove all plates and test equipment. Allow the cell to air out.
- (9) In conducting either test outlined above, the cell need not be confined by a cage or jig, providing the 1/4 psi pressure is not exceeded.

5. Flush Fuel Cap Maintenance (See Figure 2.)

NOTE: These instructions do not apply to new style fuel caps (P/N 654-556 Locking, and 654-557 Non-Locking) installed in 2006 and later.

The flush fuel cap is designed to afford the aircraft a cleaner surface and a reduction in drag. Anytime the cap does not close tightly or gas leakage is evident the cap should either be replaced, or repaired. The cap consists of three basic assemblies; the handle/plate assembly, gasket spring assembly, and lock assembly.

A. Disassembly

The cap can be disassembled as follows:

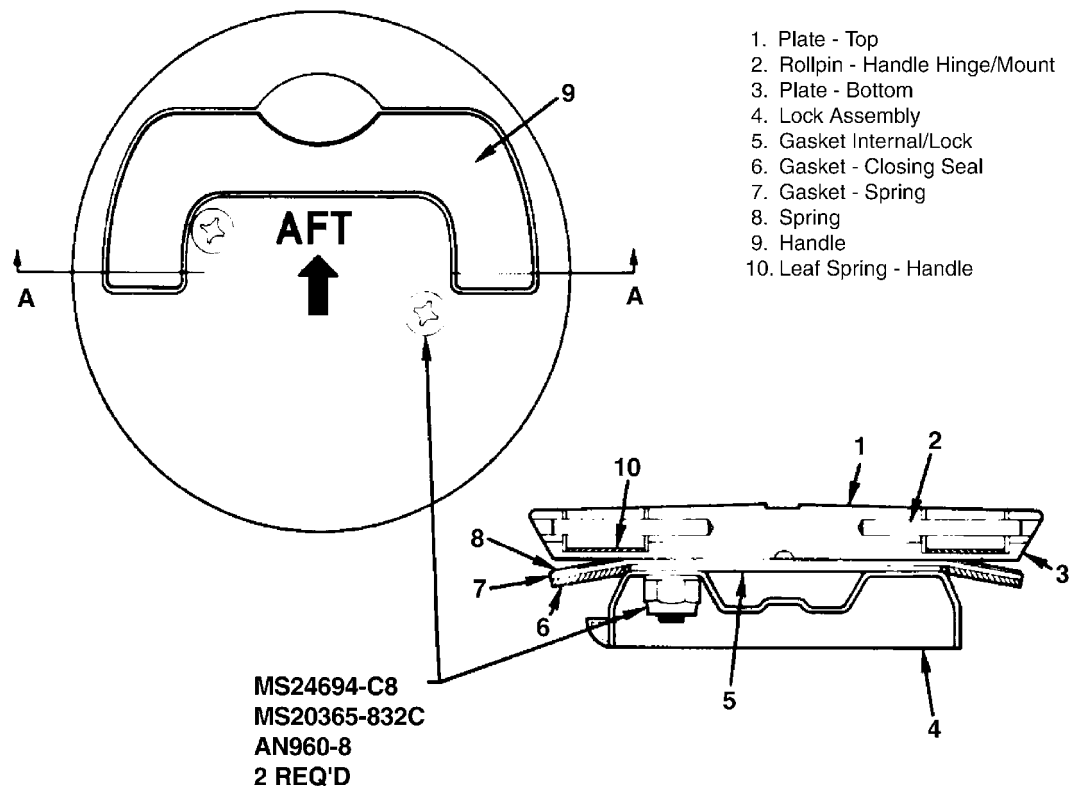
- (1) Remove the screws that hold the cap assembly together and make note of the relative position of the lock to the up plate.
- (2) Separate the assembly and replace the spring and gaskets as necessary.

B. Assembly

The cap should be assembled as follows:

- (1) Install the gaskets on the spring assembly if necessary and align the gasket and spring on the handle plate with the spring concave towards the lock.
- (2) Align the lock assembly against the gasket and spring assembly in the same position as noted at removal.
- (3) Coat the threads of the bolts with Tite-Seal Gasket and Joint Sealing Compound (medium weight).
- (4) Install bolts.

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Flush Fuel Cap Assembly
Figure 2

6. Locking Fuel Cap

NOTE: These instructions do not apply to “new style” fuel caps (P/N 654-556 Locking, and 654-557 Non-Locking) installed in 2006 and later.

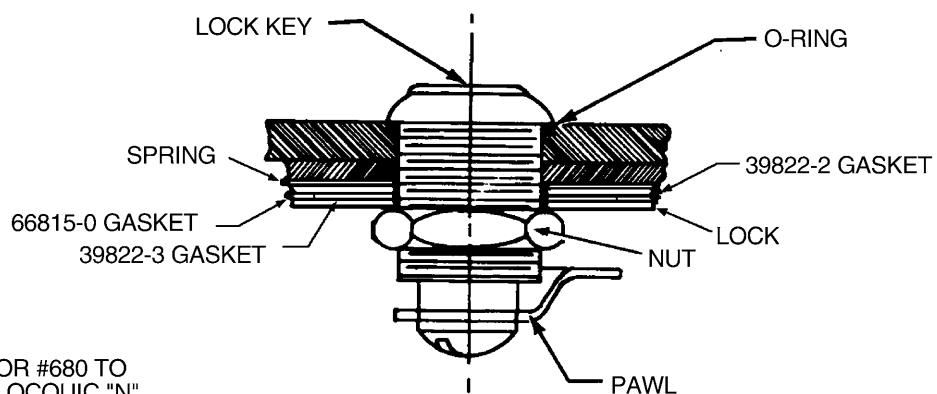
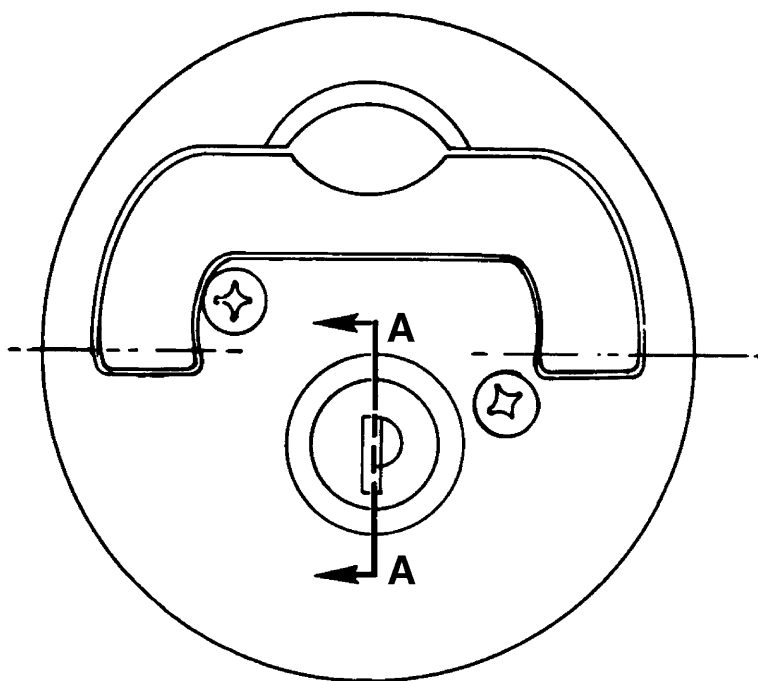
A. Disassembly (Refer to Figure 3.)

- (1) Remove the two screws from the top of the fuel cap.
- (2) Remove the screw and lock washer which secures the pawl to the bottom of the key lock. Remove pawl.
- (3) Remove the nut which secures the key lock to the cover.
- (4) Slide lock, gaskets and spring over the back of the key lock.
- (5) The key lock may be removed by removing the o-ring and pushing the key lock through the cover. Ensure that the teflon lock gasket is not lost.

B. Assembly

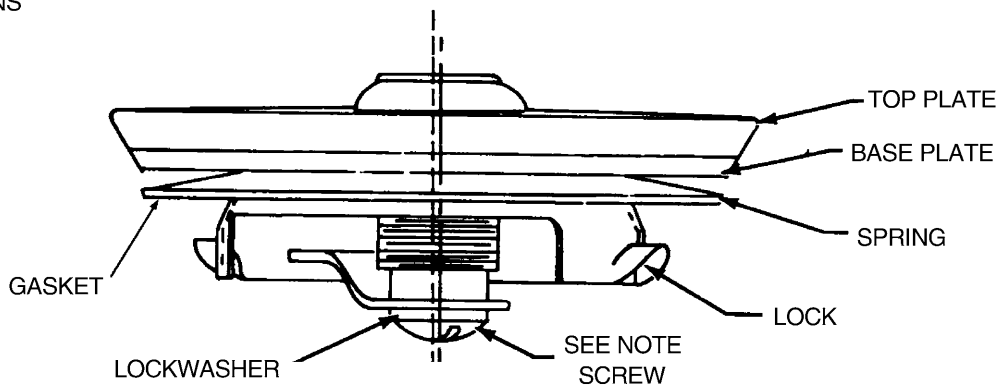
- (1) Insert the key lock through the cover; making sure that the teflon lock gasket is installed under the head of the key lock.
- (2) Insert the o-ring in the groove on top of the cover.
- (3) Slide spring, gaskets and lock over the back of the key lock.
- (4) Reinstall nut which secures the key lock to the cover.
- (5) Attach the pawl to the back of the lock assembly with the screw and lock washers.
- (6) Reinstall the two screws and lockwashers on top of the fuel cap.

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NOTE

APPLY LOCQUIC #271 OR #680 TO
THREADS PRIME WITH LOCQUIC "N"
OR "T" PER MANUFACTURERS
INSTRUCTIONS



Old Style Locking Fuel Cap
Figure 3

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DISTRIBUTION

1. Fuel Vent and Vapor Return Systems

A. Vapor Return System (*Seneca IV only*)

Both fuel systems utilize vapor return and vent systems. Although it is not difficult to maintain the systems, it is recommended that they be inspected routinely with the following information in mind.

The fuel system on each engine is a "continuous flow" type and makes use of a vapor return line to provide a tank return for fuel vaporized in the pump swirl chamber. The vapor return line for each engine is routed from the forward elbow of the engine driven fuel pump back over the top of the engine to an elbow mounted to the baffle on the right side of the engine. At this point the installations differ slightly in that on the left engine installation the hose, connected to the rear of the elbow, is routed to the left side of the firewall just outboard of the engine mount attachments, while the right engine has the related hose routed to the right side of the firewall but also outboard of the engine mount attachment. Both installations however use an elbow on the firewall to connect the hose from the engine and tubing from the tank.

It is important to note that the check valve included in the line from the firewall to the tank used to prevent reverse flow, is installed in a specific manner in order for it to operate properly. On the barrel of the valve is an arrow showing fuel direction, and on one of the flats the HINGE. When installed the arrow must be pointed in the direction of the tank and the flat with HINGE on it facing up (refer to Figure 1). Access to the valve can be made by removing the leading edge fairing at the outboard root of the wing and nacelle.

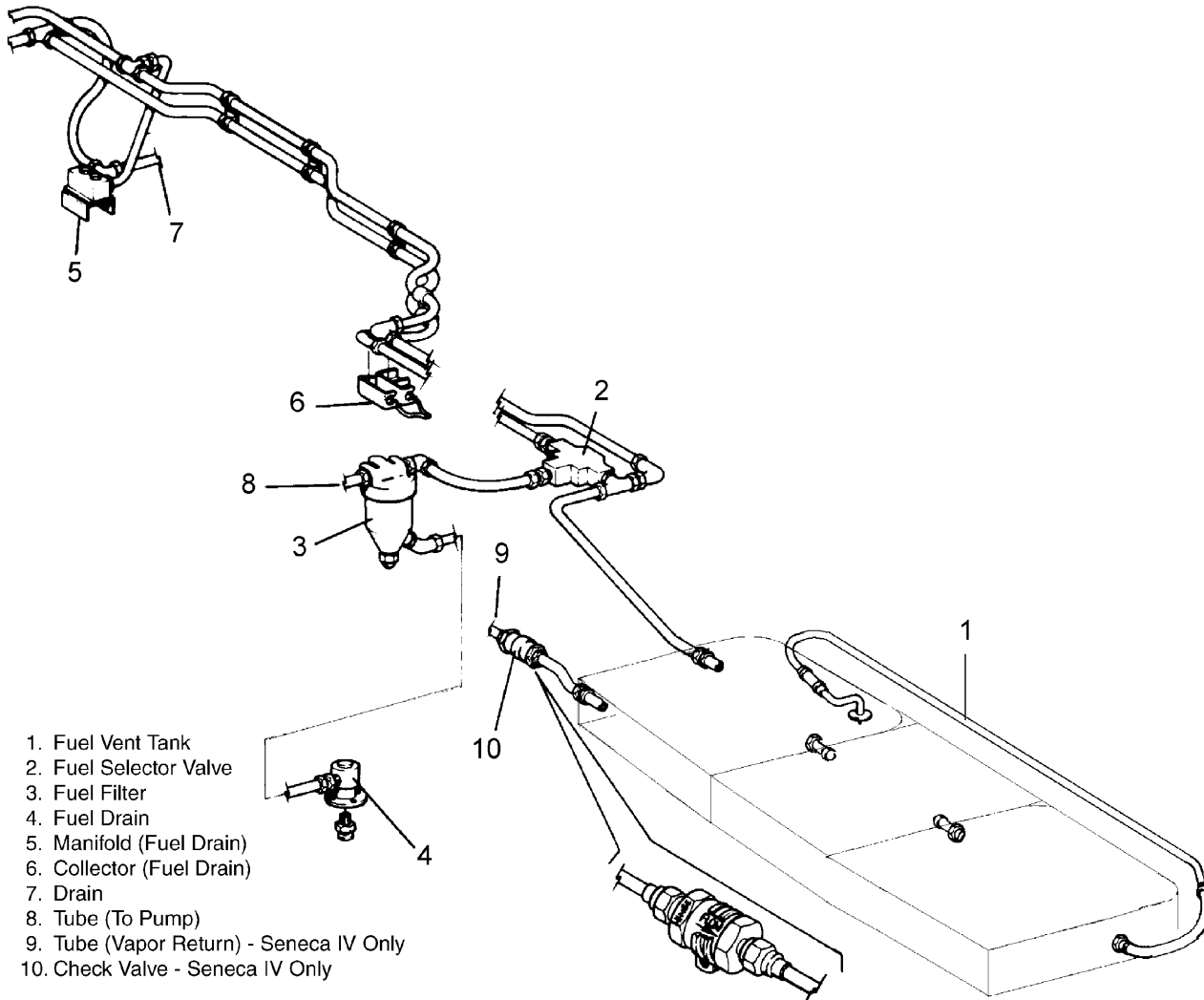
B. Vapor Return System

The two fuel systems also use their own vent system. Each system is similar and designed to vent through the outboard tank with interconnects between the other tanks cells. The vents are located under their respective wing and behind the main spar near Wing Station 119.10. A line made up of a series of hoses and tubing connects the outboard tank and vents. The vent line is connected to the outboard tank through a limited check valve which functions to vent ambient pressure into the tank while preventing fuel from escaping. The vent underneath the wing should therefore be checked periodically for fuel stains or other indications of significant fuel leakage to make sure the limited check valve is functioning properly.

2. Cleaning the Fuel System

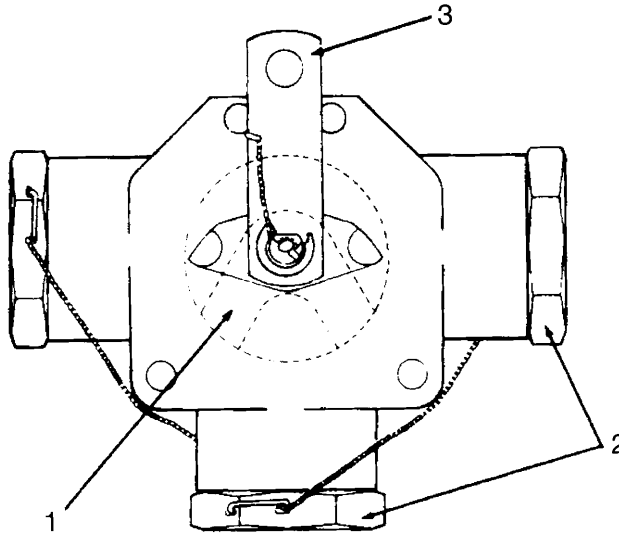
- A. To flush the fuel tank and selector valve, disconnect the fuel line from the injector.
- B. Select a tank, turn on the electric fuel pump and flush fuel through the system until the tank is empty. Agitation of the fuel within the tank during this operation will help pick up and remove dirt and other foreign matter from the fuel tank and selector valve.
- C. Repeat this procedure for each fuel tank.
- D. When all the tanks are flushed, clean the filter and fuel tank finger screens.

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Fuel Vent System
Figure 1

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- 1. VALVE BALL
- 2. END FITTING
- 3. SELECTOR ARM

Fuel Selector Valve
Figure 2

3. Fuel Selector Valve

CAUTION: NO FIELD DISASSEMBLY OR REPAIR OF FUEL SELECTOR VALVES IS AUTHORIZED. MAINTENANCE IS LIMITED TO REMOVAL AND REPLACEMENT OF THE WHOLE UNIT.

A. Removal

- (1) Remove the access plate located forward of the main spar on the under side of the wing and outboard of the nacelle.
- (2) Drain the appropriate fuel tank (refer to Draining Fuel Tank, Chapter 12).
- (3) Disconnect the control cable from the valve selector arm. Disconnect fuel lines and mounting hardware. Remove fuel selector valve.

B. Leak Test

- (1) Connect the inlet port of the valve assembly to a 50 psi air source.
- (2) Plug the right hand port and close the left hand port by moving the handle counterclockwise (as viewed with the lever facing you) until the stop is reached.
- (3) Apply pressure to 50 psi. There should be no evidence of leakage either through the port or around the fitting and lever when the selector valve is submerged in kerosene or a similar petroleum based fluid for 30 seconds.
- (4) Depressurize. Remove the plug from the right hand port and place it in the left hand port. Close the right port by moving the handle clockwise (as viewed with the lever facing you) until the stop is reached.
- (5) Repeat Step (3).
- (6) Disconnect and wipe fluid from the valve exterior.

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C. Installation

- (1) Position the selector valve in the wing with the lever facing down and the center port facing forward. Secure to the mounting bracket with four screws and nuts.
- (2) Connect the fuel lines and control cable to the valve.
- (3) Refer to the following paragraph for rigging of the selector valve.
- (4) Install access panel.

D. Rigging

- (1) Remove the access panel located on the underside of the wing, forward of the main spar, outboard of the nacelle.
- (2) Ensure that the selector valve is connected to the control cable and the selector valve arm is in its center detent position.
- (3) Ensure that the control cable is disconnected where it attaches to the cockpit lever.
- (4) Place the fuel selector handle in the cockpit in its OFF position (the levers centered on the OFF position of the cover placard). Adjust and connect the cable end to the cockpit lever.
- (5) Actuate the selector to ascertain that the valve moves into its three detent positions and that the control levers have a positive clearance between the lever and cover assembly.
- (6) Reinstall the access panel.

4. Electric Fuel Pump

NOTE: Electric Fuel Pump replacement is on condition / as required.

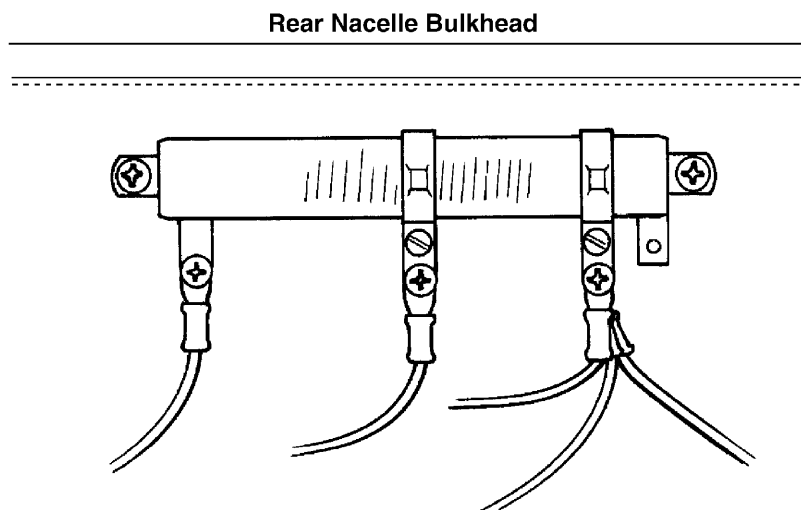
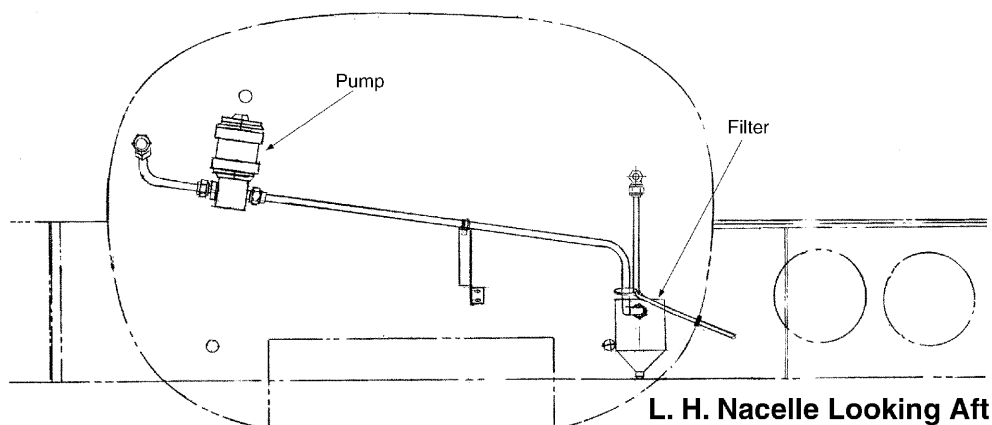
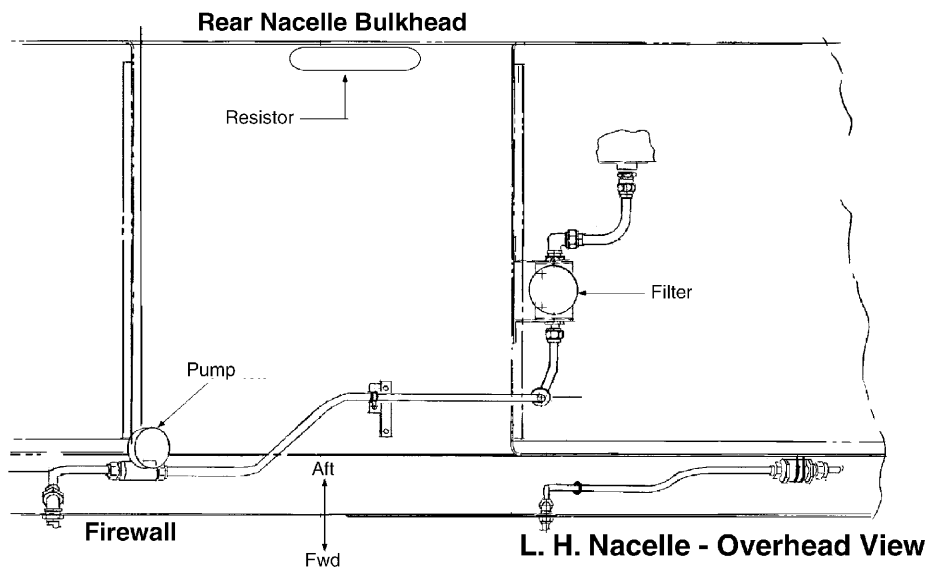
A. Removal and Installation of Electric Fuel Pump

- (1) There is one electric rotary vane type fuel pump for each engine. The pump is mounted in a bracket on the aft side of the firewall. To remove pump, proceed as follows:
 - (a) Remove rectangular hatch assembly located on the top of the nacelle, aft of the firewall.
 - (b) Remove fuel lines from the pump and disconnect the electrical leads.
 - (c) Remove straps holding pump in position and withdraw pump through hatch opening.
 - (d) Do not attempt to disassemble or repair the fuel pump. If fuel pump proves to be defective, it should be replaced.
 - (e) Reinstall pump in reverse order of removal.

B. Auxiliary Fuel System Adjustment (*Seneca IV only*)

- (1) Adjustment of the auxiliary fuel system if installed is accomplished as follows for each engine:
 - (a) Remove the access panels from the top of each engine nacelle to gain access to the slider resistor mounted on the nacelle bulkhead.
 - (b) Install a calibrated pressure gauge (31 to 37 psi) in the fuel line forward of the firewall.
 - (c) Pull the circuit protector (for the auxiliary fuel pump which is to be adjusted) to the off position and ensure that the aircraft master switch is in the off position also.
 - (d) Connect the negative lead from an external DC power source to ground on the aircraft and the positive lead to the slider resistor high position. (Refer to Figure 3.)
 - (e) Using a calibrated voltmeter, adjust the external power source to indicate 12.0 to 12.5 volts DC at the auxiliary fuel pump. Note the voltage reading on the external power source voltmeter.
 - (f) The calibrated pressure gauge should indicate 31 to 37 psi.
 - (g) Connect the positive lead from the external power source to the slider resistor low position. (Refer to Figure 3.) Adjust the power supply voltage level to the same voltage obtained in Step (e).

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Fuel Pump, Slide Resistor and Filter Installation
Figure 3

Effectivity
Seneca IV

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- (h) Adjust the slider on the variable resistor to obtain a pump pressure of 8 to 10 psi. Readjust the power supply and slider to ensure a pump pressure of 8 to 10 psi, at the power supply voltage noted in Step (e), then secure the slider in position on the resistor.
- (i) Disconnect the manifold pressure switch located on the firewall, and connect the positive lead from the power supply to the slider resistor medium position.
- (j) Adjust the power supply voltage level to the same voltage obtained in Step (e).
- (k) Adjust the slider on the variable resistor to obtain a pump pressure of 23.5 to 24.5 psi. Readjust the power supply and slider to ensure a pump pressure of 23.5 to 24.5 psi, at the power supply voltage noted in Step (e), then secure the slider in position on the resistor and reconnect the manifold pressure switch.
- (l) If the aircraft is equipped with an optional fuel diverter valve, operate the primer switch and ensure that the diverter valve is being energized and that pump is in high boost. Release the primer switch and operate the fuel pump switch in the Hi-Boost position and ensure that the fuel pump operates and that the diverter valve does not.
- (m) Perform Steps (a) thru (n) on the opposite engine, then reinstall the access panels.
- (n) Refer to Chapter 72, Engine Setup Procedures, for additional adjustments relating to the power plant fuel control system.

C. Auxiliary Fuel System Operational Check ([Seneca IV only](#))

- (1) Disconnect the external power source from the aircraft, and disconnect the electrical leads from the manifold pressure switch located on the firewall.
- (2) Check to ensure that all cockpit controllable electrical equipment switches are in the off position, except as directed in the following steps.
- (3) Place the master switch in its on position.
- (4) Place the electric fuel pump switch in its low position. The calibrated fuel pressure gauge should indicate a pressure increase (not exceeding 10 psi), which would show that the pump is operating.
- (5) Place the electric fuel pump switch in its high position. The calibrated fuel pressure gauge should indicate a pressure above 10 psi but not more than 24.5 psi.
- (6) Place the aircraft master switch in the off position then reconnect the leads to the manifold pressure switch.
- (7) Keep the fuel pump switch in its high position and return the master switch to its on position. The calibrated pressure gauge should indicate a pressure above 24.5 psi but not more than 37 psi.
- (8) Place the fuel pump switch in its off position and depress the prime switch. The calibrated pressure gauge should indicate a pressure above 24.5 psi but not more than 37 psi.

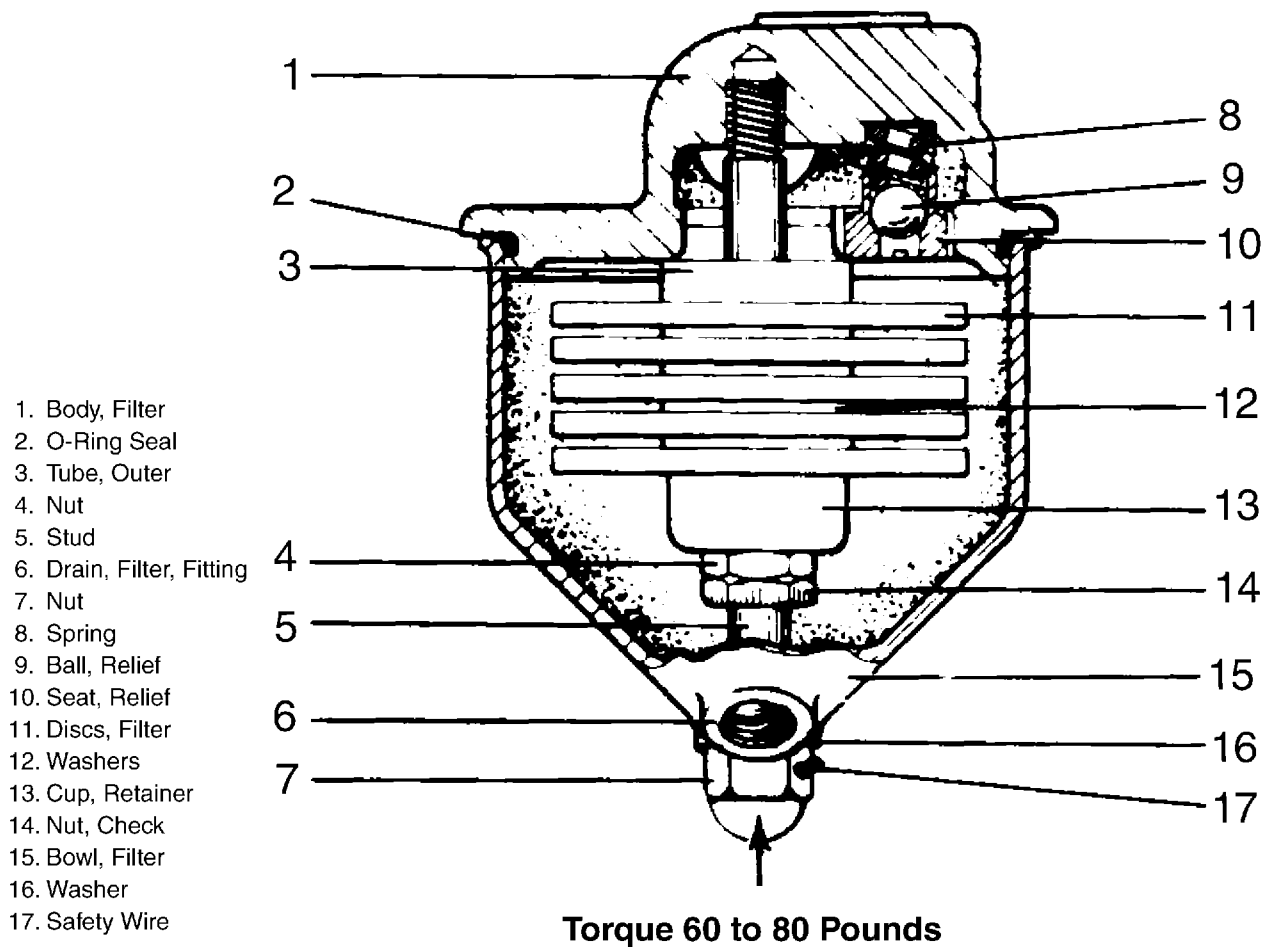
5. Fuel Filters

A. Removal of Fuel Filter (Refer to Figure 4.)

The instructions given are for the removal of the complete filter from the airplane. For cleaning and servicing purposes, only Steps (1) and (2) of this paragraph are necessary; then proceed to the next paragraph.

- (1) Position the fuel selector valve to the OFF position.
- (2) Remove the access panel forward of the main spar, at Wing Station 91.00, on the bottom of the wing panel.
- (3) Disconnect the filter drain line and fuel lines from the filter assembly. Cap the line ends to prevent contamination.
- (4) Remove the bolts that secure the filter to its mounting bracket and remove the filter from the aircraft.

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Fuel Filter Assembly
Figure 4

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B. Disassembly of Fuel Filter (Refer to Figures 3 and 4.)

- (1) Cut safety wire and remove cap nut from the bottom of the filter bowl.
- (2) Remove the bowl from the filter body.
- (3) The O-ring seal may be removed from the body.
- (4) Loosen and remove both the check nut and nut from the stud that holds the filter cartridge subassembly.
- (5) Slide the filter cartridge from the stud. The filter discs and washers need not be separated from the filter cartridge.
- (6) If necessary to disassemble the filter cartridge, remove the retainer cup from the outer tube and slide discs and washers from the outer tube. Do not use a screwdriver or sharp tool that may damage the discs.
- (7) The filter bypass assembly may be removed by using the proper size screwdriver and turning out the relief seat. Remove relief ball and spring element outer tube for normal cleaning.

C. Cleaning, Inspection and Repair of Fuel Filter

- (1) Carefully remove the filter pack from the housing and remove all O-rings, valves, springs, etc. Do not disassemble the filter pack from the center tube at this time.
- (2) Plug the open ends of the filter and immerse in oil solvent such as Stoddard solvent. Let soak for 30 to 60 minutes.
- (3) Metal valve parts may also be soaked in this cleaner.
- (4) Remove filter and parts (if any) from the cleaner and rinse thoroughly in clean hot flowing tap water.
- (5) Drain or blow off with filtered low pressure air to dry.
- (6) Inspect the filter discs for damage and/or broken screens.
- (7) Check condition of bowl O-ring seal and washer.
- (8) Check for corrosion of filter parts.
- (9) Check movement of bypass valve.
- (10) Normal repairs necessary for the filter are replacement of bowl gaskets and damaged filter discs.

D. Assembly of Fuel Filter (Refer to Figure 4.)

- (1) If removed, install bypass valve spring, relief ball and seat.
- (2) Place the filter pack (assembled) on the housing stud. Ascertain that the end of the outer tube has positioned itself in the filter body.
- (3) Secure the filter pack with nut. Torque nut 10 to 15 inch-pounds. Torque check nut against nut 40 to 60 inch-pounds.
- (4) Place the O-ring packing on the housing and install bowl, washer and cap nut. Torque cap nut 60 to 80 inch-pounds and safety.
- (5) Install the filter in the aircraft. If the filter was not removed, proceed to Step 3 of the next paragraph.

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E. Installation of Fuel Filter

- (1) Position the filter assembly in the wing. Ascertain that it is positioned properly and secure to its mounting bracket with the two bolts.
- (2) Connect the drain line to the filter bowl.
- (3) Connect the fuel lines to the filter assembly.
- (4) Turn the fuel selector to the ON position and check for any fuel leaks.
- (5) Install the access plate.

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**GRIDS 3G20 THRU 3G24
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INDICATING

NOTE: The fuel quantity calibration procedure for the Seneca V fuel quantity gauge is found in this section. Additional information on the fuel quantity gauge installed in Seneca V models is found in 77-40-00.

1. Seneca IV

A. Fuel Quantity Sender Units

Each fuel cell contains a sender unit which is interconnected with the other units of its particular system to provide the gauge with a combined, calibrated resistance.

The resistances of these units (1.0 ohm maximum at the empty position, and 45 ± 2 ohms at the full position) should be checked before installation. If any unit is assumed to be faulty check for proper travel, and resistance. Full travel of the units should be $95^\circ \pm 2^\circ$.

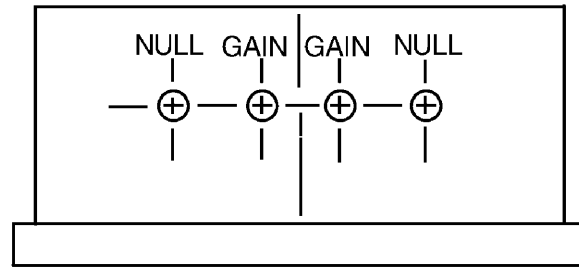
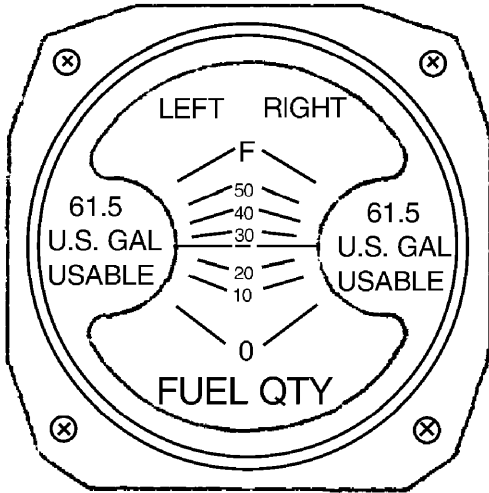
B. Installed Fuel Quantity Sender/Gauge Check

- (1) Level airplane laterally and longitudinally, $\pm 1^\circ$ (refer to Leveling, Chapter 8).
- (2) Place battery switch in OFF position.
- (3) Connect external power supply unit to airplane's external power connector.
- (4) Adjust power supply to provide 24 to 28 Vdc.
- (5) With tanks completely dry, position fuel selector to left or right.
- (6) Add 2 1/2 U. S. gallons of fuel to each tank. Check that needle of each (left and right) gauge points to "0". If not, adjust appropriate NULL trim potentiometer until needle centers on 0, +0, -1/2 needle width (Refer to Figure 1.)
- (7) Completely fill fuel tanks. Check that needle of each gauge points to "F". If not, adjust respective GAIN trim potentiometer until needle centers on F. (Refer to Figure 1.)
- (8) If gauge system fails to pass test specified in items 1 thru 6:

NOTE: Measure all fuel drained or added with a suitable device

- (a) With tanks full, drain fuel from each tank per Chart 1.
 - (b) After measured amount has been drained, vibrate tank by bumping its lower surface. Vibrate gauge by tapping gauge glass with fingers.
 - (c) The fuel quantity reading at each increment, after fuel has been drained, shall be within the tolerance specified in Chart 1.
- (9) Replace appropriate gauge and/or sender of any system that fails to meet the accuracy requirements specified above.

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Seneca IV Fuel Quantity Indicators
Figure 1

CHART 1
FUEL QUANTITY SENDER GAUGE TOLERANCES (SENECA IV)

Additional Fuel Drained (U. S. Gallons)	Total Fuel Remaining Within Tanks (U.S. Gallons)	Gauge Reading (U.S. Gallons)	Resistance Both Senders (Ohms)
0	64	F ($\pm 1 \frac{1}{2}$)	90.0
11 $\frac{1}{2}$	52 $\frac{1}{2}$	50 ($\pm 1 \frac{1}{2}$)	73.5
10	42 $\frac{1}{2}$	40 ($\pm 1 \frac{1}{2}$)	62.5
10	32 $\frac{1}{2}$	30 ($\pm 1 \frac{1}{2}$)	53.5
10	22 $\frac{1}{2}$	20 (± 1)	38.5
10	12 $\frac{1}{2}$	10 ($\pm \frac{3}{4}$)	26.5
10	2 $\frac{1}{2}$	0 (+0, -1)	6.5

NOTE: Values in parentheses are needle-width tolerances.

NOTE: If starting test with empty tanks, add 2 $\frac{1}{2}$ U. S. gallons to each tank and start at bottom of table and progress upward.

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2. [Seneca V](#)

A. DDMP Fuel Quantity Calibration

CAUTION: REPLACEMENT OF THE FUEL QUANTITY INDICATOR REQUIRES THAT THE NEW INDICATOR BE CALIBRATED PER THE PROCEDURE BELOW.

NOTE: Calibration is not required if the existing instrument is simply removed and reinstalled.

(1) Prepare the aircraft for testing as follows:

- (a) Level the aircraft ± 1 degree laterally and longitudinally. (See 08-20-00.)
- (b) Place the battery switch in the OFF position.
- (c) Connect the external power supply unit to the aircraft electrical system using the APU connector.
- (d) Adjust the power supply to provide 28.0 ± 1 VDC.
- (e) Record test results in logbook.

(2). Initial Calibration Procedure

NOTE: If power failure occurs during calibration, the calibration must be started over.

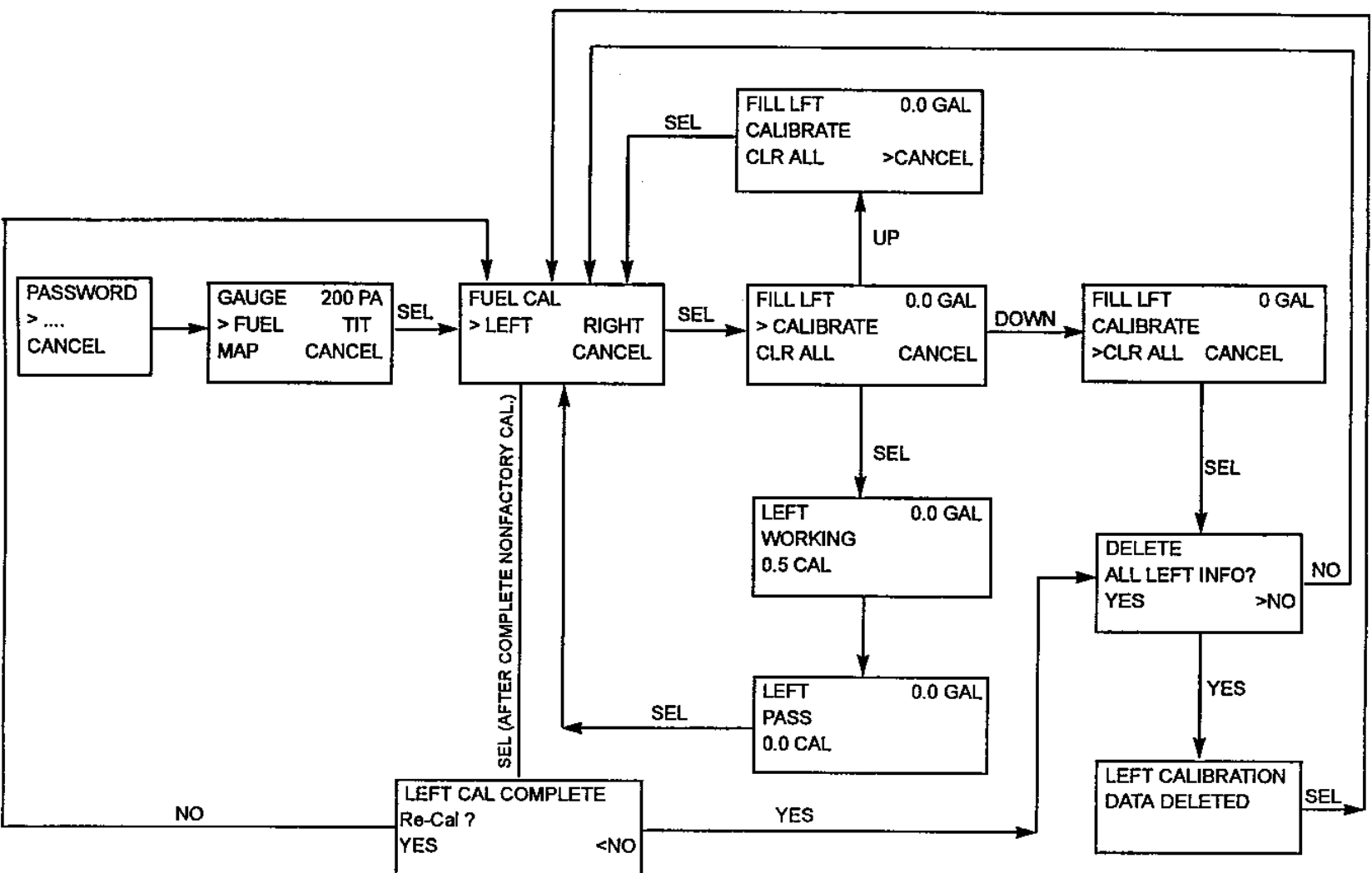
- (a) Enter the maintenance mode of the Digital Display Monitor Panel (DDMP) by turning the rotary switch to "electrical mode", and pressing the key sequence up, down, up, up, "SEL". If entered incorrectly, the DDMP will show an error message.
- (b) The next screen allows you to select between maintenance mode, initiate self test, or set the clock. Press the "SEL" key to select maintenance mode.
- (c) Press the "SEL" key to start the password sequence. Enter the password using the up/down arrow to change the character, and the "SEL" key to enter that character and move to the next. The password is currently "A130". (See Figure 2 for menu flow chart.)
- (d) Select "fuel" using the up/down arrow to move the cursor, then press the "SEL" button to enter the selection.
- (e) Select "left" tank, then press the "SEL" key.
- (f) When "left cal complete re-cal" appears move cursor to "yes" and press "SEL".
- (g) Choose "yes" to delete all left info and press "SEL" key. (This will delete non-factory calibration program).
- (h) When "left calibration data deleted" menu appears press "SEL" key.
- (i) The next menu to appear will be "fuel cal; left; right; cancel," move cursor to "left" and press "SEL" key.
- (j) The DDMP will now query the instrument to find out what calibration step it is at. The instrument knows which quantities have been calibrated, and automatically goes to the next quantity to be calibrated. This requirement forces the instrument to be calibrated sequentially at "E", 10, 20, 30, 40, 50, and "F". Once the DDMP has queried the instrument, it displays the quantity to be calibrated, and gives the user three choices: "start the calibration", "clear all", or "cancel". "Cancel" takes you out of the menu, with nothing being modified, "start calibration" begins the sequence and "clear all" uncalibrates the instrument. In other words, the clear command will delete all auxiliary calibration data, and revert to the factory calibration.

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- (k) Add 3.0 gallons of fuel (unusable) to left wing tank. Select "calibration" from menu in DDMP. Use up/down buttons to move cursor to selection noted above and enter by pressing the "SEL" key. After selection has been made "o.o" will appear in upper part of right window for the first quantity to be calibrated. Wait one minute for the fuel to stop sloshing. Press "SEL" key and in middle of right window a message "working" will flash. In lower portion of left window, the digits will change until the number is within + or - (0.1) of the number in upper portion of right window. When this occurs, the message changes from "working" to "pass". If "error" message appears, the resistance of the tank senders is out of range and one or both senders may have to be replaced. Also, during this step, a horn will sound indicating a low fuel level (5 + or - 1 gallon) condition. Depress "SEL" key and the horn will be canceled.
- (l) Once the "SEL" key is depressed after the message "pass" has appeared, the menu will display allowing a choice between "right" or "left" tanks. Select "left" tank and depress "SEL" key. (10) will appear in the upper portion of the right screen. Add 10 gallons to left tank and wait one minute for fuel to stop sloshing. Press "SEL" key and a "working" message will appear. When the digits in the lower portion of the left window agree to within + or - (0.1) of the (10) indicated in upper portion of right window, the "working" message will change to "pass" and the "SEL" key can be depressed.
- (m) Repeat step (12) for 20, 30, 40, 50, and (F) calibration points.

NOTE: The calibration must be done sequentially; otherwise, a possible error could be introduced into the program.

- (n) When "complete" message is displayed, depress "SEL" key and use cursor to select right tank and hit "SEL" to accept.
- (o) Repeat steps (10), (11), (12), (13), and (14), for right tank.
- (p) When right tank calibration is complete, turn rotary switch to "Inst" mode. This will save the calibration.



Fuel Calibration Menu Flow Chart (Seneca V)
Figure 2

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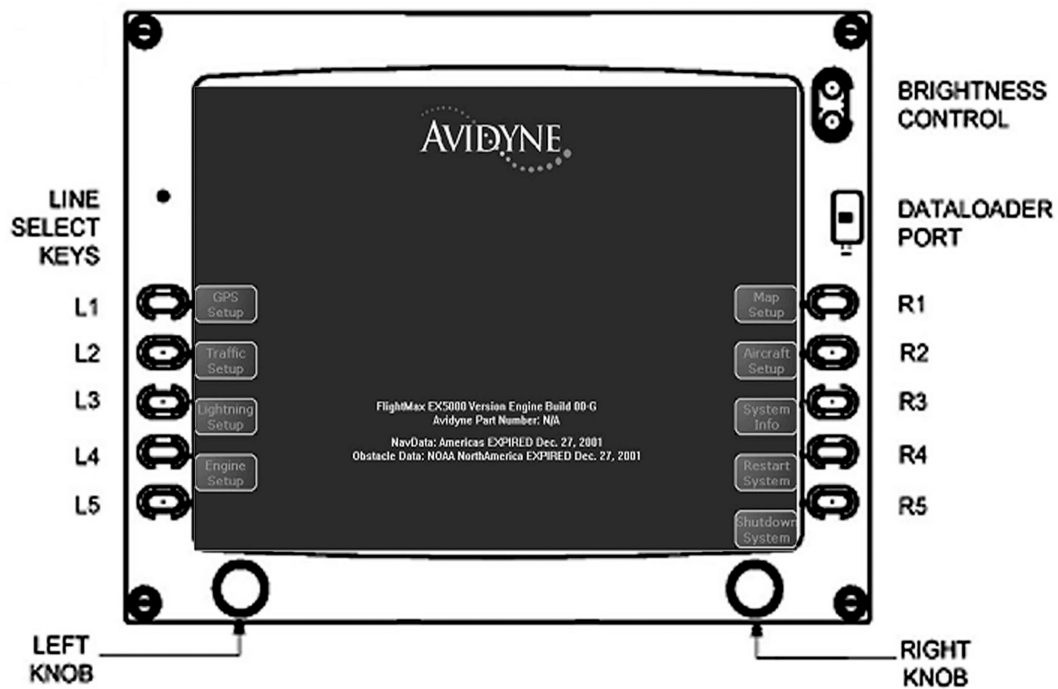
B. AVIDYNE Fuel Quantity Calibration (From Engine Setup Page)

CAUTION REPLACEMENT OF ANY OF THE FUEL QUANTITY SENDERS OR REPLACEMENT OF THE MULTI-FUNCTION DISPLAY REQUIRES RECALIBRATION.

- (1) Prepare the aircraft for testing
 - (a) Level the aircraft ± 1 degree laterally and longitudinally. (See 08-20-00.)
 - (b) Place the battery switch in the OFF position.
 - (c) Connect the external power supply unit to the aircraft electrical system using the APU connector.
 - (d) Adjust the power supply to provide 28.0 ± 1 VDC.
- (2) Initial Calibration Procedure. (see 28-40--00 fig 5)
 - (a) From the maintenance page, depress line select key (L4) to access the Engine setup Page Depress the Fuel Cal button (L1) to enter the fuel calibration page
 - (b) Depress "Begin Cal" button (R3) and follow the on-screen calibration procedure for left & right tank zero fuel (3.0 \pm 1.0 gal. unusable) and full fuel calibration (61 \pm 0.1 gal. usable) points.
 - (c) Use the Left Knob to select the current calibration point. The selected calibration point is highlighted and the value displayed is the current reported fuel quantity from the DAU. A message at the bottom of the screen prompts the operator to add the appropriate amount of fuel and then to select "Accept Value" once the value reported from the DAU has stabilized.
 - (d) If the DAU reported value is not within 2.5 gallons of the test point value, a message "DAU Reported Fuel Quantity Out of Tolerance" will be presented and the value will not be accepted.
 - (e) Once all points have been calibrated, the operator presses "Calibration Complete" to cause the calibration factors to be computed and applied to the DAU reported fuel quantity.
 - (f) Other options from the Calibration Underway state are to "Restore Last Cal" and "Clear Cal".
 - 1 Pressing "Restore Last Cal" causes the calibration values from the last completed calibration to be restored and the state to change to Calibrated.
 - 2 Pressing "Clear Cal" causes all calibration values to be cleared and the state to change to "Not Calibrated". An "Are Your Sure?" prompt will give the operator a chance to reconsider the decision to either "Restore Last Cal" or "Clear Cal".
 - (g) When the calibration procedure has been completed, press the Save button. If you decide not to save the changes, pressing the Cancel button from the Underway state causes the current calibration session to be aborted with any unsaved interim calibration values being discarded. Changes will not take effect until the MFD has been restarted.

NOTE: The "empty" and "full" fuel readings on this set-up page will NOT display zero(0) or 61 gallons usable fuel for the respective empty and full calibration points. However, the appropriate zero and full (61 U.S. gallons) will be displayed on the MFD in normal operation mode (not maintenance set-up).

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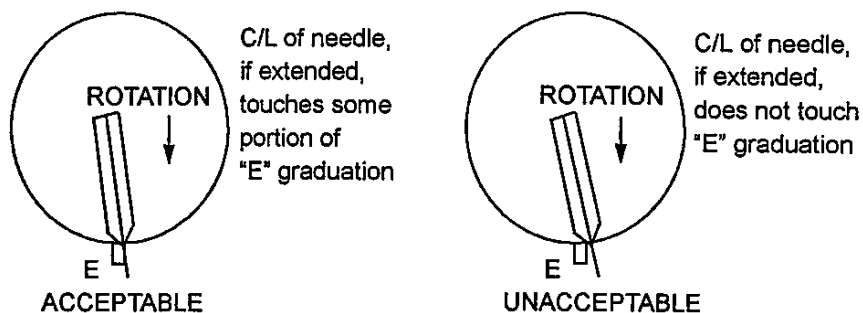
Avidyne Fuel Quantity Calibration
Figure 5

[Effectivity](#)
[Seneca V](#)
[with Avidyne Option](#)

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C. Full Gauge Range Check

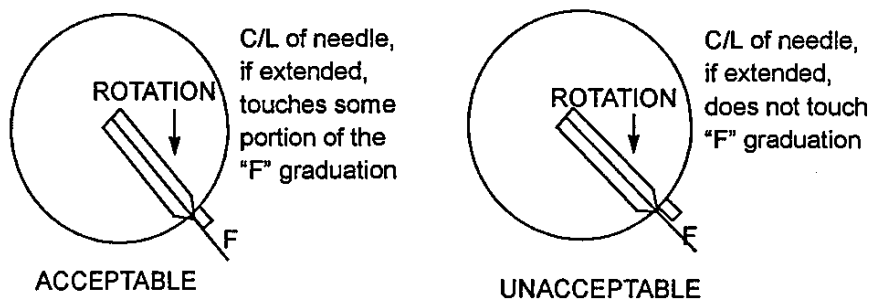
Defuel both fuel tanks. Add 3 gallons of fuel to each tank (unusable). Verify that fuel gauges indicate "O" or "E". See Figure 3 for analog needle display limits at empty. Add 10 gallons of fuel to each tank and again observe analog and digital gauge readings. Repeat this procedure for 20, 30, 40, 50, and "F" gallons for left and right tanks. For analog needle display limits at full, see Figure 4. Allow ± 2 gallon tolerance at each increment except for "E", 3 gallons (unusable) and "F". "E" and 3 gallons (unusable) have ± 0 tolerance and "F" (full) tolerance is $+0/-1$ gallons. Record data in a xerox copy of Chart 2.



Tolerance on "E" (empty indication) is ± 0 gallons.

Analog Needle Display Limits at Empty ([Seneca V](#))

Figure 3



Analog Needle Display Limits at Full ([Seneca V](#))

Figure 4

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**CHART 2
FUEL CALIBRATION (SENECA V)**

FUEL CALIBRATION				
TANK CAPACITY (EITHER SIDE) (GALLONS)	RESISTANCE ¹ (OHMS) (± 1)	GAUGE READINGS ²		TOLERANCE (GALS) (ON GAUGE READING)
		ANALOG	DIGITAL	
0.0 (E)	0.5			± 0
(3) Gal. Unusable	0.5			± 0
10	24.0			± 2
20	38.0			± 2
30	52.0			± 2
40	64.0			± 2
50	75.0			± 2
61 (F)	93.0			+ 0, - 1
<p>1 - Reference only - not a required measurement.</p> <p>2 - Allowed 1 gallon spread between analog and digital readings except at "0", "(3) gal unusable" and "Full". Digital and analog must read the same at "0", "(3) gal unusable" and "Full".</p>				

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CHAPTER

29

HYDRAULIC POWER

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CHAPTER 29 - HYDRAULIC POWER

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GENERAL

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

CAUTION: PRIOR TO STARTING ANY INVESTIGATION OF THE HYDRAULIC SYSTEM, PLACE THE AIRPLANE ON JACKS (SEE JACKING, 07-10-00.)

The hydraulic system components covered in this section consist of the combination hydraulic pump and reservoir, hydraulic pressure switch, free-fall valve assembly, actuating cylinders and hydraulic lines. The brake system, although hydraulically operated, is not included in this section as it has its own hydraulic system independent of the gear retraction system. The brake system along with landing gear and components is covered in 32-00-00.

This section provides instructions for remedying difficulties which may arise in the operation of the hydraulic system. The instructions are organized so that the mechanic can refer to: Description, for a basic understanding of the system; Troubleshooting, for a methodical approach in locating difficulty; Corrective Maintenance, for the removal, repair and installation of components; and; Adjustments and Checks, for the operation of the repaired system.

1. Description (See Chart 1.)

Hydraulic fluid to the landing gear actuating cylinders is supplied by an electrically powered reversible pump located in the right forward area of the fuselage nose section. A reservoir is an integral part of the pump. The pump is controlled by a selector handle on the instrument panel, to the left of the control quadrant. As the handle is placed in either the up or down position, the pump directs fluid through the particular pressure line to each individual actuating cylinder. As fluid pressure increases at one side of a cylinder piston, fluid at the other side is directed back through the other line to the pump. Both lines serve either as pressure or return passages depending on the rotation of the pump to retract or extend the gear.

A pressure switch is mounted on the pressure line in the right aft side of the nose cone. This switch opens the electrical circuit to the pump solenoid when the gear fully retracts and pressure in the system increases to 1800 + 100 psi. The switch will continue to hold the circuit open until pressure in the system drops 200 to 400 psi; when at that time the pump will again operate to build up pressure as long as the gear selector is in the up position. The down position of the selector handle does not affect the pressure switch.

The Oildyne hydraulic pump is a gear type unit driven by a 24 volt reversible motor designed to operate in a pressure range of 2,400 ± 200 psi. To prevent excessive buildup of pressure in the hydraulic system due to expansion, a primary thermal relief valve is incorporated in the pump body which will open at 3,000 +300/-200 psi. Other valves in the pump, channel fluid to the proper outlet during retraction or extension of the gear. A shuttle valve located in the base of the pump allows fluid displaced by the cylinder pistons to return to the reservoir without back pressure. This shuttle valve has a delivery pressure of 400-800 psi during the extension cycle.

A bypass free-fall valve assembly is incorporated in the system to permit extension of the landing gear should a malfunction in the system occur. This valve is manually operated by means of an emergency gear knob located on the instrument panel. This knob must be fully extended to permit emergency extension. Restrictions in the system prevent the gear from extending too fast.

For a description of the landing gear and electrical switches, see 32-00-00.

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**CHART 1
Hydraulic System Leading Particulars (with Oildyne Pump)**

Hydraulic Pump: High Pressure	2,400± 200 psi
Low Pressure	600 ± 200 psi
Flow Rate @ 1000 psi	60 cu. in. per minute
High Pressure Control	2,400± 200 psi
Hydraulic Fluid	MIL-H-5606
Thermal Relief Valve	3,000+ 300/-200 psi
Shuttle Valve Delivered Pressure	400 to 800 psi
Pressure Switch	
Open (OFF) Pressure	1,800 ± 100 psi
Close (ON) Pressure	Pressure decreasing 200 to 400 psi

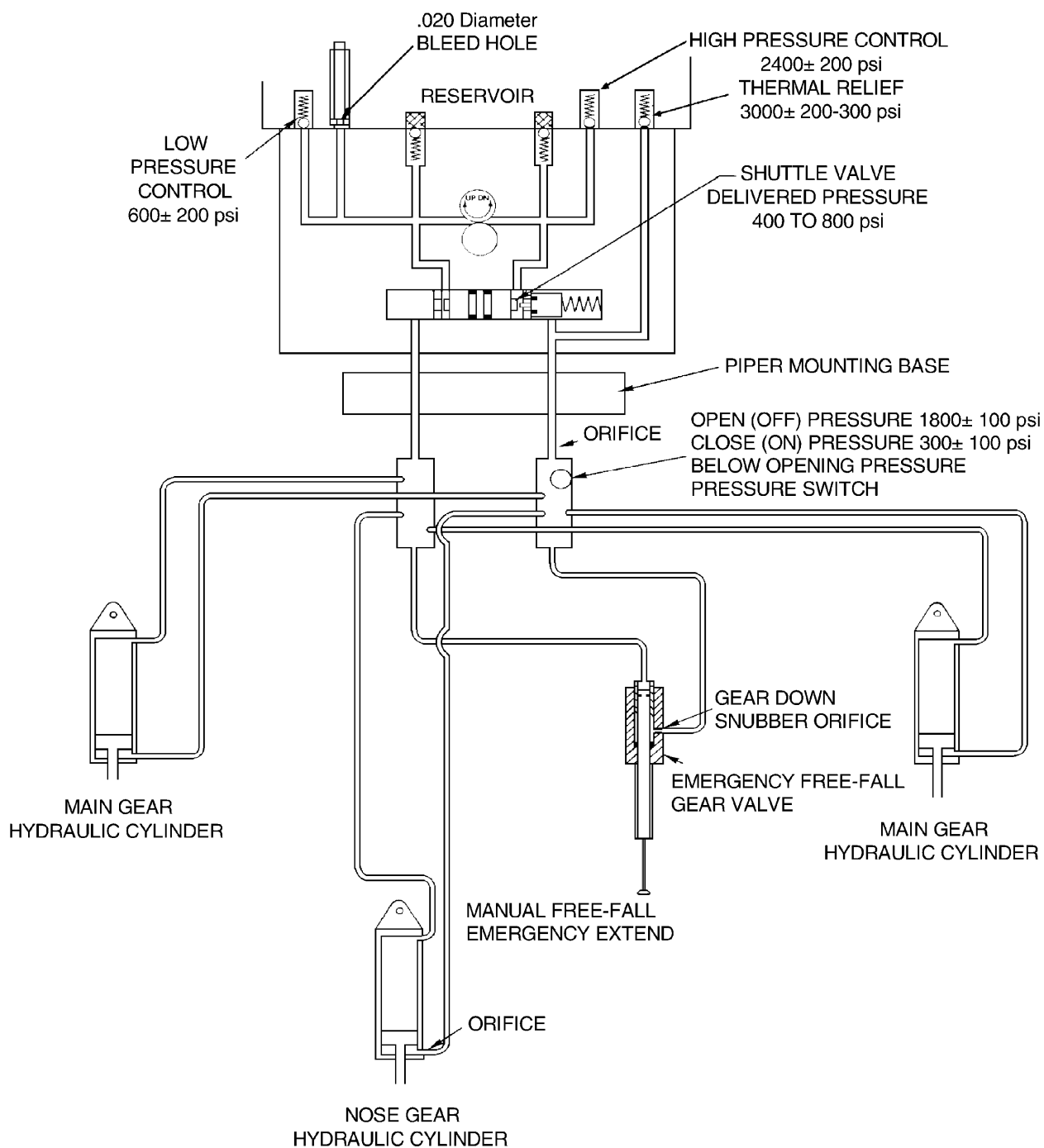
2. Troubleshooting

CAUTION: PRIOR TO STARTING ANY INVESTIGATION OF THE HYDRAULIC SYSTEM, PLACE THE AIRPLANE ON JACKS. WITH THE AIRPLANE ON JACKS, PULL THE FREE-FALL VALVE KNOB FULL OUT, THUS PREVENTING THE BUILDUP OF UNNECESSARY PRESSURE ON THE ACTUATING CYLINDERS AND CONNECTING HYDRAULIC LINES WHEN THE GEAR IS RAISED OR LOWERED MANUALLY. FAILURE TO COMPLY WITH THESE INSTRUCTIONS COULD RESULT IN THE BUILDUP OF SUFFICIENT PRESSURE TO UNLOCK THE DOWN LOCK MECHANISM ALLOWING THE GEAR TO COLLAPSE WHEN THE WING JACKS ARE REMOVED. PRIOR TO REMOVING THE AIRPLANE FROM JACKS, PUSH THE FREE-FALL VALVE KNOB IN, TURN ON THE MASTER SWITCH AND SELECT GEAR DOWN, OBSERVE THAT ALL THREE GREEN LIGHTS INDICATING THE LANDING GEAR IS DOWN AND LOCKED ARE ENERGIZED. TURN MASTER SWITCH OFF.

Malfunctions in the hydraulic system will result in failure of the landing gear to operate properly. When trouble develops, jack up the airplane (see Jacking, 07-00-00) and then proceed to determine the extent of the trouble. Generally, hydraulic system troubles fall into two types; trouble involving the hydraulic supplying system and troubles in the landing gear hydraulic system. Chart 2 lists the troubles which may be encountered and their probable cause, and suggests a remedy for the trouble involved. A hydraulic system operational check may be conducted using Figures 1 and 2. When the trouble has been recognized, the first step in troubleshooting is isolating the cause. Hydraulic system troubles are not always traceable to one cause. It is possible that a malfunction may be the result of more than one difficulty within the system. Starting first with the most obvious and most probable reasons to the trouble, check each possibility and, in turn, by process of elimination, isolate the troubles.

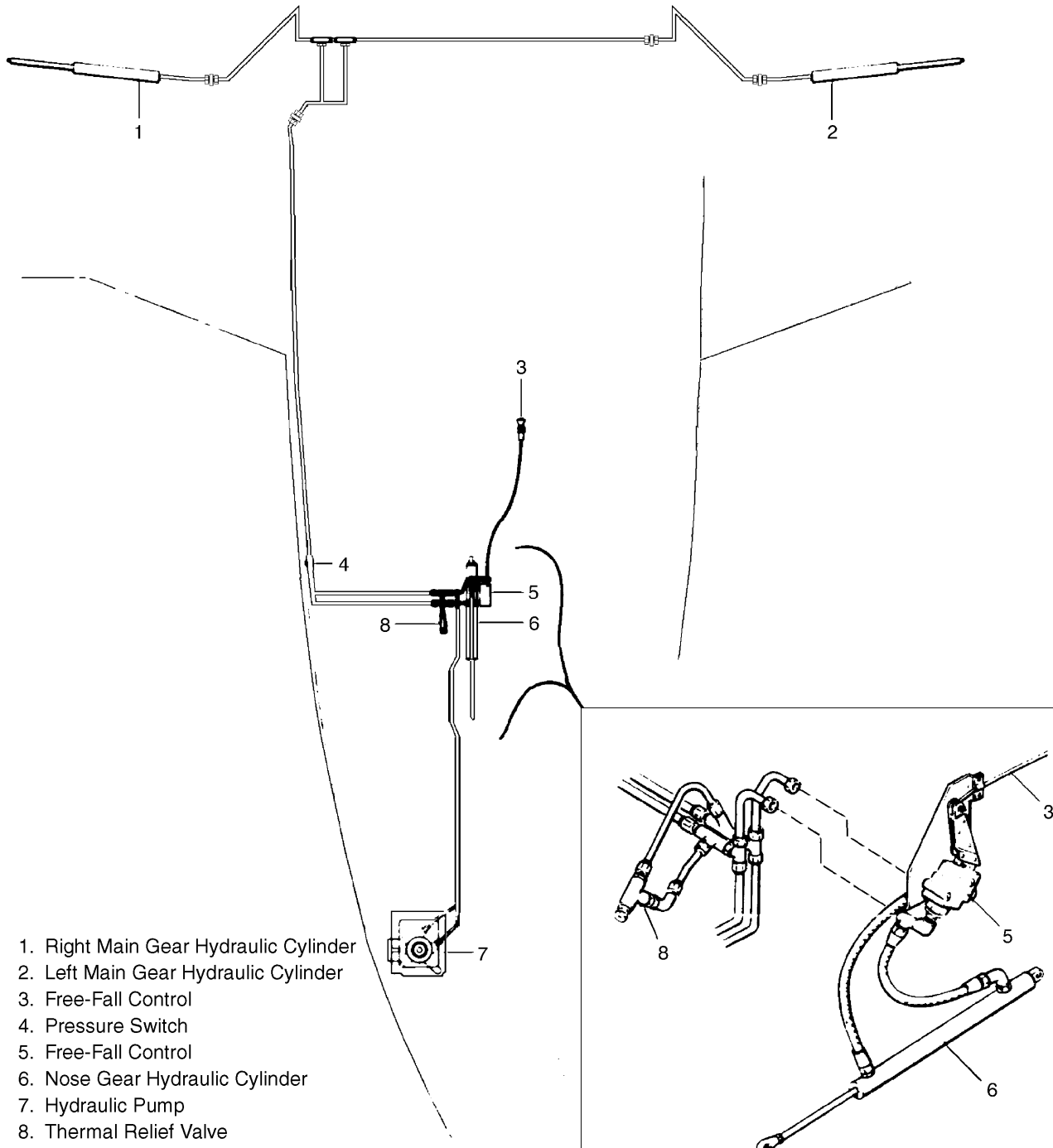
NOTE: Field service of the Oildyne hydraulic pump is limited to motor replacement and removal, cleaning, and inspecting the hydraulic fluid reservoir. Should pump malfunction, replace pump, or return pump to Piper via your local Piper distributor for servicing or repairs.

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Hydraulic System Schematic Diagram (Oildyne)
Figure 1

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Hydraulic System Installation
Figure 2

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**CHART 2 (Sheet 1 of 4)
TROUBLESHOOTING HYDRAULIC SYSTEM**

Trouble	Cause	Remedy
Landing gear retraction system fails to operate.	Landing gear actuator circuit breaker open.	Reset circuit breaker and determine cause for open circuit breaker.
	Landing gear selector circuit breaker open.	Reset circuit breaker and determine cause for open circuit breaker.
	Landing gear actuator circuit wires broken.	Check wiring.
	Landing gear selector circuit wires broken.	Check wiring.
	Safety (squat) switch out of adjustment.	Readjust switch. (Refer to Adjustment of Safety Switch, Chapter 32.)
	Squat switch inoperative.	Replace switch.
	Pressure switch inoperative.	Replace switch.
	Pump retraction solenoid inoperative (upper solenoid).	Replace solenoid.
<p>NOTE: If the retracting solenoid of the pump can be heard to actuate when operating the gear selector switch, it may be assumed that the gear control circuit is operating properly and the actuator circuit should be further checked.</p>		
	Gear selector switch ground incomplete.	Check ground.
	Gear selector switch inoperative.	Replace switch.
	Hydraulic pump ground incomplete.	Check ground.
	Hydraulic pump inoperative.	Replace or overhaul pump.
	Hydraulic fluid in reservoir below operating level.	Fill reservoir with hydraulic fluid.
	Battery low or dead.	Check condition of battery.
	Check for internal leakage of free-fall valve.	Replace valve.
	Check for internal leakage of gear up check valve in pump.	Replace or overhaul pump.

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CHART 2 (Sheet 1 of 4)
TROUBLESHOOTING HYDRAULIC SYSTEM

Trouble	Cause	Remedy
Landing gear extension system fails to operate.	Landing gear actuator circuit breaker open.	Reset circuit breaker and determine cause for open circuit breaker.
	Landing gear selector circuit breaker open.	Reset circuit breaker and determine cause for open circuit breaker.
	Landing gear actuator circuit wires broken.	Check wiring.
	Landing gear selector circuit wires broken.	Check wiring.
	Pump extension solenoid inoperative (lower solenoid).	Replace solenoid.
	<p>NOTE: If the extension solenoid of the pump can be heard to actuate when operating the gear control circuit is operating properly and the actuator circuit should be further checked.</p>	
	Gear selector switch ground incomplete.	Check ground.
	Gear selector switch inoperative.	Replace switch.
	Hydraulic pump ground incomplete.	Check ground.
	Hydraulic pump inoperative.	Replace or overhaul pump.
Landing gear retraction extremely slow.	Hydraulic fluid in reservoir below operating level.	Fill reservoir with hydraulic fluid.
	Restriction in hydraulic lines.	Isolate and check hydraulic lines.
Pump stops during gear retraction.	Landing gear actuator circuit breaker opens.	Reset circuit breaker and determine cause for overload.
	Landing gear selector circuit breaker opens.	Reset circuit breaker and determine cause for overload.
	Pressure switch out of adjustment.	Remove and readjust or replace switch.
	Mechanical restriction or obstruction in hydraulic system to allow pressure to build up and shut off pump before gear has retracted.	Place airplane on jacks and run retraction check. Isolate and determine cause.

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**CHART 2 (Sheet 1 of 4)
TROUBLESHOOTING HYDRAULIC SYSTEM**

Trouble	Cause	Remedy
Pump stops during gear extension	Landing gear actuator circuit breaker opens	Reset circuit breaker and determine cause for overload.
	Landing gear selector circuit breaker opens.	Reset circuit breaker and determine cause for overload.
Pump fails to shut off though gear has fully retracted.	Pressure switch in-operative.	Replace switch.
	Pressure switch out of adjustment.	Replace switch.
	Pump retraction solenoid sticking (inboard solenoid).	Replace solenoid.
	Internal leakage of system.	Check gear actuating cylinders and free-fall valve for internal leakage. Check for internal damage to hydraulic pump.
	External leakage of system.	Check gear actuating cylinders for external leakage. Check for broken or damaged hydraulic lines or hoses.
	Pump relief valve out of adjustment.	Replace pump.
Pump fails to shut off though the gear has fully extended.	Pump extension solenoid sticking (outboard solenoid.)	Replace solenoid.
	Nose gear down limit switch actuator out of adjustment.	Adjust switch actuator. (Ref. Nose Gear Down Limit Switch, Chapter 32.)
	Nose gear down limit switch failed.	Replace switch.
	Main gear down limit switch out of adjustment.	Adjust switch. (Refer to Adjustment of Main Gear Down Limit Switch, Chapter 32.)
	Main gear down limit switch failed.	Replace switch.
<p>NOTE: The out of adjustment or failed switch may be determined by noting which down light is not lit.</p>		

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**CHART 2 (Sheet 1 of 4)
TROUBLESHOOTING HYDRAULIC SYSTEM**

Trouble	Cause	Remedy
Pump running intermittently after gear has retracted.	Leakage of high pressure check valve.	Remove pump and replace check valve.
	Internal leakage of system.	Check free-fall valve for internal leakage.
		Check gear actuating cylinders for internal leakage.
	External leakage of system.	Check gear actuating cylinders for external leakage. Check for broken or damaged hydraulic lines.
Gear stops part way up, but pump continues to run	Pump high pressure relief valve out of adjustment.	Replace pump.
	Internal leakage of system.	Check gear actuating cylinders and free-fall valve for internal leakage. Check for broken or damaged hydraulic lines.
	Hydraulic fluid in reservoir below operating level.	Fill reservoir with hydraulic fluid.
All gears fail to free-fall.	Free-fall valve fails to open.	Check valve and replace.

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MAIN

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

1. Hydraulic Pump

A. Removal (See Figure 1.)

The Oildyne hydraulic pump with reservoir incorporated is located in the nose section of the fuselage. Access to the pump is through the access panel in the nose baggage compartment.

- (1) Remove the ABS nose gear cover.
- (2) Remove anti-splash cover (Piper P/N 96374-0) by removing the four attaching screws.
- (3) Disconnect the three knife connectors that attach the black, blue, and green forward and reverse harness wires.
- (4) Disconnect and plug the “up” and “down” pressure hydraulic lines from pump mount. Cap the lines.
- (5) Remove the three each mounting bolts and washers securing pump mount to deck.
- (6) Lift assembly from airplane.

B. Installation (See Figure 1.)

- (1) Position assembled pump, bracket, and pump mount on pump deck in airplane.
- (2) Secure pump assembly to deck by installing the three AN3-10 bolts with one MS35489-64 washer under each bolt head and three No. 5712-45 (Piper P/N 494 192) washers between Piper mount assembly and pump deck.

NOTE: Before positioning the complete hydraulic pump assembly on the mounting bracket, ensure that the cushion pad is secured in place on the reservoir base.

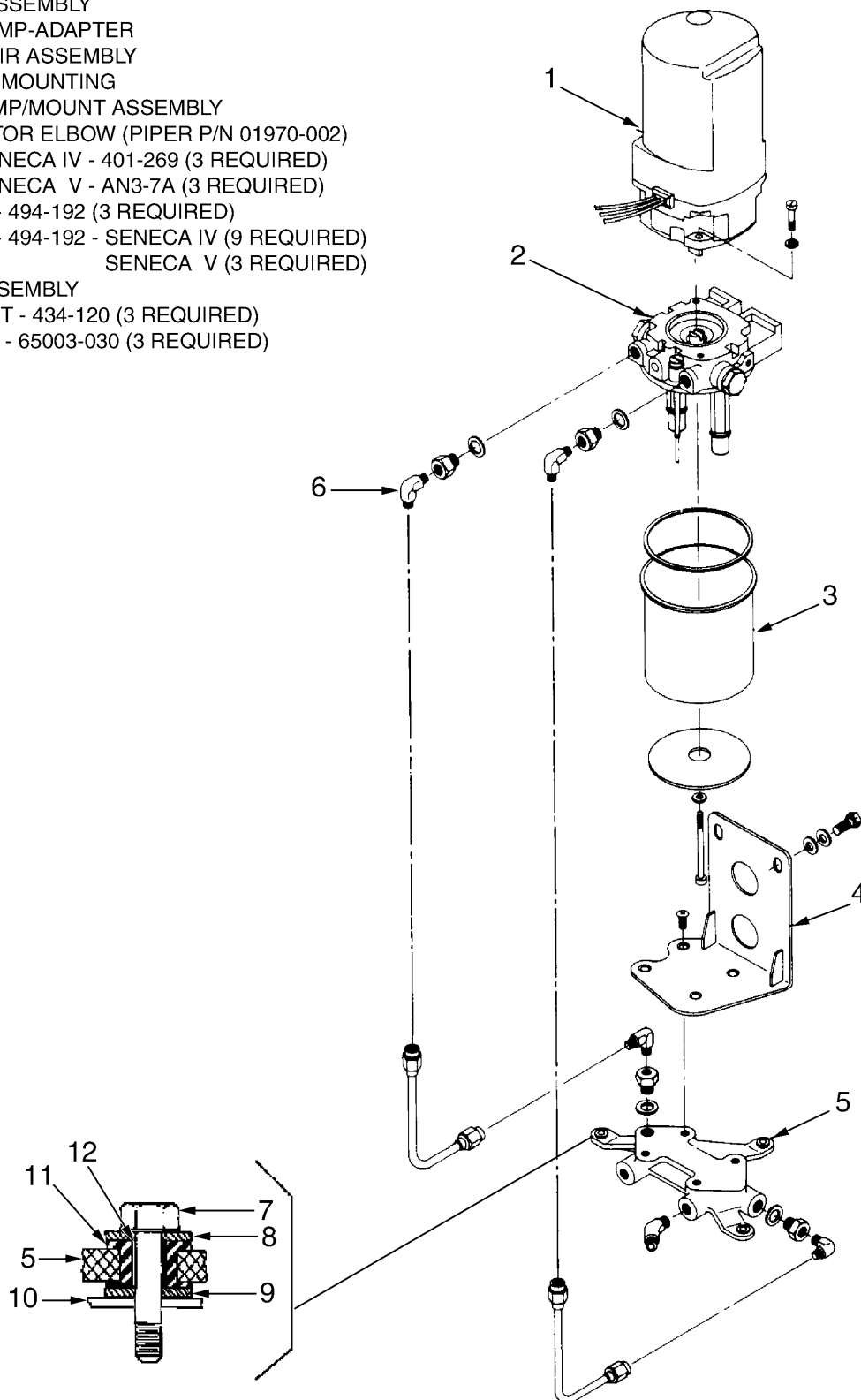
- (3) Install the “up” and “down” pressure hydraulic lines to pump mount.
- (4) Connect the three knife connectors that attach the black, blue, and green forward and reverse harness wires.

**CHART 1
CHARACTERISTICS, HYDRAULIC PUMP - OILDYNE**

Electrical Characteristics:	
Voltage	24 DC
Rotation	Reversible
Polarity	Negative ground
Operating Current	25 amps, max. at 24 volts (both rotations)
Operating Time	Continuous with circuit breaker protection.
Overload Protection	Thermal circuit breaker 25 amp
Mechanical Characteristics:	
NOTE: Since the Oildyne hydraulic pump has a sealed motor assembly, with disassembly not approved, there are no mechanical characteristics.	

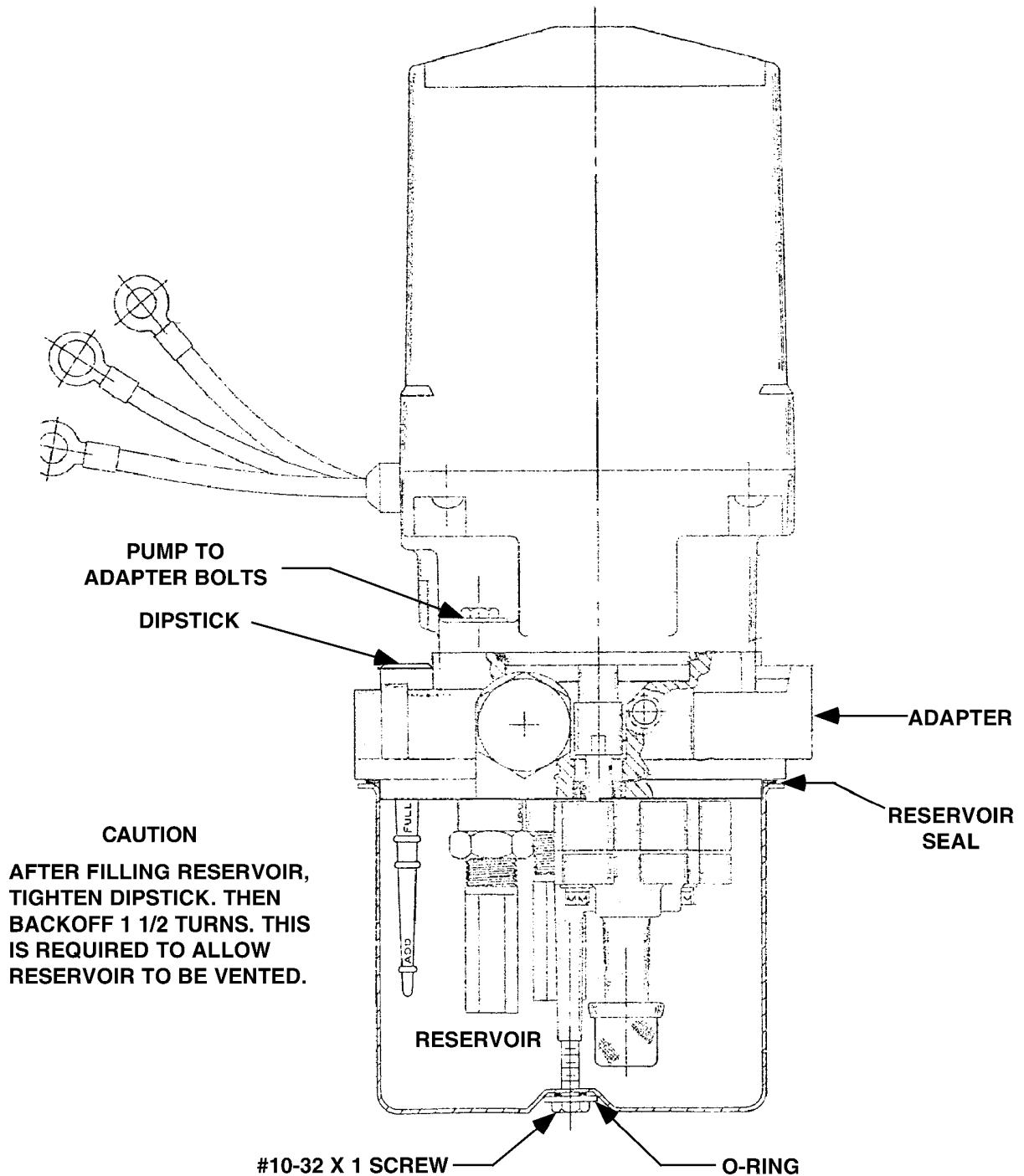
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1. MOTOR ASSEMBLY
2. BASIC PUMP-ADAPTER
3. RESERVOIR ASSEMBLY
4. BRACKET-MOUNTING
5. BASE-PUMP/MOUNT ASSEMBLY
6. RESTRICTOR ELBOW (PIPER P/N 01970-002)
7. BOLT - SENECA IV - 401-269 (3 REQUIRED)
SENECA V - AN3-7A (3 REQUIRED)
8. WASHER - 494-192 (3 REQUIRED)
9. WASHER - 494-192 - SENECA IV (9 REQUIRED)
SENECA V (3 REQUIRED)
10. DECK ASSEMBLY
11. GROMMET - 434-120 (3 REQUIRED)
12. BUSHING - 65003-030 (3 REQUIRED)



Oildyne Hydraulic Pump
Figure 1 (Sheet 1 of 2)

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Oildyne Hydraulic Pump
Figure 1 (Sheet 2 of 2)

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- (5) Install anti-splash cover (Piper P/N 96374-0) by installing the four attaching screws,
- (6) Install the ABS nose gear cover.

C. Field Service

Field service of Oildyne hydraulic pump is limited to motor replacement and removal, cleaning, and inspecting the hydraulic fluid reservoir. Should pump malfunction, either replace pump, or return pump to Piper, via the local Piper distributor, for servicing or repairs.

D. Disassembly

- (1) Oildyne Hydraulic Pump from Piper Bracket (See Figure 1.)
 - (a) Remove safety wire securing two bolts that attach bracket to pump.
 - (b) Remove the two bolts and washers.
 - (c) Separate pump assembly from bracket.
- (2) Oildyne Motor Assembly from Oildyne Pump/Adapter Assembly (See Figure 1.)
 - (a) Remove two each mounting bolts on flange of motor assembly and separate the motor assembly from the pump.
 - (b) Remove coupling and O-ring and discard.

NOTE: New O-ring and coupling are included in replacement motor assembly.

- (3) Oildyne Reservoir Assembly from Oildyne Pump/Adapter Assembly (See Figure 1.)

CAUTION: DO NOT DISASSEMBLE PUMP ASSEMBLY FROM ADAPTER ASSEMBLY. DAMAGE TO VALVES AND PRESSURE SETTINGS, WHICH ARE NON-ADJUSTABLE, WILL OCCUR.

- (a) Remove screw and O-ring securing the reservoir to the adapter assembly.
- (b) Remove reservoir and reservoir seal.
- (c) When replacing reservoir, remove the cushion pad. It will have to be bonded to the new reservoir base using Scotch Grip 2210 or Contact Adhesive B-10161 rubber cement.

E. Assembly

- (1) Oildyne Reservoir Assembly to Oildyne Pump/Adapter Assembly (See Figure 1.)
 - (a) Locate the cushion pad and bond it to the bottom surface of the reservoir using Scotch Grip 2210, or Contact Adhesive B-10161 rubber cement.
 - (b) Position the reservoir seal between the reservoir and the adapter assembly.
 - (c) Locate the O-ring and bolt that secures the reservoir to the pump-adapter assembly and apply a light coating of Titeal No. 3 in back of first two bolt threads.
 - (d) Position the O-ring on the bolt, and install it through the reservoir and into the pump-adapter securing the reservoir.
 - (e) Tighten this bolt to a torque value of 40 - 50 inch pounds.
- (2) Oildyne Motor Assembly to Oildyne Pump/Adapter Assembly (See Figure 1.)
 - (a) Locate the replacement O-ring and coupling.
 - (b) Place the coupling and O-ring into position between the motor assembly and pump-adapter assembly.
 - (c) Apply light coating of Titeal No. 3 in back of the first two threads of mounting bolts.
 - (d) Positioning the two units in place, install two each mounting bolts through the flange of the motor assembly and into the pump-assembly housing.
 - (e) Torque bolts to 15 -20 inch pounds.

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- (3) Oildyne Hydraulic Pump to Piper Bracket (See Figure 1.)
 - (a) If bracket was removed from pump mount, install bracket to Piper pump mount with four MS24693-S298 screws.
 - (b) Position pump assembly on bracket so that tapped holes in oildyne adapter align with bolt holes on bracket.
 - (c) Install two AN960-616 washers and two MS20074-06-05 bolts to secure pump assembly to bracket.
 - (d) Safety bolts with MS20995-C41 wire.

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2. Landing Gear Free Fall Valve Assembly

A. Inspection and Repair

This valve is located directly above the nose wheel actuating cylinder. Inspection is limited to determining if any signs of hydraulic fluid leakage are evident around the seam between the end fitting and valve body, and around the periphery of the piston assembly shaft. If leaks appear, the valve assembly should be replaced since it is impractical to repair the valve.

B. Removal (See Figure 2.)

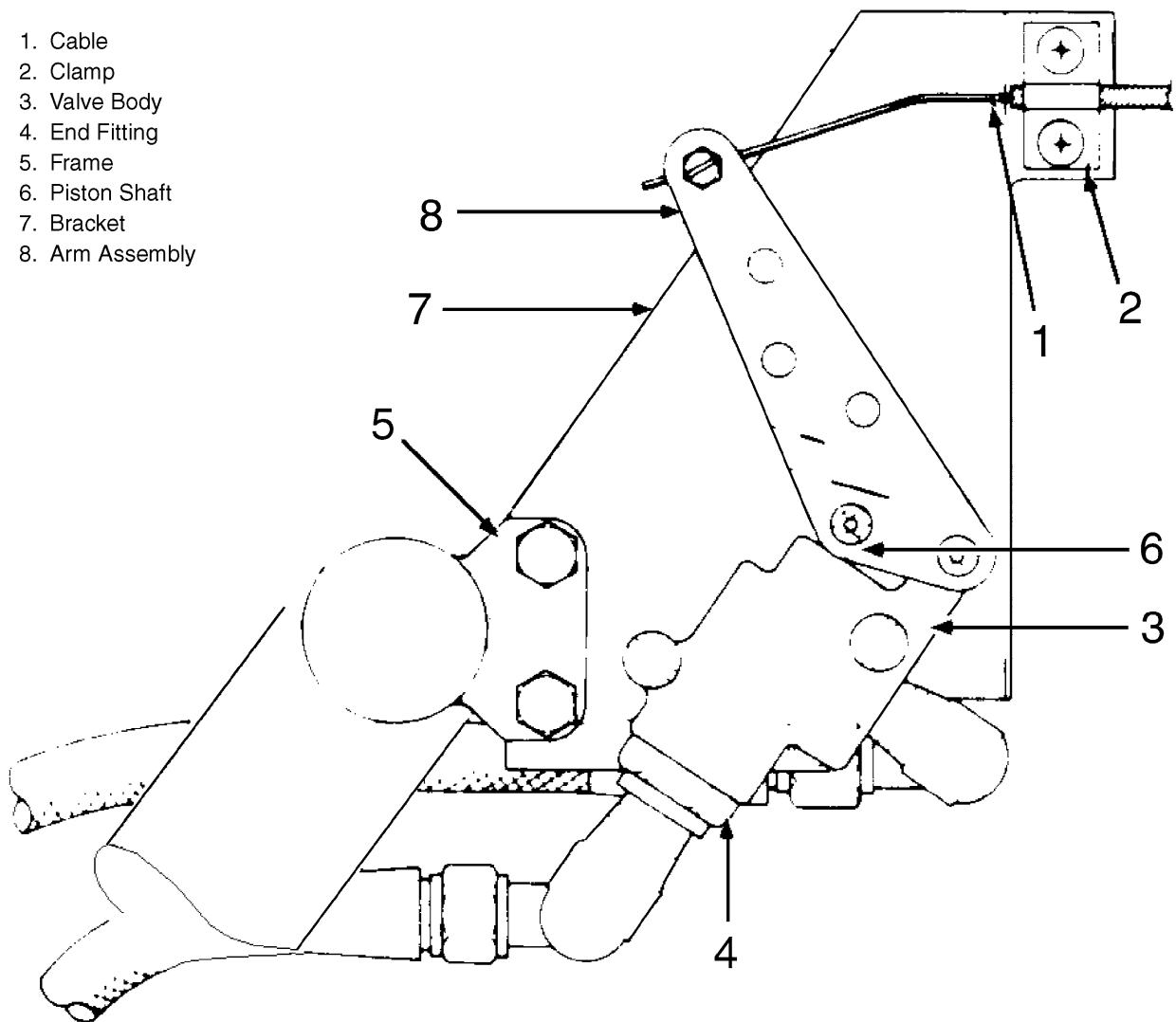
In the event it becomes necessary to replace the free-fall valve assembly, proceed as follows:

- (1) Loosen three screws and clamp securing cable in position and withdraw cable.
- (2) Disconnect hydraulic lines connected to the valve. Place a rag in position to absorb any hydraulic fluid spillage that may result. Cap the lines to avoid contamination.
- (3) Remove the hex head bolts securing the valve and bracket to the frame and remove the assembly from the airplane.
- (4) Remove rivet and nut securing link to piston shaft. Note position of elbow and tee fittings to assure their being replaced in the same position at reassembly. Remove fittings and two bolts securing the valve to the bracket.

C. Installation (See Figure 2.)

- (1) Apply Tite seal No. 3 in back of first two MALE threads of elbows and tees and insert fittings in valve. Apply Tite seal should be sparingly to prevent it entering the hydraulic system.
- (2) Install valve on bracket and secure in position. Push piston shaft into the valve until it bottoms. Align hole in link with hole in piston shaft and insert rivet. Attach nut to rivet.
- (3) Position bracket with valve on frame. Apply Tite seal No. 3 in back of first two MALE threads of tees and connect hydraulic lines. Apply Tite seal should be sparingly to prevent it entering the hydraulic system.
- (4) Push arm assembly fully forward. Pull cable full forward. Place clamp over reinforced portion of cable and tighten screws. Insert loose end of cable through the hole in the bushing of the arm assembly. Tighten lock screw on cable.

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Free-Fall Valve Assembly Figure 2

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3. Hydraulic Lines

Removal and Installation

Remove damaged hydraulic lines by disconnecting fittings at both ends and disconnecting where secured by brackets. See Figure 2, 6-00-00, as an aid in locating attaching brackets and bends in lines. Provide a small, clean container for draining the lines. Install a new or repaired line in reverse. Operate the pump to purge air from the system. Check fluid level in the reservoir.

4. Testing Hydraulic System

CAUTION: TURN MASTER SWITCH OFF BEFORE INSERTING OR REMOVING EXTERNAL POWER SUPPLY PLUG.

The hydraulic system should be tested to determine that it functions properly after performing any service or repairs. It is suggested that the airplane be connected to an outside power source in order to conserve the battery. (See External Power Receptacle, 12-00-00 and 24-00-00.)

- A. Place airplane on jacks. (See Jacking, 07-00-00.)
- B. With gear down, master switch ON, and circuit breaker closed, place landing gear selector handle in the UP position. The pump should immediately start operating and the gear retract. The red gear unsafe light on the instrument panel should light up until the gear is fully retracted. The hydraulic pump should stop operating after full retraction of the gear.
- C. Place gear selector handle in DOWN position. The gear should extend and lock in position. Gear down lights on the instrument panel will light up when all three gears are locked in position. Inspect hydraulic system for leakage of hydraulic fluid.
- D. Recycle the landing gear to determine that it functions properly.

CAUTION: PRIOR TO REMOVING THE AIRPLANE FROM JACKS, TURN MASTER SWITCH ON AND DETERMINE THAT ALL THREE GREEN LIGHTS ARE ENERGIZED. THIS WILL INDICATE THE LANDING GEAR IS DOWN AND LOCKED.

- E. To check operation of the free-fall valve assembly, retract the landing gear and turn the master switch off. Pull the free-fall valve knob full out. The landing gear should extend and lock in position.

5. Servicing Hydraulic Pump/Reservoir

The Oildyne pump incorporates a dipstick to check the quantity of hydraulic fluid in the reservoir. Check the fluid level every 50 hours time-in-service. Replenish only with MIL-H-5606 petroleum base hydraulic fluid. (See Figure 1.)

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CHAPTER

30

ICE AND RAIN PROTECTION

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GENERAL

The material contained in this chapter provides information for general maintenance characteristic of the ice protection system. If further information is necessary contact the product manufacturer or Piper Service Representative.

Description and Operation

The ice protection system is actually made up of five separate systems: a pneumatic deice system (30-10-00, Figure 1); an electrical prop deice system (30-60-00, Figure 1); an electrically heated windshield panel (30-40-00, Figure 1); heated pitot/ stall warning system(30-30-00, Figure 1); and an ice detection light installation (30-80-00). These systems can be installed individually or in any combination. The switches for all installed ice protection systems are in a common group installed directly in the instrument panel directly above the throttle quadrant.

The pneumatic system, which utilizes boots to displace ice from the leading edges of the flight surfaces, necessitates, on [Seneca IV](#) models, replacing the standard air pumps with pumps of greater capacity. On [Seneca V](#) models, the pumps of greater capacity are standard. Along with the boots and related plumbing, the system also utilizes two control valves, two check valves, a deflate valve, and a timing module. A control and check valve are used on each side of the system and, being mounted behind their respective firewall, are accessible upon removal of the appropriate nacelle hatch cover. The deflate valve and time module are mounted under the floor on the left side of the fuselage as shown in 30-10-00, Figure 1.

Boots are attached to the leading edge of the wings, vertical stabilizer, and stabilator. The boots are of a fabric reinforced rubber containing built-in span wise inflation tubes. A ply of conductive neoprene is cured to each boot surface to dissipate static electric charges and prevent damage to the boots from those charges, as well as preventing a fire hazard after each flight. Attached to the flight surfaces with cement, the boots are connected to the plumbing, through the skin by flexible and/or aluminum air connections.

Operation of the pneumatic deice system is controlled by a momentary, single pole, single throw switch on the control panel. During normal operation, vacuum, provided continuously from the pump inlets to the vacuum system, is also directed to the boots system through the deflate valve to hold the boots down in flight. The control valves, closed during normal operation, allow pressure air from the pumps to be dumped overboard. Activation of the momentary switch initiates power to the aforementioned units causes: (1) the deflate valve to close the system to vacuum and outside pressure; and, (2) activation of the timer in the timing module.

When the switch is activated, pressure begins to build in the system. Upon reaching 8 psi, a pressure switch on the deflate valve activates an indicator light on the control panel. With the system still operating, pressure continues to build until a pressure activated switch (also on the deflate valve) senses 17 psi, or the timer reaches 6 seconds, whichever comes first. At this point power is removed from the control valves and deflate valve causing: (1) the control valves to close, routing pump pressure overboard; and, (2) the deflate valve to dump system pressure overboard. As pressure decreases, the 8 psi switch is deactivated extinguishing the light. With the pressure dumped from the system, the deflate valve again directs vacuum to the boots. The system, now operating in its normal condition, can be reactivated if necessary, through the momentary switch on the control panel. The vacuum gauge may fluctuate momentarily upon deice cycling.

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The propeller deice system, which can be installed by itself, or included in a package with others of the ice protection system, is designed for both the two and three blade propeller installations. Each propeller deice system consists of: (1) an electrically heated boot bonded to each blade; (2) (on [Seneca IV](#) models) a slip ring assembly connected to the hub of each propeller or (on [Seneca V](#) models) a slip ring assembly connected to the engine crankshaft flange; (3) modular brush assemblies; (4) a timer; (5) a circuit breaker and (6) a control switch located on the control panel; (7) an ammeter; and, (8) a shunt installation located on the left side of the fuselage on a longeron behind the side panel on the left side of the cockpit.

On [Seneca IV](#) models, dual element deicers are utilized on the two blade propeller installation. Each deicer has two separate heaters: one for the outer half and one for the inner half. By heating all outer or inner heaters on only one propeller at a time, rotational balance is held during deicing. Current is drawn from the airplane electrical system through the switch, ammeter and timer. The timer delivers current via the slip ring and modular brush arrangement to (phase 1) the outer heaters on the right propeller, (phase 2) the inner heaters on the same propeller, (phase 3) the outer heaters of the left propeller, and (phase 4) the inner heaters on the left propeller. The timer energizes each of these four phases in turn for about 34 seconds and then repeats the cycle as long as the control switch is on. The cycling sequence given is vital so that outboard heaters on each propeller operate before the inboard heaters. See cycle sequence. (See Figure 2, 30-60-00.) The system may be used continuously in flight if needed. To conserve electrical power, current is cycled to the deicer heaters at timed intervals rather than continuously.

NOTE: Heating may begin at any phase in the cycle depending on the timer position when the switch was turned off from previous use.

On [Seneca V](#) models, single element deicers are utilized on the two blade propeller installation. (See Figure 2, 30-60-00, Sheet 3.)

On [Seneca IV](#) and [Seneca V](#) models, the three blade propeller installation utilizes single element deicers. When the switch is turned on power is directed through the brush block and slip ring to all the heating elements on one propeller for approximately 34 seconds. The timer then directs the power to the other propeller for approximately 34 seconds. This cycle continues until the switch is turned off.

A heated windshield panel can also be installed as a separate item or with any combination of systems. The installation utilizes a glass panel, imbedded with wire filaments, mounted to a metal frame just outside of the windshield on the pilot's side, and secured to the fuselage by two screws. The panel is controlled by a switch on the deice control panel. The frame is hinged at its base to facilitate cleaning of the windshield and panel. When not required, the panel can be removed by removing the two attaching screws and harness from the fuselage.

The pitot and stall warning heat systems are operated as a single system. It should be noted that, although the pitot heat system can be installed in the aircraft by itself, the stall warning heat combination can only be included if the pitot heat system is also installed. These system(s) utilize a switch located among the deice switches installed directly in the instrument panel above the throttle quadrant. Other parts of the system(s) include: (1) a heated pitot head; (2) heated lift detectors (inner and outer); and (3) two circuit breakers (one for each part of the system).

An ice detection light can also be included with the systems for seeing and detecting ice at night. When installed, it is mounted to the outboard side of the left nacelle. It is controlled by a push ON-push OFF switch located among the deice switches installed directly in the instrument panel above the throttle quadrant.

NOTE: For wiring diagrams (schematics) see 91-30-60.

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AIRFOILS

Airfoil deicing is performed by the pneumatic deicing system. The system utilizes inflatable boots to clear ice off the leading edges of the wings, vertical stabilizer, and stabilator.

The boots are of a fabric reinforced rubber construction containing built-in span wise inflation tubes. Attached to the leading edges of the flight surfaces with cement, they are connected through the skin by aluminum and/or flexible rubber air connection stems.

A ply of conductive neoprene is provided on the surface to dissipate static electric charges. These charges, if allowed to accumulate, would eventually discharge through the boot to the metal skin beneath creating static interference with radio equipment, and possible punctures in the rubber. Also such static charges would constitute a temporary fire hazard after each flight.

1. Description and Operation

The pneumatic system, which utilizes boots to displace ice from the leading edges of the flight surfaces, necessitates, on [Seneca IV](#) models, replacing the standard air pumps with pumps of greater capacity. On [Seneca V](#) models, the pumps of greater capacity are standard. Along with the boots and related plumbing, the system also utilizes two control valves, two check valves, a deflate valve, and a timing module. A control and check valve are used on each side of the system and, being mounted behind their respective firewall, are accessible upon removal of the appropriate nacelle hatch cover. The deflate valve and time module are mounted under the floor on the left side of the fuselage as shown in Figure 1.

Boots are attached to the leading edge of the wings, vertical stabilizer, and stabilator. The boots are of a fabric reinforced rubber containing built-in span wise inflation tubes. A ply of conductive neoprene is cured to each boot surface to dissipate static electric charges and prevent damage to the boots from those charges, as well as preventing a fire hazard after each flight. Attached to the flight surfaces with cement, the boots are connected to the plumbing, through the skin by flexible and/or aluminum air connections.

Operation of the pneumatic deice system is controlled by a momentary, single pole, single throw switch on the control panel. During normal operation, vacuum, provided continuously from the pump inlets to the vacuum system, is also directed to the boots system through the deflate valve to hold the boots down in flight. The control valves, closed during normal operation, allow pressure air from the pumps to be dumped overboard. Activation of the momentary switch initiates power to the aforementioned units causes: (1) the deflate valve to close the system to vacuum and outside pressure; and, (2) activation of the timer in the timing module.

When the switch is activated, pressure begins to build in the system. Upon reaching 8 psi, a pressure switch on the deflate valve activates an indicator light on the control panel. With the system still operating, pressure continues to build until a pressure activated switch (also on the deflate valve) senses 17 psi, or the timer reaches 6 seconds, whichever comes first. At this point power is removed from the control valves and deflate valve causing: (1) the control valves to close, routing pump pressure overboard; and, (2) the deflate valve to dump system pressure overboard. As pressure decreases, the 8 psi switch is deactivated extinguishing the light. With the pressure dumped from the system, the deflate valve again directs vacuum to the boots. The system, now operating in its normal condition, can be reactivated if necessary, through the momentary switch on the control panel. The vacuum gauge may fluctuate momentarily upon deice cycling.

2. Troubleshooting

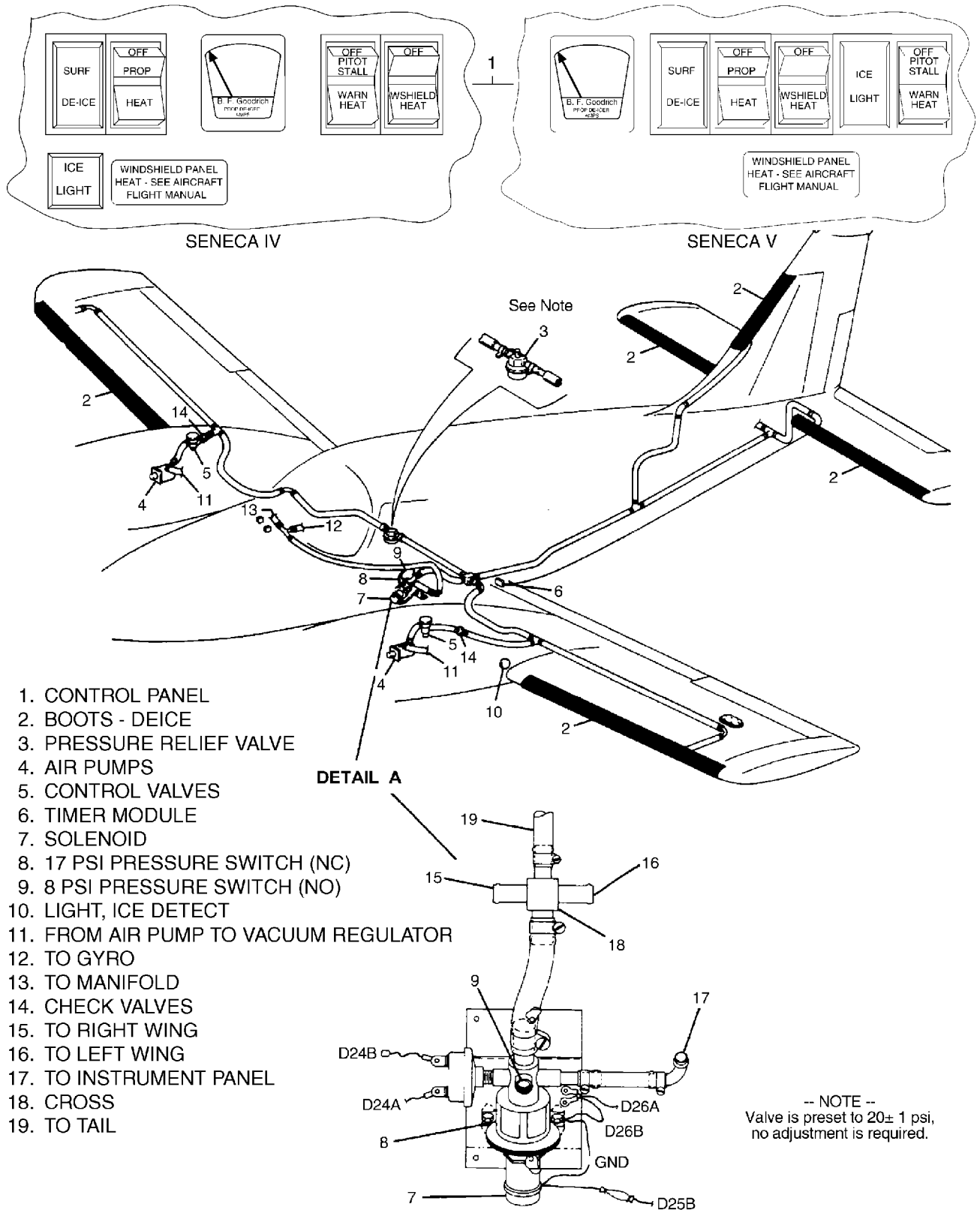
The troubleshooting chart contained herein is based on the premise, except as specified, that the engine driven pneumatic pumps and the electrical system are operating properly. It is further assumed that the system components were installed properly. See Chart 1.

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**CHART 1
TROUBLESHOOTING PNEUMATIC DEICE SYSTEM**

Trouble	Cause	Remedy
Deicers do not inflate. Both engines operating at minimum cruise rpm or either engine at 2575 rpm.	Open circuit breaker.	Push circuit breaker to set.
	System connection loose or wire broken.	Tighten or repair as required.
	Timer not functioning.	Test or replace as required.
	Control valves not functioning.	Make electrical test. Check for sticking poppet. Clean. Insure that both vent ports on solenoid are open.
	Lines blocked or not connected.	Blow out lines and inspect inspect connections. Make air leakage test.
Deicers INFLATE slowly (inflation time - 6 seconds).	Lines partially blocked or not connected securely.	Blow out lines and inspect connections. Perform air leakagetest.
	Deflate valve not functioning properly.	Insure that both vent ports on solenoid are open.
	System pressure not being reached.	Check performance to manufacturers specifications.
	Deicer puncture.	Repair per specification or replace.
Deicers DEFLATE slowly.	Lines partially blocked.	Inspect and blow out lines.
	Deflate valve not functioning properly.	Insure that both vent ports on solenoid are open.
Deicers inflate, indicator light does not function. (Ascertain that deicer boot switch is ON.	Indicator lamp burned out	Replace lamp.
	System pressure not being reached.	Check "Deicers Inflate Slowly" above.
	Pressure switch not functioning.	Make electrical test and replace if required.
	Wires loose or broken. Poor grounding of pressure switch.	Make electrical test. Repair or eplace broken wires. Check for proper ground.
Deicer boots do not hold their form in flight or vacuum to the system inadequate.	Deflate valve not functioning properly by not moving to full position.	Remove and troubleshoot valve. Replace if necessary.
	Vacuum line restricted.	Disconnect line from instruments and deflate valve, and blowout line.
	Broken line.	Inspect system and repair.

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Pneumatic Deice System Installation
Figure 1

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3. Inspection

A ground check of the entire deicer system should be made at least every 100 hours time-in-service.

Before checking the system, all deicers should be inspected for damaged areas and repaired according to the procedure in this section outlining cold patch or vulcanized repairs. In order to check the system, See Chart 2 and the paragraph "Final Test and Adjustment of Pneumatic System" for operating pressure and check procedures.

A. Ground Procedure

After the test pressure range is established, connect an external source of air providing this pressure and a pressure gauge to the pneumatic deice line at the manifold assembly. Disconnect the deice line from the manifold to accomplish the test. The deicer system should be within one psig of the recommended operating pressure with each inflation cycle.

If deicers do not reach the operating pressure, check the inflation time to ascertain that the solenoid valves are open the specified length of time (six seconds). If this is not the cause of trouble or if the boots deflate slowly, the lines or valves may be plugged; then the lines should be disconnected and blown clear.

Check the timing of the system through several complete cycles. Boots ON six seconds, then OFF. The wing and empennage boots operate simultaneously. If cycle time is off the specified time, determine and correct the difficulty.

Inflation must be rapid to provide efficient deicing. Deflation should be complete before the next inflation cycle of the boots.

B. 100 Hour Inspection

At each 100 hour inspection of the airplane, inspect and operate the deicer boots. Make checks as follows:

CAUTION: IN COLD WEATHER, EXTREME CARE MUST BE TAKEN TO SEE THAT ENGINE OIL DOES NOT COLLECT IN CRITICAL PARTS OF THE SYSTEM AND CONGEAL. CONGEALED OIL WILL CAUSE STICKING OF THE CONTROL VALVES AND DEFLATE VALVE. IF STICKING OF THESE PARTS IS ENCOUNTERED, REMOVE FROM AIRPLANE, CLEAN OUT AND REPLACE.

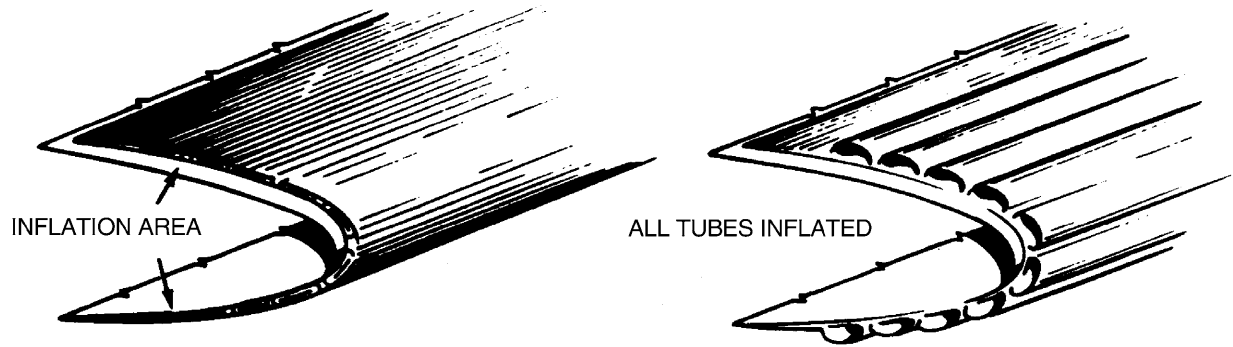
CAUTION: OIL WHICH REACHES THE DEICERS WILL CAUSE RAPID DETERIORATION OF THE RUBBER.

- (1) Carefully inspect the deicers for evidence of damage or deterioration, and repair or replace damaged boots.
- (2) Resurface boots which show signs of considerable wear or deterioration.

**CHART 2
OPERATING PRESSURES**

Recommended Operating Pressure PSIG	Test Pressure in PSIG	
	MIN.	MAX.
15	13	17
18	16	20

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Pneumatic Deicer Boots Operation
Figure 2

- (3) Inspect all hose connections which form a part of the pneumatic deicing system. Replace deteriorated sections on non-kink hose.
 - (4) Check the operation of the boots and the operating pressure of the system as outlined in this section.
 - (5) If new or replacement boots have been installed, check the tube inflation to make sure that the air connection stems have been properly connected.
 - (6) Disconnect all drain lines in the system and check for proper drainage.
 - (7) Check the on-off control switch for freedom of action. Check associated electric wiring.
 - (8) Clean or replace the air filters.
- C. Operation Check (See Figures 1 and 2.)

The pneumatic deicing system should be checked at least every 100 hours. This check can be done on the ground. A visual inspection should be performed to determine the condition of the deicer boots, and any areas in need of repair should be taken care of before continuing with the operation check of the system.

CAUTION: DO NOT MANUALLY HOLD SURFACE DEICE SWITCH IN ON POSITION. THE SWITCH IS SPRING LOADED AND HOLDING SWITCH IN ON POSITION COULD INDUCE SYSTEM FAILURE.

With one engine operating, activate the deicing system switch (place switch in ON position and release). Observe the operation of the deicers carefully for evidence of malfunctioning. Look for tubes which leak or fail to inflate and deflate properly. Repeat the procedure for the other engine.

4. Electrical Tests

A. Procedures

- (1) With engines OFF turn ON-Master Switch.
CAUTION: DO NOT HOLD SURFACE DEICE SWITCH IN ON POSITION.
- (2) **TIMER:** Activate the Deice System Switch. The switch is momentary push type.
 - (a) Check Timer operates immediately. (See Figure 1.)
 - (b) If Timer does not indicate operation, check aircraft power from Circuit Breaker thru switch, to Timer- BLUE and GREEN leads. Also, check BLACK lead for proper ground.
 - (c) If no electrical faults are present - replace Timer.

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- (3) LEFT AND RIGHT CONTROL VALVE SOLENOIDS: Activate the De-Ice System Switch and run engines.
 - (a) Check both Control Valve Solenoids actuate. (An audible "CLICK" can be heard or the action can be felt by holding a hand against the unit.)
 - (b) Check system pressure begins to build in the boot system.
 - (c) If pressure does not build (check LIGHT on control panel after 6 seconds) Control Valves are suspect.
 - (d) Disconnect electrical leads from Control Valve Solenoids and measure power is available when system is activated. Also confirm ground is good on BOTH SOLENOIDS.
 - (e) If problem is not electrical - perform "TEST FOR PRESSURE LEAKS."
- (4) DEFLATE VALVE ASSEMBLY: Activate De-Ice System Switch.
 - (a) Check LIGHT glows on control panel after system pressure builds to 8 psi. Continue to monitor system as pressure continues to build to 17 psi system pressure, or 6 seconds, whichever occurs first.
 - (b) Control Valves should actuate and dump pressure overboard.
 - (c) As pressure decreases below 8 psi, LIGHT should extinguish as cycle is completed.
 - (d) Check power applied to Deflate Valve and confirm grounds are both good. If no electrical faults exist, replace Deflate Valve Assembly.
- (5) If Step (3) shows Control Valves to be operating correctly, but Step (4) shows system cycle to be faulty, and system "Test For Pressure Leaks" shows no leaks; check DEFLATE VALVE ASSEMBLY.
- (6) DEFLATE VALVE ASSEMBLY:
Check power applied to Deflate Valve and confirm grounds are both good. If no electrical faults exist, replace Deflate Valve Assembly.

5. Pressure Leak Test

- A. This test can be performed in either the left or right nacelles.
- B. Cap the overboard ports of the control valve.
- C. Connect a source of clean air to the inlet port of the control valve. It is necessary that the inlet pressure be a minimum of 18-20 psig pressure to the system. By means of a hand operated valve, trap the pressure in the deicer system. Observe the system for leakage. The leakage rate should not exceed a pressure drop of 3.0 psig per minute.

CAUTION: INSTALL ALL VACUUM LINES DRY.

NOTE: Seal all pneumatic pipe threads with Loctite No. 567 PST sealant or Titeseal No. 3. Lubricate all pneumatic male hose connections and threaded fasteners with LPS heavy duty silicone lubricant. Allow LPS lubricant to dry before assembly.

- D. Remove test equipment, lubricate all threads, and replace all system components.

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6. Component Maintenance and Replacement

A. Filters

Air supply for the system is supplied through the vacuum system. See 37-10-00 for additional information.

B. Control Valves

After each 100 hours of engine operation, the valve poppet and internal lining of the control valve can become coated with a film of dried oil causing the valve to stick. Perform electrical test to determine if valve poppet is sticking. If solenoid checks satisfactory, remove valve poppet and clean control valve bore and poppet.

To clean:

- (a) Remove nacelle hatch cover to gain access to the valve.

CAUTION: DO NOT LOSE STEEL HEX ACTUATOR PIN.

- (b) Remove electrical connector. Unscrew solenoid.
- (c) Remove valve poppet. It may be necessary to apply slim nose pliers to pin projection to pull poppet from valve.
- (d) Thoroughly clean valve bore and poppet with commercial hydrocarbon type solvent.
- (e) Assemble valve and solenoid.

C. Timer

No field maintenance is recommended. For repair or replacement, contact your B. F. Goodrich dealer or distributor.

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7. Pneumatic Boots

WARNING: CEMENTS AND SOLVENTS USED TO REMOVE AND INSTALL DEICERS ARE EXTREMELY FLAMMABLE AND TOXIC. EXTINGUISH OPEN FLAMES. AVOID SPARKS. USE IN WELL-VENTILATED AREA. AVOID SKIN CONTACT AND/OR PROLONGED BREATHING OF VAPORS. CONSULT MSDS FOR ADDITIONAL SAFETY INFO.

CAUTION: DISPOSE OF UNUSED MEK AND OTHER CHEMICALS AND SOLVENTS IN A MANNER CONSISTENT WITH LOCAL LAWS AND/OR ENVIRONMENTAL PROTECTION AGENCY REGULATIONS.

NOTE: Goodrich Black Standard Pneumatic De-Icer Installation, Maintenance & Repair Manual, ATA Report No. 30-10-31, provides approved, alternate procedures for removing and installing deice boots. Reference to it is highly recommended. It can be obtained online at <http://www.goodrich.com/TechPubs>.

A. Removal of Boots

The removal of deicer boots should be done in a well ventilated area to avoid difficulty from fumes of the solvents. Materials required to remove the boots are a pressure handle squirt can, methyl ethyl ketone (MEK) and B. F Goodrich KE9002 paint remover (or equivalent).

NOTE: Disconnect line fittings from boot fittings.

- (1) Fill the squirt can with MEK. Start at one corner of the upper trailing edge of the deicer, apply a minimum amount of MEK to the seam line while tension is applied to peel back the corner of the deicer.
- (2) Using MEK, separate the deicer boot from the surface for a distance of 4 inches all the way along the upper trailing edge.
 - (a) If the deicer is to be preserved, continue to use MEK to soften the adhesion line and pull down and toward the lower trailing edge with uniform tension.
 - (b) If the deicer is to be scrapped, it is easier to remove it by stripping it in sections parallel to the tubes. It is recommended that the stretchable surface material in the tube area be removed first by slitting around the edges and down the thread lines. Remove remainder of the deicer by stripping in sections.
- (3) Remove any remaining installation cement from the wing and deicer using B. F. Goodrich KE9002 paint remover or equivalent.
- (4) Clean area thoroughly with Methyl ethyl ketone (MEK).

B. Repair of Pneumatic Boots

Deicer repairs are classified as cold repairs (temporary), which are made with the boot installed on the airplane, and vulcanized repairs, which are made on the demounted boot in the shop. (See the appropriate paragraph for vulcanized repairs.)

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C. Cold Repair

The materials and supplies for making cold repairs are listed in Chart 3.

(1) Scuff Damage

This type of damage will be most commonly encountered and, fortunately, it is not necessary in most cases to make a repair. On those rare occasions when the scuff is severe and has caused the removal of the entire thickness of surface ply in spots (the brown natural rubber underneath is exposed), repair the damage using Part No. 74-451-16 and proceed as follows:

- (a) Clean the area around the damage with a cloth dampened slightly with solvent. Buff the area around the damage with steel wool so that it is moderately but completely roughened. Wipe the buffed area with a clean cloth slightly dampened with solvent to remove all loose particles.
- (b) Select a patch of ample size to cover the damaged area. Apply one even thorough coat of cement, Part No. 74-451-20, to the patch and the corresponding damaged area. Allow cement to set a couple of minutes until tacky.
- (c) Apply the patch to the deicer with an edge, or the center adhering first. Work down the remainder of the patch carefully to avoid trapping air pockets. Thoroughly roll the patch with stitcher-roller, Part No. 74-451-73, and allow to set for 10 to 15 minutes.
- (d) Wipe the patch and surrounding area from the center outward with a cloth slightly dampened with solvent. Apply one light coat of A-56-B conductive cement, Part No. 74-451-11, to the patched area.
- (e) Satisfactory adhesion of patch to deicer will be reached in four hours. Deicer may be inflated for checking repair in a minimum of 20 minutes. (Shop check only, do not place in service.)

(2) Tube Area Damage.

CAUTION: THESE PATCHES ARE MANUFACTURED SO THAT THEY WILL STRETCH IN ONE DIRECTION ONLY. BE SURE TO CUT AND APPLY THE PATCH SELECTED SO THAT STRETCH IS IN THE WIDTHWISE DIRECTION OF THE INFLATABLE TUBES.

CAUTION: DO NOT TRAP AIR BETWEEN PATCH AND DEICER SURFACE

CAUTION: ALLOW A MINIMUM OF FOUR HOURS BEFORE INFLATING A REPAIRED DEICER

Repair cuts, tears, or ruptures to the tube area shall be repaired with fabric reinforced patches, Part No. 74-451-16) depending on size of damage.

- (a) Select a patch of ample size to cover the damage and to extend to at least 5/8 inch beyond the ends and edges of the cut or tear. If none of the patches is of proper size, cut one to the size desired from one of the larger patches. If this is done, bevel the edges by cutting with the shears at an angle.
- (b) Buff the area around the damage with buffing stick, Part No. 74-451-75. so that the surface is thoroughly roughened.
- (c) Apply the patch to the deicer with the stretch in the widthwise direction of the inflatable tubes. Stick edge of patch in place. Work remainder down with slight pulling action so the injury is closed.

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**CHART 3 (Sheet 1 of 2)
MATERIAL AND SUPPLIES FOR COLD REPAIR**

Part No.	Quantity	Description
74451-C (FSN1650-856-7939)	1	Cold Patch Repair Kit (B. F. Goodrich Co.)
74-451-11	1/1 pt. can	A-56-B Conductive Cement
74-451-16	30 pcs.	Small Oval Patch 1-1/4 x 2-1/2 in.
74451-17	30 pcs.	Medium Oval Patch 2-1/2 x 5 in.
74451-18	10 pcs.	Large Oval Patch 5 x 10 in.
74-451-19	3 pcs.	Patch 5 x 19 in.
74-451-20	(2) 1/2 pt.	* No. 4 Cement (patching only)
74-451-70	2	Cement Brush 1/2 in.
74-451-73	1	1/8 in. Steel Stitcher
74-451-75	6	Emery Buffing Sticks
74-451-87	1	Buffing Shield
* This cement will give best results with the patches in this kit.		
The following items may be procured from the B. F. Goodrich Co., Akron, Ohio, or other manufacturer, as required:		
74-451-21	6 ft. roll x 6 in. wide	Type 21 or 22 Fillet
74-451-22	15 ft. roll x 2 in. wide	Neoprene Coated Spicing Tape
74-451-23	4 ft. roll x 8 in. wide	Neoprene Surface Ply
74-451-24 (FSN80628-4199 and/ or FSN8040-514-1880)	1 quart	§ EC-1403 Cement and/or EC-1300 L
74-451-74	1	2-1/2 in. Sponge Rubber Roller
§ Minnesota Mining and Manufacturing Company, Adhesives Division 3M Center; St. Paul, MN 55144 (612-733-1110)		

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**CHART 3 (Sheet 2 of 2)
MATERIAL AND SUPPLIES FOR COLD REPAIR**

Part No.	Quantity	Description
The following materials may be obtained from local supply:		
	As required	Toluol
		Clean, Lint-Free Cloths (preferably cheese cloth)
	Rolls	1 in. Masking Tape
	1	Sharp Knife
	6 ft. long	Steel Measuring Tape
	1	Fine Sharpening Stone
	As required	Steel Wool Pads
	As required	Hypodermic needles (22 gauge or smaller)
Methylethylketone (MEK) can be used instead of Toluol, however MEK causes very rapid drying and provides only 10 seconds working time compared with 40 seconds for Toluol.		

(3) Loose Surface Ply in Dead Area (non-inflatable area).

Peel and trim the loose surface ply to the point where the adhesion of surface ply to the deicer is good.

- (a) Scrub (roughen) area in which surface ply is removed with steel wool. Scrubbing motion must be parallel to cut edge of surface ply to prevent loosening it. Scrub with steel wool and Toluol directly over all edges, but parallel to edges of surface ply to taper them down to the tan rubber ply.
- (b) Cut a piece of surface ply material. Part No. 74-451-23, to cover the damaged area and extend at least one inch beyond in all directions.
- (c) Mask off the damaged boot area 1/2 inch larger in length and width than the size of surface ply patch. Apply one coat of cement, Part No. 74-451-11, to damaged area and one coat to patch. Allow cement to set until tacky. Roll the surface ply to the deicer with 2 inch rubber roller, Part No. 74-451-74. Roll edges with stitcher-roller, Part No. 74-451-73. Apply just enough tension on the surface ply when rolling to prevent wrinkling and be careful to prevent trapping air. If air blisters appear after surface ply is applied, remove them with a hypodermic needle.
- (d) Clean excess cement from deicer with solvent.

(4) Loose Surface Ply in Tube Area.

Loose surface ply in tube area is usually an indication of the deicer starting to flex fail. This type of failure is more easily detected in the form of a blister under the surface ply when deicer is pressurized. If this type of damage (or void) is detected while still a small blister (about 1/4 or 3/8 inch diameter) and patched immediately, the service life of the deicer will be appreciably extended. Apply repair patch as outlined in Paragraph 1.

- (5) Damage to Fabric Back Ply of Deicer During Removal of cement has pulled loose from the wing skin and adhered to the back surface of the deicer, remove it with steel wool and MEK. In those spots where the coating has pulled off the fabric, leaving bare fabric exposed, apply at least two additional coats of cement, Part No. 74-451-24. Allow each coat to dry thoroughly.

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D. Vulcanized Repairs

Due to the variety of boot damage possible, it is recommended that the B. F. Goodrich Company be contacted so they can determine the extent of damage and whether it is repairable by the vulcanized method or not. The overall condition of the deicer boot must be given careful consideration before deciding on any repairs. Damages can vary from minor punctures which may be easily repaired, to extensive ripping of the tube or stretch areas which may make repairs exceedingly difficult or actually impossible. The determination of just where this division between repairable and unrepairable damage exists will depend upon the careful judgment of the inspector. For this reason, we recommend contacting the B. F. Goodrich Company at Akron, Ohio.

E. Installing Pneumatic Boots

NOTE: The following procedures assume the aircraft is set up with the provisions for the necessary connections and hardware.

NOTE: Balance stabilator per instructions in Chapter 55 of this manual.

F. Preparation of Leading Edges

- (1) Remove all paint including zinc-chromate primer.

NOTE: It is permissible to install deicers on alodined or anodized surfaces. Satisfactory adhesion is also possible on epoxy surfaces if they are sanded lightly to remove the gloss.

- (2) With one inch (1) masking tape, mask off leading edge boot area, allowing 1/2 inch (1.27 cm) margin for non-recessed boots. Mask the area accurately.
- (3) Clean the metal surfaces thoroughly, at least twice, with MEK or Acetone.
- (4) For final cleaning, wipe the solvent film off quickly with a clean, dry cloth before it has time to dry.

G. Preparation of Deicer Boot

CAUTION: DO NOT SATURATE THE BACK SURFACE TOO HEAVILY WITH SOLVENT OR SCRUB IT REPEATEDLY. ALLOW THE DEICER TO DRY THOROUGHLY BEFORE CEMENTING.

- (1) Moisten a clean cloth with MEK or acetone and carefully clean the rough, back surface of the boot at least twice.
- (2) Change cloths frequently to avoid recontamination of the cleaned areas.
- (3) Fill gaps of skin splices that lead under deicers with sealing compound EC-801.
- (4) Remove the sump plugs from the air connection grommets. In some cases, it will be necessary to remove sections of doped fabric used to cover the air connection holes. Draw out the ends of the non-kink hose section so that they protrude through the connection holes in the leading edge. If hose is cracked or deteriorated, replace with new hose.

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H. Mounting Boot on Leading Edge

WARNING: THE CEMENTS AND SOLVENTS USED FOR INSTALLATION ARE FLAMMABLE AND THEIR FUMES SLIGHTLY TOXIC. THEREFORE, ALL WORK SHOULD BE DONE IN A WELL VENTILATED AREA AWAY FROM ANY SPARKS OR FLAMES. (THE USE OF SOLVENT RESISTANT TYPE GLOVES IS RECOMMENDED.)

NOTE: Ambient temperature for installation should be held between 40° (4.5° C) and 110°F (43°C). However, longer drying time of the cement coats may be required as the humidity approaches 99%.

NOTE: Deicer and leading edge may be cemented for a maximum of 48 hours before actual installation, if cemented parts are covered and kept clean.

- (1) Thoroughly mix EC-1403 cement before using.
- (2) Apply one even brush coat to the cleaned back surface of the boot and to the cleaned metal surface.
- (3) Allow the cement to air dry for a minimum of one hour.
- (4) Apply a second coat to both surfaces and allow to air dry a minimum of one hour.
- (5) Snap a chalk line along the leading edge of the airfoil section.
- (6) Intensify chalk line on leading edge and the white reference line on the boot with a ball point pen.

CAUTION: TIGHTEN EACH CLAMP WITH A PAIR OF SLIP JOINT PLIERS. DO NOT SQUEEZE THE CLAMP SO TIGHT THAT THE HOSE IS DAMAGED.

NOTE: Most boots are made with an excess of material at the inboard and outboard edges for final trimming after installation.

- (7) Holding the backside of the boot close to the leading edge, fasten the end of each non-kink hose to the corresponding air connection stem. Tinnerman or other suitable non-kink hose clamps should be used for this purpose.
- (8) Obtain sufficient personnel to hold boot steady during installation. (Limit handling cemented side of boot with fingers.)
- (9) Position the deicer center line to coincide with leading edge center line. Hold boot in this position while reactivating about three inches around connections and around corresponding holes in leading edge, using a clean, lint-free cloth moistened with Toluol.
- (10) Insert connections in leading edge holes when cement has dried to a tacky state and rubber roll boot to leading edge in tackified area.

CAUTION: AVOID EXCESSIVE SOAKING OR RUBBING OF THE CEMENT WHICH COULD REMOVE THE CEMENT FROM THE SURFACE.

NOTE: When installing a longer boot (approximately 6 ft. [1.83m] or longer) the cement may not remain tacky to roll down the entire length of a 6 inch (15.24 cm) width. Therefore, roll the boot down part way, leaving an open angle to permit easy access for reactivating the cement.

- (11) Continue installation by reactivating the cement along the center line leading edge surface and boot in span wise strips approximately six inches wide.

CAUTION: AVOID TWISTING OR SHARP BENDING OF THE DEICER.

- (12) Rubber roll the deicer firmly against the wing leading edge, being careful not to trap any air under the deicer. Always roll parallel to the inflatable tubes.

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(13) If the deicer should attach incorrectly, use MEK to remove and reposition properly.

NOTE: All rolling should be done parallel to the inflatable tubes. Roll trailing edges with a narrow stitcher-roller.

(14) Rubber roll, apply pressure over entire surface of the deicer.

(15) Remove all masking tapes. Clean the surfaces carefully with MEK, so that no solvent will run under deicer edges.

(16) Apply masking tape to deicer edges where exposed trimmed ends or gaps between sections are to be filled with 3M EC-801-A-2 sealing compound.

NOTE: The tapes applied in steps (17) and (18) should both form a neat, straight line.

(17) Apply masking tape to the deicer approximately 1/4 inch in from trailing edges.

(18) Apply masking tape to the wing skin approximately 1/4 inch from trailing edges of the deicer.

(19) If it becomes necessary to remove or loosen installed boots, use toluol to soften the adhesion line by applying a minimum of this solvent to the seam line while tension is applied to peel back the boot. This removal should be slow enough to allow the solvent to undercut the cement, thus preventing injury to the part.

(20) A minimum of 12 hours drying time is required after installation of the boot before inflation. The airplane may not be flown before checking out the deice system.

I. Adhesion Test

Using excess boot material trimmed from the ends of any wing and empennage deicers, prepare one test specimen for each deicer installed. This specimen should be a 1 x 8 inch full thickness strip of boot material cemented to the wing skin adjacent to installed boot following the identical procedure used for installation. Leave one inch of the strip uncemented to attach a clamp. Four hours or more after the installation, attach a spring scale to the uncemented end of each strip and measure the force required to remove strip at the rate of one inch per minute. The pull should be applied 180° to the surface. (Strip doubled back on itself.)

A minimum of five pounds tension (pull) shall be required to remove the test strip. If less than five pounds is required, then acceptability of the boot adhesion shall be based on the following tests:

- (1) Carefully lift one corner of boot in question sufficiently to attach a spring clamp.
- (2) Attach a spring scale to this clamp and pull with force 180° to the surface and in such a direction that the boot tends to be removed on the diagonal.
- (3) If a force of five pounds per inch of width can be exerted under these conditions, the installation shall be considered satisfactory. Remember, the width increases as the corner peels back.
- (4) Re-cement corner following previous procedure.
- (5) Failure to meet this requirement shall result in reinstallation of the boot.

NOTE: Possible reasons for failure are: dirty surfaces, cement not reactivated properly, cement not mixed thoroughly. Corrosion of the metal skin may occur if good adhesion is not attained, especially around rivet heads and metal skin splices.

If these adhesion requirements are met, the airplane may be flown immediately. Do not inflate deicers within 12 hours of installation or until adhesion strength of 8 to 10 pounds is obtained.

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J. Cleaning Deicer Boots

CAUTION: AVOID THE USE OF PETROLEUM PRODUCTS AS CLEANING AGENTS.

NOTE: The temperature of the soap solution and rinse water should by exceed 140°F (60°C).

NOTE: If cleaning compound MIL-C-25769 is used to clean the airplane, thoroughly rinse off the deicers with clean water.

- (1) Wash deicers with a mild soap and water solution.
- (2) Rinse with clean water.
- (3) 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.
- (4) If difficulty is encountered with the water freezing on the boots, direct a blast of warm air along the region being cleaned, using a portable type ground heater.
- (5) Limited use of mineral spirits or non-leaded gasoline is not harmful in cleaning the deicers if the cloth is dampened (not dripping) with solvent and a clean, dry cloth is used to wipe the deicer before the solvent has time to soak into the rubber.

K. Icx Application

WARNING: USE ONLY WITH ADEQUATE VENTILATION. AVOID PROLONGED OR REPEATED BREATHING OF VAPOR. AVOID PROLONGED OR REPEATED CONTACT WITH SKIN. KEEP COMPOUND AWAY FROM OPEN FLAMES AND ELECTRIC HEATERS; DECOMPOSITION PRODUCTS MAY BE HARMFUL.

- (1) Before applying Icx, thoroughly clean deicer surfaces with a rag dampened with non-leaded gasoline. Follow by a scrub wash of mild soap and water. Allow time for surfaces to dry.
- (2) Apply Icx sparingly to the dry deicer in a strippling fashion with a felt pad or small, soft cloth. Avoid a heavy, sticky application of "fly paper" consistency.
- (3) Follow the application by rubbing the entire surface with a soft, dry cloth until a smooth gloss is achieved.
- (4) Reapply Icx every 150 hours.
- (5) Icx is not a cure-all for icing problems. Icx will not prevent or remove ice formations. Its only function is to keep ice from initially getting a strong foothold, thus making removal easier.
- (6) One quart can of Icx will cover approximately 500 square feet.

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L. Resurfacing Conductive Cement

WARNING: CEMENTS AND SOLVENTS USED FOR RESURFACING ARE FLAMMABLE AND THEIR FUMES SLIGHTLY TOXIC. THEREFORE, ALL WORK SHOULD BE DONE IN A WELL VENTILATED AREA AWAY FROM ANY SPARKS OR FLAMES.

(1) The following materials are required to remove and replace the old, damaged coating:

- (a) Fine grit sandpaper.
- (b) Two inch paint brush.
- (c) One inch masking tape.
- (d) Conductive neoprene cement, No. A-56-B, B.F. Goodrich Company.
- (e) Isopropyl Acetate, Federal Specification TT-1-721, as cleaning or thinning solvent.
- (f) Alternate solvent (Toluol or Toluene may be used as an alternate for Isopropyl Acetate).

During cold weather, place the airplane in a warm hangar and locate so that the boots are in line with one or more blast heaters. Do resurfacing before any other work on the airplane to allow as much time as possible for the new coat to cure.

NOTE: If, for some reason the resurfacing cannot be done indoors, it may be deferred at the discretion of the inspector until a warm, clear day permits the work to be satisfactorily accomplished outdoors. However, if the deicers are in such condition that immediate resurfacing is required, remove them from the airplane and resurface in a shop.

(2) Clean deicer thoroughly with Isopropyl Acetate.

- (a) Roughen entire surface of boot, using a fine grit sandpaper.
- (b) Clean surface again with clean, lint-free cloth moistened with cleaning solvent.
- (c) Apply masking tape beyond upper and lower trailing edges, leaving a 1/4 inch gap of bare metal.
- (d) Mask off any legible deicer brands.
- (e) Apply one brush coat of A-56-B cement to deicer and allow to dry at least one hour. Then apply second coat and allow to dry at least four hours before operating deicers. Plane may be flown as soon as cement is dry.

NOTE: If A-56-B cement has aged 3 months or over, it may be necessary to dilute the cement with Isopropyl Acetate to obtain proper brushing consistency. Mix thoroughly, approximately 5 parts cement to one part Isopropyl Acetate.

8. Final Test and Adjustment

- A. Remove the hatch covers on each nacelle and disconnect the line between the control valve and check valve.
- B. On each installation install a pressure gauge having a capacity of 0 to 25 psi in between the two valves. Set them up such that they can be read in the cabin.
- C. Perform the following procedure with just the left engine operating and then just the right engine operating.
 - (1) Start the specific engine. Allow the engine to warm up and bring up the power to 2400 rpm.
 - (2) Check the vacuum regulator for 5.0 + 0.2 in. of mercury (Hg). If the reading is not correct, check system for fouled filters, or old lines. Should the system check out ok, adjust the vacuum regulator on the left side of the respective firewall.

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- (3) Observing the blue indicator light on the control panel, depress the pneumatic deice actuating switch.

NOTE: Do not manually hold surface deice switch on "ON" position, as this switch is spring loaded and holding switch on "ON" will induce system failure.

When the blue light comes on cross check the pressure gauges to insure the 8 psi pressure switch is actuating properly. Full inflation pressure should read 17.0 + 1.0 psi and occur within two to three seconds (at sea level). All cells should fully inflate.

- (4) After full inflation, the boots should deflate within 15 seconds due to vacuum being reapplied to the system, and be at complete hold down. Hold down vacuum is the same as gyro vacuum.

NOTE: Several cycles may be required to complete the above. Allow thirty seconds between cycle activations to assure complete cycling.

- (5) Shut down the operating engine and perform the same test with the other engine system.

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PITOT AND STATIC

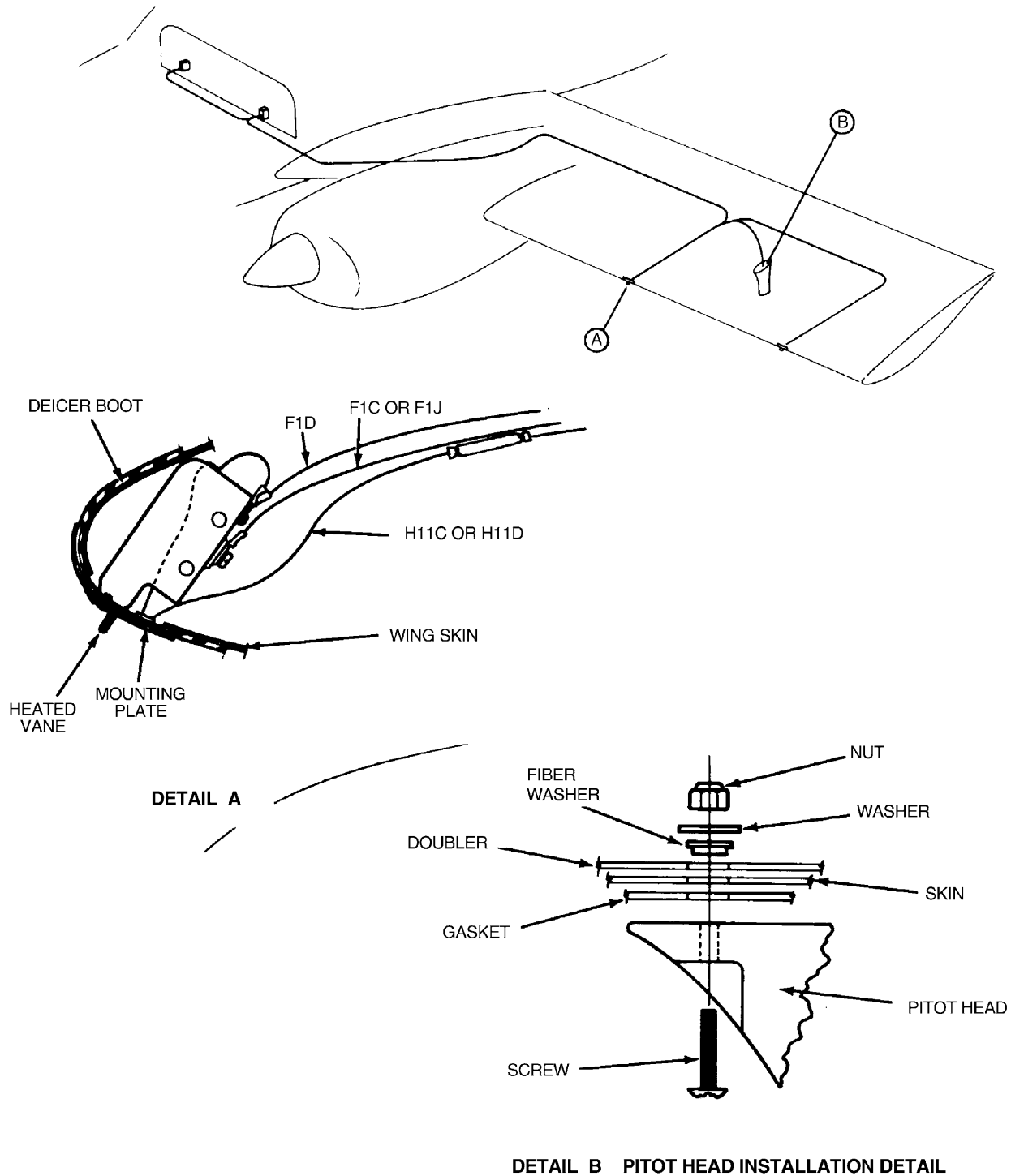
Both a heated pitot and heated stall warning system are available. It is significant to note that although they are separate systems in themselves, they are installed as an individual system controlled by a single switch located among the deice switches installed directly in the instrument panel above the throttle quadrant. However, if both systems are not installed, the pitot system can be installed by itself using the same spot for the switch as previously mentioned.

These systems are quite simple in that they contain a heated pitot head, heated lift detectors (inner and outer); and two circuit breakers (one for each part of the system). The units for these installations are installed on the left wing (see Figure 1). See 27-30-00 and 34-10-00 for removal and installation procedures. For wiring diagrams (schematics) see Chapter 91.

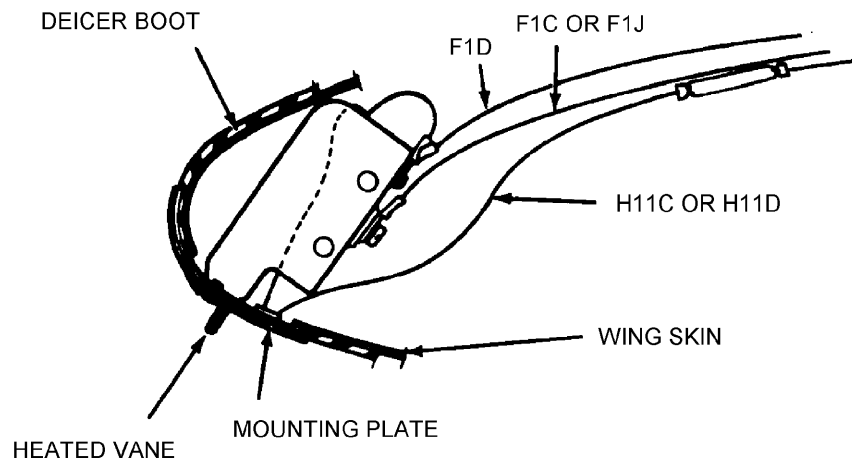
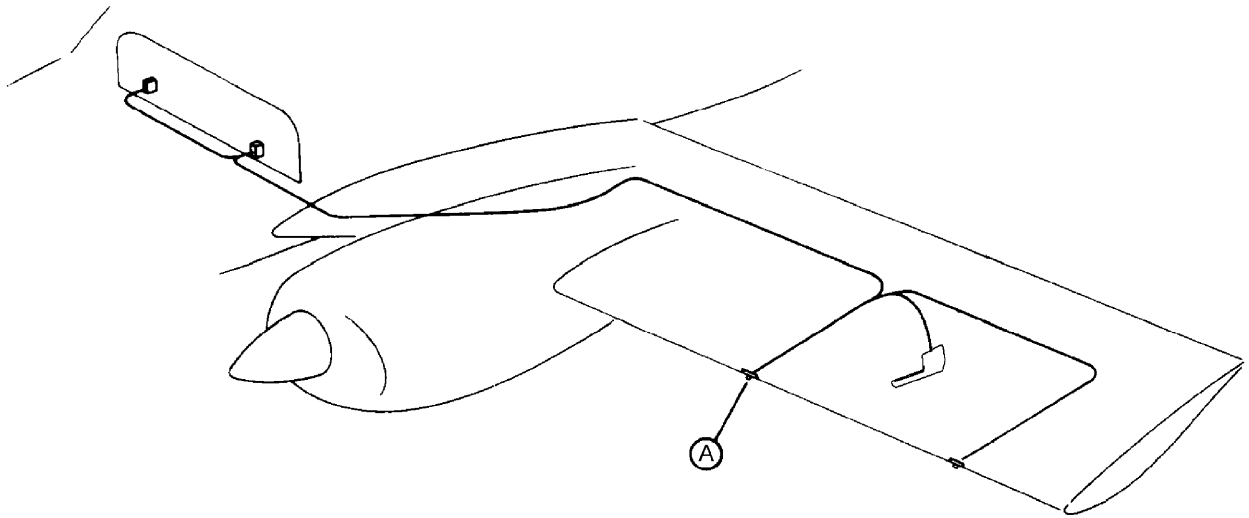
Pitot Heat Test

- A. Remove the pitot head from mast assembly and the wing. (See 34-10-00.)
- B. With one of the test leads connected to one of the terminals of the head, ground the other lead to the metal body of the head assembly. There should be no continuity.
- C. Reinstall the pitot head into the mast assembly and the wing.

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DETAIL A

Heated Pitot & Stall Warning System Installation
Figure 1 (Sheet 2 of 2)

[Effectivity](#)
[Seneca V](#)

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WINDOWS AND WINDSHIELD

1. Heated Windshield Panel

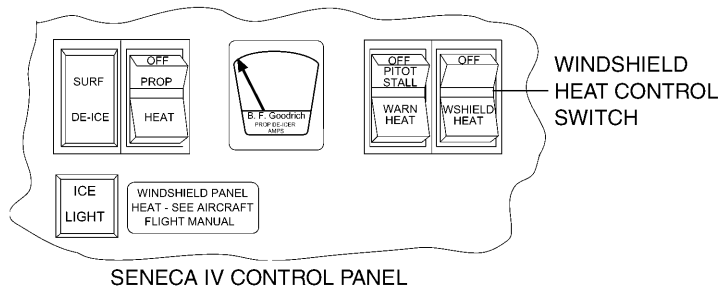
The heated windshield panel is a rectangular glass panel containing electrically heated wires imbedded in the glass which is mounted in a metal frame. The assembly is mounted on the exterior side of the pilot's windshield and is hinged at its base to facilitate windshield cleaning. The heated panel is operated by a single pole, single throw rocker type switch located among the deice switches installed directly in the instrument panel above the throttle quadrant. It is protected by the WSHLD HEAT circuit breaker installed in the circuit breaker panel.

2. Heated Panel

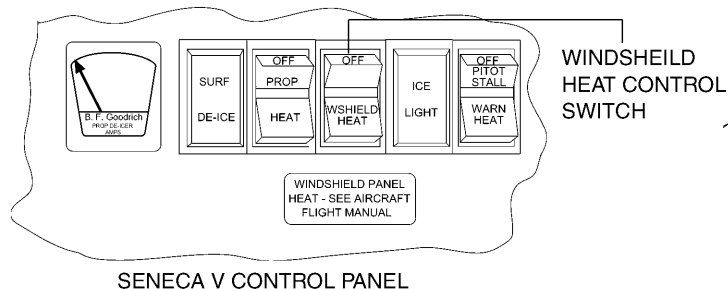
Removal and Installation

- (1) Disconnect the electrical connector located next to the heated panel on the exterior side of the windshield, by removing the two screws and pulling the plug out of the receptacle.
- (2) Remove the two screws that attach the panel assembly to the windshield collar. Remove the panel from the airplane.
- (3) If the airplane is to be flown with the heated panel removed, rotate the receptacle plate 180° and replace it to cover the holes in the fuselage skin. Also replace the windshield collar screws.
- (4) Installation of the heated windshield panel is accomplished in the reverse order of removal.

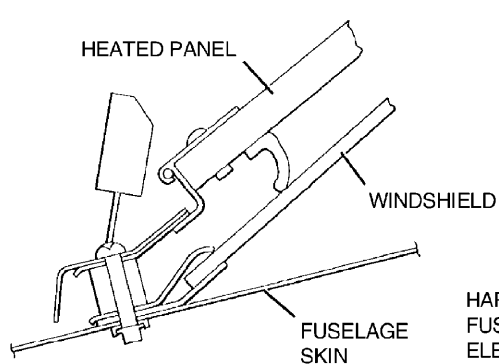
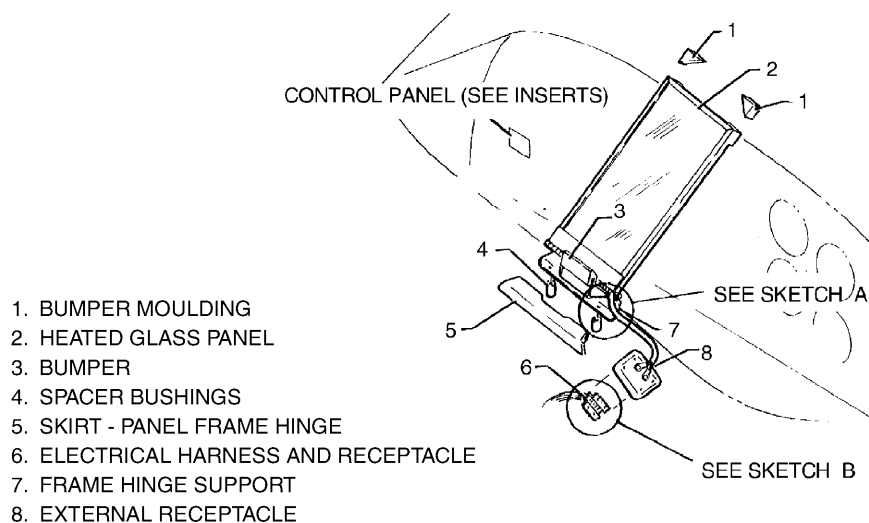
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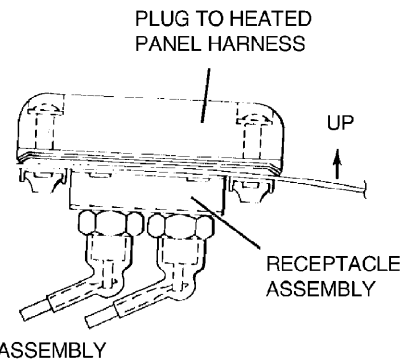
SENECA IV CONTROL PANEL



SENECA V CONTROL PANEL



SKETCH A



SKETCH B

Windshield Heat
Figure 1

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PROPELLERS

The deice system for the propeller uses electrically heated rubber boots, glued to the inner portion of each blade. The boots which contain special heater wires, are designed to be protected on the air side by pieces of rubber impregnated fabric resistant to abrasion and oil. When installing the boots, ensure the side with the dull finish is glued to the propeller, with the glossy finish towards the air.

1. Description and Operation

The propeller deice system, which can be installed by itself, or included in a package with others of the ice protection system, is designed for both the two and three blade propeller installations. Each propeller deice system consists of:

- A. an electrically heated boot bonded to each blade;
- B. a slip ring assembly: connected to the hub of each propeller (Seneca IV); or, connected to the engine crankshaft flange (Seneca V);
- C. modular brush assemblies;
- D. a timer;
- E. an ammeter;
- F. a shunt installation located on the left side of the fuselage on a longeron behind the side panel on the left side of the cockpit;
- G. a control switch located on the control panel; and,
- H. a circuit breaker.

On [Seneca IV](#) models, two bladed propellers have two heating elements incorporated in each boot, while three bladed propellers use boots incorporating a single heating element. On [Seneca V](#) models, two bladed propellers and three bladed propellers both use boots incorporating a single heating element.

The dual element deicers ([Seneca IV only](#)) have a separate lead for the inboard and outboard heater and a third lead which is a common ground. These leads are so marked. An unmarked ground can be identified by using an ohmmeter across the three possible pairs of leads. One pair will show twice the resistance of the other pairs. The latter are the "hot" leads and the lead excluded from the pair that shows twice the resistance of the other pairs is the ground lead.

Current is drawn from the airplane electrical system through the switch, ammeter and timer. The timer delivers current via the slip ring and modular brush arrangement to (phase 1) the outer heaters on the right propeller, (phase 2) the inner heaters on the same propeller, (phase 3) the outer heaters of the left propeller, and (phase 4) the inner heaters on the left propeller. The timer energizes each of these four phases in turn for about 34 seconds and then repeats the cycle as long as the control switch is on. The cycling sequence given is vital so that outboard heaters on each propeller operate before the inboard heaters. See cycle sequence (Figure 4). The system may be used continuously in flight if needed. To conserve electrical power, current is cycled to the deicer heaters at timed intervals rather than continuously.

The single element deicers have only two leads; one input and one ground.

When the switch is turned on power is directed through the brush block and slip ring to all the heating elements on one propeller for approximately 34 seconds. The timer then directs the power to the other propeller for approximately 34 seconds. This cycle continues until the switch is turned off.

NOTE: Heating may begin at any phase in the cycle depending on the timer position when the switch was turned off from previous use.

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**CHART 1 (Sheet 1 of 4)
TROUBLESHOOTING PROPELLER DEICE SYSTEM**

Trouble	Cause	Remedy
Ammeter shows zero current (All 4 phases of the 2 minute cycle – 2 Bladed Propeller.) (Both phases of the 1 minute cycle – 3 Bladed Propeller.)	Tripped circuit breaker.	Locate and correct short before setting circuit breaker.
	No power from airplane.	If no voltage into switch, locate and correct open.
	Circuit breaker switch faulty.	If no voltage at switch output with voltage at switch input, replace the switch. If voltage is satisfactory at switch output, go to next step.
	Ammeter faulty. (If some or all deicers heat with ammeter at zero, replace the ammeter.)	Test for voltage up to and out of ammeter. If low or zero output and input satisfactory, replace ammeter. If no voltage to ammeter, locate and fix open between switch and ammeter.
	Open ammeter to timer.	Disconnect harness at timer and check voltage at Pin B (of harness) to ground. If none, locate and correct open.
Ammeter shows normal current part of cycle, zero current rest of cycle.	Open in wiring between timer and brush block assembly.	Use heat test to find deicers not heating & test for voltage on that contact of wire harness plug. (At brush block assembly.) If zero over 2 minutes (2 bladed propeller), or 1 minute (3 bladed propeller) locate and fix open in wiring from timer to wire harness plug.
	Open between brush block assembly and deicer lead straps.	If there is voltage to brush block wire harness plug, try voltage at junction to deicer lead and slip ring lead. If no voltage, find and correct open in wiring within brush block or no contact of brush to slip ring.
	No ground circuit, one engine.	If voltage is found at deicer leads, locate and fix open from deicer to ground.

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CHART 1 (Sheet 2 of 4)
TROUBLESHOOTING PROPELLER DEICE SYSTEM

Trouble	Cause	Remedy
Ammeter shows normal current part of cycle, low current rest of cycle.	Inner and outer deicers heating same phase (2 bladed Propeller).	Locate and repair incorrect connections.
	Open in deicer or slip ring leads.	Disconnect deicer harness to check heater resistance. If satisfactory, locate and fix open in slip ring leads.
	High resistance in circuit with low current.	If not in contact of brush to slip ring (including ground brush), trace wiring to deicer and to timer to fix partially broken wire, loose or corroded connection.
Ammeter shows low current over entire cycle.	Aircraft voltage low.	Check voltage into switch.
	Ammeter faulty.	Test for voltage up to and out of ammeter. If low or zero output and input satisfactory, replace ammeter. If no voltage to ammeter, locate and fix open between switch and ammeter.
	High resistance up to timer.	Check for partially broken wire, loose or corroded connection in wiring from aircraft supply to timer input.
Ammeter shows excess current over entire cycle.	Ammeter faulty.	Test for voltage up to and out of ammeter. If low or zero output and input satisfactory, replace ammeter. If no voltage to ammeter, locate and fix open between switch and ammeter.
	Ground between ammeter and timer.	Disconnect harness at timer and with ohmmeter check from Pin B (of harness) to ground. If ground is indicated, locate and correct.

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**CHART 1 (Sheet 3 of 4)
TROUBLESHOOTING PROPELLER DEICE SYSTEM**

Trouble	Cause	Remedy
Ammeter shows normal current part of cycle, excess current rest of cycle.	Ground between timer and brush block.	Disconnect leads at brush block and with ohmmeter check from power leads to ground. If ground indicated, locate and correct.
	Ground between brush block and deicers. (Excluding ground brush circuit.)	If no short exists at brush slip ring contact, check for ground from slip ring lead to propeller assembly while flexing slip ring and deicer leads. If a ground is indicated locate and correct.
	Short between two adjacent circuits.	Check for cuts or low resistance between circuits. If any, locate and correct.
	Timer faulty.	Test timer.
Ammeter does not "flick" approximately every 34 seconds.	Timer ground open.	Disconnect harness at timer and check with ohmmeter from Pin G (of harness) to ground. If no circuit, fix open per schematic diagram.
	Timer contacts are welded (caused by short circuit in system).	Test timer. If timer does not cycle with voltage at Pin B, replace timer but be sure short causing original failure has been located and corrected.
Ammeter flicks between 34 second phase periods.	Loose connection between aircraft power supply and timer input.	If trouble occurs over entire cycle, trace wiring from power source to timer input to locate and tighten loose connection.
	Loose or poor connection timer to deicers.	If trouble occurs in part of cycle, find which deicers are affected and check for rough or dirty slip rings causing brush to "skip." If not this, trace circuits to locate and fix loose or poor connection. (If all deicers on one propeller are affected, check the ground circuit.) Flex deicer straps for break in deicer straps.

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CHART 1 (Sheet 4 of 4)
TROUBLESHOOTING PROPELLER DEICE SYSTEM

Trouble	Cause	Remedy
Ammeter flicks between 34 second phase periods. (cont.)	Timer cycles erratically.	Test timer.
Radio noise or interference with deicers on.	Brushes "arcing."	Check brush alignment Look for rough or dirty slip rings. If this is the cause, clean, machine, or replace slip ring assembly, as required. Check slip ring alignment.
	Loose connection.	Refer to "Ammeter flicks between 34 second phase period."
	Switch faulty.	Try jumper wire across switch. If radio noise disappears, replace the switch.
	Wiring located within 8 inches of radio equipment wiring.	Relocate at least 8 inches away from input wiring to radio equipment.
Cycling sequence not correct.	Crossed connections.	Check system wiring circuit diagram for improper connections. (Refer to Figure 2.)
Rapid brush wear or frequent breakage.	Brush block out of alignment.	Check brush alignment.
	Slip ring wobbles.	Check slip ring alignment with dial indicator as shown in Figure 3.

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The ammeter is located among the deice switches installed directly in the instrument panel above the throttle quadrant. If replacement is necessary, take care to ensure the correct replacement ammeter (by part number) is used.

It is important to note that during periods of low battery voltage, which can occur when an engine is shut down, the ammeter will indicate lower than at full voltage. When operating at full voltage, the needle should be within the shaded range, if current flow to the deicers is normal.

Control of the propeller deice system is through a switch located on the ice protection control panel.

The complete circuit, along with its component parts, are protected by a circuit breaker located on the main bus circuit breaker panel. The ampere value of the circuit breaker varies depending on whether the system is installed on two bladed or three bladed propellers.

2. Troubleshooting

See Chart 1.

3. Using the Ammeter

Whether in flight or during ground testing, the ammeter can be used to indicate the general nature of most electrical problems. The troubleshooting chart is primarily based on the use of the ammeter and assumes that the user does understand all normal operating modes of the system as described in the beginning of this section.

NOTE: When troubleshooting, first use the "ammeter test" and "heat test" to determine which circuits are involved. Use electrical schematic, 91-30-60 for assistance to check voltages or continuity.

Helpful Tips

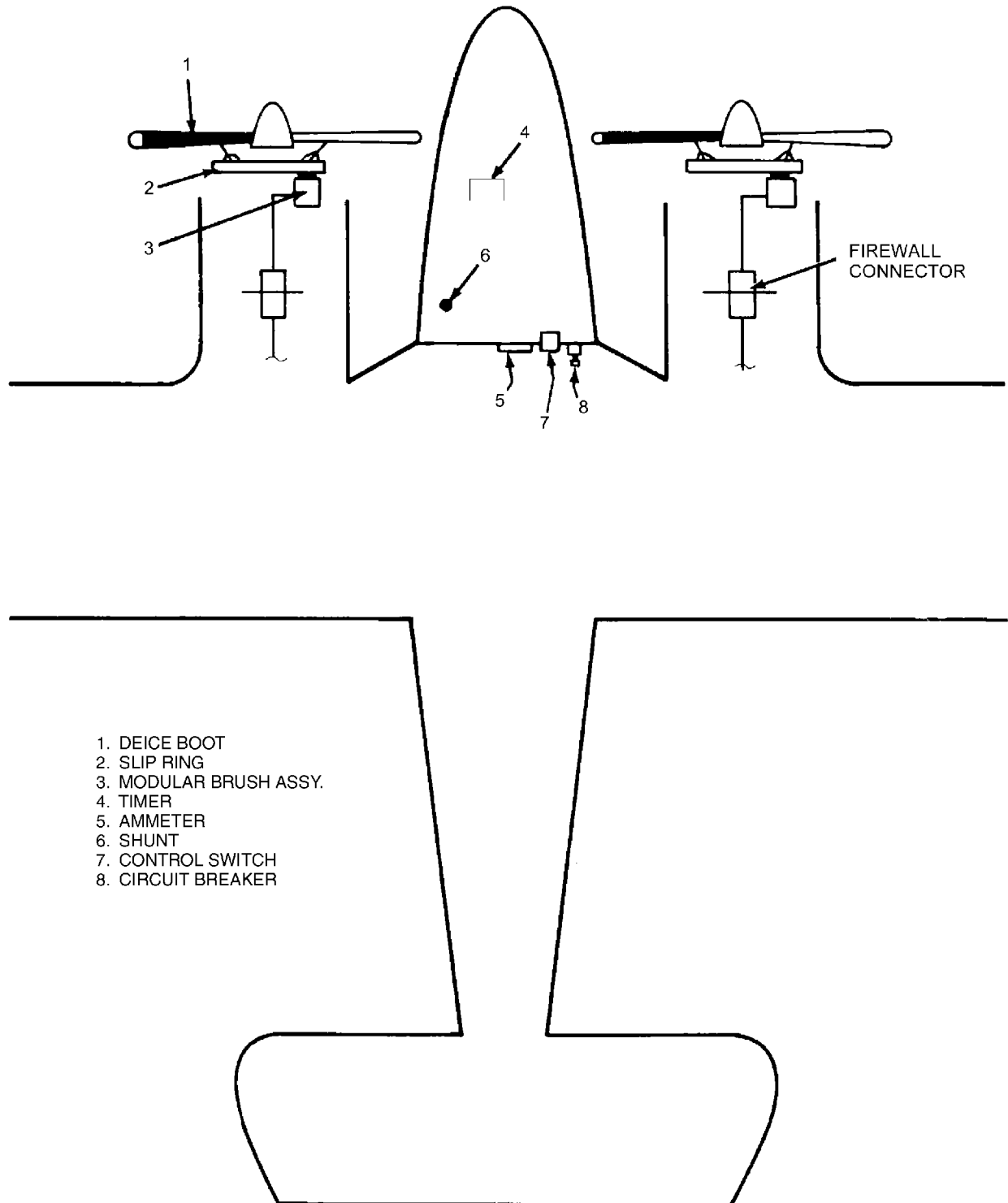
- (1) (Seneca IV, two blade prop) If the ammeter reading drops to one-third normal current, this indicates that one heater circuit is open or, on the dual element deicer, possibly improper connections are allowing both inboard and outboard units to heat at the same time.
- (2) Excess current reading on the ammeter always indicates a power lead is shorted to ground. Thus, when trouble of this nature is found, it is vital that the grounded power lead be located and corrected.
- (3) A considerable number of timers that have been returned for repair proved to be fully workable when tested. Accomplish the test described in "Timer Test" before concluding that the timer is defective.

4. Inspection

A. 50 Hour Inspection

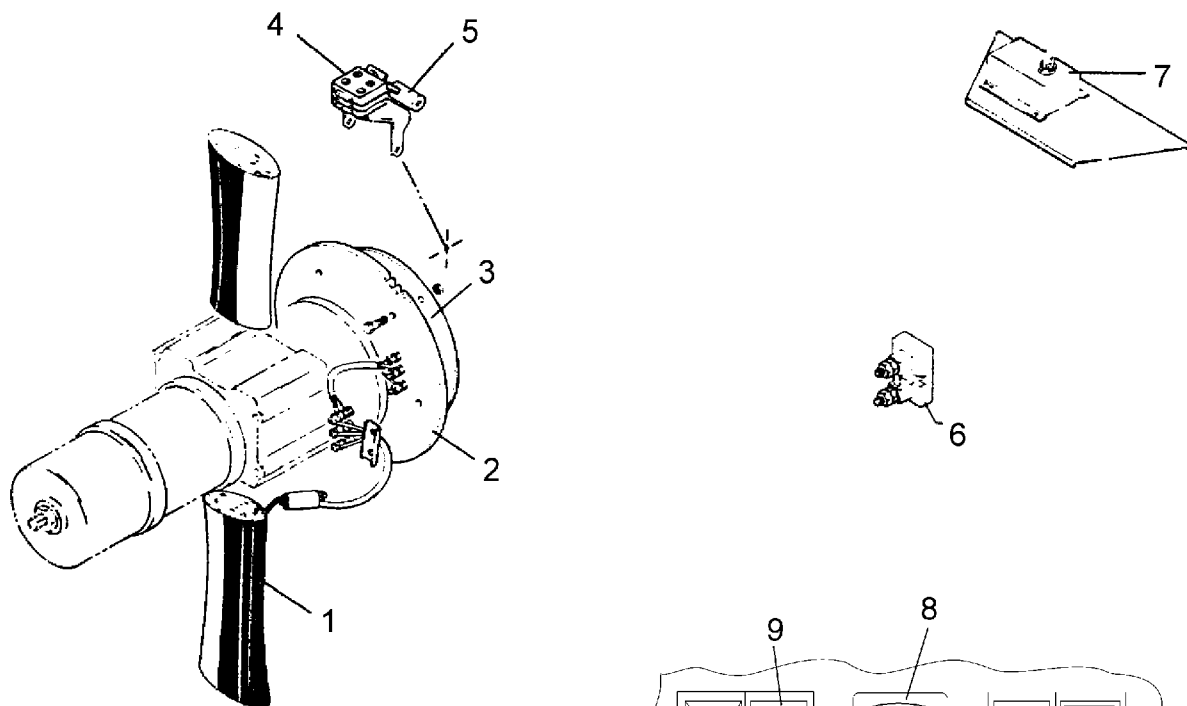
- (1) Lock brakes and operate engines at near takeoff power. Turn deicer system switch ON and observe deicer ammeter for at least two minutes. Ammeter needle must rest within the shaded band, except for a "flicker", approximately every 34 seconds, as the step switch of the timer operates. If not, refer to the appropriate entry of the troubleshooting chart.
- (2) (Seneca IV, two blade prop) With engines stopped, turn deicer switch ON and feel deicers on propellers for proper sequence of heater operation. The starting point is not important but sequence is vital and must be: Right Outboard, Right Inboard, Left Outboard and Left Inboard Heaters, in that order. Temperature rise should be noticeable and each heater should warm for about 34 seconds. Local hot spots indicate surface damage of deicer heaters; inspect and repair as directed in the boots section of this chapter.
- (3) Remove spinner dome and engine cowling. With assistant observing deicer ammeter and with deicer switch ON, flex all accessible wiring, particularly the deicer lead straps, leads from slip ring assembly, and the firewall electrical connectors and their wiring. Any movement of the ammeter needle other than the "34 second flicker" of cycling indicates a short or open that must be located and corrected.

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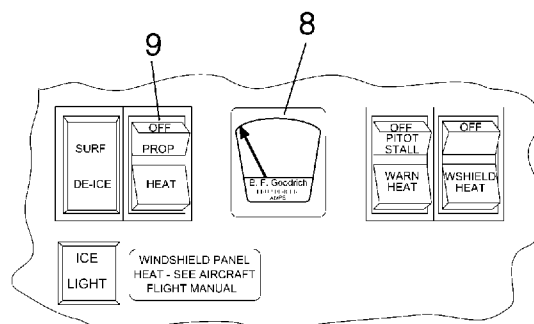


Propeller Deice Installation
Figure 1 (Sheet 1 of 3)

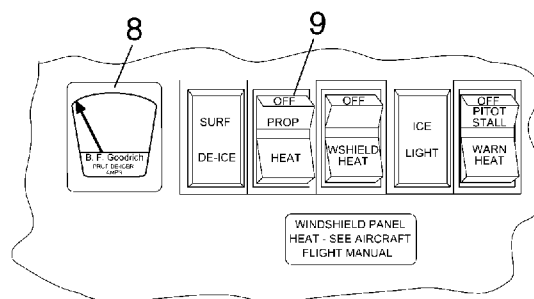
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1. PROPELLER DEICER BOOT
2. SLIP RING
3. MOUNTING PLATE
4. MODULAR BRUSH ASSEMBLY
5. MODULAR BRUSH ADJUSTMENT
6. SHUNT (LOCATED ON LONGERON)
BEHIND PILOT'S SIDE PANEL
7. TIMER
8. AMMETER
9. PROP DEICE SWITCH



SENECA IV

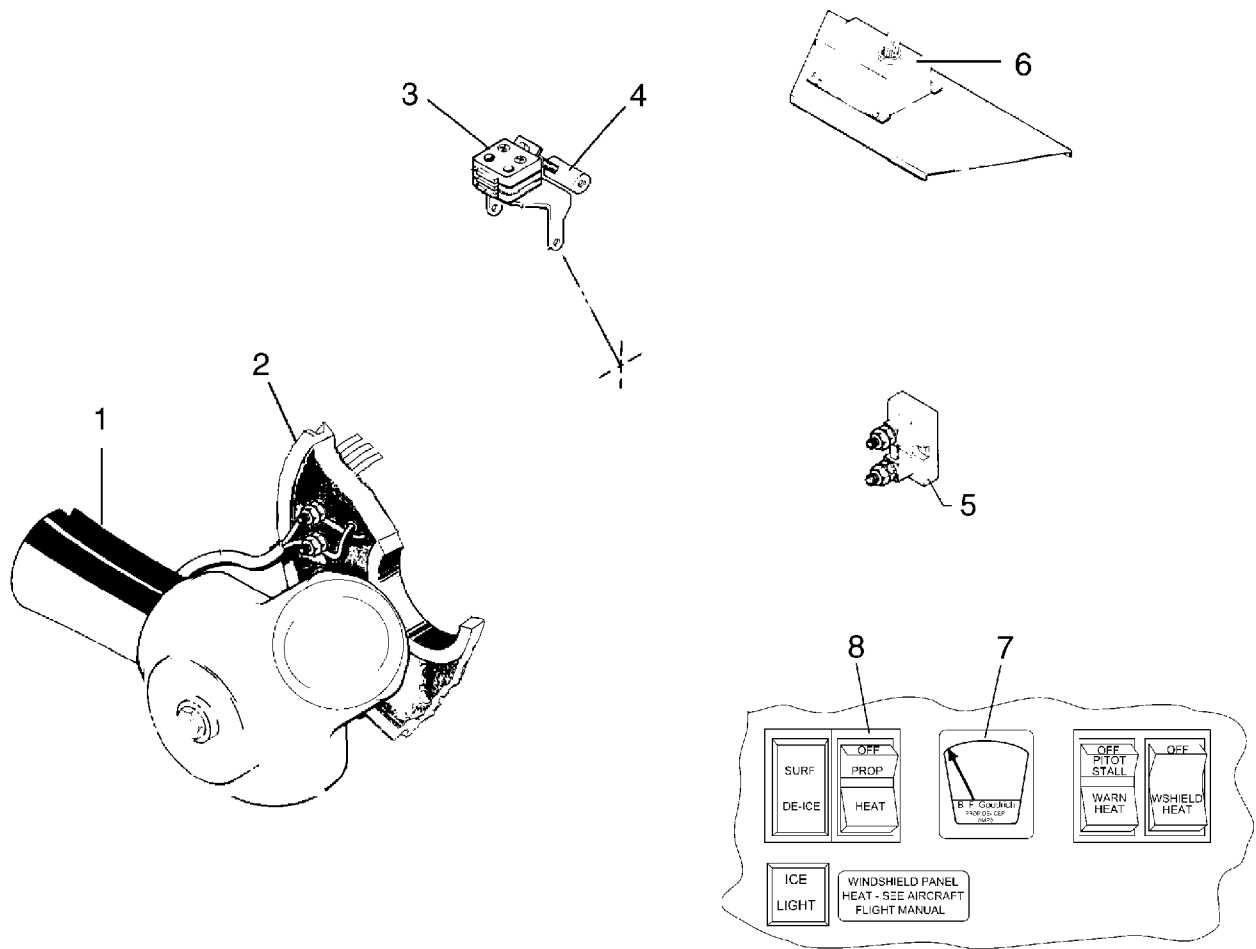


SENECA V

TWO BLADE INSTALLATION

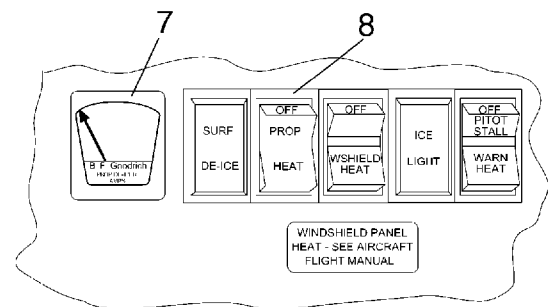
Propeller Deice Installation
Figure 1 (Sheet 2 of 3)

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1. PROPELLER DEICER BOOT
2. ALTERNATOR DRIVE SHEAVE
3. MODULAR BRUSH ASSEMBLY
4. MODULAR BRUSH ADJUSTMENT (SENECA IV ONLY)
5. SHUNT (LOCATED ON LONGERON)
6. TIMER
7. AMMETER
8. PROP DEICE SWITCH

SENECA IV



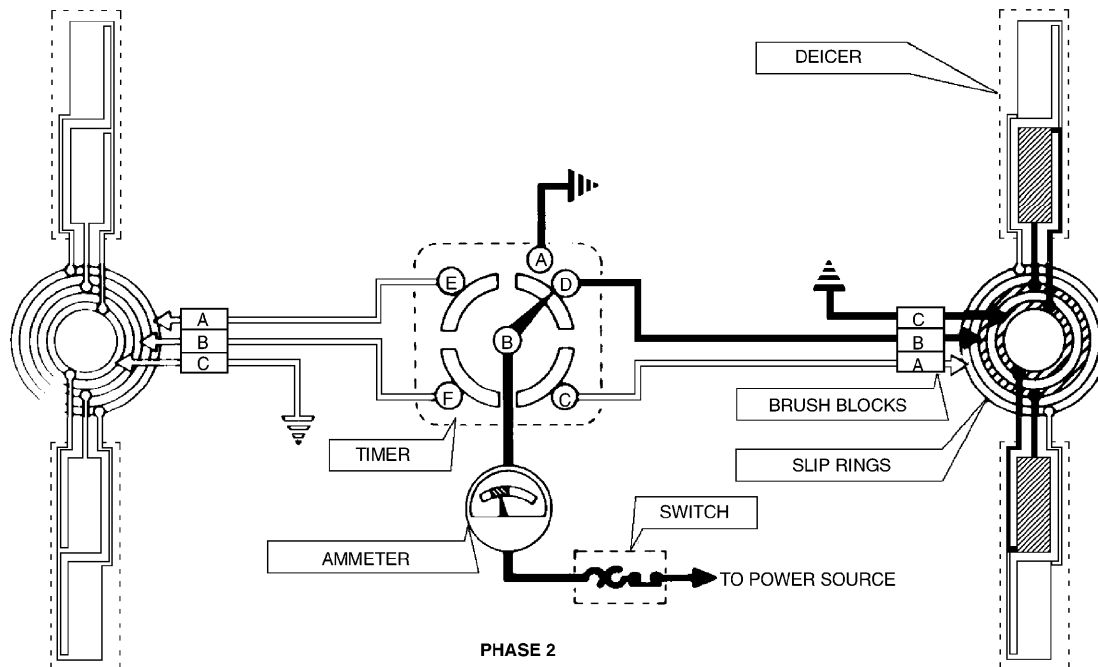
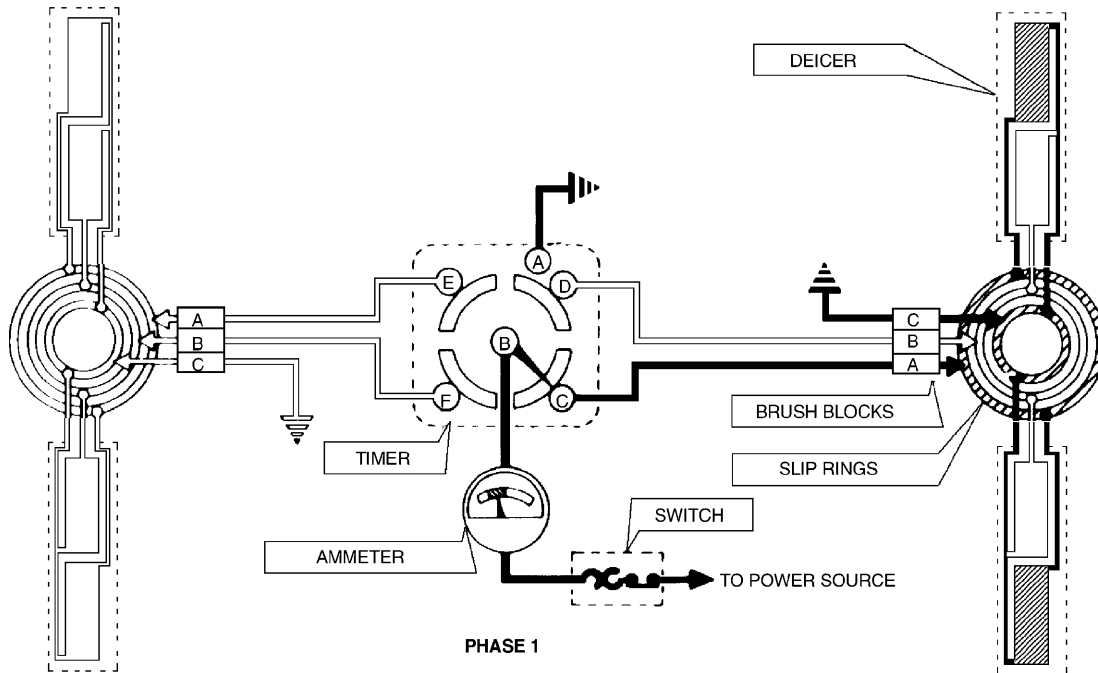
SENECA V

THREE BLADE INSTALLATION

Propeller Deice Installation
Figure 1 (Sheet 3 of 3)

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ELECTRICAL DIAGRAM
SHOWING CYCLE SEQUENCE

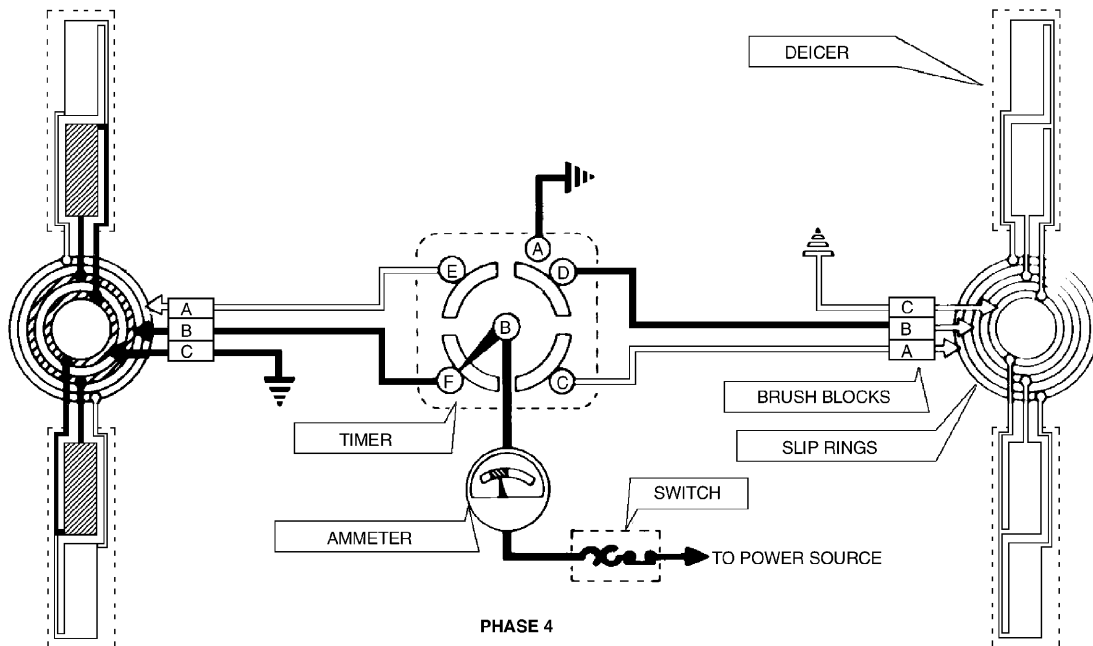
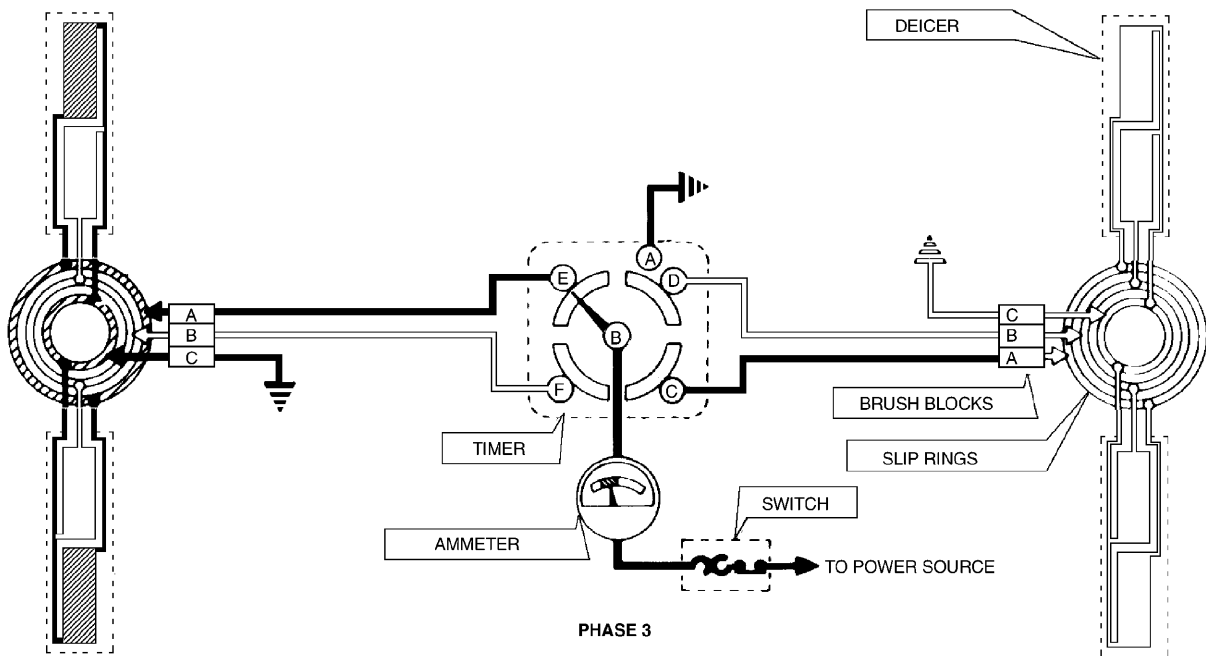


Effectivity
Seneca IV - Two Blade

Deicer Cycling Sequence
Figure 2 (Sheet 1 of 4)

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ELECTRICAL DIAGRAM
SHOWING CYCLE SEQUENCE

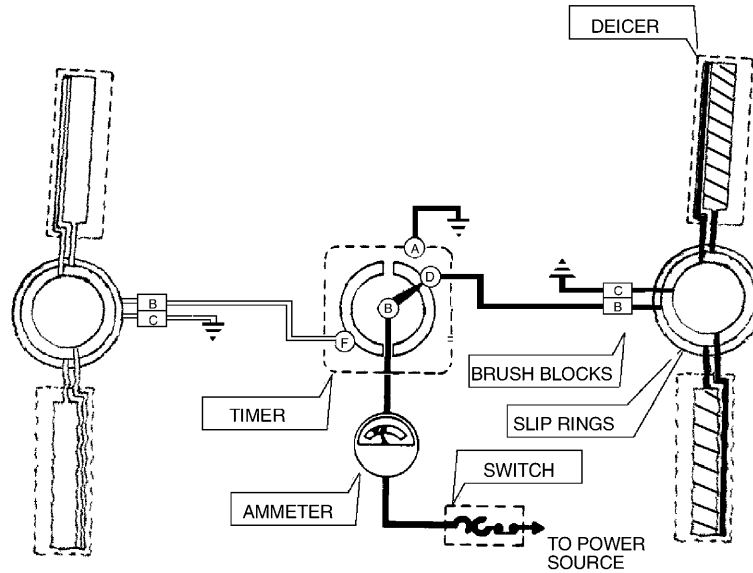


Deicer Cycling Sequence
Figure 2 (Sheet 2 of 4)

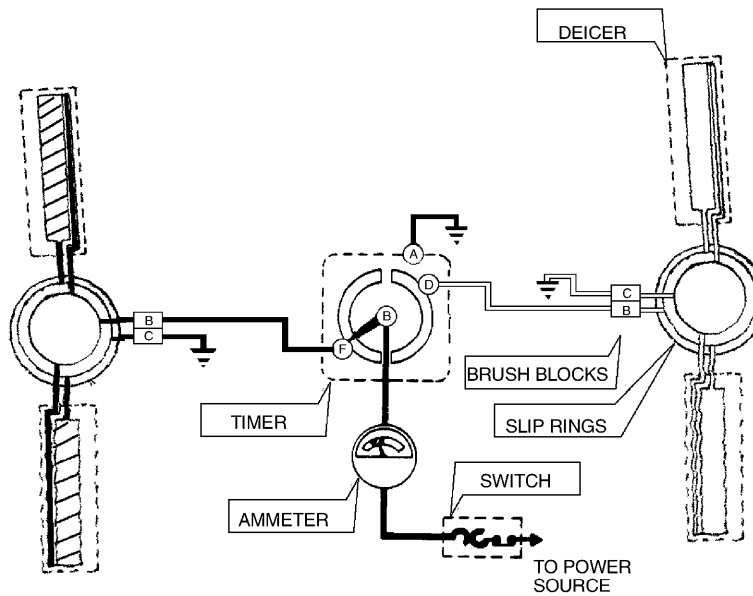
Effectivity
Two Blade - Seneca IV

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ELECTRICAL DIAGRAM
SHOWING CYCLE SEQUENCE



PHASE 1



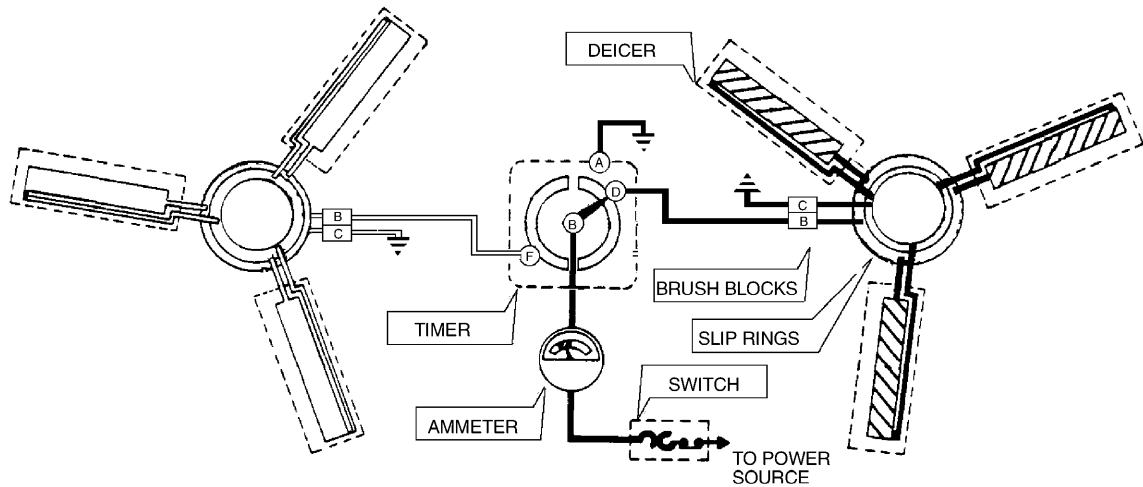
PHASE 2

Effectivity
Seneca V - Two Blade

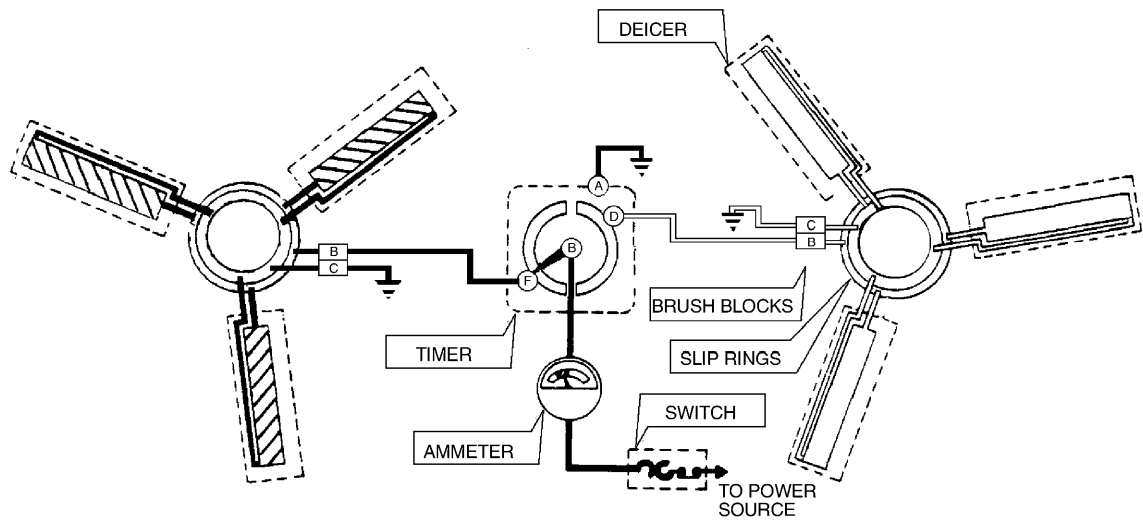
Deicer Cycling Sequence
Figure 2 (Sheet 3 of 4)

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ELECTRICAL DIAGRAM
SHOWING CYCLE SEQUENCE



PHASE 1



PHASE 2

Deicer Cycling Sequence
Figure 2 (Sheet 4 of 4)

[Effectivity](#)
[Three Blade](#)

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B. 100 Hour Inspection

- (1) Remove cowling.
- (2) Conduct 50 hour inspection.
- (3) Check for radio noise or radio compass interference by operating the engine at near takeoff power with radio gear ON while turning deicer switch ON and OFF. If noise or interference occurs with deicer switch ON and disappears when switch is OFF, see troubleshooting chart.
- (4) Ascertain that all clamps, clips, mountings and electrical connections are tight. Check for loose, broken or missing safety wire.
- (5) Deicers: Closely check deicers for wrinkled, loose or torn areas, particularly around the outboard end and where the strap passes under the strap retainer. Look for abrasion or cuts, especially along the leading edge and the flat or thrust face. If heater wires are exposed in damaged areas or if rubber is found to be tacky, swollen or deteriorated (as from oil or solvent contact), replace the damaged deicer in accordance with the appropriate information in this chapter.

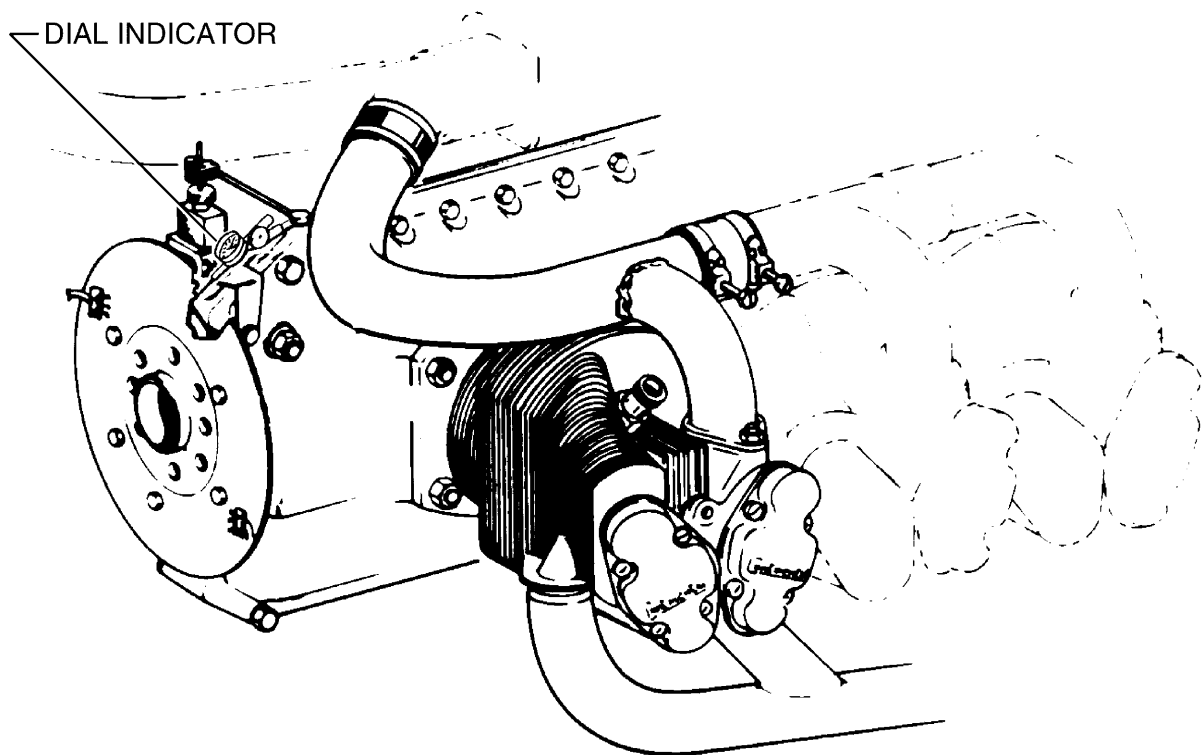
NOTE: Check the strap restrainers are correctly located and secure. Look for cracks or other damage. Operate propeller from "full pitch" to "feathering" and check that deicer lead straps do not come under tension or are pinched by propeller blade. (See Figure 1.)

- (6) Slip Rings: Check slip rings for gouges, roughened surface, cracks, burned or discolored areas, and for deposits of oil, grease or dirt.
 - (a) Clean greasy or contaminated slip rings with CRC 2-26 solvent. (This solvent is available from C.R.C. Chemical Division, Webb Inc. C-J10 Limekiln Pike, Dreshner, PA 19025.)
 - (b) If uneven wear is found or if wobble is noticed, set up a dial indicator as shown in Figure 3 and check alignment of the slip rings to the propeller shaft as explained in this section.
- (7) Brush Block - Brushes: Examine mounting brackets and housing for cracks, deformation or other physical damage.
 - (a) Test that each brush rides fully on its slip ring over 360°. Figure 4 shows the wear pattern if this condition is not corrected. If alignment is off, shim where brush block is mounted to bracket or adjust mounting bracket support arm.

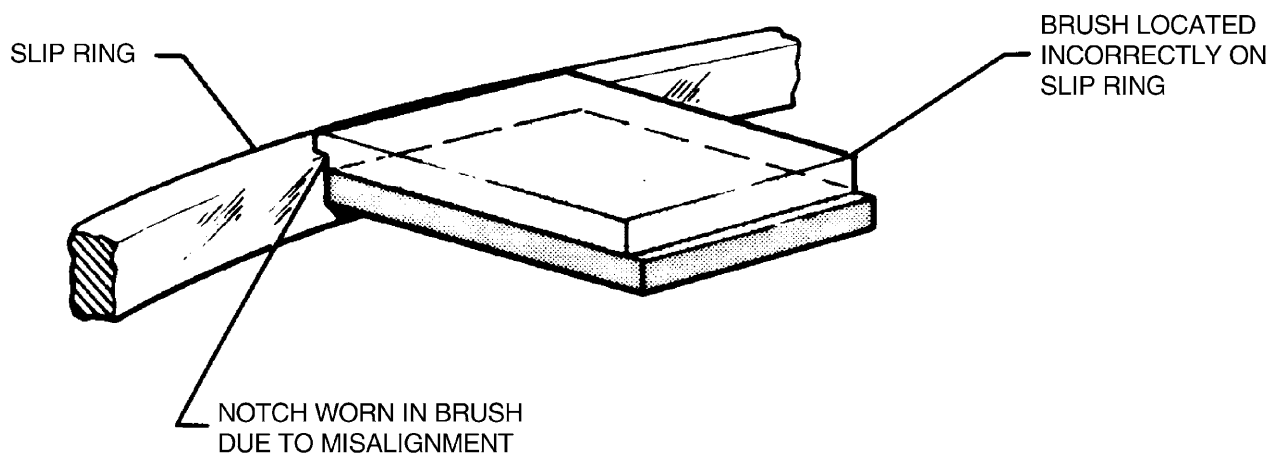
NOTE: The shim is a series of laminates and may be peeled for proper alignment of brushes to slip ring.

- (b) Check for proper clearance of brush block to slip rings as shown in Figure 5. If not correct, loosen mounting screws and move in elongated holes to correct block clearance before tightening securely.
 - (c) Visually check brush block for approximately 2° angle of attack. (See Figure 5.) If not, loosen mounting screws and align block, but be sure to hold clearance limits shown when tightening.
- (8) System Wiring: With deicer system operating, have assistant observe ammeter while visually inspecting and physically flexing wiring from brush blocks through firewall, to timer, to ammeter, to switch and to aircraft power supply. The ammeter will flicker as the timer switches approximately every 34 seconds in the cycle. Jumps or flickers at other times indicates loose or broken wiring in the area under examination at that moment. In such case, check continuity through affected harness, while flexing and prodding each wire in the area that gave initial indication of trouble. Use the wiring diagrams in 91-30-60.

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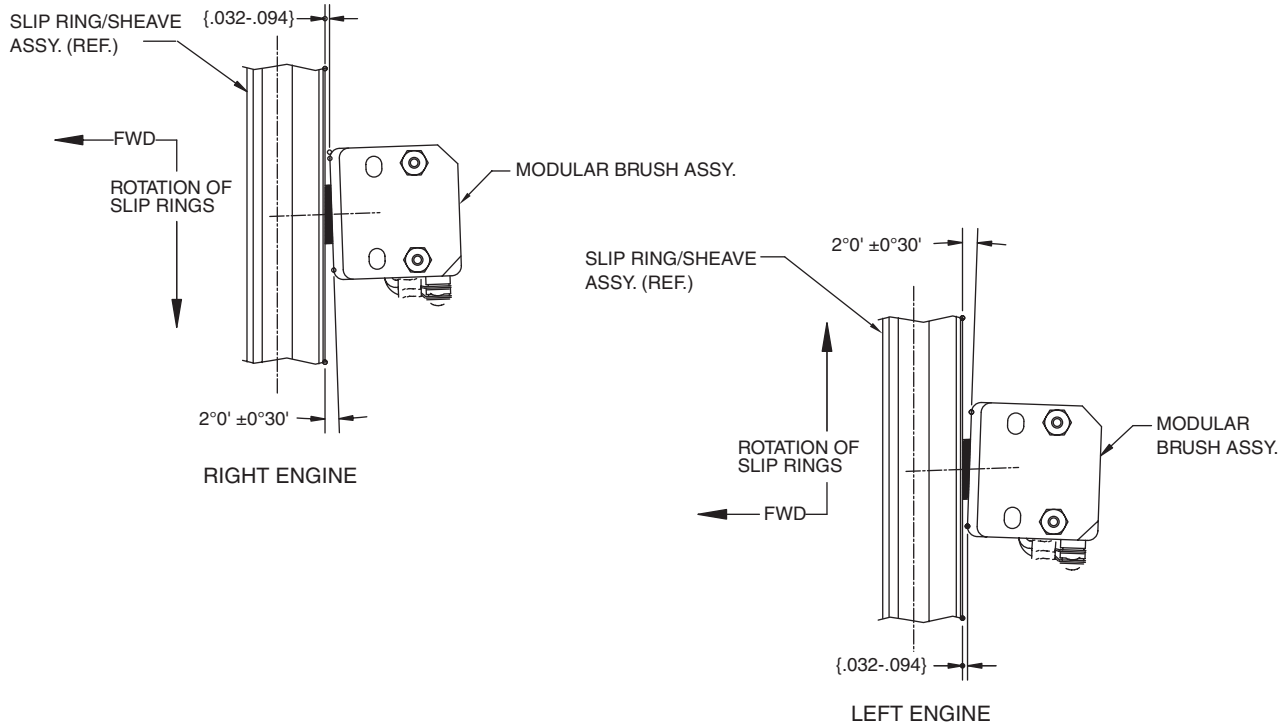


Using Dial Indicator
Figure 3

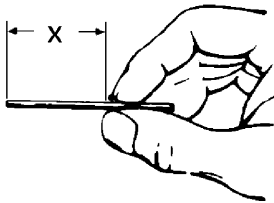


Centering of Brushes on Slip Rings
Figure 4

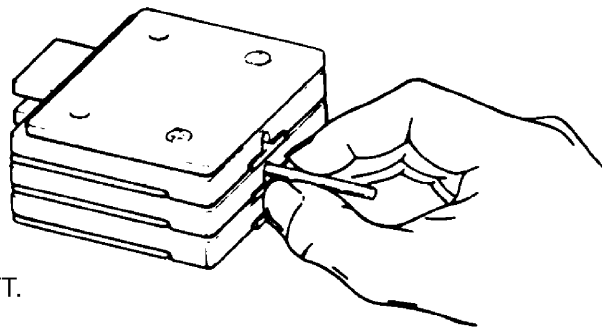
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Modular Brush Assembly Alignment and Clearance
Figure 5



MEASURE BRUSH WEAR AS SHOWN, X - DIMENSION (INCHES) GIVEN INDICATES WHEN BRUSHES MUST BE REPLACED. DURING MEASUREMENT ONLY, 1/16 INCH OF BRUSH SHOULD BE ALLOWED TO PROTRUDE FROM BRUSH BLOCK. THIS IS NORMAL POSITION OF THE BRUSH WHEN INSTALLED ON THE AIRCRAFT.



X DIMENSION

BRUSH BLOCK ASSEMBLY	MUST REPLACE
3E-2042-1	23/64
3E-2062-2	23/64

Measuring Brush Assemblies
Figure 6

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5. Brush Assemblies

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

A. Brush Module Replacement

Brush modules should be replaced when .375 inch of brush material remains; brush modules must be replaced when .250 inch remains. Measure the brushes as shown in Figure 6. Replace brush modules as follows:

NOTE: Brushes are not offered individually as replacements. When a brush wears out, the module containing it should be replaced.

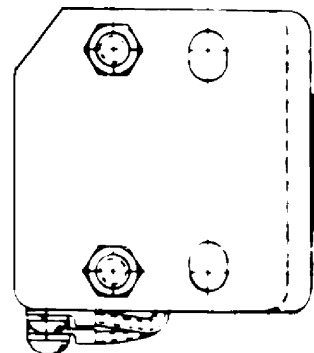
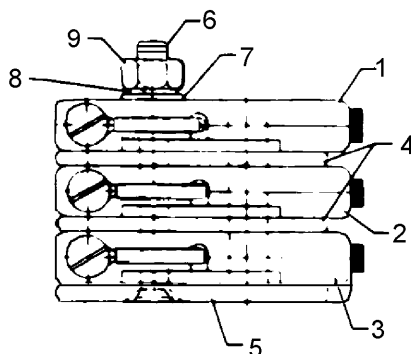
- (1) Remove the modular brush assembly from the aircraft, by removing the attachment hardware, and disconnect the engine wire harness.
- (2) Remove assembly screws and separate modules and spacers.

NOTE: The part number of each module is etched into the surface of the plastic housing; replace with the same part number module.

- (3) Restack modules and spacers as shown in Figure 7 or 8. If there is interference between adjacent ring terminals, reorient center module as shown in Figure 9.

NOTE: Ascertain flat washer is positioned between star washer and housing.

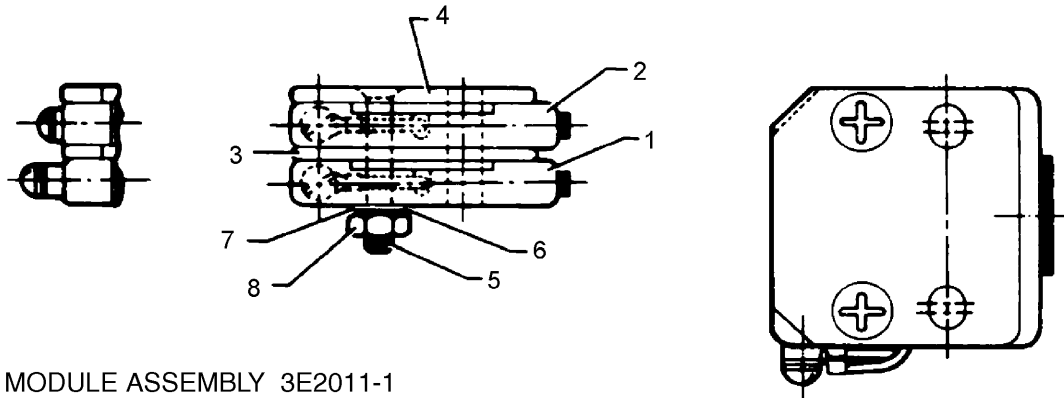
- (4) Reconnect aircraft wire harness and ensure adjacent ring terminals are not touching.
- (5) Install assembly on aircraft and check adjustment.



1. BRUSH MODULE ASSEMBLY 3E2011-1
2. BRUSH MODULE ASSEMBLY 3E2011-2
3. BRUSH MODULE ASSEMBLY 3E2011-3
4. SPACER
5. SPACER
6. SCREW
7. WASHER
8. LOCKWASHER
9. NUT

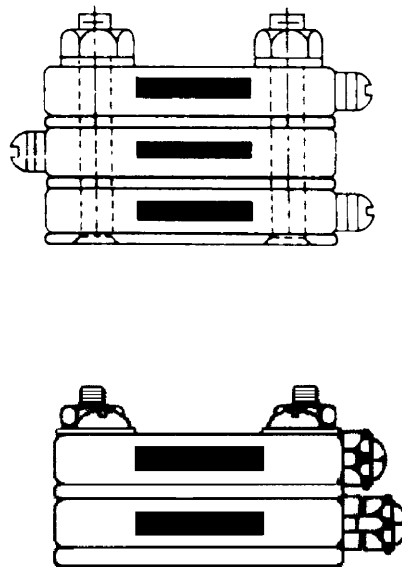
Modular Brush Assembly 3E2042-1
Figure 7

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1. BRUSH MODULE ASSEMBLY 3E2011-1
2. BRUSH MODULE ASSEMBLY 3E2011-2
3. SPACER
4. SPACER
5. SCREW
6. WASHER
7. LOCKWASHER
8. NUT

Modular Brush Assembly 3E2062-2
Figure 8



Typical Module Stacking Arrangements
Figure 9

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B. Alignment of New Brushes

Any time the brush block assembly is dismantled, the alignment at reinstallation must be checked as described in step (7) under "100 Hour Inspection."

C. Brush Block Alignment

A brush alignment template is available for adjusting brush alignment. Refer to Miscellaneous Section of the Parts Catalog under Special Tools.

6. Slip Rings

A. Alignment

Excessive slip ring run-out will result in severe arcing between the slip ring and brushes and cause rapid brush wear. If the run-out is not corrected, rapid deterioration of the slip ring and brush contact surfaces will result and lead to eventual failure of the Deicing System. Check the slip ring run-out with a dial indicator securely attached to the engine with the pointer resting on the slip ring. (Refer to Figure 3.) Rotate the propeller slowly noting the run-out indicated on the gauge. The total run-out must not exceed 0.005 inch \pm 0.0025 inch and 0.002 inch in any 4 inch interval of slip ring travel.

NOTE: Some error may be induced in the readings by pushing in or pulling out on the propeller. Care must be taken to exert a uniform push or pull.

Small amounts of run-out may be corrected by varying the torque on the slip ring mounting bolts (AN4-7A) between 40 to 100 inch-pounds to obtain the required flatness.

B. Replacement

Slip ring assemblies that are open or shorted electrically, cracked or damaged structurally, or which have damaged surfaces beyond the scope of minor repair to clean up, should be replaced.

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7. Deicer Boots

WARNING: CEMENTS AND SOLVENTS USED TO REMOVE AND INSTALL DEICERS ARE EXTREMELY FLAMMABLE AND TOXIC. EXTINGUISH OPEN FLAMES. AVOID SPARKS. USE IN WELL-VENTILATED AREA. AVOID SKIN CONTACT AND/OR PROLONGED BREATHING OF VAPORS. CONSULT MSDS FOR ADDITIONAL SAFETY INFO.

CAUTION: PROPELLER DEICER REPAIR IS LIMITED TO REFURBISHMENT OF EDGE SEALER. **FOR HARTZELL BLADES**, SEE LATEST REVISION OF HARTZELL MANUAL NO. 133 (61-13-33).

GOODRICH PROPELLER DE-ICERS ARE NOT REPAIRABLE. DEICER SURFACE DAMAGE, SUCH AS PUNCTURES, CUTS, SCUFFS, EROSION, THAT EXPOSES THE WIRE OR ETCHED ELEMENT IS GROUNDS FOR REPLACEMENT, AS ADDITION OF REPAIR MATERIAL COULD AFFECT DEICER PERFORMANCE.

CAUTION: DISPOSE OF UNUSED MEK AND OTHER CHEMICALS AND SOLVENTS IN A MANNER CONSISTENT WITH LOCAL LAWS AND/OR ENVIRONMENTAL PROTECTION AGENCY REGULATIONS.

A. Resistance Check of Deicer Boots

Disconnect the deicer lead harness to measure heater resistances individually. See Chart 2 or 3 for resistances. If this check is off limits, the deicer is damaged and must be replaced.

B. Replacement

If tests show the blade deicer to have an open circuit, to be the wrong resistance or to be visibly damaged beyond repair as outlined in this section, replace the deicer as directed in the following paragraphs.

CHART 2
DEICER ELECTRICAL RESISTANCE - SENECA IV

Resistance Check	Min.	Max.
Two Bladed Propeller		
Each Element	4.58	5.26
2 Elements in Parallel	2.29	2.63
Three Bladed Propeller		
Each Element	4.74	4.90
3 Elements in Parallel	1.58	1.63

CHART 3
DEICER ELECTRICAL RESISTANCE - SENECA V

Resistance Check	Min.	Max.
Two Bladed Propeller		
Each Element	4.74	4.90
2 Elements in Parallel	2.37	2.45
Three Bladed Propeller		
Each Element	4.74	4.90
3 Elements in Parallel	1.58	1.63

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C. Removal and Installation on [Hartzell propellers](#)

NOTE: The following applies to factory propeller installations only.

See latest revision of Hartzell Aluminum Blade Overhaul Manual, Manual No. 133 (61-13-33).

D. Removal ([McCauley Propellers only](#))

NOTE: This and the following paragraphs E thru H apply exclusively to the removal and installation of deicers on McCauley propellers.

NOTE: Goodrich's Installation and Maintenance Manual for Prop De-Icing Systems ATA Report No. 30-60-02 and Removal and Installation Manual, Standard and FASTprop Electrothermal Propeller De-Icers ATA Report No. 30-60-07, provide approved, alternate procedures for removing and installing deice boots. Reference to them is highly recommended. They can be obtained online at <http://www.goodrich.com/TechPubs>.

NOTE: See Chart 4 for required materials.

- (1) Disconnect terminals of propeller deicer from studs on the spinner bulkhead.

CAUTION: DO NOT ALLOW SOLVENTS TO LEAK INTO PROPELLER HUBS AND CAUSE DAMAGE TO SEALS.

- (2) Use MEK or Toluol to soften the adhesion line between the deicer and the propeller blade.
- (3) Starting at one corner of the deicer, loosen enough of the deicer to grasp in the jaws of vise grip pliers or similar tool.
- (4) Apply a steady pull on the deicer to pull it off the propeller surface. Continue using MEK or Toluol to soften the adhesion lines. Unless the deicer being removed is damaged and is to be scrapped, cushion the jaws of any pulling tool used to prevent damage to the deicer surface. Remove very slowly and carefully. If deicer has failed and is to be returned under request for warranty, extreme care should be exercised so that no additional damage is incurred to the deicer during and after removal.
- (5) Remove residual cement from blade. Use Turco No. 3 or equivalent to help with dried cements.

**CHART 4
REQUIRED MATERIALS FOR REPAIR OF PROPELLER DEICER**

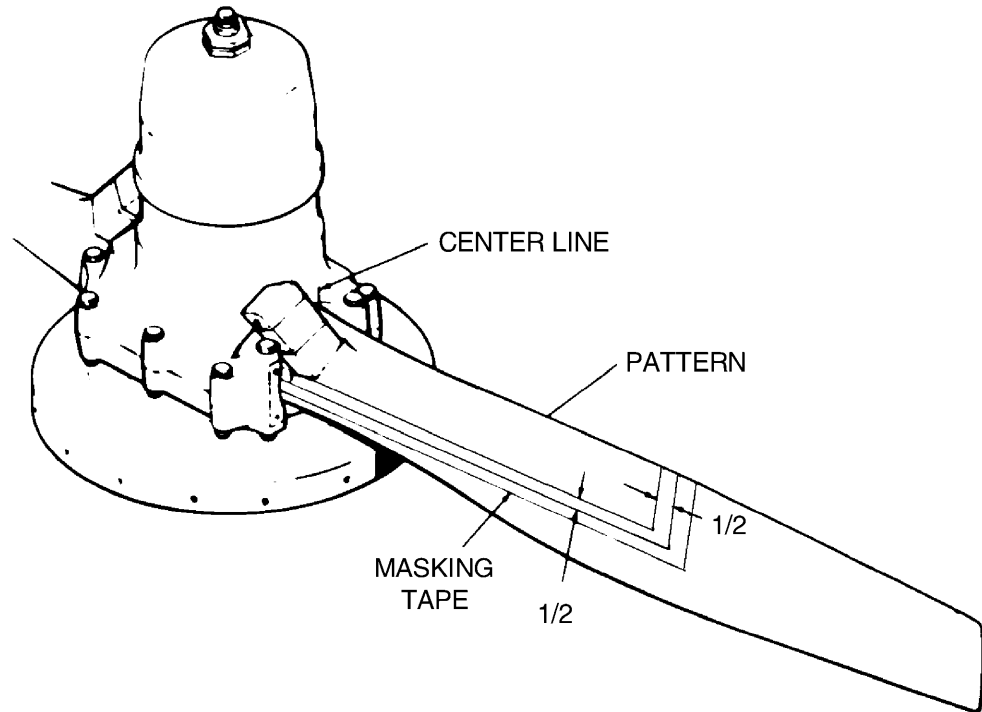
The materials and tools listed below are commercially available and are not supplied by B.F. Goodrich in kit form:

Cement 1300L (Minnesota Mining & Mfg. Co.) (*Piper P/N 912-019)
Filler EC801 (6 Hour) *Piper P/N 279-047)
Sealer A-56-B *Piper P/N 912-018
Cleaning Solvent - MEK (MethylEthylKetone) or Acetone
Tackifying Solvent - Toluol or MEK (See Note)
Cleaning Cloth - any clean, lint-free cloth
1 inch paint brushes
2 inch rubber hand roller
1/4 inch hand stitcher
Masking tape

Piper Part Numbers reflect 1 quart containers.

NOTE: MEK may be used instead of Toluol to tackify cement, but it provides approximately 10 seconds working time for deicer applications, whereas Toluol provides approximately 40 seconds working time.

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Installation of Deicer Boot
Figure 10

E. Blade Preparation (McCauley Propellers only)

CAUTION: CLEANLINESS OF METAL AND RUBBER PARTS CANNOT BE TOO HIGH STRESSED. ONLY PERFECTLY CLEAN SURFACES WILL ASSURE MAXIMUM ADHESION.

NOTE: All deicers on a single propeller must be located at same distance from the hub for rotational balance.

- (1) Mark and cut from masking tape a pattern the size of the propeller deicer. (See Figure 10.)
- (2) Place a mark at the hub end of the blade in line with the blade leading edge. The location for this mark can be determined by sighting along the leading edge. Starting at the hub (see Note above), center the pattern on this mark and stick the pattern to the leading edge. Mark the position of the deicer harness.

CAUTION: DO NOT CLEAN PROPELLER BLADE TO BARE METAL. McCAULEY PROPELLERS HAVE A SPECIAL PROTECTIVE COATING NOT EASILY REMOVED BY SOLVENT. BOND DEICER DIRECTLY TO THIS PROTECTIVE COATING.

- (3) Remove the pattern and clean the marked off area thoroughly, with MEK or acetone. For final cleaning, wipe the solvent off quickly with a clean, dry lint-free cloth to avoid leaving a film.
- (4) Using a pencil or pen, mark a centerline at the hub of the propeller blade and on the tape at the outboard edge of the masked area.

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F. Cement Application (McCauley Propellers only)

- (1) Using a marker pencil, mark a centerline on the glossy side of the deicer.
- (2) Moisten a clean cloth with MEK or acetone and clean the unglazed surface of the deicer, changing cloth frequently to avoid contamination of the clean area.
- (3) Thoroughly mix the 1300L cement. Apply one even brush coat of cement to the unglazed back surface of the deicer. Cement one inch of the deicer lead strap. Allow to air dry for a minimum of one hour at 40°F (4.5°C) or above, when the relative humidity is less than 75%. If the humidity is 75% to 90%, allow two hours drying time. Do not apply cement if the relative humidity is higher than 90%. After allowing the proper amount of drying time, apply a second even brush coat of 1300L cement.

NOTE: If curling of the deicer edges is a problem, apply masking tape to the edges of the glazed side before applying cement to the unglazed side. Remove the tape before starting to install the deicer.

- (4) Apply an even brush coat of 1300L cement on the cleaned surface of the propeller blade, immediately after the second coat of cement has been applied to the deicer. This timing is important for the cement on both surfaces to reach the tack stage at the same time.

G. Installation (McCauley Propellers only)

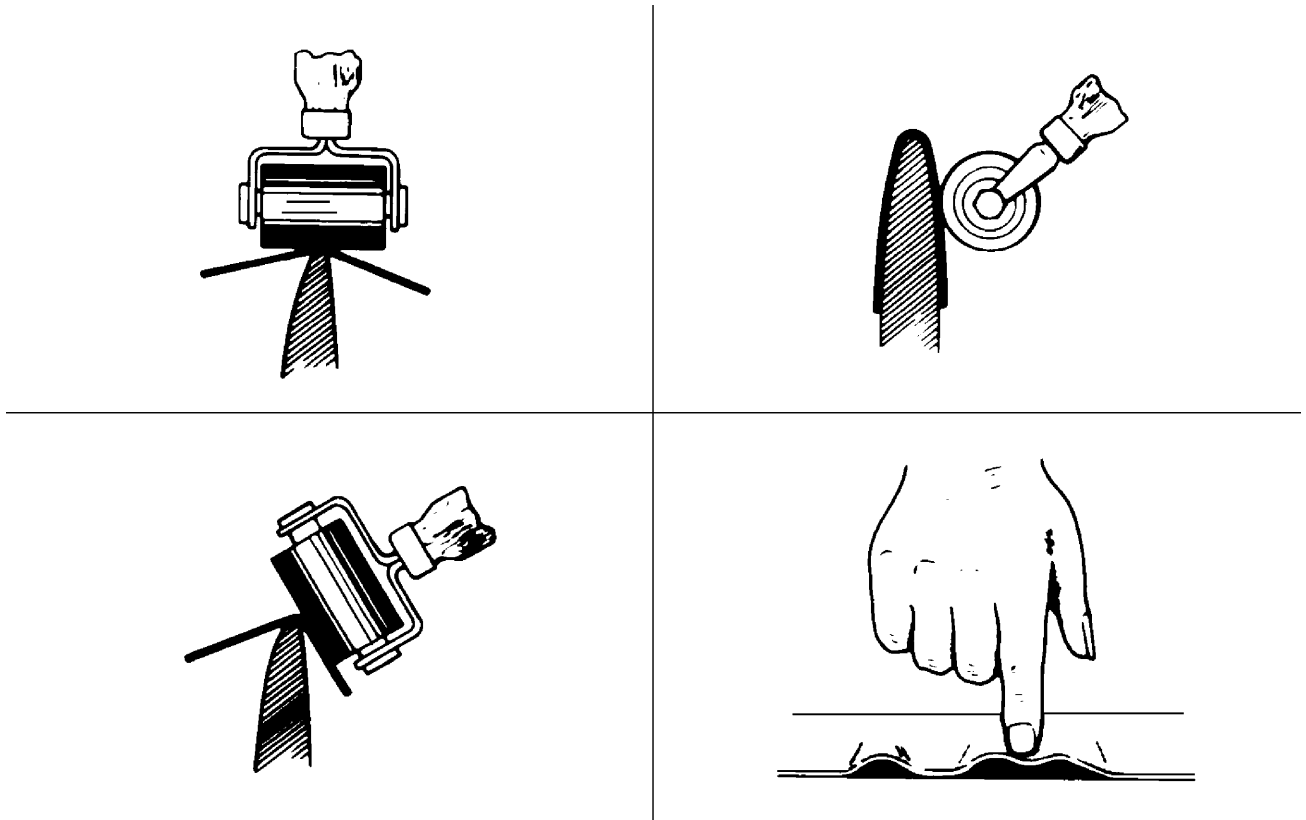
It is imperative that the following instructions be followed exactly to ensure maximum adhesion to the propeller blades:

- (1) When the cement coats are tacky (slightly sticky to the touch - like masking tape), dry on both the propeller surface and deicer surface, position deicer on blade leading edge. Start at hub end, using centerlines as a guide. (See Figure 10.)
- (2) Make sure that the harness will fall in the previously marked position.
- (3) Working outward toward the tip, tack the deicer centerline to the leading edge of the propeller blade.
- (4) Use the tackifying solvent as necessary. If deicer is allowed to get off course, pull up with a quick motion and re-apply deicer.
- (5) If cement is removed from either surface, completely remove the deicer and re-apply cement as explained in the previous paragraph.
- (6) When the deicer is correctly positioned, roll firmly along the centerline with a rubber roller. (Refer to Figure 11.)
- (7) Gradually tilt the rubber roller and carefully work the deicer over either side of the blade contour to avoid trapping air. Roll outwardly from centerline to edges. Be especially careful to work out excess material at outboard edge of deicer before other edges are completely rolled down. If excess material at edges tends to pucker, work out puckers smoothly and carefully with fingers.

CAUTION: TO AVOID DAMAGE TO DEICER RESISTANCE WIRES, DO NOT USE METAL STITCHER ON BODY OF DEICER. AREA WHERE METAL STITCHER IS PERMITTED NOT TO EXCEED 3/16" ALONG DEICER EDGE.

- (8) Roll the tapered edges, especially inboard edge of the deicer with the metal stitcher.

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Wrinkled Deicers
Figure 11

H. Preparation and Application of Sealer ([McCauley Propellers only](#))

Deicers loosened due to destruction of adhesive bond by lubricants do not respond well to recementing. Therefore, removal, cleaning, and reinstallation of the deicers are recommended.

- (1) Clean an area .500 of an inch wide around the circumference of the deicer down to the bare metal. Use MEK or Acetone and clean thoroughly.
- (2) Clean outer .500 of an inch of all deicer edges and back under deicer about .250 of an inch on all sides past loosened areas with MEK or Acetone. For final cleaning, quickly wipe off solvent with a clean, dry lint-free cloth to avoid leaving a film.
- (3) Recement loosened areas of deicers in accordance with the paragraph on cement application.
- (4) Mix filler, sealer, or paint thoroughly and in the proper proportions by weight, see Chart 5.
- (5) Locate masking tape approximately .125 of an inch beyond the cemented area around the deicer to permit filler material to contact bare metal.
- (6) Apply one even coat of filler to area around the inboard end and sides of the deicer. (See Figure 12.) Immediately remove the masking tape and allow the filler to dry for six hours.
- (7) Apply masking tape about .125 of an inch beyond filler or .250 of an inch beyond cemented area when no filler is used, to permit sealer to contact bare metal. Apply one even brush coat of sealer to the area around the deicer. (See Figures 10 and 12.) Remove masking tape immediately and allow sealer to dry. Allow 12 hours cement curing time before starting engine, allow 24 hours cement curing time before operating the deicers.

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**CHART 5
MIXING OF MATERIALS**

Material	Manufacturing & No.	Mixing Proportions
Filler	EC801 (6 Hr.) (Qt.) Piper P/N 279 047	Base 100 parts by weight. Accelerator 10 parts by weight.
Sealer Conductive Cement	A-46-B (Qt.)	None

I. **Wrinkled Deicers (See Figure 11.)**

If edge of deicer is found wrinkled or loose, try recementing. Use MEK or Toluol to loosen the bond for an additional 1/4 inch beyond the loose or wrinkled area. Apply one coat of 1300L cement to the deicer and propeller bonding surfaces and allow to air dry for one hour. Then apply a second coat of 1300L cement to both the deicer and bonding surface. Allow to dry. Retackify with MEK or Acetone and press with fingers to work out wrinkles or to secure loose edges. If material has stretched and will not cement flat, replace the deicer.

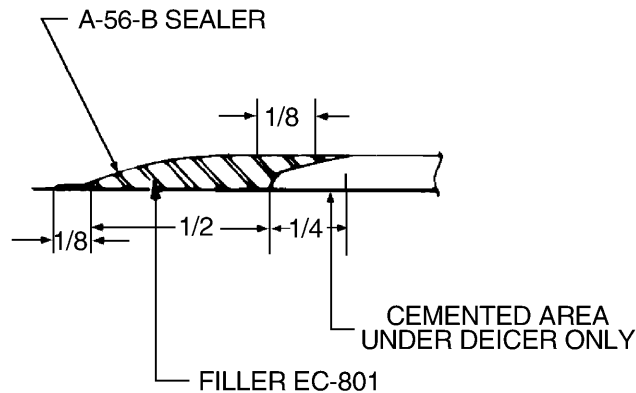
8. **Electrical Check**

Procedures

- (1) Check the electrical resistance of each of the two elements within the deicer. (See Electrical Schematic, 91-30-60, and Charts 2 and 3.)
- (2) Check for intermittent open circuits by tensioning the deicer strap slightly while measuring the resistance. Also, press lightly on the deicer surface in the area adjacent to the harness. Resistance must not vary.
- (3) Identification of the circuits within the element may be confirmed by referring to the resistance values and schematic diagram. Proper identification is necessary in order to make the system cycle properly and to obtain the correct amperage values during system operation.

NOTE: These resistances apply only to deicers that are not connected to terminal studs.

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Sealer Application (Boot)
Figure 12

9. Deicer Wiring Harness

A. Two Bladed Propellers (Refer to Figure 13.)

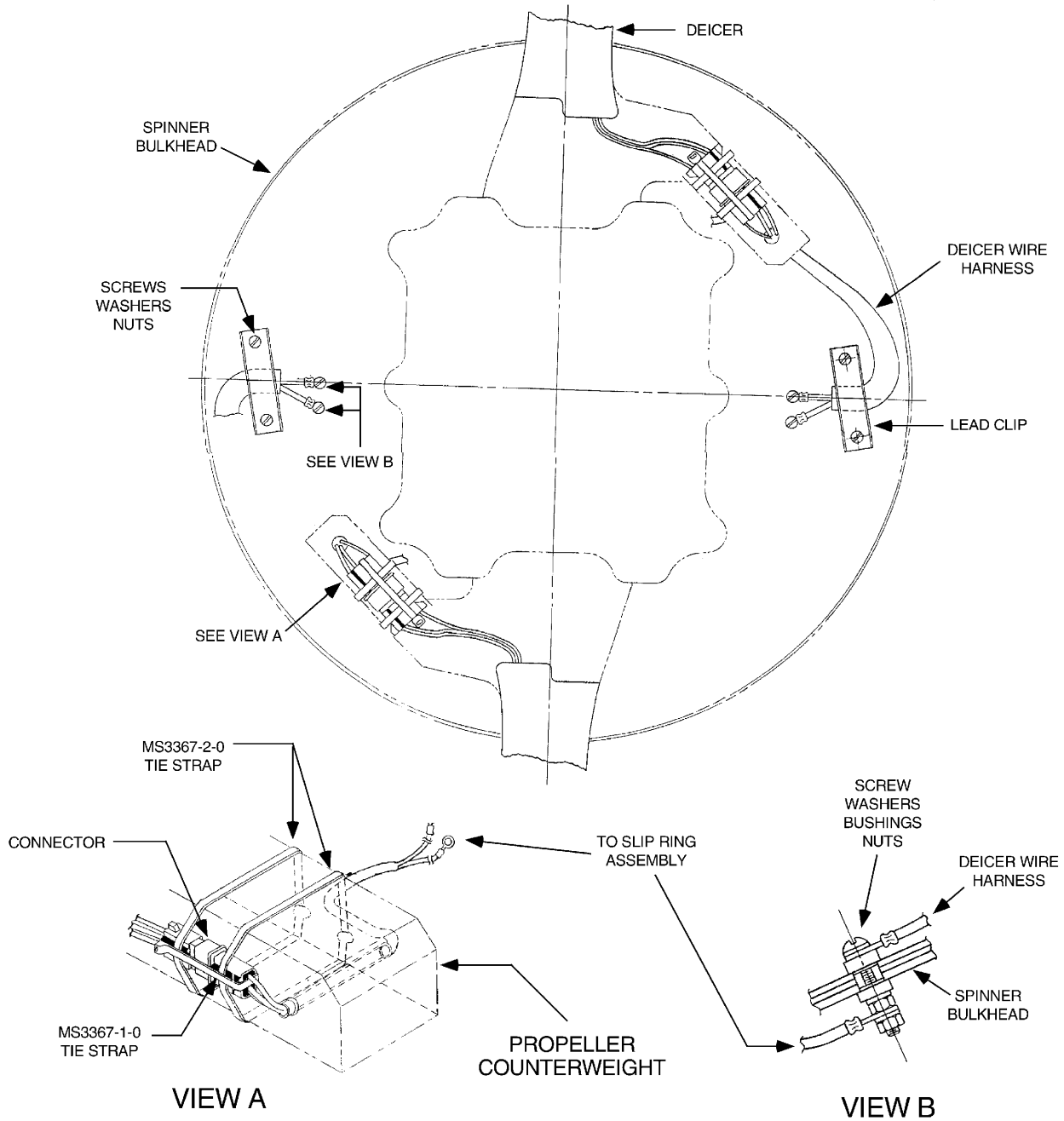
The deicer wiring harness must be installed to the propeller counterweight as follows:

- (1) Install deicer harness through 9/32 inch hole in counterweight.
- (2) Refer to view A. Install MS3367-1-0 strap between leads along length of plug. Do not tighten.
- (3) Refer to view A. Install two MS3367-2-0 straps under MS3367-1-0 strap and around counterweight. Do not tighten.
- (4) Install tubing over deicer wire harness.
- (5) Route the wire harness and protective tubing under both MS3367-2-0 straps. Tighten both tie straps.
- (6) Tighten MS3367-1-0 strap around plug.
- (7) Install deicer harness wire terminals to screws on spinner bulkhead. (Refer to view B.).
- (8) Install lead clip over harness.

B. Three Bladed Propellers (Refer to Figure 14.)

- (1) If necessary, install connector mounting bracket to propeller hub using appropriate number of screws and washers.
- (2) Join connector plug on end of harness to connector plug extending from propeller deicer boot. Secure connection by installing a MS3367-2-0 strap around connector. (Refer to view B). Ensure that strap is routed between wires leads extending from each end of connector.
- (3) Secure connector to connector mounting bracket using two MS3367-1-0 straps. (Refer to views A and B.) Route straps under MS3367-2-0 strap. Note position of strap buckles in Figure 14.
- (4) Using two MS3367-1-0 straps, secure harness and wires leading to propeller deicer boot to connector mounting bracket as shown in view B.
- (5) Secure harness to spinner bulkhead using clamp, screw, washer, and nut. Clamp must be positioned 90° to radial line as shown in Figure 14. Ensure clamp is installed in correct mounting hole with respect to propeller rotation.
- (6) Connect harness to terminal strip.

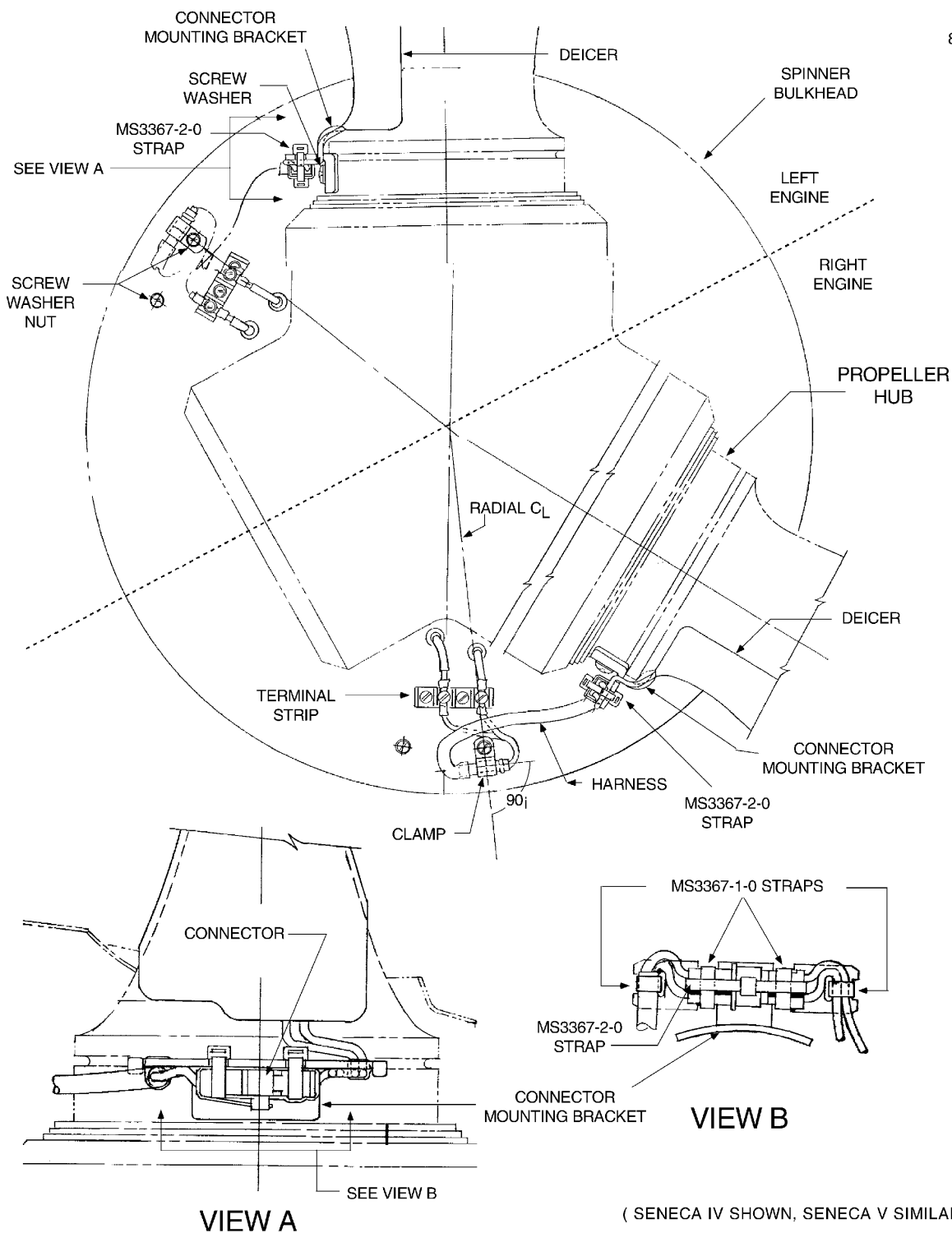
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Two Bladed Propeller Deicer Harness Installation
Figure 13

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Three Bladed Propeller Deicer Harness Installation
Figure 14

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C. Balancing

To assure balance of the propeller assembly, the original balancing weights or their equivalents must be reinstalled. The weights must be left in the original position on the propeller hub. The restrainer and weights should not interfere with any part of the propeller assembly under any condition. If for any reason balance weights were removed, reinstall safety wire on screws. The deicer wire harness must be installed on the propeller as just described.

D. Final Electric Check

- (1) Make certain that all terminals are tight. Do not over torque.
- (2) Check the electrical resistance between the deicer terminals or between the slip rings. The reading should be per Charts 2 and 3.

10. Other Components

Do not attempt internal repairs of the timer, ammeter or switch. If inoperative, these components must be replaced with one of the correct part numbers. For any other repair or maintenance problems not covered in this manual, inquire at B.F. Goodrich Deicing Systems, 1555 Corporate Woods Park, Uniontown, Ohio 44685.

11. Timer

The timer for controlling both the right and left systems is mounted in the nose of the aircraft. The unit is sealed and, if found inoperative, must be replaced. Timer field repairs are not authorized.

Testing

Field experience indicates that too often the timer is considered at fault when the true trouble lies elsewhere. Before removing a timer as defective, perform this test:

- (1) Disconnect wire harness at timer and with deicer switch ON, check voltage from Pin B of harness plug to ground. If system voltage is not present, the fault is not in the timer. If system voltage is present at Pin B, check ground circuit using ohmmeter from Pin G to ground. If no circuit is shown, the fault is in ground lead, not in timer. If ground connection is open, the timer step switch will not change position.
- (2) When power and ground circuits have been checked, connect a jumper wire from Pin B of harness to B contact of timer socket to power timer. Connect a jumper wire from Pin G of harness to G contact of timer socket to complete the power circuit. Now use voltmeter from ground to the timer socket and check that timer is cycling to deliver system voltage to C, D, E, and F contacts in that order. (The starting point is not important but sequence must be as given.) Each of these four contacts must deliver voltage for approximately 34 seconds, in turn, and there must be zero voltage on the three contacts not energized.
- (3) If the timer meets these requirements, it is not the cause of the trouble. If it fails to perform as specified above replace timer.

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DETECTION

Ice Detection Light

This light is used in conjunction with the pneumatic deicing system and will aid the pilot to detect any ice formation on the left wing leading edge during night flying operations.

The light is mounted in the left outboard edge of the left nacelle just above leading edge of the wing. It is a sealed beamed, 24 volt unit. The light is controlled from a push ON–push OFF type switch mounted on the deice switch grouping in the center of the instrument panel. The light is positioned in the nacelle to illuminate the leading edge of the wing when the switch is activated in the cockpit.

A. Servicing

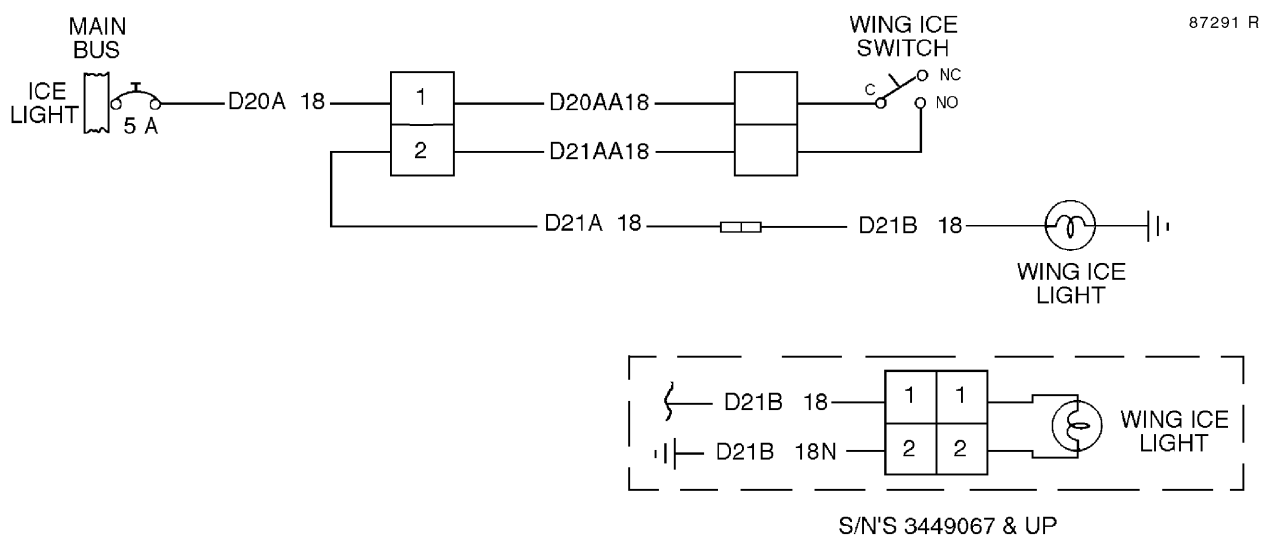
The only service required of this unit is the replacement of a burned out lamp.

B. Removal

- (1) Be sure the switch is in the off position.
- (2) Remove the top access panel from the left nacelle.
- (3) Within the nacelle, remove the screws the socket in the retainer.
- (4) Pull the socket aft and remove the lamp.

C. Installation

- (1) Position the new lamp in the receptacle of the socket, then secure the socket in the retainer with the screws.
- (2) Activate the switch in the cockpit to check the lamp operation.
- (3) Replace the nacelle access panel with the attachment hardware.



Ice Detection Light Schematic (Typical)
Figure 1

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**GRIDS 3L14 THRU 3L24
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AIRPLANE MAINTENANCE MANUAL

CARD 4 OF 7

PA-34-220T

Seneca IV

(SN's 3447001 THRU 3447029)

SENECA

(SN's 3449001 AND UP)

THE NEW PIPER AIRCRAFT, INC.

Published by
Technical Publications

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Manufacturers Association

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AEROFICHE REVISION STATUS

Revisions to Maintenance Manual (P/N 761-888) issued July 12, 1995, are as follows:

<u>Revision</u>	<u>Publication Date</u>	<u>Aerofiche Card Effectivity</u>
ORG950712	November 7, 1996	1, 2, 3, 4 and 5
PR980415	April 15, 1998	1, 2, 3, 4 and 5
PR981115	November 15, 1998	1, 2, 3, 4 and 5
PR020531	May 31, 2002	1
CR050819	August 19, 2005	1, 2, 3, 4, 5, 6 and 7
PR051107	November 7, 2005	1, 2, 4 and 5
PR060428*	April 28, 2006	1, 2, 3, 4, 5, 6 and 7

*** PARTIAL REVISION OF MAINTENANCE MANUAL 761-888**

Revisions appear in Aerofiche Cards 1, 2, 3, 4, 5, 6, and 7. Accordingly, discard your existing Aerofiche Cards and replace them with the cards dated April 28, 2006.

Consult the Customer Service Information Aerofiche (P/N 1753-755) for current revision dates for this manual.

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INTRODUCTION

LIST OF EFFECTIVE PAGES

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Intro-Table of Contents	1	Apr 28/06			
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INTRODUCTION

1. Instructions for Continued Airworthiness

WARNING: INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA) FOR ALL NON-PIPER APPROVED STC INSTALLATIONS ARE NOT INCLUDED IN THIS MANUAL. 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 ICA 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, THE PIPER PROVIDED ICA MAY NOT BE VALID FOR AIRPLANES SO MODIFIED.

The PIPER PA-34-220T Seneca IV / V Maintenance Manual constitutes the Instructions for Continued Airworthiness (ICA) as required by Federal Aviation Regulations (FAR) Part 23, Appendix G. Chapter 4 contains the Airworthiness Limitations section (4-00-00) and the Inspection Program is in Chapter 5 (5-20-00).

2. General

This publication is prepared in accordance with the General Aviation Manufacturers Association (GAMA) Specification No. 2, with respect to the arrangement and content of the System/Chapters within the designated Chapter/Section-numbering system.

WARNING: USE ONLY GENUINE PIPER AIRCRAFT PARTS OR PIPER AIRCRAFT APPROVED PARTS OBTAINED FROM PIPER APPROVED SOURCES, IN CONNECTION WITH THE MAINTENANCE AND REPAIR OF PIPER AIRPLANES.

This manual generally does not contain hardware callouts for installation. Hardware callouts are only indicated where a special application is required. To confirm the correct hardware used, refer to the PA-34-220T Parts Catalog, P/N 761-887, and FAR 43 for proper use.

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.

THE NEW PIPER AIRCRAFT, INC. expressly disclaims any responsibility for malfunctions, failures, damage or injury caused by use of non-PIPER approved parts.

NOTE: THE NEW PIPER AIRCRAFT, INC. expressly reserves the right to supersede, cancel and/or declare obsolete any part, part numbers, kits or publication that may be referenced in this manual without prior notice.

In any question concerning the care of your airplane, be sure to include the airplane serial number in any correspondence.

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3. Effectivity

This maintenance manual is effective for PA-34-220T Seneca IV airplanes, serial numbers 3447001 thru 3447029, and Seneca V airplanes, serial numbers 3449001 and up.

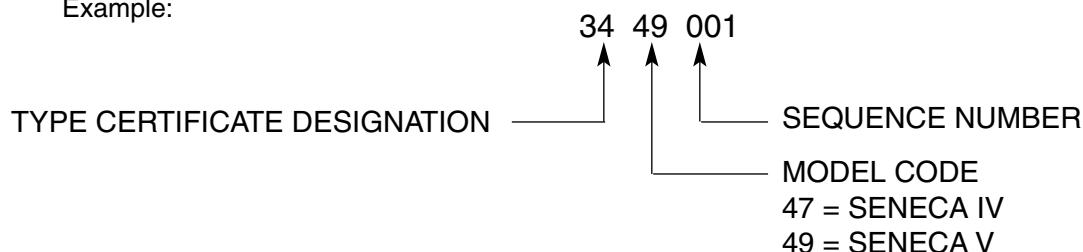
This encompasses the following model years:

NOTE: The following is provided as a general reference only.

<u>Model</u>	<u>Serial Numbers</u>	<u>Model Year</u>
Seneca IV	3447001 thru 3447012	1995
	3447013 thru 3447029	1996
Seneca V	3449001	Prototype
	3449002 thru 3449041	1997
	3449042 thru 3449096	1998
	3449097 thru 3449151	1999
	3449152 thru 3449195	2000
	3449196 thru 3449231	2001
	3449232,	2002
	3449237 thru 3449239, and	
	3449241 thru 3449268	
	3449269, 3449273, and	2003
	3449275 thru 3449300	
	3449301 thru 3449310	2004
	3449311 thru 3449322	2005
	3449323 and Up	2006

4. Serial Number Explanation

Example:



5. Assignment of Subject Material

This publication is divided into industry standard, three element, numeric subject groupings as follows:

- A. System/Chapter - The various groups are broken down into major systems such as Environmental Systems, Electrical Power, Landing Gear, etc. They are assigned a number, which becomes the first element of the standardized numbering system. Thus, the element "28" of the number 28-40-01 refers to the chapter "Fuel". Everything concerning the fuel system will be covered in this chapter.
- B. Sub-System/Section - The major systems/chapters of an airplane are broken down into subsystems. These sub-systems are identified by the second element of the standard numbering system. The element "40" of the number 28-40-01 concerns itself with the indicating section of the fuel system.

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- C. Unit/Subject - The individual units within a sub-system/section may be identified by the third element of the standard numbering system. The element "01" of the number 28-40-01 is a subject designator. This element is assigned at the option of the manufacturer and is normally zeroed out by PIPER.

Refer to paragraph 14, Chapter/Section Index Guide, for a complete breakdown and list. The material is arranged in ascending numerical sequence.

6. Pagination

The Chapter - Section (i.e. - 28-40-00) numbering system (explained above) forms the primary page numbering system for this manual. Within each Section, pages are numbered consecutively beginning with Page 1 (i.e. - 28-40-00, Page 1). Additionally, the aerofiche grid numbering system (explained below) is also used to indicate location within the manual.

7. Aerofiche Effectivity

- A. The General Aviation Manufacturers Association (GAMA) has developed specifications for microfiche reproduction of aircraft publications. The information compiled in this Aerofiche Maintenance Manual will be kept current by revisions distributed periodically. These revisions will supersede all previous revisions and will be complete Aerofiche card replacements and shall supersede Aerofiche cards of the same number in the set. The "Aerofiche Effectivity" page at the front of this manual lists the current revision for each card in this set.

- B. Conversion of Aerofiche alpha/numeric grid code numbers:

First number is the Aerofiche card number.

Letter is the horizontal row reference per card.

Second number is the vertical column reference per card.

Example: 2J16 = Aerofiche card number two, row J, column 16.

- C. To aid in locating information, the following is provided at the beginning of each aerofiche card:

- (1) A complete Introduction containing the Chapter/Section Index Guide for all fiche in this set.
(2) A complete subject Index for all fiche in this set.

8. Identifying Revised Material

A revision to a page is defined as any change to the printed matter that existed previously. Revisions, additions and deletions are identified by a vertical line (i.e. - change bar) along the left-hand margin of the page opposite only that portion of the printed matter that was changed.

A change bar in the left-hand margin opposite the footer (i.e. - chapter/section/subject, page number and date), indicates that the text was unchanged but the material was relocated to a different page.

Example.

NOTE: Change bars are not used in the title pages, list of effective pages, or index.

9. Indexing

An alphabetically arranged subject Index follows this introduction to assist the user in locating desired information. In addition, each System/Chapter begins with an individual Table of Contents.

10. List of Effective Pages

Each System/Chapter has a List of Effective Pages preceding the Table of Contents to identify the effective revision date for each page in that chapter.

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11. Warnings, Cautions and Notes

These adjuncts to the text are used to highlight or emphasize important points when necessary. **Warnings** call attention to use of materials, processes, methods, procedures or limits which must be followed precisely to avoid injury or death to persons. **Cautions** call attention to methods and procedures which must be followed to avoid damage to equipment. **Notes** call attention to methods which make the job easier. Warnings and Cautions shall be located directly above and Notes directly beneath the text and be in line with the paragraphs to which they apply.

12. Accident/Incident Reporting

To improve our Service and Reliability system and aid in our compliance with FAR 21.3, knowledge of all incidents and/or accidents must be reported to Piper immediately. To expedite and assist in reporting all incidents and accidents, Piper Form 420-01 has been created. See Service Letter 1041 for latest revision. This procedure is to be used by all Dealers, Service Centers and Repair Facilities.

13. Supplementary Publications

The following publications/sources provide servicing, overhaul and parts information for the PA-34-220T Seneca IV / V airplanes and their various components. Use them to supplement this manual.

A. Piper Publications: (by Part Number)	Seneca IV	Seneca V
(1) Parts Catalog:	761-887	761-887
(2) Periodic Inspection Report:	230-1061	767-012
(3) Progressive Inspection Manual (50 Hour):	761-753	767-006

B. Vendor Publications:

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY.

(1) AIR CONDITIONING COMPRESSOR:

Vendor:	Sanden International (USA), Inc. 601 South Sanden Blvd. Wylie, TX 75098-4999 http://www.sanden.com	PH: - (972) 442-8400
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(2) AUTOFLIGHT:

Vendor(s):	Honeywell One Technology Center 23500 W. 105th St., M/D #45 Olathe, Kansas 66061-1950 http://www.bendixking.com/	(or)	S-TEC Corporation One S-TEC Way Mineral Wells, Tx 76067 PH: - (940) 325-9406 www.s-tec.com
Flight Control:	Bendix/King		
System Flight Line Installation Manual:	KFC 150 P/N 006-0287-00		

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(3) BATTERY:

Vendor:	GILL Batteries A Division of Teledyne Continental Motors http://www.gillbatteries.com	PH: - (800) 456-0070
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(4) BRAKES AND WHEELS:

Vendor:	Parker Hannifin Corp. Aircraft Wheel and Brake Division 1160 Center Road Avon, Ohio 44011 http://www.parker.com/cleveland/Universe/book.pdf	PH: - (800) 272-5464
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(5) ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS):

Vendor:	Meggitt Avionics, Inc. 10 Ammon Drive Manchester, NH 03103-7406 http://www.meggittavi.com/	PH: - (603) 669-0940 FAX: - (603) 669-0931
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Vendor:	Avidyne Corporation 55 Old Bedford Road Lincoln, MA 01773 http://www.avidyne.com/index.htm	PH - (800) 284-3963
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Instructions for Continued Airworthiness

Primary Flight Display and Magnetometer/OAT:	Document No. AVPFD-174
Multifunction Display:	Document No. AVMFD-167
Data Acquisition Unit:	Document No. AVSIU-011

(6) EMERGENCY LOCATOR TRANSMITTER:

Vendor:	Artex Aircraft Supplies 14405 Keil Road NE Aurora, Oregon 97002 http://www.artex.net/	PH: - (800) 547-8901
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(7) ENGINE:

Vendor:	Teledyne Continental Motors Attn: Aircraft Products Division Mobile, Alabama 36601	PH: - (800) 718-3411 FAX: - (251) 432-7352
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[SENECA IV](#)

Overhaul Manual =	CONTINENTAL - Form No. X-30030A
Parts Catalog =	CONTINENTAL - Form No. X-30031A
Operators Handbook =	CONTINENTAL - Form No. X-30553

[SENECA V](#)

Maintenance Manual =	CONTINENTAL - Form No. X-30645A
Overhaul Manual =	CONTINENTAL - Form No. X-30596A

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(8) FIRE EXTINGUISHER (PORTABLE):

Vendor:	H3R Inc. 43 Magnolia Ave # 4 San Francisco, California 94123-2911 http://www.h3r.com/index.htm	PH: - (800) 249-4289
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(9) FUEL CELLS:

Vendor:	Engineered Fabrics Corporation 669 Goodyear Street Rockmart, Georgia 30153-0548 http://www.kfefc.com/index.htm	PH: - (770) 684-7855 FAX: - (770) 684-7438
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(10) FUEL PUMP:

Vendor:	Weldon Pumps P.O. Box 46579 640 Golden Oak Parkway Oakwood Village, Ohio 44146 http://www.weldonpumps.com/index.html	PH: - (440) 232-2282 FAX: - (440) 232-0606
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(11) GEAR LOCKING ACTUATORS, HYDRAULIC PUMP, AND ALL HYDRAULIC COMPONENTS:

Vendor:	Parker Hannifin Corporation 6035 Parkland Boulevard Cleveland, OH 44124-4141 USA email: c-parker@parker.com	PH: - (800) C-PARKER (800) 272-7537 FAX: - (440) 266-7400
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(12) KEVLAR:

Vendor:	KEVLAR Special Products E.I. DuPont De Nemours & Co. Inc. Textile Fibers Department Centre Road Building Wilmington, Delaware 19898
---------	---

A Guide to Cutting and Machining Kevlar Aramid

(13) LIGHTS - NAVIGATION, STROBE, AND MAP LIGHTS:

Vendor:	Whelen Engineering Co. Inc. Route 145, Winthrop Rd. Chester, Connecticut 06412 http://www.whelen.com/	PH: - (860) 526-9504 FAX: - (860) 526-2009
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(14) MAGNETOS:

Vendor: TCM Aircraft Products PH: - (800) 718-3411
P. O. Box 90 FAX: - (251) 432-7352
Mobile, AL 36601
<http://www.tcmlink.com/>

Installation, Operation and Maintenance Teledyne Continental Motors (TCM)
Service Support Manual, P/N x42002

Instructions = S-20 / S-200 Series High Tension Magnets

or,

Vendor: Slick Aircraft Products PH: - (904) 739-4000
Unison Industries FAX: - (904) 739-4006
Attn: Subscription Service
7575 Baymeadows Way
Jacksonville, FL 32256
http://www.unisonindustries.com/news/service_documents.html

Installation, Operation and Maintenance F1100 MASTER SERVICE MANUAL,
4300/6300 SERIES MAGNETO MAINTENANCE AND
Instructions: OVERHAUL MANUAL - L-1363

(15) NAVIGATION, COMMUNICATIONS, AND GPS (NAV/COM/GPS):

Vendor: Garmin International PH: - (913) 397-8200
1200 East 151ST Street
Olathe, KS 66062
<http://www.garmin.com>

(16) OXYGEN SYSTEM:

Vendor: Scott Aviation PH: - (716) 683-5100
2225 Erie Street
Lancaster, New York 14086
<http://www.scottaviation.com/>

(17) PROPELLER:

Vendor: Hartzell Propeller Inc. PH: - (937) 778-4379
One Propeller Place FAX: - (937) 778-4321
Piqua, OH 45356-2634
<http://www.hartzellprop.com/index2.htm>

Overhaul Instructions: Manual No. 117

or,

Vendor: McCauley Accessory Division
3535 McCauley Drive
P.O. Drawer 5053
Vandalia, Ohio 45377-5053

McCAULEY C500 SERIES SERVICE MANUAL - P/N 810915

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(18) STANDBY ATTITUDE INDICATOR:

Vendor Address: Mid-Continent Instruments Co., Inc. PH - (316) 630-0101
9400 E. 34 TH Street N. FAX - (316) 630-0723
Wichita, KS 67226
<http://www.mcico.com/index.html>

Installation Manual and
Operating Instructions: Manual No. 9015762

(19) STARTER:

Electro Systems, Inc.
(see "Voltage Regulator," below)

(20) VACUUM PUMP:

Vendor: Aero Accessories, Inc. PH: - (800) 822-3200
1240 Springwood Avenue
Gibsonville, NC 27249
<http://www.aeroaccessories.com/index.html>

(21) VACUUM REGULATOR:

Vendor: Parker Hannifin Corp. PH: - (800) 382-8422
Airborne Division
711 Taylor Street
Elyria, Ohio 44035
<http://www.parker.com/cleveland/Universe/book.pdf>

(22) VOLTAGE REGULATOR:

Vendor: Electro Systems, Inc. PH: - (888) 461-6077
Airport Complex
P. O. Box 273
Fort Deposit, Alabama 36032
<http://www.kellyaerospace.com/index.htm/>

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14. Chapter/Section Index Guide

NOTE: The following GAMA Specification No. 2 standard chapters are not included in this Maintenance Manual: 23, 36, 38, 49, 53, 54, 60, 72, 75, and 83. These chapters are omitted because the subject system is either: not installed in these airplanes; adequately covered in vendor or other manuals; or, for ease of use, has been combined with another chapter.

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		00 General	
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7	LIFTING AND SHORING		1F5
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		20 Taxiing	
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		80 Detection	
31	INDICATING / RECORDING SYSTEMS		4C1
		50 Central Warning Systems	
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INDICATING / RECORDING SYSTEMS

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CENTRAL WARNING SYSTEMS

Annunciator Panel (See 91-31-50 for electrical schematics.)

The annunciator panel provides a visual warning of possible malfunctions, including failure alert and precautionary warnings.

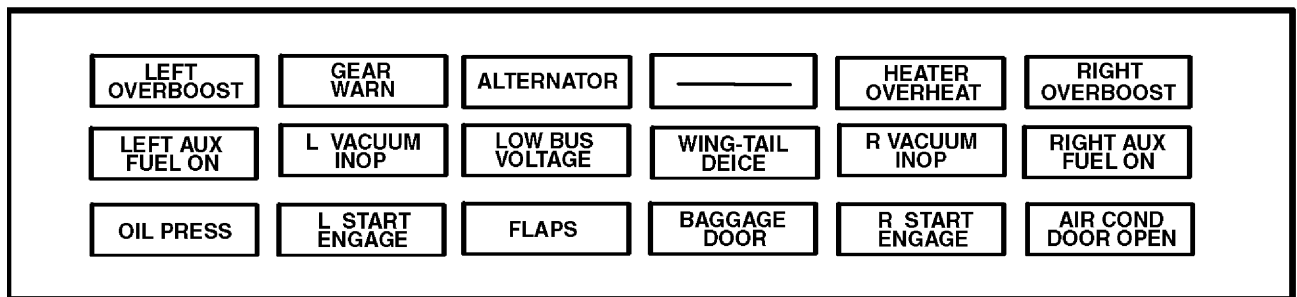
On [Seneca IV](#) models, an annunciator panel light cluster is mounted in the top of the instrument panel just above the pilot's altimeter. The PUSH TO TEST switch is located on the right side of the annunciator panel. A DAY - NIGHT toggle switch, located on the left side of the panel, operates the dimmer control box, enabling the pilot to dim the annunciator lights during night flight. The dimmer control box is located under the floor board on the right side of the fuselage near the flap torque tube brackets.

On [Seneca V](#) models, the annunciator system consists of two separate clusters mounted in the top center of the instrument panel. The PUSH TO TEST switch is located between the two clusters. The DAY - NIGHT toggle switch is also located between the two clusters, and operates the dimmer control box enabling the pilot to dim the annunciator lights during night flight. The dimmer control box is located under the floor board on the right side of the fuselage near the flap torque tube brackets.

Power is supplied to the annunciator panel through a five amp circuit breaker located on the main electrical bus circuit breaker panel.

A. Troubleshooting

See Chart 1.

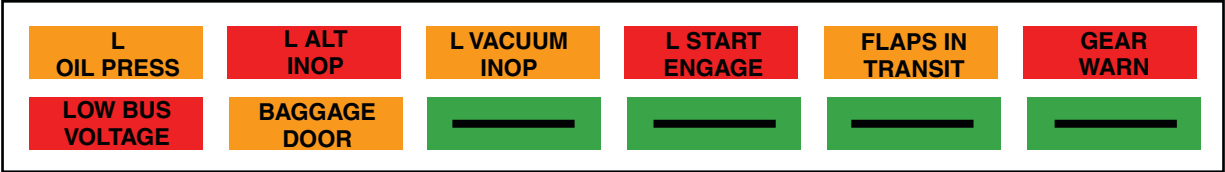


Annunciator Panel
Figure 1 (Sheet 1 of 2)

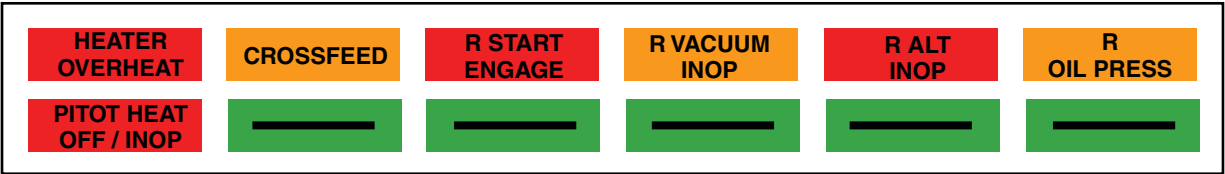
[Effectivity](#)
[Seneca IV](#)

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89452 AC



LEFT



RIGHT

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**CHART 1
ANNUNCIATOR PANEL TROUBLESHOOTING**

Trouble	Cause	Remedy
"Ground Applied" warning lights fail to operate.	ANUN Circuit breaker disengaged (OUT).	Reset (push IN) breaker on circuit breaker panel.
All lights fail to operate.	No current.	Check all wire segments and connections at connectors on annunciator light assembly.
All the warning lights fail to extinguish after engine is running.	Test switch shorted.	Check terminals and wires for short. Replace switch if required.
Oil or gyro air warning light fails to extinguish.	Sensor activates at too high a setting.	Replace.
	Sensor terminals bridged.	Remove material between terminals.
	Defective sensor.	Replace.
Oil or gyro air warning	Lamp burned out. light fails to operate.	Replace.
	Sensor activates at too low a setting.	Replace.
	Defective Sensor	Replace.
Overboost warning light fails to extinguish. (Seneca IV only)	Manifold pressure gauge sensors set too low.	Check sensor activation. Sensors should activate at 39.5 to 40 inches of mercury.
Overboost warning light fails to activate. (Seneca IV only)	Lamp burned out.	Replace.
	Defective sensor switches.	Replace.
Alternator warning light fails to operate.	Lamp burned out.	Replace.
Alternator warning light fails to extinguish.	ALTNR FIELD Circuit breaker disengaged (OUT)	Reset (push IN) breaker on circuit breaker panel.
	Defective alternator output circuit.	Check and repair.
Test switch fails to activate warning lights.	Bad switch or connections.	Check wires and replace switch if necessary.

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**CHART 2
SENECA IV ANNUNCIATOR PANEL FUNCTION DESCRIPTIONS**

Nomenclature	Color	Cause of Illumination
L or R OVERBOOST	AMBER	Illuminates when engines manifold pressure exceeds 39.5 to 40 inches of mercury.
GEAR WARN	RED	Illuminates when gear is in neither the full up nor the full down position.
ALTERNATOR	RED	Illuminates when either alternator fails or is selected "OFF."
L or R AUX FUEL ON	AMBER	Illuminates when "HI" auxiliary fuel pump is on.
L or R VACUUM INOP	AMBER	Illuminates when either vacuum switch is activated. The vacuum switches are attached to regulators, set to close at $4 \pm .25$ In Hg. vacuum.
OIL PRESSURE	AMBER	Illuminates when engine's oil pressure has decreased to 15 psi. or less.
FLAPS	AMBER	Illuminates when flap motor is in operation and flaps are in transit.
BAGGAGE DOOR	AMBER	Illuminates when nose baggage door is open, sensing latch pin position.
L or R START ENGAGE	RED	Illuminates when either left or right engine starter is activated.
AIR COND DOOR OPEN	AMBER	Illuminates when A/C control switch is "ON" and fan switch is in an operating position, indicating proper air conditioner condenser door activation.
LOW BUS VOLTAGE	RED	Illuminates when main bus voltage drops to battery voltage.
WING-TAIL DEICE	GREEN	Illuminates when wing or tail deice boots inflate to 8.0 psi.
HEATER OVERHEAT	RED	Illuminates when combustion heater overheats.
GEAR WARN	RED	<p>Illuminates when gear is in neither the full up nor the full down position.</p> <p>Illuminates when gear selector switch is in up position while airplane is on ground with weight on wheels.</p> <p>Illuminates when power is reduced below approx. 14 inches of manifold pressure with landing gear up.</p>

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**CHART 3
SENECA V ANNUNCIATOR PANEL FUNCTION DESCRIPTIONS**

Nomenclature	Color	Cause of Illumination
GEAR WARN	RED	<p>Illuminates when gear is in neither the full up nor the full down position.</p> <p>Illuminates when gear selector switch is in up position while airplane is on ground with weight on wheels.</p> <p>Illuminates when power is reduced below approx. 14 inches of manifold pressure with landing gear up.</p>
L or R ALT INOP	RED	Illuminates when either alternator fails or is selected "OFF."
L or R VACUUM INOP	AMBER	Illuminates when either vacuum switch is activated. The vacuum switches are attached to regulators, set to close at $4 \pm .25$ In Hg. vacuum.
LOW BUS VOLTAGE	RED	Illuminates when the electrical system drops from bus voltage to battery voltage. Fuse overload protection is provided to voltage monitor.
L or R OIL PRESSURE	AMBER	Illuminates when engine's oil pressure has decreased to 15 psi. or less.
FLAPS IN TRANSIT	AMBER	Illuminates when flap motor is in operation and flaps are in transit.
BAGGAGE DOOR	AMBER	Illuminates when nose baggage door is open, sensing latch pin position.
L or R START ENGAGE	RED	Illuminates when either left or right engine starter is activated.
AIR COND DOOR OPEN	AMBER	Illuminates when A/C control switch is "ON" and fan switch is in an operating position, indicating proper air conditioner condenser door activation.
HEATER OVERHEAT	RED	Illuminates when combustion heater overheats.
CROSSFEED	AMBER	Illuminates when either fuel selector is in X-feed position.
PITOT HEAT OFF/INOP	AMBER	Illuminates when pitot heat fails or is selected off.

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B. Light Tests

(1) Seneca IV

The annunciator lights may be tested as follows:

NOTE: The sequence of the test may be varied at the option of the mechanic.

- (a) Press the annunciator test button to ensure that the annunciators illuminate.
- (b) Start the right engine and observe that the right vacuum inop light extinguishes as the engine starts. Operate the engine at approximately 700-1000 rpm. Note that oil pressure, air pressure or vacuum, and alternator output are normal.
- (c) Start the left engine and observe that the left vacuum inop light extinguishes as the engine starts. See that the oil pressure, air pressure or vacuum, and alternator output is normal.
- (d) Idle one engine at a time while observing it's oil pressure gauge. The oil annunciator light should illuminate at 15 psi.

NOTE: The mixture control can be moved to cut-off, then to rich in order to get lower than normal idle speeds.

- (e) Run both engines at approximately 900 rpm. Sequentially place the alternator switches in the off position. Check that either or both alternator switches in the off position cause the alt annunciator to illuminate.
- (f) After ensuring that the propellers and the propeller blast will do no damage, run up the engines one at a time to check that each overboost annunciator comes on at $39.5 \pm .5$ inches of mercury manifold pressure.
- (g) If the optional air conditioning system is installed, check that the air cond door open light illuminates when the air conditioner is on, the fan switch is in the high or low position, and the air conditioning door is open.
- (h) Shut down the right engine and check that the right vacuum inop light illuminates just as the engine slows to approximately 300 rpm. Check that the other annunciator lights are on.
- (i) Repeat step (8) for the left engine, ensuring that the left vacuum inop light illuminates.
- (j) Locate the heater terminal strip on the upper forward side of the heater assembly. Attach a test jumper wire from terminal 1 (the most forward terminal) to terminal 4. Turn the aircraft's battery switch on, momentarily place the heater switch to the heat position and observe that the heater overheat annunciator illuminates. Return the battery and heater switches to the off position and remove the test jumper wire.
- (k) Refer to 32-30-00, for the functional test for the gear unsafe light.

(2) Seneca V

(PIR-PPS60057-4, Rev. A)

The annunciator lights may be tested as follows:

NOTE: The sequence of the test may be varied at the option of the mechanic.

- (a) With the battery switch on, press the annunciator test button to ensure that all annunciators illuminate. Locate the Day/Night switch and activate the switch to both Day and Night positions with the annunciator with the annunciator test button pressed. Check that all annunciators illuminate bright for Day and dim for Night.
- (b) Verify that the baggage door lamp illuminates when the baggage door is unlatched and extinguishes when the baggage door is latched.

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- (c) With fuel pumps OFF, move the left engine fuel control lever to the X feed position and check that the crossfeed annunciator illuminates. Move the left engine fuel control lever to the ON position. The crossfeed annunciator will extinguish. Move the right engine fuel control lever to the X feed position and check that the crossfeed annunciator illuminates. Move the right engine fuel control lever to the ON position. The crossfeed annunciator will extinguish.
- (d) Make sure flaps are cleared and select a new position of the flap handle. The flaps annunciator light will illuminate. When the flaps stop moving, the annunciator will extinguish.
- (e) Start the left engine. Check that L START ENGAGE annunciator is illuminated when start switch is depressed, and extinguishes when start switch is released. Observe the L OIL PRESSURE annunciator. The annunciator light should extinguish when oil pressure is above 15 psi and illuminate when oil pressure is 15 psi or less.
- (f) Repeat step (e) checks with the right engine.
- (g) With both engines running at approximately 900 rpm, turn the left alternator switch off. The L ALT INOP annunciator will illuminate. Turn the left alternator on, turn the right alternator off. The R ALT INOP annunciator will illuminate. Check that low bus voltage annunciator extinguishes when alternators are on.
- (h) If the optional air conditioning system is installed, check that the A/C door open light illuminates when the air conditioner is on, the fan switch is in the HIGH or LOW position, and the air conditioning door is open. Check that the lamp extinguishes when the door is fully closed and the air conditioning switch is in the OFF position.
- (i) Momentarily turn pitot heat on. Pitot heat OFF/INOP annunciator will extinguish. Check that pitot heat OFF/INOP annunciator is illuminated when pitot heat switch is off.
- (j) Shut down the right engine and check that the R VAC INOP annunciator illuminates as the engine slows to approximately 300 rpm. Repeat for left engine. (Vacuum annunciator switches are set at $4 \pm .25$ inches of mercury.)
- (k) Locate the heater terminal strip on the upper forward side of the heater assembly. Attach a test jumper wire from terminal 1 (the most forward terminal) to terminal 4. Turn the aircraft's battery switch ON, momentarily place the heater switch to the heat position and observe that the heater overheat annunciator illuminates. Return the battery and heater switches to the off position and remove the test jumper wire.
- (l) Refer to 32-30-00 for the functional test for the gear unsafe light.

C. Rigging Fuel CROSSFEED Annunciator ([Seneca V only](#))

- (1) Set the fuel control levers to "OFF." Move the fuel control levers aft to a point where any further movement aft would result in the levers falling into the crossfeed detent position.
- (2) Adjust the fuel selector valve control cable to obtain .000 to .020 inch clearance between the actuator arm on the fuel selector valve and crossfeed "ON" stop on the fuel selector valve.
- (3) Adjust the annunciator micro-switches to obtain illumination of the crossfeed annunciator light with the valve and levers in the above position.
- (4) Re-inspect and adjust, as required, that the fuel control levers in the fuel "OFF" and fuel "ON" positions are still coordinated with the fuel selector valve.

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LANDING GEAR

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Squat Switches Adjustment		3	4F23
Gear Warning Switches		5	4G1
Throttle Micro-switch		5	4G1
Manifold Pressure Switches		6	4G2

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GENERAL

This chapter contains instructions for overhauling, inspecting and adjusting the various components of the PA-34-220T landing gear and brake system, with the exception of the hydraulic pump and lines - see Chapter 29 for those components. Also included are adjustments for the electrical limit, safety and warning switches.

1. Description

The PA-34-220T airplane is equipped with a retractable tricycle air-oil strut type landing gear, hydraulically raised or extended by an electrically powered reversible pump. A selector switch in the instrument panel to the left of the control quadrant is used to select gear UP or DOWN position.

When the gear is down and locked, gear positions are indicated by three green lights, located to the left of the selector switch. A red light, incorporated in the annunciator panel at the top of the instrument panel, illuminates when the gear is unsafe. Activation of all three down lock switches will shut the hydraulic pump off. The green lights, along with the red gear unsafe annunciator light will be dimmed by placing the DAY – NIGHT toggle switch, located to left of the annunciator lights, in the NIGHT position.

As manifold pressure drops below approximately 14 inches of mercury, and if the landing gear has not been extended, a throttle switch located in the quadrant will actuate a warning horn indicating to the pilot the landing gear is still up. The warning horn will continue to operate until the landing gear is down and locked, at which time three green lights on the instrument panel will energize.

The landing gear is extended and retracted by means of the gear selector knob. In the event of hydraulic or electrical failure, the gear can be extended by pulling the free-fall valve, thus permitting the gear to fall free. Once the gear are down a spring maintains pressure on the truss assembly in the locked position until released by hydraulic pressure.

While the airplane is sitting on the ground, should the gear selector knob be placed in the UP position with the BATT switch in the ON position, a safety switch (squat switch) located on the left main gear should prevent the hydraulic pump from actuating. When the plane leaves the ground, the safety switch will actuate as the oleo extends, permitting the hydraulic pump to raise the landing gear. In the event the airplane is placed on jacks and raised to the extent that the oleo extends in excess of 8 inches, the safety switch will actuate the hydraulic pump, thus raising the landing gear if the landing gear selector knob is placed in the UP position and the BATT switch is selected ON.

The nose gear is steerable by the use of the rudder pedals. As the gear retracts, the steering linkage becomes separated from the gear so that rudder pedal action with gear retracted is not impeded by the nose gear operation. A gear centering spring mechanism is incorporated in the nose gear steering mechanism.

The two main wheels are equipped with self-adjusting single disc hydraulic brake assemblies which are actuated by individual toe brake cylinders mounted on the rudder pedals. The cylinders are supplied hydraulic fluid from a reservoir located on the forward side of the cabin main bulkhead. The parking brake is engaged by depressing the toe brake pedals and pulling out the parking brake knob located on the lower left instrument panel. The parking brake is released by depressing the toe brake pedals and pushing in on the parking brake knob.

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**CHART 1 (Sheet 1 of 4)
TROUBLESHOOTING LANDING GEAR**

Trouble	Cause	Remedy
Green gear down lights fail to go out with gear in transit or retracted.	Gear down limit switch failed.	Replace switch.
One or more gear down lights out when gear is down and locked.	Burned out bulb.	Replace bulb.
	Improperly adjusted gear down light switch.	Adjust switch(es) as necessary.
	Open wire in gear light circuit.	Check annunciator light wiring.
Gear down lights do not dim when DAY/NIGHT annunciator switch is in NIGHT position.	Faulty DAY/NIGHT switch	Replace switch.
Gear warning light and horn fail to operate when throttle is near closed and landing gear is retracted.	Landing gear control circuit breaker open.	Reset circuit breaker and determine cause for open circuit breaker.
	Micro switch at throttle out of adjustment.	Adjust micro switch.
	Micro switch failed.	Replace switch.
	Warning horn and light circuit wire broken.	Check wiring.
Red gear unsafe light remains on with gear retracted and throttles advanced.	One or more of the landing gears not fully retracted. One or more gear up switches out of adjustment.	Check gears for full retraction. Adjust up switch(es) as necessary.
Landing gear doors fail to close completely.	Landing Gear not retracting completely.	Check adjustment of landing gear.
	Door retraction rods out of adjustment.	Check adjustment door retraction rods.

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**CHART 1 (Sheet 2 of 4)
TROUBLESHOOTING LANDING GEAR**

Trouble	Cause	Remedy
Nose landing gear fails to fully lock down during emergency gear extension (i.e. - free fall).	Binding or distortion	Check that the trunnion, drag link, and all parts of the down lock linkage move freely on their pivots and that no binding or distortion is present at the attachment points. Lubricate on condition.
	Damaged down lock link.	Inspect down lock link. Ensure that the end fittings are not bent or cracked and that the spring retaining pin has not elongated, distorted, or crushed the upper edge of the .191 dia hole in the link sleeve. Check the attachment holes for distortion or enlargement. Replace on condition.
	Retraction link retention spring worn out.	Inspect the retraction link retention spring for end wear and general condition. Using a suitable tension scale, check that the spring tension is: 20.5 lbs (± 2.0 lbs) when the spring is extended from its free length of 2.61 to 3.44 inches. 36.0 lbs (± 3.6 lbs) when the spring is extended from its free length of 2.61 to 4.31 inches. Replace on condition.
	Hydraulic actuator damaged.	Inspect the hydraulic actuator. Check that the rod is straight, free of distortion and that the bearings in the end fittings are not seized. Check that the piston rod can be moved smoothly in and out of the cylinder with hand pressure, and that no binding occurs. Replace on condition.
<p>NOTE: Reinstall good components, replace bad components, and rig per 32-20-00, Nose Landing Gear, Installation and Rigging.</p>		

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**CHART 1 (Sheet 3 of 4)
TROUBLESHOOTING LANDING GEAR**

Trouble	Cause	Remedy
Nose landing gear shimmy during fast taxi, takeoff, or landing.	Internal wear in centering springs.	Replace shimmy dampener.
	Center springs or bracket loose at mounting.	Replace necessary parts.
	Tire out of balance.	Check balance and replace tire if necessary.
	Worn or loose wheel bearings.	Replace and/or adjust wheel bearings.
	Worn torque link bolts and/or bushings.	Replace bolts and/or bushings.
Excessive or uneven wear on nose tire.	Incorrect operating pressure.	Inflate tire to correct pressure.
	Wear resulting from shimmy.	Inflate tire to correct pressure.
Nose gear fails to steer properly.	Oleo cylinder binding in strut housing.	Lubricate strut housing (See Lubrication Chart.) Chart and/or strut housing bushings damaged.
	One brake dragging.	Determine cause and correct.
	Steering arm roller sheared at top of strut.	Replace defective roller.
	Steering bellcrank loose on attachment plate.	Readjust and tighten.
	Steering bellcrank bearing and/or bolt worn.	Replace bearing and/or bolt.
	Centering springs galling or binding.	Replace.
Nose gear fails to straighten when landing gear retracts.	Steering arm roller sheared at top of strut.	Replace defective roller.
	Incorrect rigging of nose gear steering.	Check nose gear steering adjustment.
	Centering guide roller sheared.	Replace roller.
	Damaged guide.	Replace guide.

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**CHART 1 (Sheet 4 of 4)
TROUBLESHOOTING LANDING GEAR**

Trouble	Cause	Remedy
Main landing gear shimmies during fast taxi, takeoff, or landing.	Tire out of balance.	Check balance and replace tire if necessary.
	Worn or loose wheel bearings.	Replace and/or adjust wheel bearings.
	Worn torque link bolts and/or bushings.	Replace bolts and/or bushings.
Excessive or uneven wear on main tires.	Incorrect operating pressure.	Inflate tire to correct pressure.
	Wheel out of alignment (toe in or out).	Check wheel alignment.
	Lower side brace link out of adjustment, allowing gear to slant in or out.	Check gear adjustment.
Strut bottoms on normal landing or taxiing on rough ground.	Insufficient air and/or fluid in strut.	Service strut with air and/or fluid.
	Defective internal parts in strut.	Replace defective parts.

2. Troubleshooting

CAUTION: WHEN NECESSARY TO RAISE OR LOWER EITHER THE NOSE GEAR OR THE MAIN GEAR MANUALLY, THE FREE-FALL VALVE KNOB SHOULD BE PULLED FULL OUT TO PREVENT A BUILDUP OF UNNECESSARY PRESSURE ON THE ACTUATING CYLINDERS AND CONNECTING HYDRAULIC LINES. FAILURE TO COMPLY WITH THESE INSTRUCTIONS COULD RESULT IN THE BUILDUP OF SUFFICIENT PRESSURE TO UNLOCK THE DOWN LOCK MECHANISM ALLOWING THE GEAR TO COLLAPSE WHEN THE WING JACKS ARE REMOVED.

Mechanical and electrical troubles peculiar to the landing gear system are listed in Chart 1. When troubleshooting, first eliminate hydraulic malfunctions as listed in 29-00-00, Chart 1. Then proceed to switch malfunctions, and last to the mechanical operation of the gear itself, both of which are included in this section.

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MAIN GEAR AND DOORS

1. Main Gear Oleo

A. Disassembly (See Figure 1.)

The main gear oleo assembly may be removed and disassembled from the oleo housing with the gear removed for or installed in the airplane. The following instructions assume the gear is still installed.

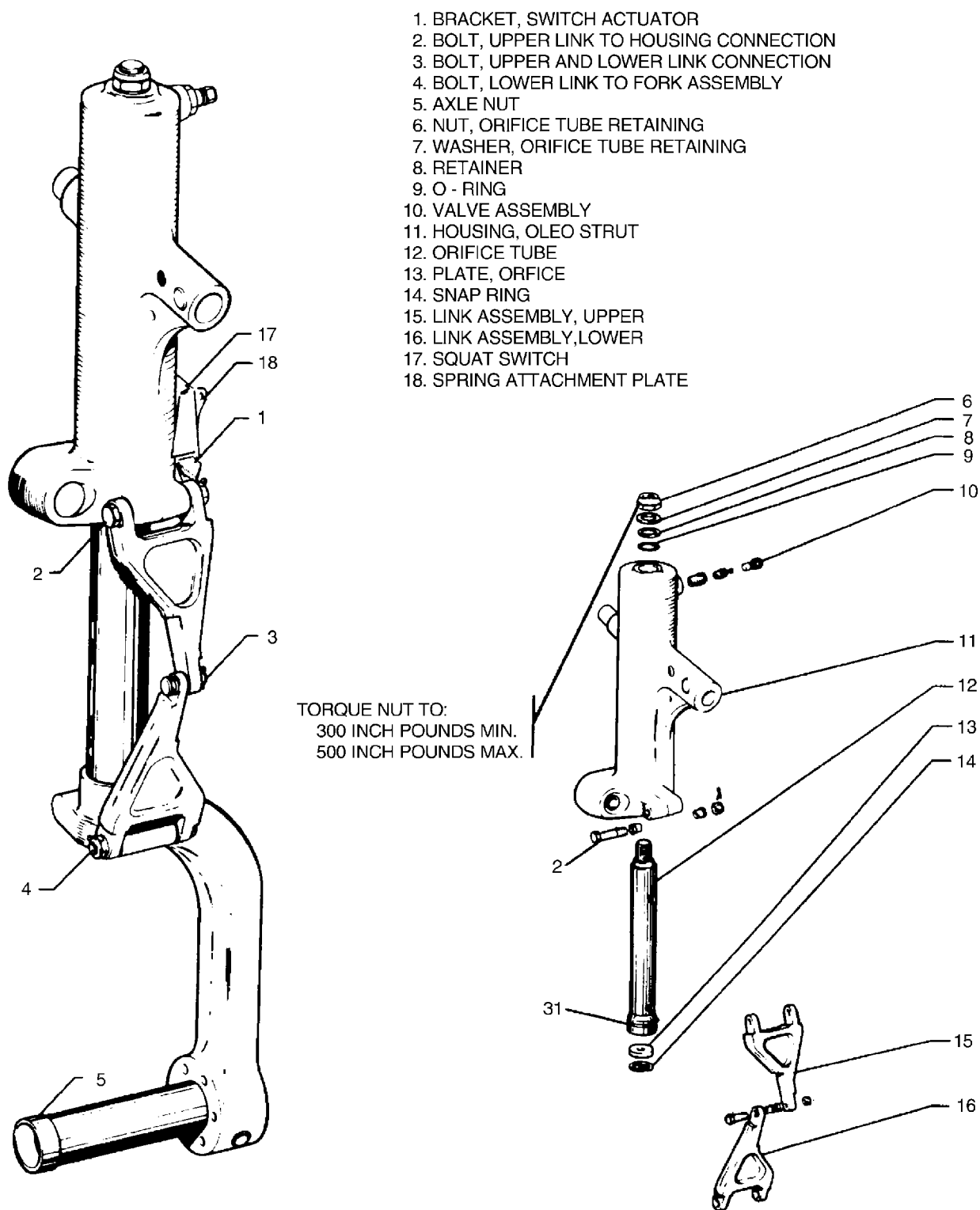
- (1) See 7-10-00 and jack up the airplane.
- (2) Place a drip pan or other container under the affected gear to catch spillage.
- (3) Depress air valve core pin until strut pressure has diminished. After removing the plug, insert a thin hose and siphon as much hydraulic fluid from the strut as possible.
- (4) Disconnect the hydraulic brake line from the brake assembly and the clamps from the fork and torque link.
- (5) Support the strut assembly and remove the upper-to-lower torque link connecting bolt. Note the number and thickness of spacer washers between the two links and make sure to replace them at reinstallation.
- (6) Compress the piston tube slightly, to take off any load on the bearing assembly and make sure it is held in its position.
- (7) In the bottom of the housing, release the snap ring from its slot in the housing.
- (8) Carefully pull the piston tube and bearing assembly from the bottom of the housing.
- (9) The bearing and other related assemblies can be removed from the strut position tube by removing the retaining snap ring and sliding the assemblies off the tube.
- (10) The orifice tube is secured to the strut housing by a locknut where the tube extends through the top of the housing. Remove the locknut and washer.
- (11) Draw the orifice tube with the teflon retainer ring out of the strut housing.
- (12) As necessary, the orifice plate can be removed from the bottom of the orifice tube by releasing the snap ring holding the plate in position.

NOTE: It is not recommended that the piston tube (strut) and fork be separated due to shrink fit tolerance built in when manufactured.

B. Cleaning, Inspection, and Repair

- (1) Clean all parts with a suitable dry type cleaning solvent.
- (2) Inspect landing gear oleo assembly components for the following:
 - (a) Bearings and bushings for excess wear, corrosion, scratches and overall damage.
 - (b) Retaining pins for wear and damage.
 - (c) Lock rings for cracks, burrs, etc.
 - (d) Cylinder and orifice tube for corrosion, scratches, nicks and excess wear.
 - (e) Orifice plate for hole restriction.
 - (f) Fork tube for corrosion, scratches, nicks, dents and misalignment.
 - (g) Air valve general condition.

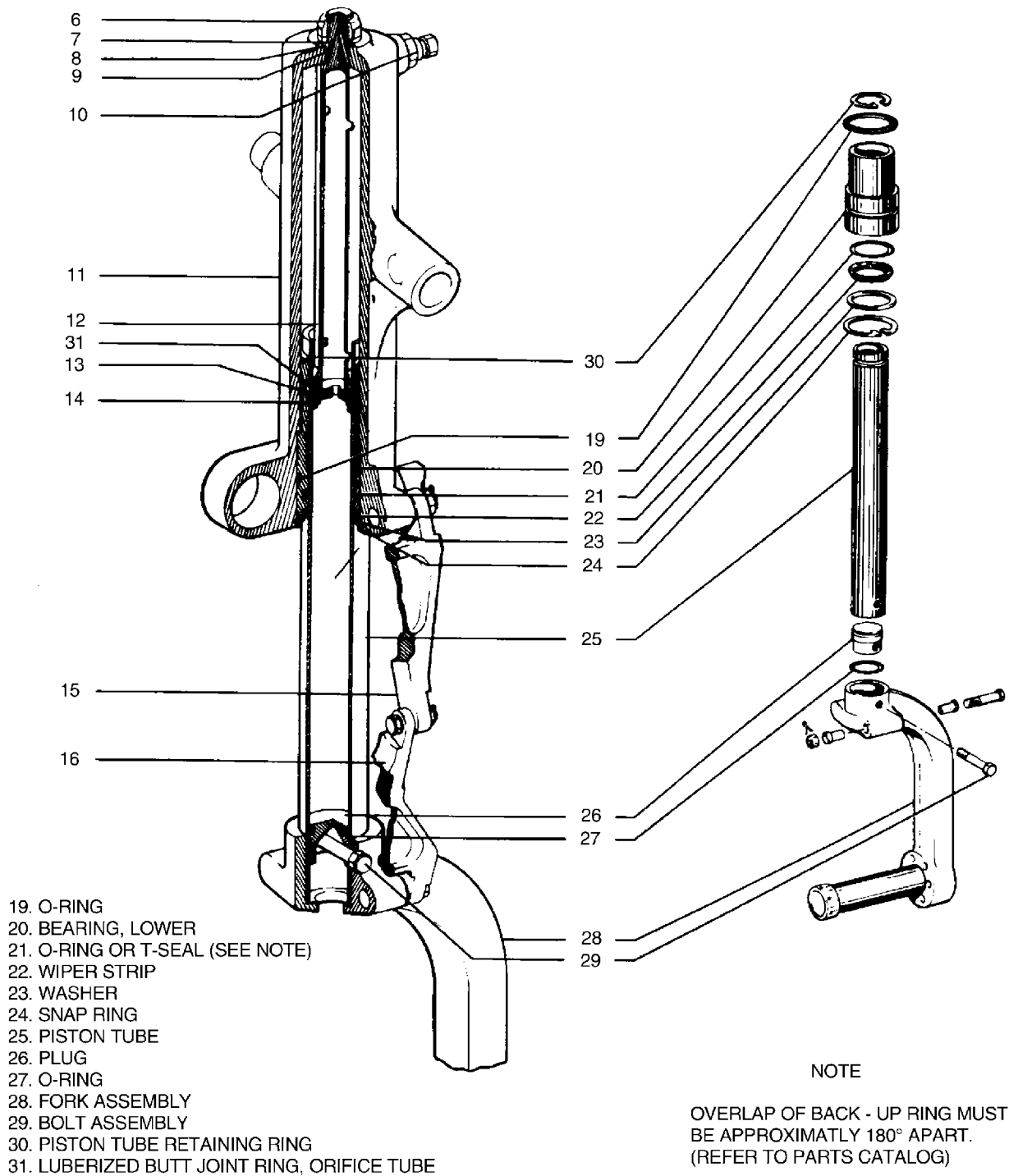
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Main Gear Oleo Strut Assembly
Figure 1 (Sheet 1 of 2)

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Main Gear Oleo Strut Assembly
Figure 1 (Sheet 2 of 2)

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- (3) Repair of the oleo is limited to smoothing out minor scratches, nicks and dents and replacement of parts.

NOTE: Check all impregnated bearing surfaces, such as Garlock DU bearings (06U08 in the lower truss link assembly), for wear. Natural wear will show more and more bronze. Replace any bearing when at least 70% of the bearing surface is bronze and the bronze starts to smear. Do not apply grease. Use oil for aircraft kept in a highly corrosive environment. When oil is used it must be followed by scheduled lubrication.

C. Assembly (See Figure 1.)

- (1) Make sure all parts are cleaned and inspected as described in the last paragraph.
- (2) If the orifice tube has been removed and maintained, proceed as follows:
 - (a) Make sure the old butt joint ring is replaced and its annular seat is clean and undamaged.
 - (b) Ensure there is no damage to the orifice plate seat in the orifice tube.
 - (c) Install orifice plate in the end of the orifice tube and secure with its snap ring.
- (3) The orifice tube can be reinstalled in the housing as follows:
 - (a) Insert tube into strut housing and being careful so as not to damage the threads and mating surfaces push the stud end through the top of the housing.
 - (b) Install a new O-ring (see Parts Catalog) and reinstall the teflon retaining ring in the top of the housing. Make sure they are pushed one at a time as far into the recess as they will go.
 - (c) Install the washer over the stud and install a new locknut with a torque of 300 to 500 inch-pounds.
 - (d) Torque the orifice tube locknut 300 to 500 inch-pounds.
- (4) The gear strut and its related assemblies are installed as follows:
 - (a) The bearing and its retaining hardware must first be placed in order over the piston tube. Place the bearing snap ring, retaining washer, and wiper strip in that order over the piston tube.
 - (b) Make sure the bearing annular internal and external O-ring seats are undamaged and clean. Replace the bearing if necessary.
 - (c) Install the new internal O-ring or T-seal and external O-rings. (See Parts Catalog.)
 - (d) Wet the piston tube surface with MIL-H-5606 hydraulic fluid.
 - (e) Wet the interior of the bearing with hydraulic fluid and slide the assembly over the piston tube with the wiper strip end towards the fork. Use care not to damage the internal O-ring.
 - (f) Install the retainer ring on the end of the piston tube.
 - (g) Align the piston tube opening with the end of the housing and the orifice tube. Carefully guide the piston tube strut halfway into the housing.
 - (h) Slide the bearing up the piston tube into the housing, and with it held in position, install the wiper strip, washer-retainer and snap ring.
- (5) Ensure the bushings are properly installed and with the washers and brake hose clamp used as before, reinstall the connecting bolt. Tighten the bolt just enough to remove side play.
- (6) If the left gear has been maintained and the squat switch assembly has been disassembled, proceed as follows:
 - (a) Install the switch actuator bracket on the upper link-to housing bolt.
 - (b) Install the washers and the nut on the aforementioned bolt.
 - (c) Install the squat switch bracket and spring attachment plate on the strut housing if removed.

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- (7) Reconnect the brake hose clamps and the fitting to the actuating cylinder. Bleed as described in section on "Brakes."
- (8) Lubricate gear assembly as described in 12-20-00.
- (9) Service oleo strut with fluid and air as described in 12-10-00.
- (10) Ensure the gear is down and locked and check alignment of gear as described in this chapter and check for proper gear retraction and proper activation of squat switch.
- (11) Remove aircraft from jacks.

2. Main Landing Gear

A. Removal (See Figure 2.)

- (1) Jack up the aircraft per instructions in 7-10-00.
- (2) If the side brace truss assembly is to be completely removed from the aircraft, proceed as follows:
 - (a) With the gear extended disconnect the gear down lock spring.
 - (b) Disconnect the actuator shaft rod end from the truss assembly's upper link.
 - (c) Take note of the bushings and washers on each side of the lower truss link's end bearing where it connects to the strut housing.
 - (d) Disconnect the lower truss link from the strut housing.
 - (e) Disconnect the upper truss link fork from the truss support stud bearing.
 - (f) Remove the assembly and maintain as required.
- (3) The oleo strut assembly can be removed as follows:
 - (a) Disconnect the brake line at the fitting in the gear well.
 - (b) Disconnect the gear door actuating rod from the strut housing.
 - (c) Remove the access plate located under the wing, aft of the landing gear.
 - (d) Ensure the lower truss link is disconnected and clear of the gear housing.
 - (e) Have the gear supported in a manner that as the supports are disconnected, the gear will not cant and cause unnecessary loads on the opposite support and structure.
 - (f) Remove the bolts connecting the forward gear housing support to the forward spar.
 - (g) The bearing support tube in the aft gear housing support can be removed as follows:
 - 1 Reaching through the access opening under the wing and the hole in the spar, remove the bolt securing the tube in its housing.
 - 2 Obtain a length of .040 safety wire and hook the end of it. Insert the hooked end of the safety wire through the bolt hole in the tube and, with the hook holding the tube, pull the tube from the support fitting.
- (4) The aft support fitting can be removed by reaching through the access hole to hold the nuts and removing the bolts from the wheel well.
- (5) Either of the oleo strut support bearings can be removed by removing one of the snap rings and pushing the bearing from its housing.

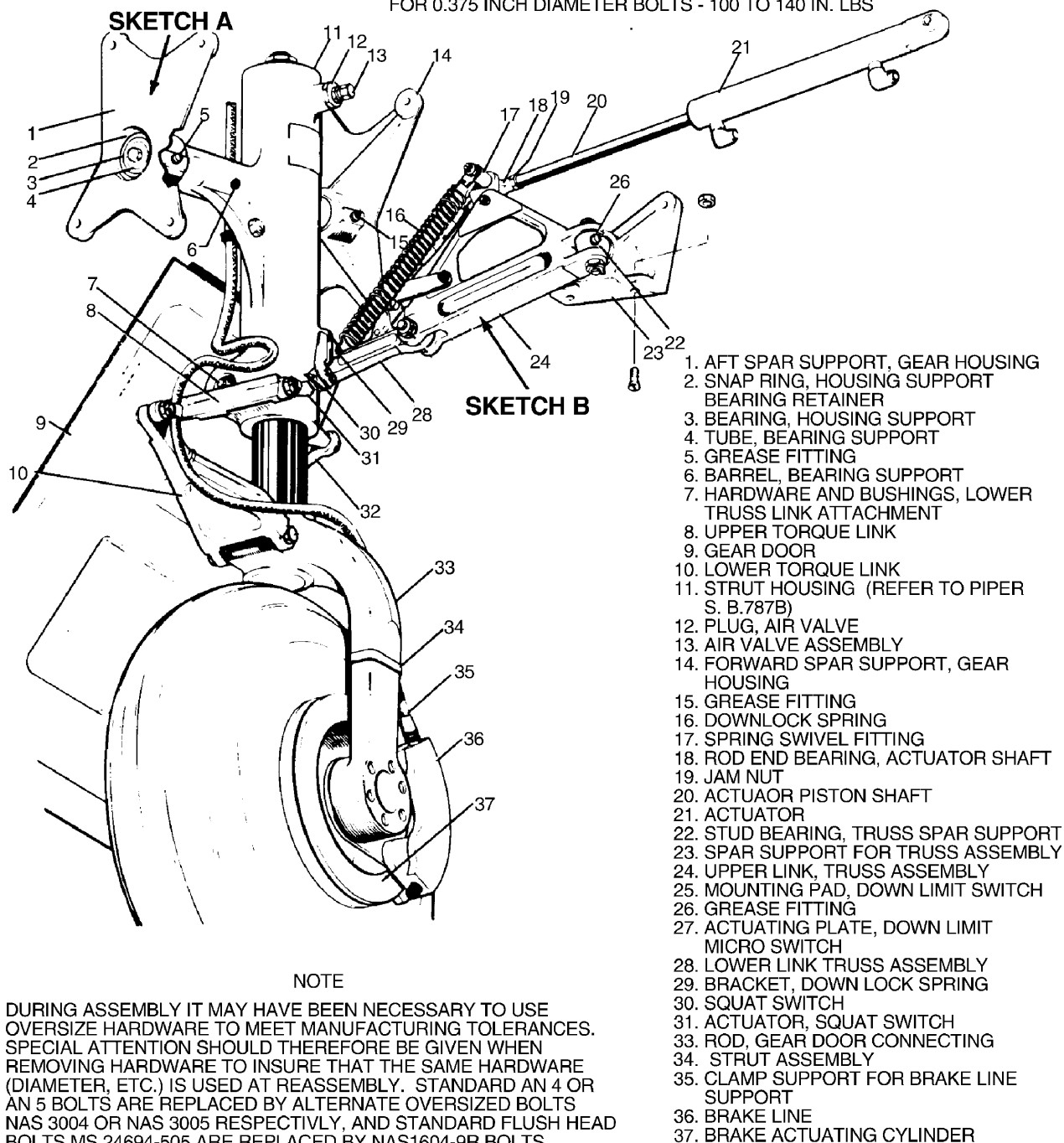
B. Cleaning, Inspection, and Repair

- (1) Clean all parts with a suitable dry type cleaning solvent.
- (2) Inspect the gear components for the following unfavorable conditions:
 - (a) Bolts, bearing and bushings for excess wear, corrosion and damage.
 - (b) Gear housing, truss links, torque links and attachment plates for cracks, bends or misalignment.

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MAX. TORQUE OF SUPPORT HARDWARE
 FOR 0.25 INCH DIAMETER BOLTS - 50 TO 70 IN. LBS.
 FOR 0.31 INCH DIAMETER BOLTS - 70 TO 90 IN. LBS.
 FOR 0.375 INCH DIAMETER BOLTS - 100 TO 140 IN. LBS



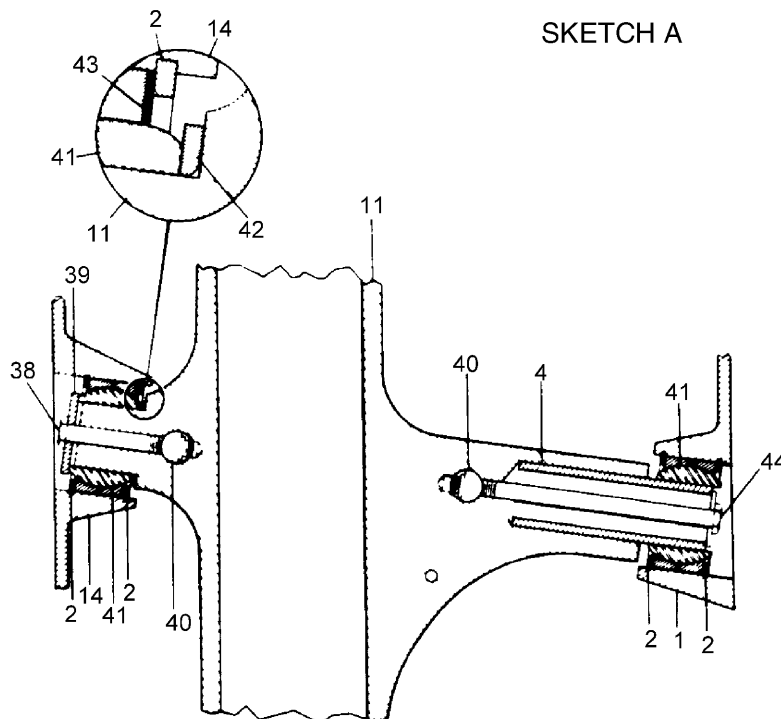
Main Gear Installation
 Figure 2 (Sheet 1 of 2)

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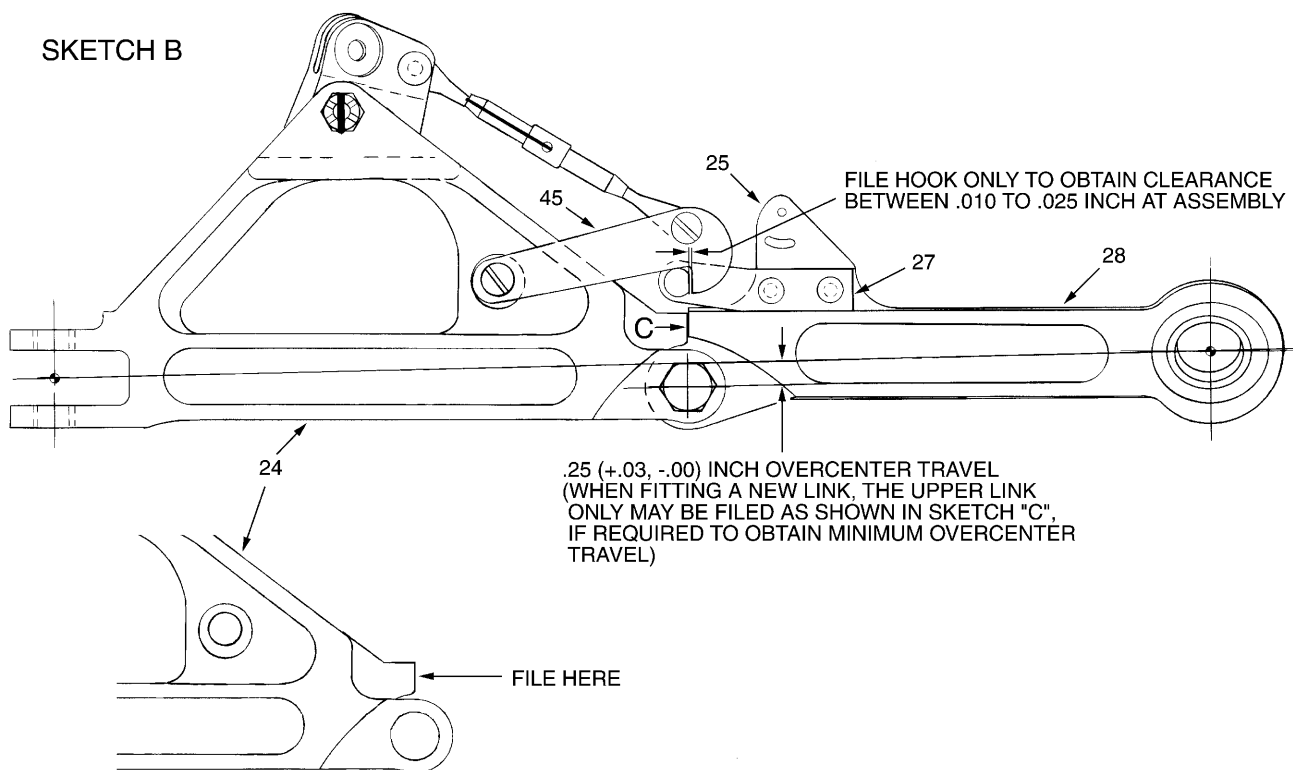
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SKETCH A

- 37. BRAKE DISC
- 38. BOLT, AN4-17A
- TORQUE 40 TO 50 IN. LBS.
- 39. WASHER, BACKUP
- 40. BARREL, NUT
- 41. BEARING, SUPPORT
- 42. WASHER, BACKUP
- 43. SHIM, WASHER
- 44. BOLT, AN4-40A
- TORQUE 50 TO 70 IN. LBS.
- 45. HOOK, DOWNLOCK



SKETCH B



SKETCH C

Main Gear Installation
Figure 2 (Sheet 2 of 2)

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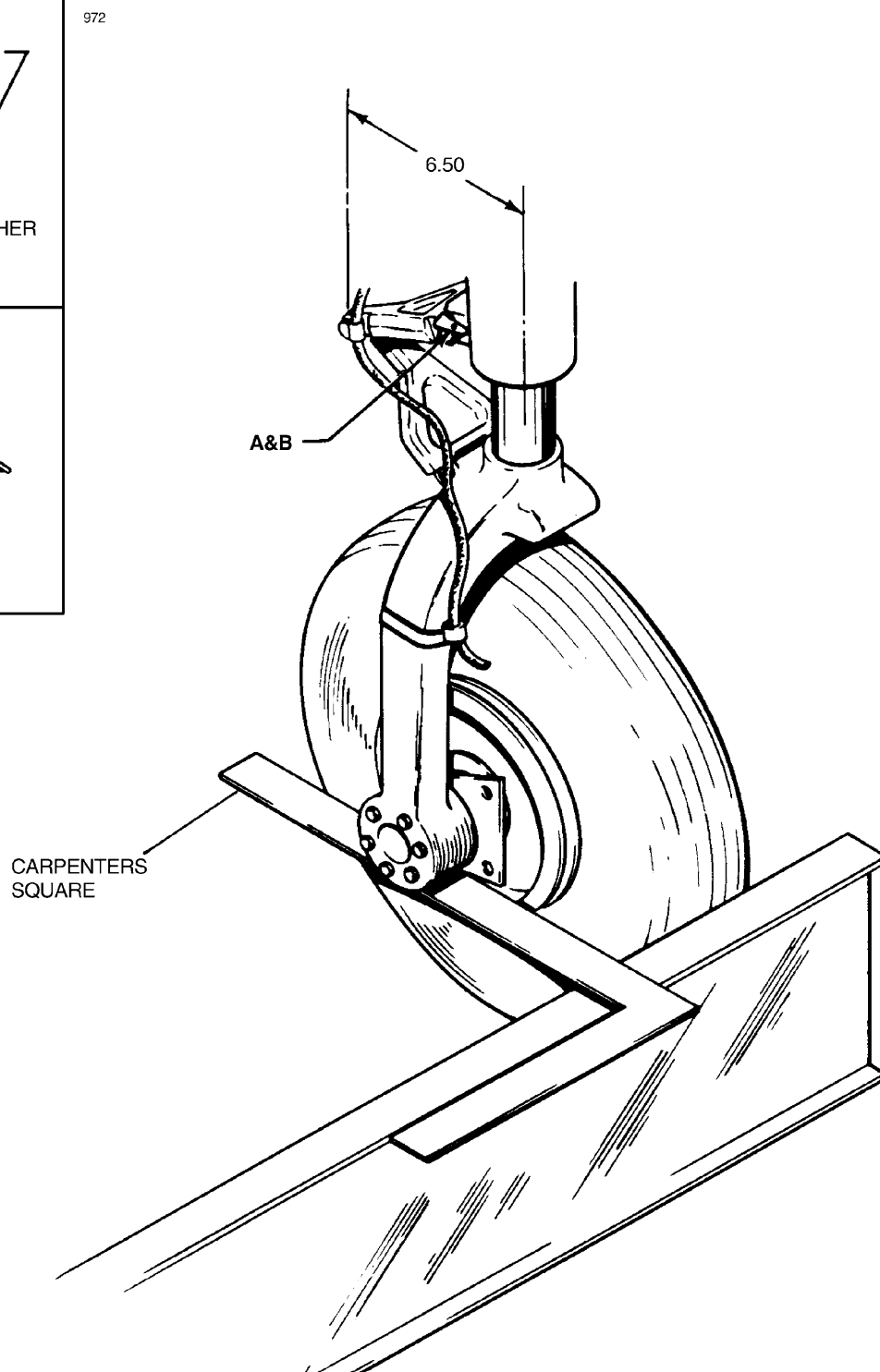
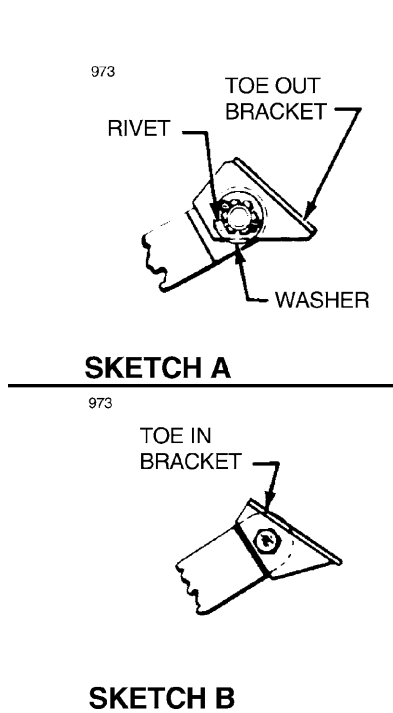
- (3) Inspect the gear down lock spring for the following:
 - (a) Excessive wear or corrosion, especially around the hooked ends of the spring. A spring should be rejected if wear or corrosion exceeds one-quarter the diameter of the spring. Clean away all corrosion and repaint.
 - (b) Check the spring for load tensions below minimum allowable tolerance. The minimum tension of the spring is 48 pounds pull at 7.9 inches. Measurement is taken from the inner side of each hook.
- (4) Check the general condition of each limit switch and its actuator and wiring for fraying, poor connections or conditions that may lead to failures.
- (5) Check side brace truss assembly over center travel by attaching the upper and lower links, setting them on a surface table and ascertaining that when the stop surfaces of the two links touch, linkage is .25/.28 of an inch over center. Should the distance exceed the required over center travel and bolt and bushings are tight, replace one or both links.
- (6) Repair of the landing gear is limited to reconditioning of parts such as replacing components, bearings and bushings, smoothing out minor nicks and scratches and repainting areas where paint has chipped or peeled. Existing components should also exhibit limited free play when installed otherwise the bearings or bushings should be replaced.

C. Installation (See Figure 2.)

NOTE: Before and/or during assembly, lubricate bearings, bushings, and friction surfaces with the appropriate lubricants as described in 12-20-00.

- (1) If either of the gear support bearings have been removed and need not be replaced, make sure they are clean. Grease and install using the appropriate snap rings to secure them.
- (2) Check the bearings in both supports for side play. Add shim washers (P/N 62833-44) as necessary. See Sketch A, Figure 2.
- (3) Referring to Figure 2, install the gear in the wing as follows:
 - (a) Place a new spacer washer on the short "forward" arm of the strut housing, ensuring the chamfered edge is toward the housing.
 - (b) Check that the barrel nut is properly positioned in the short arm of the housing and install the "forward" support fitting.
 - (c) Place the correct backup washer on the AN4-17A bolt and install the retaining bolt in the arm with a torque of 40 to 50 inch-pounds. Grease the assembly from the fitting on the support.
 - (d) Position the aft support fitting at its attachment point in the wheel well and install the nuts and washers by reaching through the access opening under the wing.
 - (e) Holding the bearing support tube for the aft support, reach through the access opening under the wing. Insert the tube through its support fitting and the hole in the spar, making sure it does not extend so far through the support that the gear cannot be aligned.
 - (f) Position the gear in the well of the wing and support the gear in its aligned position.
 - (g) With the "forward" support fitting appropriately aligned on the main spar, install the bolts and washers.
 - (h) Through the access hole in the bottom of the wing, push the bearing support tube the rest of the way through the aft support fitting into the gear housing support arm.
 - (i) Check to ensure the barrel nut is properly installed in the long (aft) arm of the housing and slide the specific backup washer (P/N 67502-0) over the retaining bolt (AN4-40A).
 - (j) Reaching through the access hole under the wing, install the retaining bolt and backup washer with a torque of 50 to 70 inch-pounds.

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Aligning Main Gear
Figure 3

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- (4) Reconnect the brake line in the gear well.
- (5) The gear truss assembly may be installed as follows:

NOTE: If the reason for gear removal was due to wing replacement, it may be necessary to remove the upper truss link support from the old wing to install on the new wing. Should this be the case, the support should be partially installed to provide a guide to back drill one .250 and one .312 hole in the spar cap if not previously done at the factor. The outboard hole is .312 diameter and not countersunk. A bump is added to gear door to clear bolt head. Inboard hole is .250 countersunk. Countersink the hole in the exterior surface of the spar cap 100° x .500. The .250 screw head must be flush with the spar cap to allow the gear door to properly close.

- (a) With the upper truss link support installed on the spar, ensure the attachment bolts are properly torqued. Check Figure 2 for torque values.
 - (b) If necessary, assemble the upper and lower truss links and check the through center travel as described in the previous subject paragraph.
 - (c) Install the truss assembly to the gear and support fitting. Torque the nut at the housing 600 ± 25 inch-pounds.
- (6) Connect the actuator rod end to the fitting in the upper truss link, making sure to properly install the spring swivel attachment.
 - (7) Install down lock spring and check adjustment of landing gear.
 - (8) Check wheel alignment per instructions in this chapter.
 - (9) Ensure the landing gear is lubricated per 12-20-00.
 - (10) Install access plates, reconnect gear door and lower airplane off jacks.

D. Alignment (See Figure 3.)

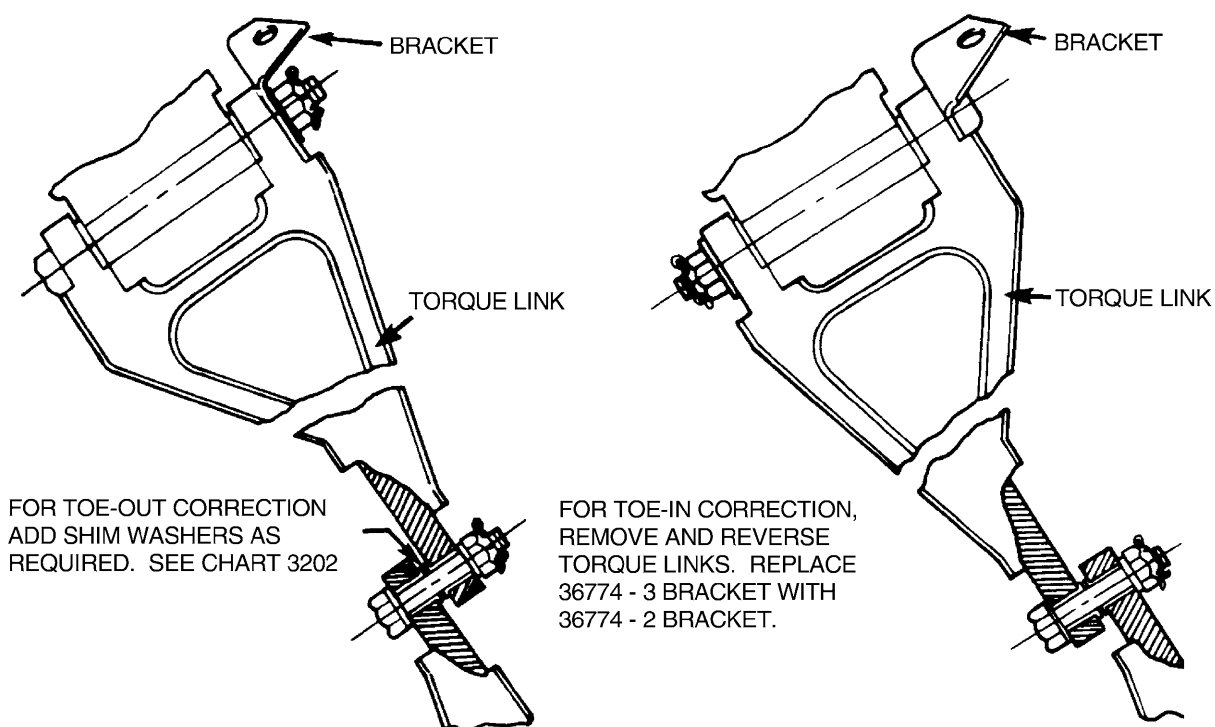
- (1) Place a straightedge no less than twelve feet long across the front of both main landing gear wheels. But the straightedge against the tire at the hub level of the landing gear wheels. Jack the airplane up just high enough to obtain a six and one-half inch dimension between the centerline of the strut piston and the centerline of the center pivot bolt of the gear torque links. Devise a support to hold the straightedge in this position.
- (2) Set a square against the straightedge and check to see if its outstanding leg bears on the front and rear side of the brake disc. (It may be necessary to remove the brake assembly to have clear access to the disc.) If it touches both forward and rear flange, the landing gear is correctly aligned. The toe-in for the main landing gear wheels should be 0 ± 1/2 degrees.

NOTE: Use a carpenter's square for checking main landing gear wheel alignment.

- (3) If the square contacts the rear side of the disc, leaving a gap between it and the front flange, the wheel is toed-out. If a gap appears at the rear flange, the wheel is toed-in.
- (4) To rectify the toe-in and toe-out condition, remove the bolt connecting the upper and lower torque links and remove or add spacer washers to move the wheel in the desired position. See Chart 2.
- (5) Should a condition exist that all spacer washers have been removed and it is still necessary to move the wheel further in or out, then it will be necessary to turn the torque link assembly over. (See Figure 4.) This will put the link connecting point on the opposite side allowing the use of spacers to go in the same direction.
- (6) Recheck wheel alignment. If the alignment is correct, safety the castellated nut with cotter pin.

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Toe-In/Toe-Out Adjustment
Figure 4

**CHART 2
TOE-IN AND TOE-OUT CORRECTION CHART**

TOE-IN TOE-OUT	SHIM WASHERS	WASHERS UNDER HEAD	WASHER UNDER NUT	AN 174 BOLT
0°		AN960-416	AN960-416 (3)	-14
0° 33"	AN960-416	AN960-416	AN960-416 (2)	-14
0° 48"	AN960-416L AN960-416	AN960-416	AN960-416	-14
1° 04"	AN960-416 (2)	AN960-416	AN960-416	-14
1° 19"	AN960-416L AN960-416 (2)	AN960-416L	AN960-416	-14
1° 35"	AN960-416 (3)	AN960-416	AN960-416 (2)	-15
2° 05" (Max. Allow.)	AN960-416 (4)	AN960-416	AN960-416	-15
AN960-416L Washers 0.31 Thick		AN960-416 Washers .062 Thick		

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- (7) If a new link on the top left main gear has to be installed or it had to be reversed during the alignment check, it will be necessary to check the gear safety switch (squat switch) bracket for engagement and locking in place. If link has to be reversed, then the bolt also has to be reversed and microswitch bracket P/N 36774-3 will be replaced by microswitch bracket 36774-2.
- (8) Check adjustment of landing gear safety switch (squat switch).

3. Main Gear Doors

A. Removal

- (1) With the landing gear extended, disconnect the door retraction rod from the door by removing nut, washers and bolt.
- (2) Remove the door from the wing panel by bending the door hinge pin straight and from the other end pulling out the pin.
- (3) The door retraction rod may be removed from the gear housing by cutting the safety wire and removing the attachment bolt and washer. Note the number of washers between rod end bearing and housing.

B. Cleaning, Inspection, and Repair

- (1) Clean the door and retraction rod with a suitable cleaning solvent.
- (2) Inspect the door for cracks or damage, loose or damaged hinges and brackets.
- (3) Inspect the door retraction rod and end bearing for damage and corrosion.
- (4) Repairs to a door may be replacement of hinge, repair of fiberglass and painting.

C. Installation

- (1) Install the door by positioning the hinge halves of the door and wing and inserting the hinge pin. It is recommended a new pin be used. Bend the end of the pin to secure in place.
- (2) Install the door retraction rod by positioning the rod at its attachment points at the door and strut housing. At the door attachment, thin washers are inserted at each side of the rod end bearing and it is secured with bolt, washer and nut. At the strut housing, place washers between rod end bearing and housing not to exceed .12 of an inch to obtain proper clearance and secure with bolt. Safety bolt with MS20995C41 wire.
- (3) Check that the all around clearance between the door and the wing skin is not less than .032 of an inch.

D. Adjustment

- (1) Place the airplane on jacks as described in 7-10-00.
- (2) Determine that the main gear is properly adjusted for gear up as explained earlier in this section.
- (3) Adjust retraction rod end at door so that door will pull up tightly when the gear is full up. Over-tightening may result in door buckling; however, if the door is too loose, it will gap in flight.
- (4) Check all rod ends for adequate thread engagement, for safety and tightness of jam nuts.
- (5) Remove airplane from jacks.

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NOSE GEAR AND DOORS

1. Nose Gear Oleo Assembly

A. Removal from Trunnion (See Figure 1.)

The nose gear oleo assembly can be removed and/or disassembled from the trunnion assembly with it mounted in or removed from the aircraft.

- (1) Jack up the airplane per 7-10-00.
- (2) Depress the air valve core pin to release the air pressure in the strut and remove the valve body from the plug.
- (3) The oleo housing can be evacuated by removing the valve, inserting a thin hose through the plug into the housing, and siphoning out the hydraulic fluid.
- (4) To remove the oleo assembly from the trunnion assembly, cut the safety wire and remove the four bolts at the top of the housing securing the tiller to the top of the oleo housing.
- (5) Remove the hardware connecting the centering spring rod end from the trunnion arm.
- (6) Pull the oleo assembly from the trunnion assembly.

B. Disassembly (See Figure 1.)

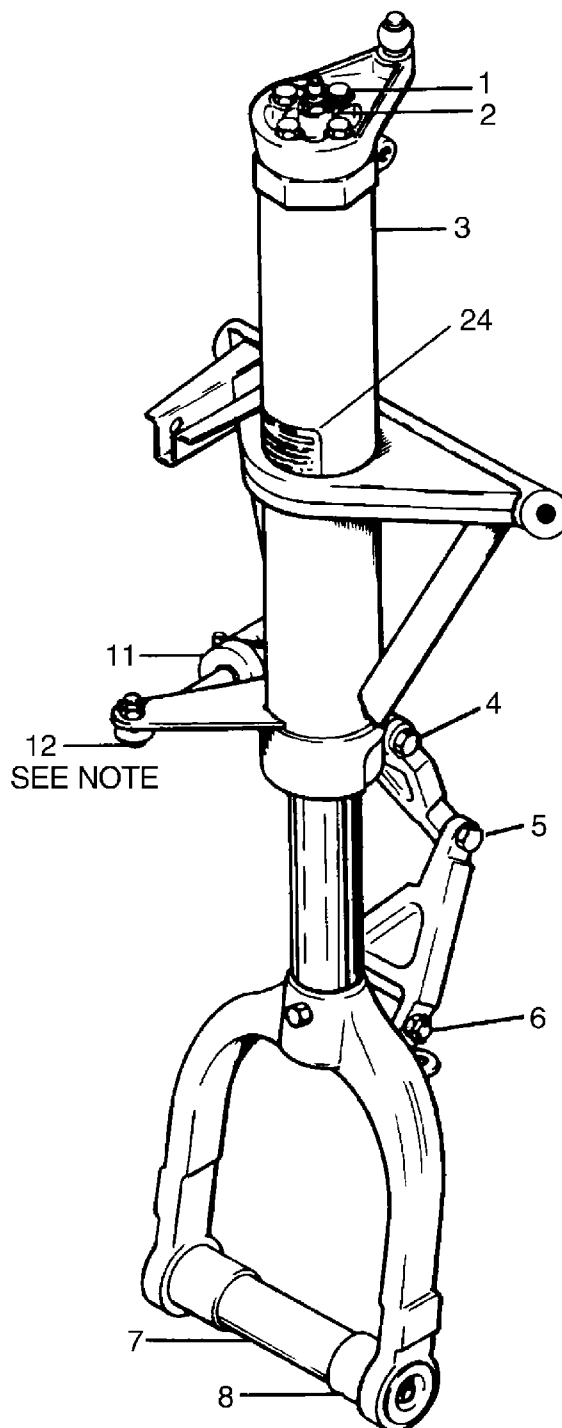
- (1) If not already accomplished, release the air pressure and remove the hydraulic fluid as described in steps (2) and (3) of the previous paragraph.
- (2) Remove the upper-to-lower torque link connecting bolt and separate the assemblies.
NOTE: Unless absolutely necessary, the fork should not be disassembled from the piston tube.
- (3) Remove the snap ring at the "bottom" of the oleo cylinder and carefully pull the strut to pull the bearing from the oleo cylinder.
- (4) Remove the snap ring at the "top" of the strut piston and slide off the bearing assembly.
- (5) Replace all O-rings and the wiper ring.

C. Cleaning, Inspection, and Repair

- (1) Clean all parts using a suitable dry type cleaning solvent.
- (2) Inspect components of the landing gear as follows:
 - (a) Bearings and bushings for excessive wear, corrosion, scratches and overall condition.
 - (b) Retaining pins for wear.
 - (c) Lock rings for cracks, nicks, burrs and overall condition.
 - (d) Cylinder and piston strut for excessive wear, corrosion, scratches and nicks.
 - (e) Orifice hole for obstruction.
 - (f) Fork for misalignment, cracks or other damage.
 - (g) Air valve for general condition.
- (3) Repair of the oleo is limited to smoothing out minor scratches, nicks and dents, and replacement of parts.

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1. CAP BOLT & WASHERS
2. SAFETY WIRE
3. TRUNNION ASSEMBLY
4. BOLT, BEARING, WASHER & NUT
5. BOLT, WASHER, NUT & COTTER PIN
6. BOLT, BUSHING, WASHER, NUT & COTTER PIN
7. AXLE
8. TUBE - SPACER
9. PLUG - WHEEL END
10. AXLE BOLT
11. NOSE GEAR CENTERING SPRING
12. BOLT, WASHERS, NUT & COTTER PIN (BOLT HEAD DOWN)
13. AIR VALVE CAP
14. AIR VALVE CORE
15. AIR VALVE BODY
16. WASHER
17. BUSHING - SHOULDER (UPPER)
18. SCREW, WASHER & NUT
19. ROLLER ASSEMBLY & BUSHING
20. TILLER
21. WASHER
22. BUSHING - SHOULDER (LOWER)
23. TRUNNION ASSEMBLY
24. PLACARD
25. O-RING
26. OLEO CYLINDER
27. BEARING
28. PISTON STRUT
29. O-RING
30. BEARING
31. TORQUE LINK
32. O-RING OR T SEAL (REFER TO PARTS CATALOG)
33. RING - WIPER
34. WASHER
35. SNAP RING
36. FORK



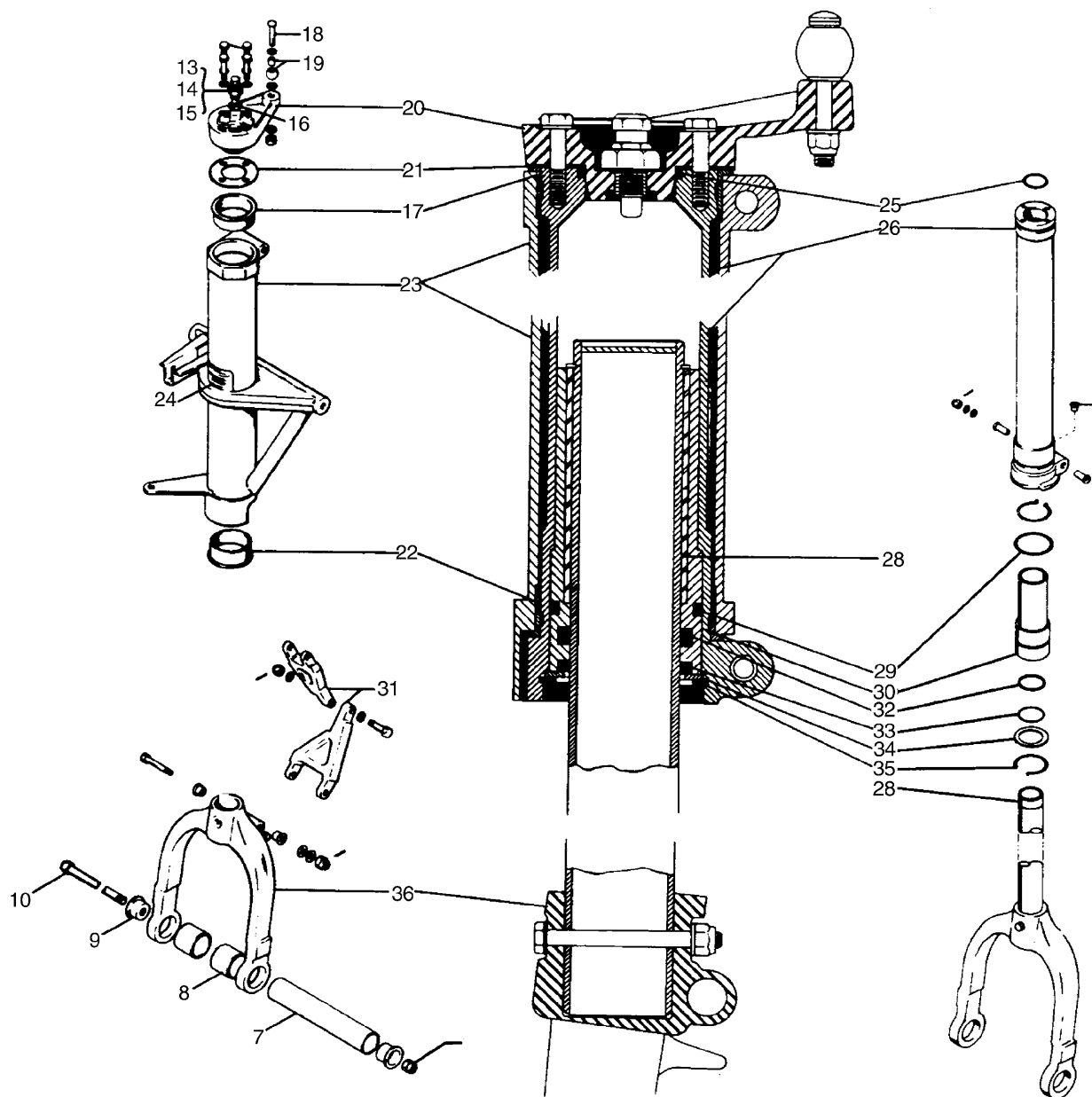
NOTE:

MAKE SURE THE TRUNNION ARM AND
CENTERING SPRING ROD END ARE
CONNECTED AS SHOWN WITH THE
BOLT HEAD DOWN.

Nose Gear Oleo and Trunnion Assemblies
Figure 1 (Sheet 1 of 2)

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Nose Gear Oleo and Trunnion Assemblies
Figure 1 (Sheet 2 of 2)

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D. Assembly (See Figure 1.)

- (1) Ensure all components are clean and inspected, especially the inside of oleo cylinder.
- (2) Dip a clean sponge in clean hydraulic fluid and wipe down the strut piston tube, making sure the tube remains clean.
- (3) Place the bearing retainer snap ring, retainer washer and wiper ring respectively over the piston tube.
- (4) Make sure the bearing assembly is inspected for damage, especially the bearing surface for gouges and wipe down with hydraulic fluid.
- (5) Install new O-rings or T-seals on bearing and slide the bearing, wiper end first, over the piston tube.
- (6) Install retaining ring on end of piston tube. (See Parts Catalog.)
- (7) Slide the bearing, wiper ring, bearing retainer ring, and snap ring up against the piston tube retaining ring. Carefully slide the assemblies into the oleo tube till the bearing bottoms and insert the bearing snap ring in the end of the oleo housing.
- (8) Connect the torque links being sure the links move freely.
- (9) If the oleo strut assembly has not been removed from the trunnion and the tiller remains attached, fill the oleo housing with 21 ± 1 oz. of MIL-H-5606 hydraulic fluid. Move the strut to ensure that it operates freely.
- (10) Reinstall air valve and torque to 350 to 400 inch-pounds. With the aircraft off the jacks and at empty weight, inflate the oleo until the strut exhibits $1.20 \pm .25$ inches visible strut extension.

E. Installation in Trunnion (See Figure 1.)

- (1) Assemble the components of the oleo strut as instructed in steps 1 through 8 of the last paragraph and tape over or enclose the top of the oleo cylinder to prevent dirt from entering.
- (2) Remove the upper and lower shoulder bushings from the trunnion assembly.
NOTE: Take proper care to avoid damaging the flanges and bearing surfaces of the bushings.
- (3) Coat the bearing surfaces of the lower shoulder bushing with the appropriate grease (See Chapter 12) and slide the bushing down the oleo cylinder until it bottoms above the upper torque link mount.
- (4) Being careful not to damage the shoulder bushing, insert the oleo assembly through the base of the trunnion, until the trunnion seats firmly on the lower shoulder bushing. Support oleo in trunnion.
- (5) Coat the upper shoulder bushing bearing surfaces with grease and carefully insert the upper bushing into its recess between the oleo cylinder and trunnion. Make sure the bushing seats firmly in trunnion.
- (6) Remove tape or covering from top of oleo cylinder and ensure the annular detent is clean and unmarred.
- (7) With the appropriate O-ring dipped in hydraulic fluid, fit it into the aforementioned annular slot in the oleo cylinder.
- (8) Place the required spacer washers between the tiller and oleo/trunnion mounting surface. Grease them as specified in 12-00-00.
- (9) Align and insert the bottom of the tiller in the oleo cylinder. Install and safety the four retaining bolts with 0.041 safety wire.

NOTE: The hardware used in connecting the centering spring rod end to the trunnion arm must be installed as shown in Figure 1.

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- (10) See Figure 1, and as shown, install nose gear centering spring assembly. Make sure the trunnion arm and centering spring rod end are connected as shown with the bolt head down.
- (11) Use 12-00-00 as reference and lubricate the gear assembly.
- (12) Fill the oleo housing with 21 ± 1 oz. of MIL-H-5606 hydraulic fluid and move the strut up and down to ensure free movement. The weight of the wheel and fork should allow strut to extend.
- (13) Install the air valve plug and body, as applicable, and torque the valve (body) in the plug 350 to 400 inch-pounds.
- (14) Check nose gear for alignment and operation.
- (15) With the aircraft at empty weight, inflate the strut until it exhibits 1.20 ± 0.25 inches visible strut extension.

2. Nose Landing Gear

A. Modified Components.

The following parts have been modified to increase their service life:

NOTE: Immediate replacement of the currently installed part is not required, as long as the part meets inspection and time-in-service requirements. When replacement is required, use the parts identified below.

- (1) Drag link-to-nose gear strut bolt, P/N 400-274 (AN7-35).

The Nose Gear Installation has been revised to change this AN7-35 bolt to P/N 693-215, (NAS6207-50D) bolt that is stronger. This bolt change is approved for all PA-34 Series aircraft, and is an Alternate Method of Compliance as a substitute for the P/N 400-274 (AN7-35) bolt per AD 93-24-14.

- (2) Steering Channel Assembly 95394-000.

The Steering Channel has been revised to increase the material thickness by 25% and the height increased to prevent "ball-out-of-track" failures. The part number for the redesigned Steering Channel is 95394-005. The 95394-005 Steering Channel is approved for all PA-34 Series aircraft.

- (3) Actuator Mount Bracket P/N 95724 and Bushing P/N 95061-89.

The Actuator Mount Bracket has gone through two major design changes, from aluminum (never installed in these airplanes) to steel, and a recent change adding reinforcements to increase the bearing surfaces for the P/N 95061-089 bushing.

All PA-34-220T aircraft are subject to the 100 Hour Actuator Mount Bracket Inspection, below, regardless of which bracket is installed.

In the Seneca IV; and Seneca V S/N's 3449001 through 3449312, less 3449262: procure and install Piper Kit No. 767-359, if the steel Actuator Mount Bracket is discrepant and must be replaced. This kit includes the latest design actuator mount bracket (i. e. - P/N 95724-006) and new, required, hardware for attaching the Nose Gear Retraction Link Assembly P/N 95712-004.

In Seneca V S/N's 3449262, and 3449313 & up: if the factory installed 95724-006 bracket fails to pass inspection, replace it and any other components which are discrepant.

- (4) Turn Limit Indicator

A Turn Limit Indicator was added to S/N's 3449061 and up to help reduce the incidence of turn stop boss failure (on the upper strut tube assembly P/N 95720). Piper Kit No. 767-368 provides the Turn Limit Indicator for installation on all earlier PA-34 Series airplanes.

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B. Cleaning, Inspection, and Repair

- (1) Clean all parts with a suitable dry type cleaning solvent.
- (2) Inspect gear components for the following unfavorable conditions:
 - (a) Bolts, bearings and bushings for excessive wear, corrosion and damage.
 - (b) Gear strut and cylinder, drag links and down lock link assembly for cracks, dents, bends or misalignment.
 - (c) Down lock link assembly for damaged threads and bearing.
 - (d) Roller assembly for freedom of movement and excessive wobble.
- (3) Check down lock spring and down lock link spring for excess wear and corrosion, particularly around the hook portion. Springs should be discarded if wear or corrosion exceeds one-quarter the diameter of the spring. Remove corrosion and paint spring.
- (4) Check down lock spring for adequate tension. This may be accomplished by observing several locking activations and checking for smooth operation with positive locking each time. If hook or down lock movement is slow or has a hesitation or jerky movement, the spring should be replaced. Check down lock link assembly for proper operation and cleanliness. Pin and hole should be carefully inspected for signs of wear or elongation.
- (5) Check general condition of limit switches and actuators, wiring for fraying and poor connections or conditions which could lead to failures.
- (6) Repairs to the landing gear are limited to reconditioning of parts such as smoothing out minor nicks and scratches, repainting areas where paint has chipped or peeled and replacement of parts.
- (7) Inspect upper and lower drag link assembly overcenter dimension as follows: (See Figures 5 and 6.

NOTE: The item numbers in the following text are keyed to Figure 5, while the procedure described is illustrated in Figure 6.)

- (a) Unbolt the downlock link assembly (3) from the lower drag link (8). Tape the downlock link assembly up out of the way.
 - (b) Remove cotter pins from nuts on the three drag link bolts (upper, center, and lower) and, without removing them, backoff the nuts approximately .25 inch.
 - (c) Lay a "true" straightedge across the exposed grips of the upper (46) and lower drag link bolts.
 - (d) Apply pressure to the top of the drag links to keep the overcenter stops in solid contact and then measure the perpendicular distance from the bottom of the straightedge and the top surface of the center bolt grip.
 - (e) The measured distance must be .250 or greater.
- (8) Service Wear Limits
- Use the wear limits in Figure 2 to determine the condition of the listed parts when performing the following inspections. Visually inspect all bolts/pins for wear, damage, or corrosion. Replace as required.

C. 100 Hour Actuator Mount Bracket Inspection

Each 100 hours time-in-service, visually inspect the actuator mount bracket (Item 36, Figure 5, Sketch B) for wear, cracks, loose mounting rivets, and elongation of the .250 diameter holes (Item 8, Figure 2) where the retraction link and the P/N 95061-089 bushing (Item 47, Figure 5, Sketch B) attach. See Figure 2 for wear limits.

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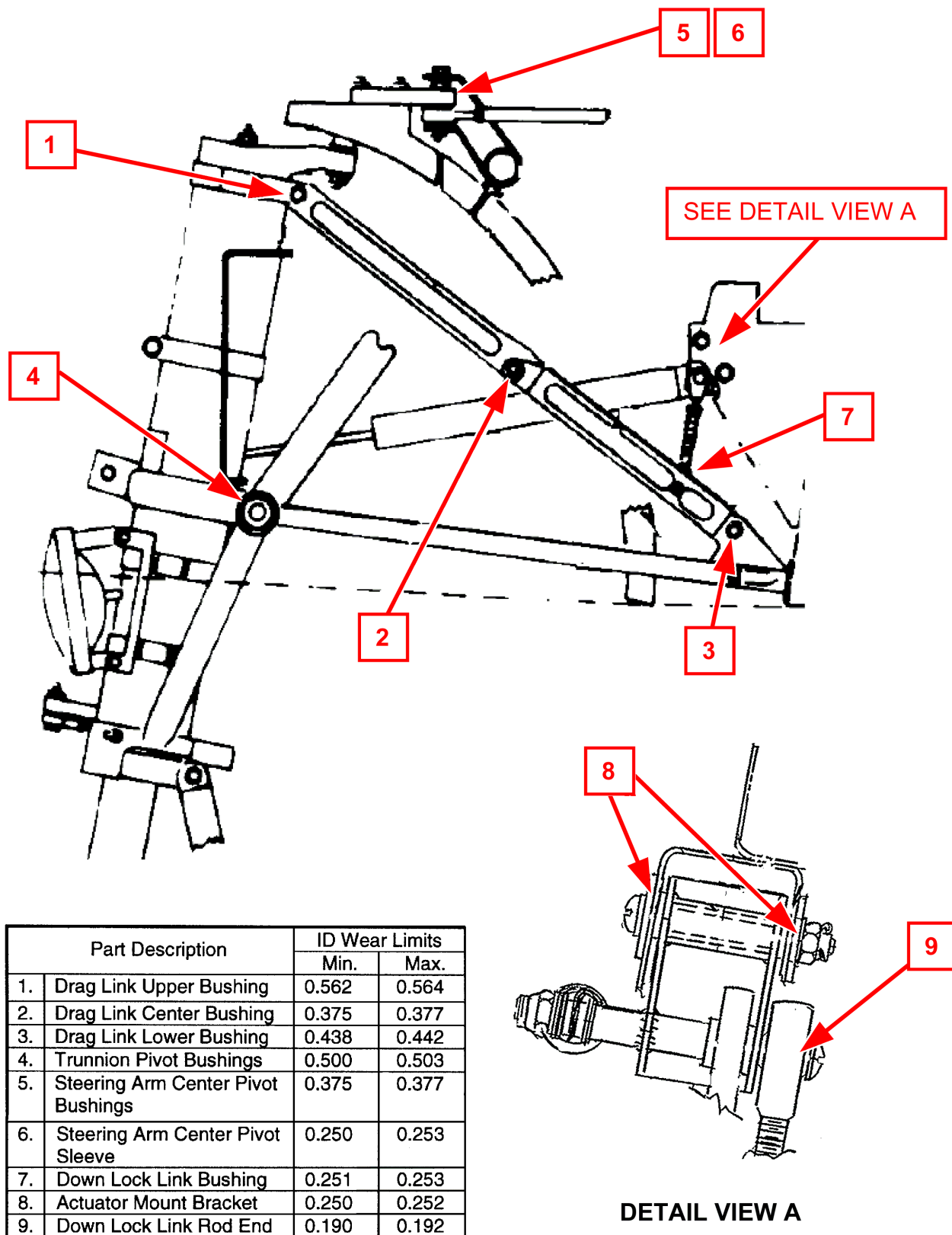


Figure 2
Service Wear Limits

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D. 100 Hour Tunnel Bracket Installation Inspection (See Figure 3.)

Inspect the rivets shown in Figure 3 for looseness. These rivets attach the Tunnel Bracket P/N 95554-000 and the Nose Gear Mount Fitting P/N 95555-000 to the tunnel aft of the bulkhead at F. S. 49.5. (See Items 90 and 350, respectively, in Figure 3.)

- (1) Place aircraft on jacks. Pull carpet away from the right side of the tunnel and secure out of the way. Remove access panel in bottom of fuselage, just aft of F.S. 49.5 at B.L. 00.0.
- (2) Extend and retract landing gear through several cycles observing the rivets, tunnel bracket, and mount fitting, from both inside and outside the airplane. Inspect for any relative motion between the riveted components. No relative motion is permissible.
- (3) Inspect the bracket attachment flange for cracks in the flange radius as shown in Figure 3.

E. 100 Hour Upper Drag Link Bolt Inspection

- (1) Each 100 hours, remove the nose gear drag link upper attach bolt AN7-35 or NAS6207-50D (P/N's 400-274 or 693-215, respectively), Item 46, Figure 5, and with a 10X magnifier visually inspect for straightness, cracking or thread wear.
- (2) If any of the above conditions exist, replace bolt and associated hardware (see Airworthiness Limitations, 4-00-00). Additionally, if replacing bolt, inspect associated bushings and bearings for deformation, cracking or wear, replace as required.

F. 1000 Hour Nose Gear Trunnion Inspection (See Figure 4.)

Beginning at 2000 hours and each 1000 hours thereafter, visually inspect the nose gear trunnion (P/N 95723-006) for cracks in the areas shown in Figure 4. Use supplemental lighting and a 10X magnifier.

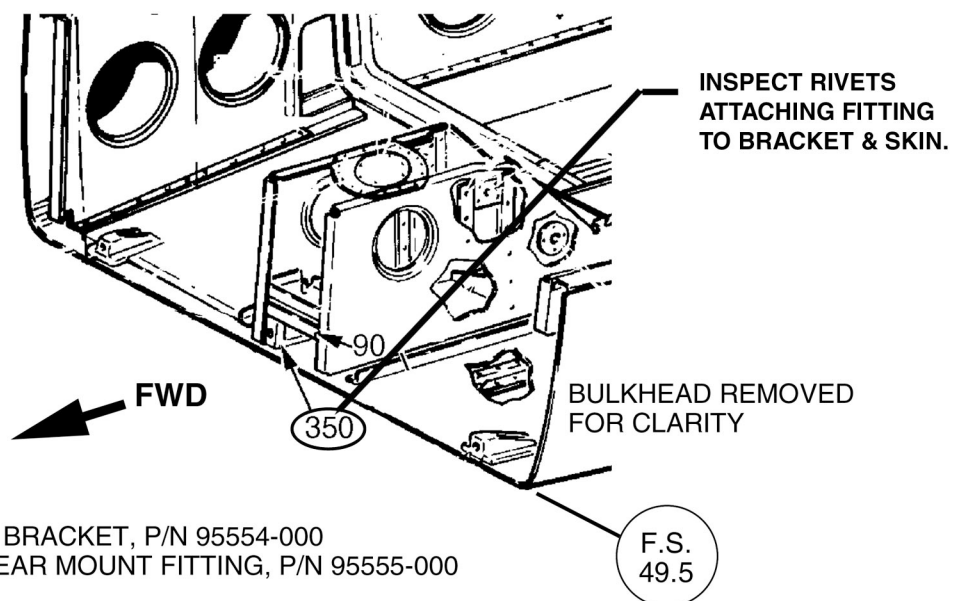
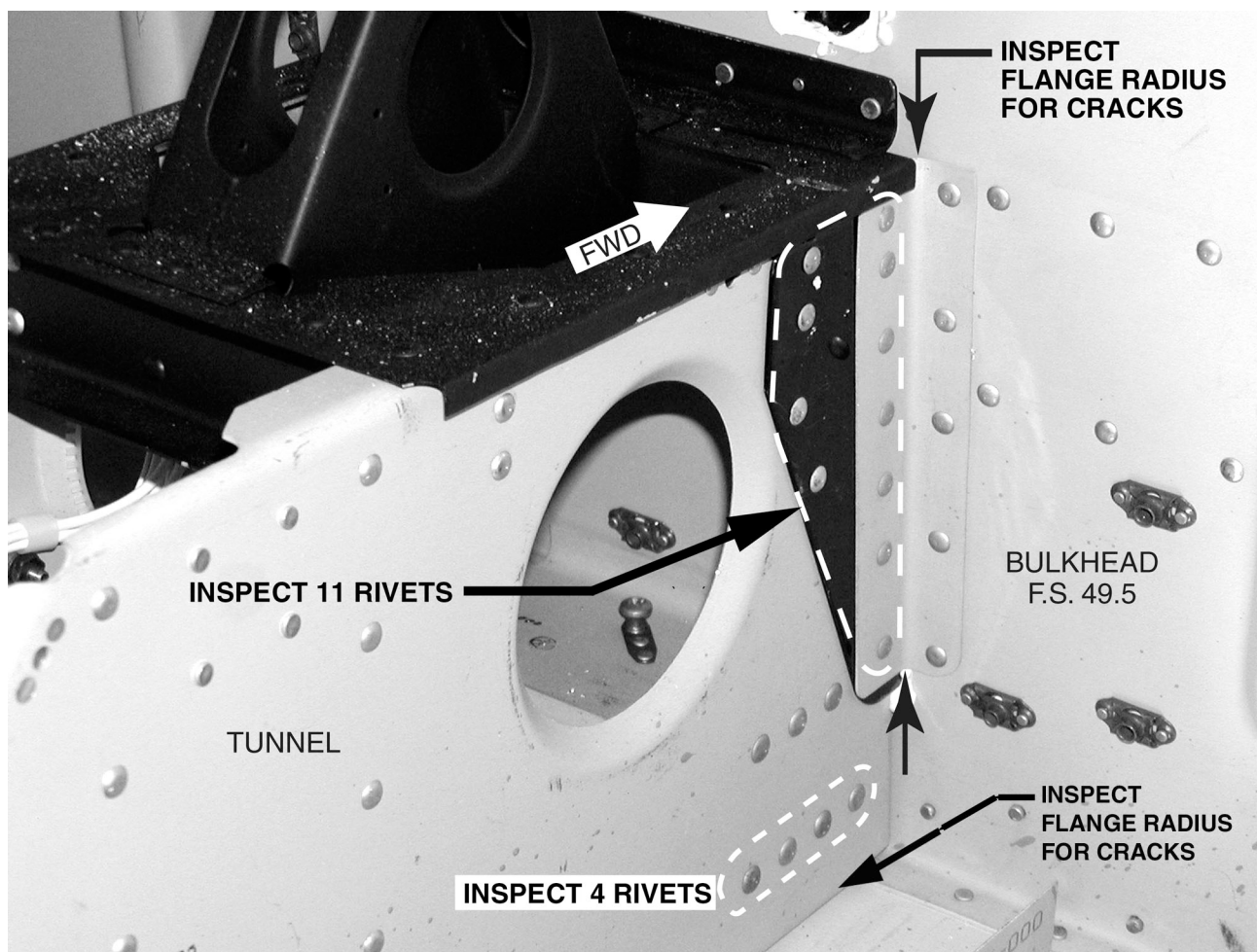
G. Removal (See Figure 5.)

WARNING: DO NOT ATTEMPT TO REMOVE THE SPRING FROM THE SHAFT ASSEMBLY OF THE NOSE GEAR CENTERING SPRING ASSEMBLY. THIS SPRING IS HELD UNDER COMPRESSION BY TWO BUSHINGS AND TWO PINS WITH FUSED HEADS.

NOTE: To gain access to the landing gear, remove access panels located in the forward baggage compartment.

- (1) Place airplane on jacks.
- (2) Disconnect leads to landing lights.
- (3) Retract the landing gear far enough to permit unlocking the down lock mechanism.
- (4) Disconnect down lock spring from aft end of gear actuating cylinder.
- (5) Disconnect upper drag link from the strut housing.
- (6) Disconnect the actuating cylinder from the strut housing.
- (7) Remove attaching hardware at strut housing pivot point and remove landing gear from the airplane.
- (8) To remove upper and lower drag links, disconnect down lock link from lower drag link and disconnect lower drag link from its attachment point.

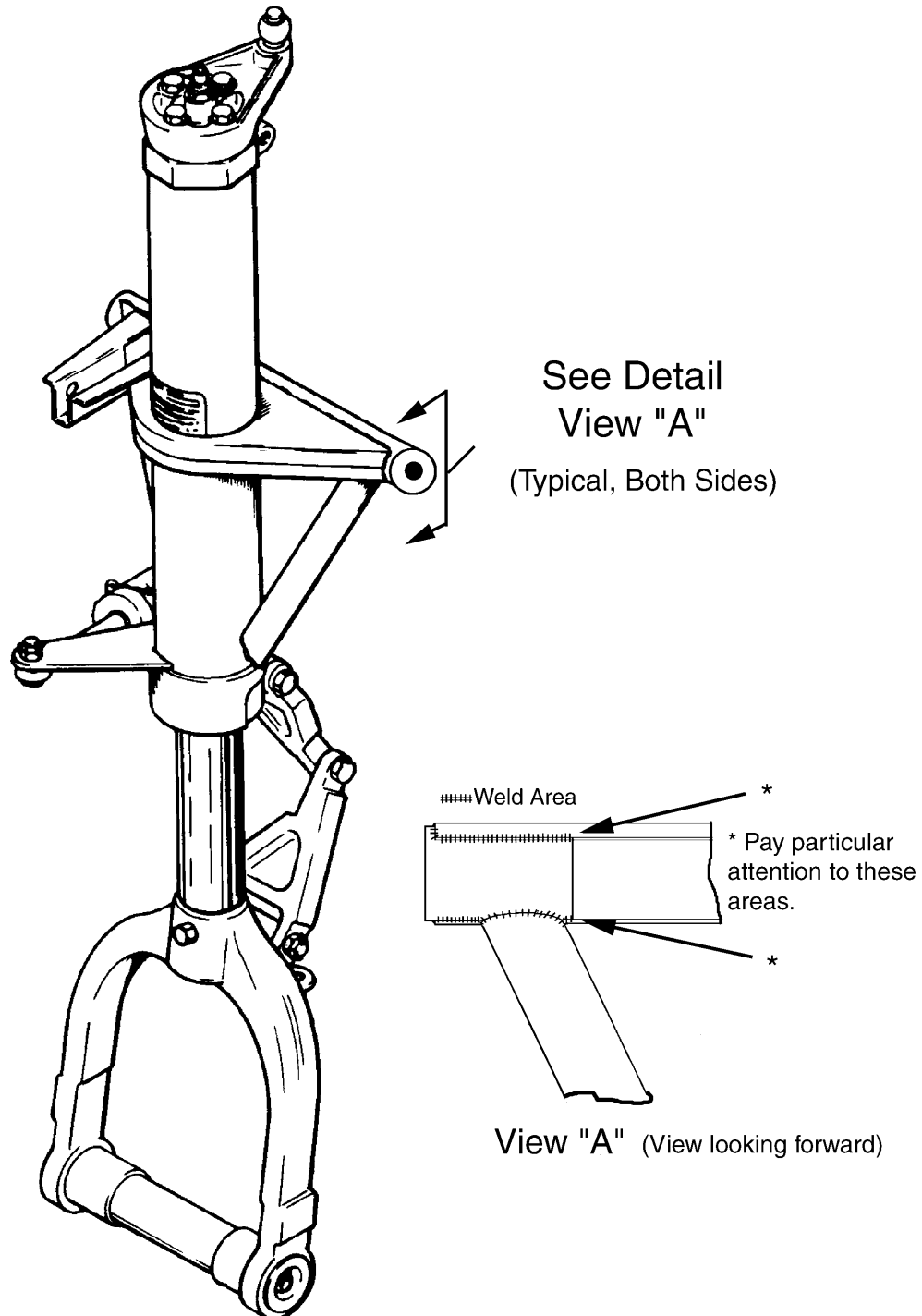
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90 = TUNNEL BRACKET, P/N 95554-000
350 = NOSE GEAR MOUNT FITTING, P/N 95555-000

Tunnel Bracket Installation Inspection
Figure 3

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Nose Gear Trunnion Inspection
Figure 4

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H. Installation and Rigging (See Figures 5 and 6.)

NOTE: See Lubrication Charts, 12-20-00, and ensure affected parts of the landing gear such as bearings, bushings, etc, are lubricated prior to and following assembly.

- (1) Position the gear assembly between the mounting points, making certain the tiller roller is properly inserted in the steering arm channel.
- (2) Align the mounting points of the strut with those on the mount and install the appropriate hardware. The bolt heads should be inboard, with the nuts outboard and just loose enough to allow the gear to swing freely.
- (3) If necessary, assemble the drag links. Installed or removed, use the appropriate instructions in this section to check their rigging.
- (4) The drag links are installed with their through center stops facing up, the upper link connection aligned with the right side of the gear's upper ring block and the lower link connection positioned in its bracket on the bottom rear of the nose gear mount (see Figure 5). With the links in position, install the connecting hardware and move the gear to assure free movement.
- (5) At the actuator housing attachment assembly (see Sketch B, Figure 5), disconnect the retention spring from the retraction link fitting.
- (6) Position the gear in its down locked position and check that the drag links have fully extended to their through center position with the stop surfaces in contact.
- (7) With the actuating piston rod extended, adjust the piston rod end such that 0.25 of an inch of rod travel remains in the actuator before full extension. Connect the rod end to its mount on the gear assembly. The retraction link to which the actuator is attached should be near its stop.
- (8) Reconnect the retention spring to the retraction link fitting.
- (9) Install the down lock link (see Figure 5) with the rod end connected to the retraction link and the other end to the bottom drag link.
- (10) Adjust the down lock link as necessary until the guide pin is completely bottomed out at the top of its slot and the retraction link is moved against its stop.

NOTE: If the down lock link is adjusted properly, the retraction link will be moved completely to its stop by the down lock link therefore taking up some of the extra actuator piston rod travel and activating the down and locked limit switch.

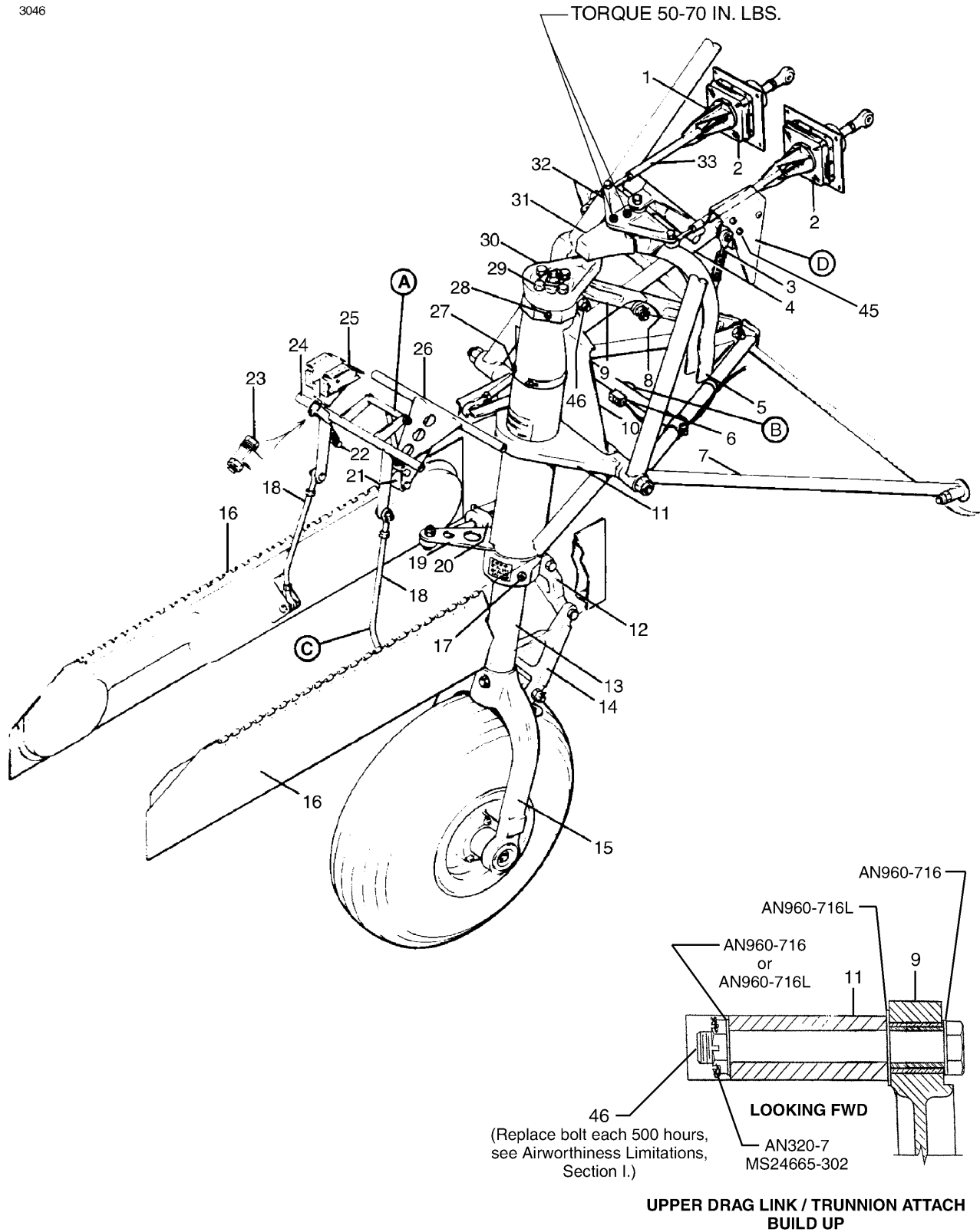
- (11) Retract and free fall the landing gear at least three times. Remove the down lock link, shorten it by 1/2 turn and reinstall.
- (12) The down and locked limit switch should be adjusted to have it actuated when the retraction link is back against its stop.
- (13) Using a tow bar to reach full travel against stops, rig the nose gear steering rod ends as necessary to allow full deflection.
- (14) See Figure 5, Sketch D and set the up stop to the dimension shown. Retract the gear and ensure the nose gear housing engages the stop under retraction pressure. Adjust as necessary.

NOTE: After any up stop adjustment, the gear must be cycled to ensure the strut engages the stop under pressure.

- (15) Retract the gear and check that the up switch is just activated when the gear contacts the stop. Following this, adjust the switch upward another 0.02 to 0.04 of an inch.
- (16) Support the gear in its up locked position and adjust the rod end of the actuator piston rod to allow a minimum of 0.06 of an inch actuator travel remaining with the gear up and locked.
- (17) Cycle the gear a few times and check down lock, and up stop action, and switch activation. Include short pickup cycles which simulate gear sag pickup in flight. Leave gear up.
- (18) Check up switch bracket override action to ensure proper activation.

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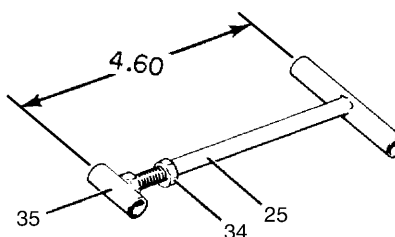


Nose Gear Installation
Figure 5 (Sheet 1 of 2)

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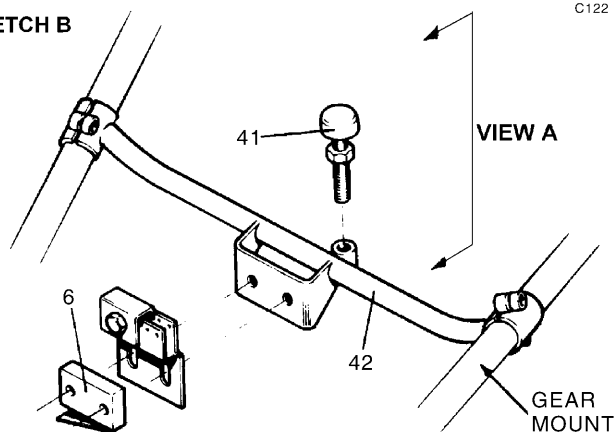
1. BUNGEE ASSEMBLY
2. BOOTS
3. DOWNLOCK LINK ASSEMBLY
4. ACTUATOR
5. TILLER TRACK
6. UP LIMIT SWITCH
7. GEAR MOUNT
8. LOWER DRAG LINK
9. UPPER DRAG LINK
10. SPLASH SHIELD PANEL
11. TRUNION ASSEMBLY
12. UPPER TORQUE LINK
13. PISTON TUBE, STRUT ASSEMBLY
14. LOWER TORQUE LINK
15. FORK, STRUT ASSEMBLY
16. GEAR DOORS
17. GREASE FITTING
18. PUSH RODS, DOOR ACTUATING
19. TRUNION ARM, SHIMMY DAMPER ATTACHMENT
20. SHIMMY DAMPER SPRING ASSEMBLY
21. ROLLER
22. SPRING, DOWN RETURN
23. BOLT, WASHERS (4 OR AS REQ.), NUT
24. GEAR DOOR DRIVE ASSEMBLY
25. DOOR ACTUATING STOP ASSEMBLY
26. GEAR DOOR ACTUATING ASSEMBLY
27. SPLASH SHIELD MOUNTING CLAMP
28. GREASE FITTING
29. HARDWARE, TILLER / OLEO ATTACHMENT
30. TILLER ASSEMBLY
31. CHANNEL, STEERING ARM
32. STEERING ARM ASSEMBLY
33. STEERING ROD (2)
34. JAM NUT
35. ACTUATING LINK
36. MOUNT BRACKET, ACTUATOR
37. RETRACTION LINK ASSY.
38. SPRING, DOWNLOCK LINK
39. DOWNLOCK MICRO SWITCH
40. SPRING, RETRACTION LINK RETENTION
41. RUBBER STOP, GEAR UP STOP
42. SUPPORT TUBE, UP STOP
43. BOSS, STOP FITTING
44. JAM NUT
45. STOP BOLT, RETRACTION LINK ASSY.
46. BOLT (AN7-35 OR NAS6207-50D)
(SEE BUILD UP, SHEET 1.)
47. BUSHING (P/N 95061-089)

SKETCH A



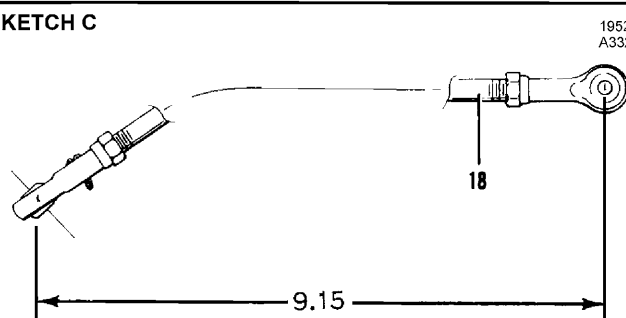
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SKETCH B



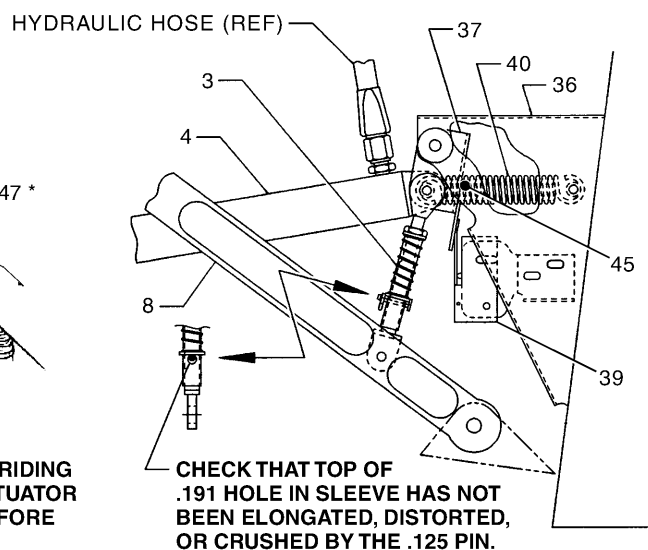
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SKETCH C



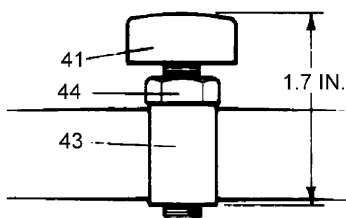
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SKETCH D

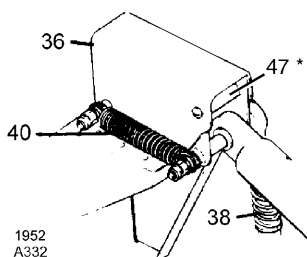


C122

RIGGING
DIMENSION



VIEW A



1952
A332

* ENSURE BUSHING IS RIDING
IN .250 HOLES OF ACTUATOR
MOUNT BRACKET BEFORE
TIGHTENING BOLT.

Nose Gear Installation
Figure 5 (Sheet 2 of 5)

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- (19) Extend the gear and check that the actuator piston travel remaining till full extension is not less than .15 of an inch.
- (20) Retract and free fall the gear to ensure the retraction link retention spring moves to the assemblies aft causing the down lock link to fully compress and the drag links to lock in their over center position.
- (21) Turn the nose gear full travel and make sure the clearance between the steering arm assembly and the tiller track is between 0.06 and 0.03 of an inch at both the left and right stops. (See the Rigging Tiller Track - Steering Arm Assy. Gap view, Figure 6.)

CAUTION: THE TILLER, TILLER ROLLER, AND STEERING ARM CHANNEL CAN BE DAMAGED IF NOSE WHEEL TURN LIMITS ARE EXCEEDED WHEN TOWING THE AIRPLANE WITH POWER EQUIPMENT. INSPECT, ADJUST, REPAIR OR REPLACE AS REQUIRED.

- (22) Verify free and correct movement of the tiller roller between the steering arm channel and the tiller track and up and down the tiller track.
- (23) See the appropriate paragraph in this section for rigging of the nose gear doors.
- (24) Lube the system as specified in 12-20-00.
- (25) Ascertain the gear is down and locked and check alignment of landing gear. See Alignment, below.
- (26) Remove airplane from jacks.

I. Nose Gear Drag Link Inspection and Adjustment (See Figure 6.)

The drag links function to lock and retain the gear in its down position by traveling to a specific through center locked position. The "through center travel" is extremely important for safe operation and should be checked regularly. Use the following procedure to check the drag links for proper through center travel and condition.

- (1) Jack up the airplane per 7-10-00.
- (2) Check all hinge bosses on the links for cracks and security. The links should move freely but not exhibit looseness or stop at the bushings.
- (3) Clean the gear with an appropriate cleaner and make sure the over center stops are unobstructed and hinge points are clean.
- (4) See 12-20-00 and lubricate the gear.
- (5) With reference to Figure 6, continue as follows for over center measurement:

NOTE: The standard over center dimension is measured from the centerlines of the drag link mounting holes. When measuring off the bolts the different bolt sizes must be taken into account in order to obtain proper centerlines.

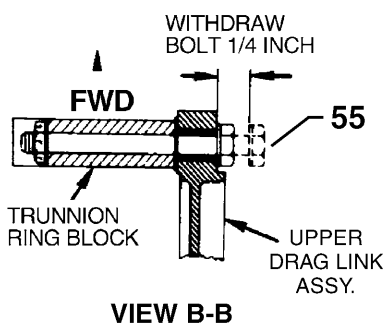
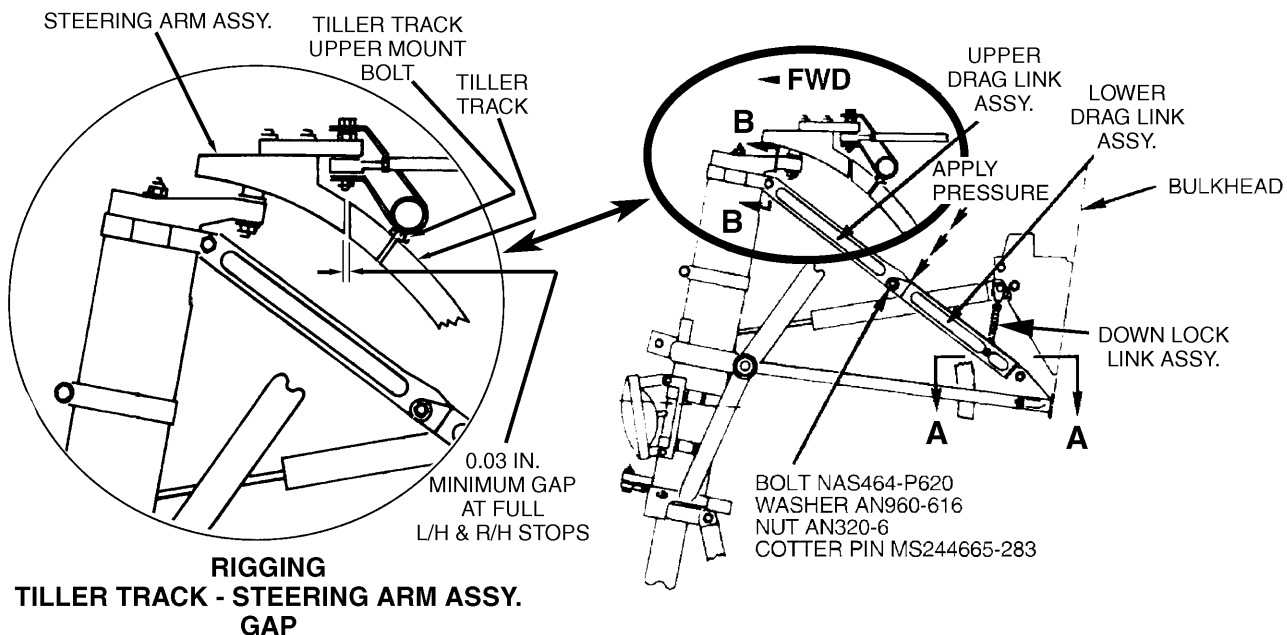
- (a) Unbolt the down lock link assembly from the lower drag link and tape it up against the retraction fitting support bracket.

CAUTION: UPPER DRAG LINK AN7-35 OR NAS6207-50D ATTACHMENT BOLT MUST BE REPLACED EACH 500 HOURS TIME-IN-SERVICE.

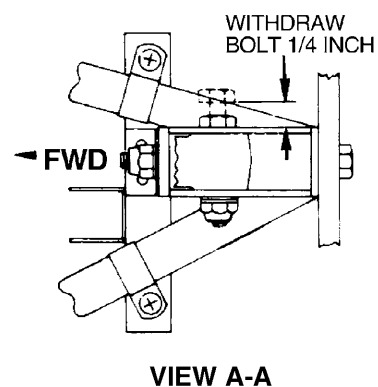
- (b) Without removing the bolts, remove the cotter pins from the three drag link bolts and loosen the nuts enough to withdraw them about 1/4 of an inch.
- (c) Lay a "true" straightedge across the exposed grips of the upper and lower drag link bolts.
- (d) Apply pressure to the top of the drag links to keep the over center stops in solid contact and measure the perpendicular distance between the top surface of the NAS464P620 bolt grip and the bottom of the straightedge.
- (e) The measured distance should be 0.250 of an inch or greater. If the measured distance is less than 0.250 of an inch, replace drag links.

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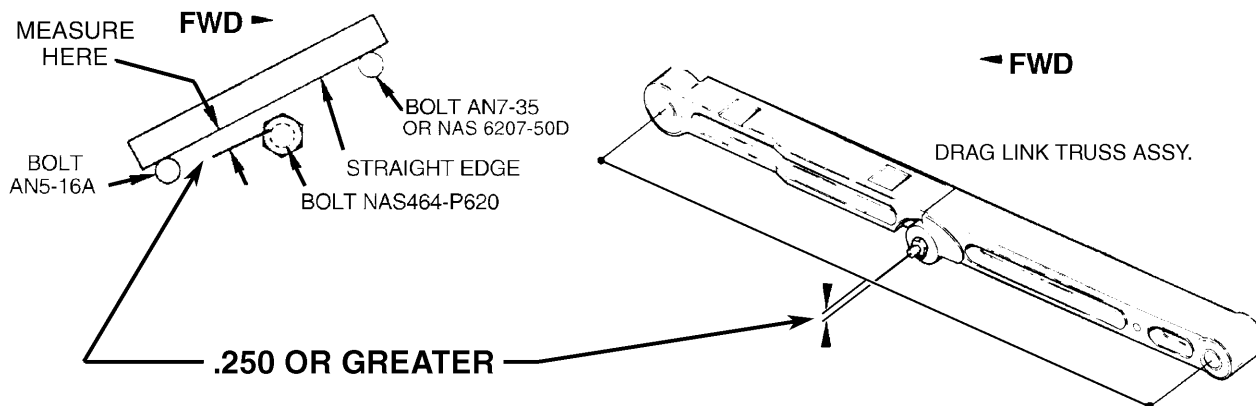
DRAG LINK OVERCENTER MEASUREMENT



PREPARING FOR MEASUREMENT



TAKING MEASUREMENT



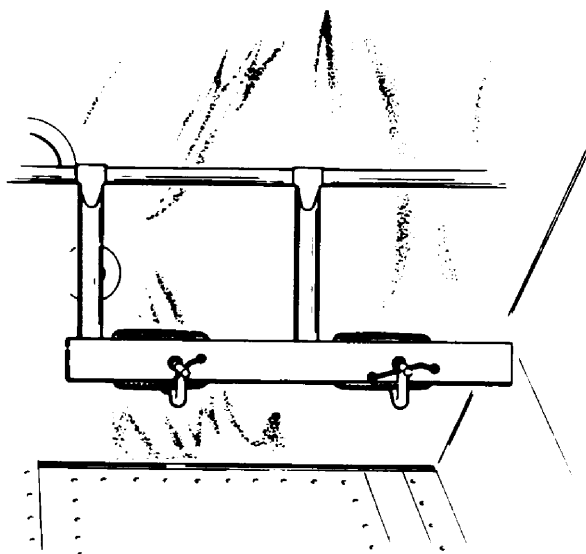
Drag Link Installation and Adjustment
Figure 6

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J. Alignment

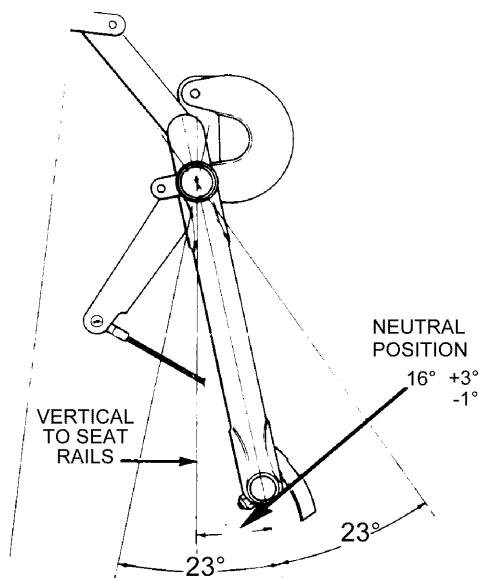
- (1) Park the airplane on a smooth level floor which will accommodate the striking of a chalk line.
- (2) Place airplane on jacks and level airplane laterally and longitudinally. (See 7-10-00 & 8-20-00.)
- (3) Extend a plumb bob from the center of the tail skid and mark the contact point on the floor.
- (4) Extend a chalk line from the mark on the floor below the tail skid to point approximately three feet forward of the nose wheel. Allow the chalk line to pass under the wheel at the centerline of the tire. Snap the chalk line.
- (5) Clamp rudder pedals to align in a lateral position. (See Figure 7.)
- (6) Adjust the rod end bearings of each steering bungee to align the nose wheel with the chalk line and to bring the rudder pedals into neutral angle fore and aft. There should be no load on the bungee springs. This condition exists when the overall measurement taken between the facing sides of the washers at each rod end of the bungee is 13.71 inches. To align the nose wheel straight forward, stand in front of the nose gear and align the center rib of the tire with the chalk line or lay a straightedge along the side of the tire and parallel with the chalk line. In neutral position, the rudder pedals are tilted aft as shown in Figure 8, with the airplane level. Place a bubble protractor against a steering tube to check this angle. One end of each steering bungee must be disconnected and the jam nuts loosened to make this adjustment; do not attempt to make the complete adjustment by means of one bearing, but divide the adjustment between the bearings at each end of each rod. Check that the rod ends have sufficient thread engagement by determining that a wire will not go through the check hole in the rod. Reinstall bungees, tighten and safety the jam nuts.
- (7) To check the nose gear steering for its correct degree of maximum travel, right and left use the wheel pivot point as the center point and draw a line at the travel degree angle on each side of the chalked centerline. Use a tow bar to turn the nose gear full travel left and right and overcome the bungee system. Should travel in one direction be excessive and not enough in the other, check the steering arm and steering bungees for damage. See 12-20-00 for lubrication instructions of the bungee assemblies.

A599



Clamping Rudder Pedals in Neutral Position
Figure 7

A295



Rudder Pedals in Neutral Angle
Figure 8

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3. Nose Gear Door

A. Removal (See Figure 5.)

- (1) With nose gear extended, disconnect door retraction rods from doors by removing attaching hardware.
- (2) To remove doors, straighten bent end of hinge pins and pull the pins out from the opposite end.
- (3) Disconnect spring from arm of upper nose gear actuating tube assembly.
- (4) Disconnect link assembly from the upper nose gear actuating tube and remove lower nose gear actuating tube assembly with roller attached.
- (5) Remove upper actuating tube assembly.

B. Cleaning, Inspection, and Repair

- (1) Clean all components with a suitable cleaning solvent.
- (2) Inspect doors for damage, loose or damaged hinges and brackets.
- (3) Inspect retraction rods for damage and rod end bearings for corrosion.
- (4) Check door tension spring for wear and tension below minimum allowable tolerance. Reject spring if load tension is below 12 ± 2 pounds with spring extended to 4.1 inches.
- (5) Check general condition of actuating tube assemblies and roller assembly.
- (6) Repairs to doors are limited to replacing hinges and brackets.
- (7) Repairs to the retraction mechanism are limited to painting and replacement of component parts.

C. Installation (See Figure 5.)

- (1) Install the upper nose gear actuating tube assembly in position between the two bearing blocks and secure with attaching hardware.
- (2) Install lower nose gear actuating tube assembly in position between the two bearing blocks and secure with attaching hardware.
- (3) Insert lower link assembly into upper link assembly and adjust as necessary to obtain a dimension of 4.60 inches between the centerline of each link. Tighten locknut. (See Sketch A, Figure 5.)
- (4) Install assembled link assembly between the two upright arms of the upper actuating tube assembly and secure with attaching hardware. Insert the lower link between the two upper holes in actuating tube assembly and secure with attaching hardware. (See Figure 5.)
- (5) Install roller directly below link on lower actuation tube assembly. Secure in position with attaching hardware making certain the roller is free to turn.

NOTE: If cracks or any signs of wear are evident, the roller must be replaced.

- (6) Adjust both retraction rods to obtain a dimension of 9.15 inches as shown. Attach upper end of retraction rod to arm of upper actuation tube assembly. The lower end should be attached to the door bracket. Install tension spring. (See Figure 5.)
- (7) Install gear doors by positioning hinge halves and inserting hinge pin. A new hinge pin should be used. Bend end of hinge pin to secure door in place.

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D. Adjustment

- (1) Place airplane on jacks.
- (2) With link assembly and retraction rods adjusted as explained in the previous paragraph, the gear should travel through the door opening with a clearance of 0.25 inch between the gear and door as their closest point.
- (3) If clearance between gear and door is less than 0.25 inch, remove washers from stop bolt until the specified clearance is obtained. If clearance between the gear and door exceed the specified clearance, add washers to the stop bolt.
- (4) If doors sag when fully retracted, tighten link assembly (Figure 5). If doors are too tight, loosen link assembly.
- (5) Check all rod ends for adequate thread engagement and for safety and tightness of jam nuts.

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EXTENSION AND RETRACTION

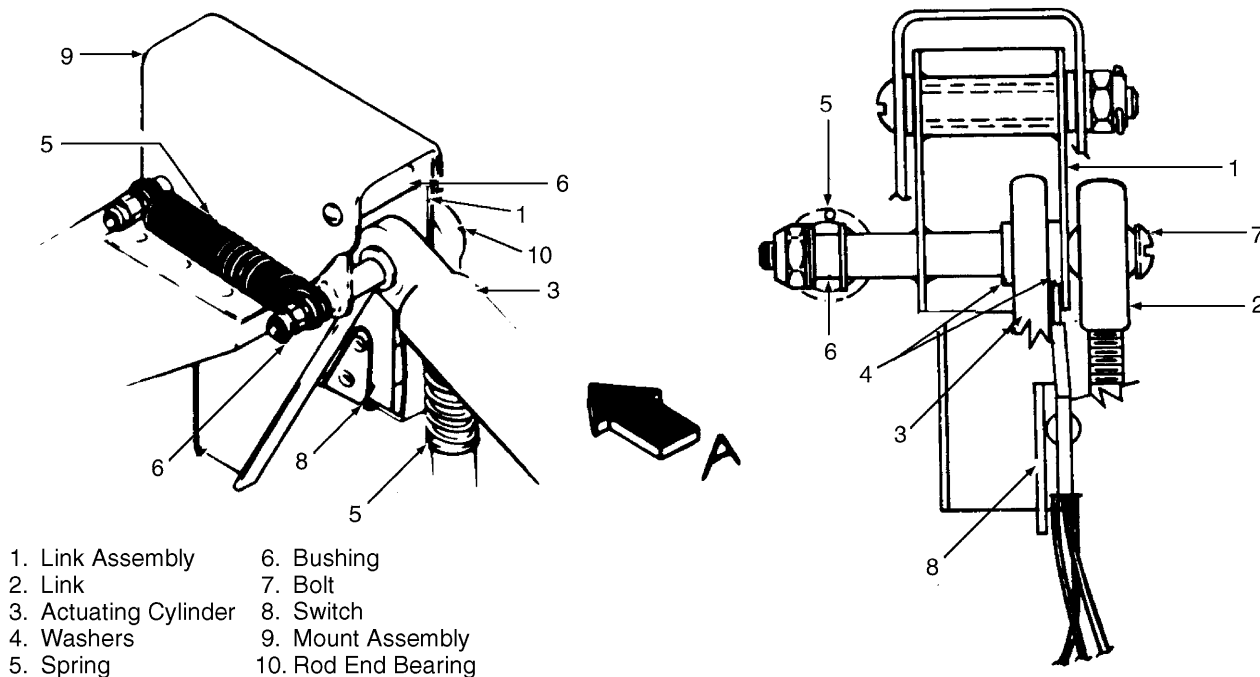
1. Nose Gear Actuating Cylinder (See Figure 1.)

A. Removal

- (1) Place airplane on jacks. (See Jacking, 7-10-00.)
- (2) Disconnect hydraulic lines from actuating cylinder and cover open line ends to prevent contamination.
- (3) Disconnect operating rod end from the bracket on the trunnion assembly by removing attaching bolt and nut.
- (4) Disconnect cylinder from the link assembly. The down lock spring and down lock link are also attached to this link assembly. After removing the cylinder, it is suggested the spring and link be temporarily reinstalled until the cylinder is ready for reinstallation.
- (5) Remove the cylinder from the wheel well.

B. Installation

- (1) See Step (D) in Removal, above. Remove bolt far enough to position clevis end of actuating cylinder in the link assembly. Insert bolt with callouts arranged as illustrated in Figure 1.
- (2) Insert the operating rod end into the bracket on the trunnion assembly and secure with bolt, nut and washers.
- (3) Connect hydraulic lines to their respective fittings on the actuating cylinder.
- (4) Check adjustment of cylinder rod end. (See 32-20-00, Nose Landing Gear, Installation and Rigging.)
- (5) Operate pump to purge system of air and check fluid level in reservoir.
- (6) Remove airplane from jacks.



Nose Gear Actuating Cylinder Installation
Figure 1

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2. Main Gear Actuating Cylinder

A. Removal

- (1) Place airplane on jacks. (See Jacking, 7-10-00.)
- (2) Disconnect hydraulic lines from actuating cylinder and cover open line ends to prevent contamination.
- (3) Disconnect gear down lock spring from swivel fitting at upper end of spring.
- (4) Remove down lock spring swivel fitting and disconnect cylinder operating rod end from upper side brace retraction fitting by removing attaching nut, washer and bolt.
- (5) Disconnect cylinder from its attachment by removing nut and bolt.
- (6) Remove cylinder from wheel well.

B. Installation

- (1) Attach the cylinder to its attachment fitting in the wheel well using bolt and nut.
- (2) Attach the operating rod end and down lock spring swivel fitting to the upper side brace retraction fitting using washer and nut. The swivel fitting must be free to rotate.
- (3) Connect down lock spring to swivel fitting.
- (4) Check adjustment of cylinder rod end.
- (5) Operate pump and purge system of air. Check fluid level in reservoir.
- (6) Remove the airplane from jacks.

3. Gear Actuating Cylinder Service (See Figure 2.)

NOTE: The following instructions apply to actuators P/N 96860-000 (i.e. - SFA232-3 and SFA232-4) only. Disassembly, Assembly, and Cleaning, Inspection and Repair instructions for later model actuators P/N 96860-002 and 96860-003 (i.e. - SFA232-5) are found in Cleveland Wheel and Brakes publication: Component Maintenance Manual - CMSFA232-5 (011-00504) available from the vendor. See Vendor Publications in the Introduction.

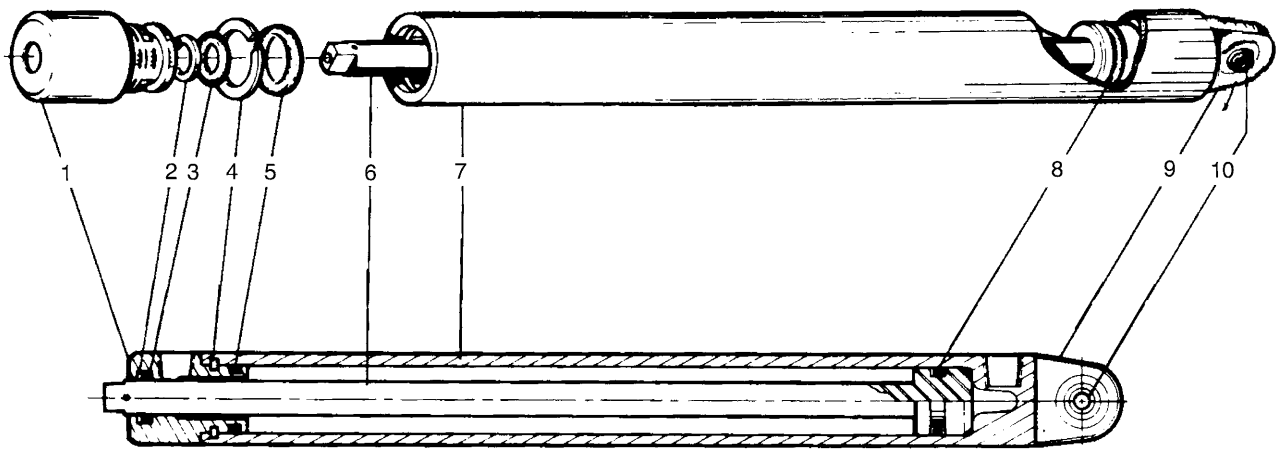
A. Disassembly

- (1) Using hand pressure, push piston rod toward clevis end to remove oil from the cylinder.
- (2) Place clevis in a soft jaw vise and clamp against the clevis bearing.
- (3) Install any 1/8-27 pipe fitting into the port on the end gland. This fitting is used for leverage only and need not be tight. (See Figure 3.)
- (4) Rotate end gland counterclockwise (with use of fitting) until end of retainer ring (Figure 3) shows in slot of cylinder body. Reverse rotation of gland (clockwise direction) allowing retainer ring to move out of slot. (It may be necessary to give the ring an assist in starting out of the slot. If so, insert a strong wire pick or other suitable tool in the slot to pry up the end of the retainer ring.)

B. Cleaning, Inspection, and Repair

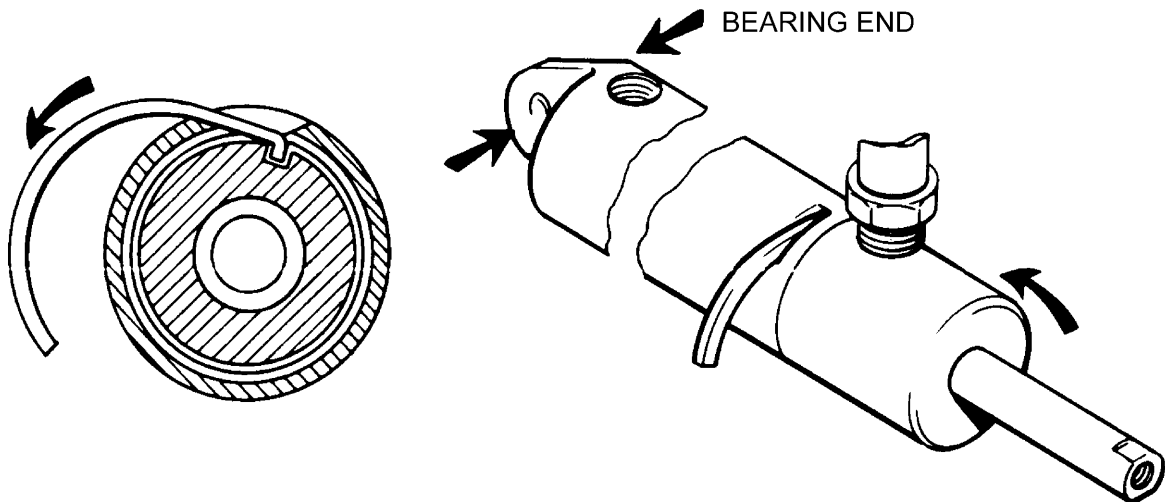
- (1) Clean cylinder components with a suitable dry type solvent and dry thoroughly.
- (2) Inspect cylinder assembly for the following:
 - (a) Interior walls of cylinder and exterior surface of the piston for scratches, burrs, corrosion, etc.
 - (b) Stripped or damaged threads.
 - (c) Rod end fitting and swivel fitting of cylinder for wear and corrosion.
 - (d) End fitting retainer slot for excess wear.
 - (e) Repairs to the cylinder are limited to polishing out small scratches, burrs, etc., and replacing components. (See Parts Catalog for replacement part numbers.)

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- | | |
|------------------|--------------------|
| 1. End Gland | 6. Piston |
| 2. Back-Up Ring | 7. Body, Cylinder |
| 3. O-Ring | 8. O-Ring |
| 4. Retainer Ring | 9. Clevis End |
| 5. O-Ring | 10. Clevis Bearing |

Gear Actuating Cylinder
Figure 2



End Gland Locking Device
Figure 3

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C. Assembly (See Figure 1.)

- (1) Install the three O-rings.
- (2) Lubricate areas around O-rings with hydraulic fluid, park-o-lube or vaseline. Slide end gland on piston rod. Slide piston into cylinder body.
- (3) Insert hook end of new lock ring (P/N 755-997) in slot cylinder body and slot in end gland. Rotate gland counterclockwise to completely wrap lock ring into assembly. (Figure 2.)
- (4) Align port in end gland and cylinder body. (Figure 2.)
- (5) Check smoothness of operation of piston and static test unit to check for possible cut O-rings.
- (6) Clean nose cylinder orifices.

4. Landing Gear Retraction System Functional Test

A. Seneca IV's and Seneca V S/N's 3449001 thru 3449300, less 3449161

(1) Setup

Before proceeding with this test, ensure that the:

- (a) Tires and struts are properly inflated (See 6-00-00 and 12-10-00).
- (b) The nose gear, main gear, limit switches and nose gear steering are properly adjusted (See the respective sections in this chapter).

CAUTION: TO PREVENT ACCIDENTAL ACTIVATION, PULL THE FOLLOWING CIRCUIT BREAKERS: SURFACE AND PROP DEICE, WSHLD HEAT, AND PITOT HEAT.

- (c) The BATT switch and all other electrical switches are OFF and remain OFF throughout the test.
- (d) Raise the aircraft on jacks per 7-10-00.
- (e) Connect a 50-ampere minimum power source of the correct voltage to the aircraft's electrical system through the external power supply.

NOTE: During all tests, add hydraulic fluid MIL-H-5606 to reservoir as necessary to keep fluid level full.

CAUTION: AFTER FILLING RESERVOIR, TIGHTEN DIPSTICK, THEN BACK OFF 1 1/2 TURNS. THIS ALLOWS THE RESERVOIR TO BE VENTED.

(2) Procedure

NOTE: Perform the following tests and checks in the sequence shown. If the system fails to respond as indicated, the malfunction must be corrected before proceeding with the next step.

- (a) Place the gear selector in the DOWN position.
- (b) Place the throttles in a closed position.
- (c) Ensure that the GEAR PUMP circuit breaker is IN. Check:
 - 1 Three green gear safe lights – ON.
 - 2 Red GEAR WARN annunciator is OFF.
 - 3 Gear warning horn does NOT sound.
 - 4 Hydraulic pump does NOT operate.
- (d) Place gear selector switch in the UP position.
 - 1 Three green gear safe lights – OFF.
 - 2 Red GEAR WARN annunciator is ON.
 - 3 Gear warning horn SOUNDS.

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- 4 All gears retract fully and nose gear doors close.
- 5 Hydraulic pump STOPS operating
- (e) Move left throttle to its mid-travel position. Check warning horn continues to sound and red GEAR WARN remains ON.
- (f) Close left throttle. Move the right throttle to its mid-travel position. Check warning horn continues to sound and red GEAR WARN remains ON.
- (g) Move both throttles to their mid-level position. Check warning horn STOPS sounding and red GEAR WARN goes OUT.
- (h) Leave gear up for five minutes. Check hydraulic pump motor does NOT operate at any time. (If pump motor does operate, there is a leak in the up line or a malfunctioning component in the system.)

NOTE: One momentary pump operation is allowable during the five minute gear up period, provided that red GEAR WARN is NOT ON and there is no repeated pump operation for a subsequent fifteen minute period.
- (i) Pull the GEAR PUMP circuit breaker OUT.
- (j) Pull the gear free fall knob. Check all gears return to the down and locked position, with the down latches engaged.
- (k) Place the gear selector switch in the DOWN position. Push the free fall knob in. Push the GEAR PUMP circuit breaker IN. Check:
 - 1 Three green gear safe lights – ON.
 - 2 Red GEAR WARN annunciator is OFF.
 - 3 Gear warning horn does NOT sound.
- (l) With the airplane on jacks, and the main gear struts extended, the squat switch on the left main gear will be in the IN-FLIGHT position. Use one of the following means to position the actuating arm in the GROUND position:
 - 1 Insert a suitable wedge under the squat switch leaf.
 - 2 Remove torque link connecting bolt and rotate upper half so the switch tang is free.
 - 3 Loosen squat switch adjustment screws and rotate switch until tang is free.
 - 4 Partially compress the left main gear shock absorber so that squat switch operating tang is free.
- (m) Move throttles to closed position.
- (n) Place the gear selector switch in the UP position. Check that the:
 - 1 Hydraulic pump does NOT run.
 - 2 Three green safe lights remain on.
 - 3 Red GEAR WARN annunciator is ON.
 - 4 Gear warning horn SOUNDS.
- (o) Move throttles to mid travel position. Check the the:
 - 1 Red GEAR WARN annunciator remains ON.
 - 2 Gear warning horn does NOT sound.
- (p) Place the gear selector switch down. Check to ensure that the:
 - 1 Red GEAR WARN annunciator remains OFF.
 - 2 The gear warning horn does NOT sound.
- (q) Return the squat switch to the IN-FLIGHT position.

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- (r) Manually "break" the left main gear down lock. Check that the:
 - 1 Hydraulic pump motor RUNS.
 - 2 Correct green safe light is OUT.
 - 3 Red GEAR WARN annunciator remains ON.
 - 4 The horn does NOT sound.
 - (s) Repeat step (24) for the right main gear.
 - (t) Move the gear selector switch to its UP position and turn the landing light switches ON. Check that:
 - 1 The hydraulic pump motor OPERATES.
 - 2 The three green safe lights are OUT.
 - 3 The Red GEAR WARN annunciator remains ON until all gear are UP; then OFF.
 - 4 All gear retract fully in less than 10 seconds.
 - 5 The pump motor STOPS operating after the gear is UP.
 - 6 The warning horn does NOT sound.
 - 7 The gear mounted landing lights are OFF when the gears are in the fully retracted position.
 - (u) Place the gear selector switch in the DOWN position. Check that:
 - 1 The hydraulic pump motor OPERATES.
 - 2 All gears return to the DOWN and LOCKED position.
 - 3 The hydraulic pump motor STOPS operating after all the gears are DOWN and LOCKED.
 - 4 The three green safe lights are ON.
 - 5 The Red GEAR WARN annunciator is OFF.
 - 6 The warning horn does NOT sound.
- NOTE:** Any momentary "blinking" of the red and/or green gear lights after the down locks are engaged indicates an improperly adjusted micro switch.
- (v) Place annunciator panel DAY/NIGHT switch to NIGHT position. Check that the three green safe lights remain on but become dim.
 - (w) Place annunciator panel DAY/NIGHT switch to DAY position.
 - (x) Disconnect auxiliary power source from the aircraft's electrical system.
 - (y) Remove aircraft from jacks.

B. Seneca V S/N's 3449161 and 3449301 & up

(PIR-PPS60033-11, Rev. A)

(1) Setup

Before proceeding with this test, ensure that the:

- (a) Tires and struts are properly inflated (See 12-00-00).
- (b) The nose gear, main gear, limit switches and nose gear steering are properly adjusted (see 32-10-00 and 32-20-00, respectively).
- (c) Connect a 28 ± 1 vdc regulated power source capable of supplying a minimum of 50 amperes to the aircraft electric system.

NOTE: During all tests, add hydraulic fluid MIL-H-5606 to reservoir as necessary to keep fluid level full.

CAUTION: AFTER FILLING RESERVOIR, TIGHTEN DIPSTICK, THEN BACK OFF 1 1/2 TURNS. THIS ALLOWS THE RESERVOIR TO BE VENTED.

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(2) Procedure

NOTE: Perform the following tests and checks in the sequence shown. If the system fails to respond as indicated, the malfunction must be corrected before proceeding with the next step.

Master switch "ON" (remains on through all tests).

- (a) All other switches off and gear selector in the down position.
- (b) Move taxi light switch from "OFF" to "ON" position and cabin heat switch to fan position.
- (c) LH engine gear warn manifold pressure switch jump wires G4E20 and G4F20 together.
- (d) RH engine gear warning manifold pressure switch jump wires G4I20 and G4J20 together.
- (e) "Landing Gear Pump" circuit breaker "IN". Verify the following:
 - 1 Three green safe lights on.
 - 2 Red gear unsafe light off.
 - 3 Hydraulic pump does not operate.
 - 4 Taxi light is illuminated.
- (f) Gear selector switch "UP". Verify the following:
 - 1 Three green safe lights off.
 - 2 Red gear unsafe light on.
 - 3 Gear warning horn sounds.
 - 4 All gear retraction fully and nose gear doors close.
 - 5 Pump motor stops operating.
 - 6 Taxi light extinguished.
 - 7 Heater fan off.
- (g) Remove jumper on LH manifold pressure switch.
Verify that the warning horn continues to sound and red unsafe light remains on.
- (h) Replace jumper on LH manifold pressure switch and remove jumper on manifold pressure switch RH.
Verify that warning horn continues to sound and red unsafe light remains on.
- (i) Remove jumpers on both LH & RH manifold pressure switch.
Verify that warning horn stops sounding and red unsafe light goes out.
- (j) Leave the gear up for five minutes.
Verify that pump motor does not operate at any time. (If the pump motor operates at any time during the five minute period, there is a leak in the "up" line of a malfunctioning component in the system.)
NOTE: One momentary pump operation is allowable during this five minute period, provided that the gear unsafe light is not lit and there is no repeated pump operation for a subsequent fifteen minute period.
- (k) Pull "Landing Gear Pump" Circuit Breaker "OUT".
- (l) Pull gear free-fall knob.
Verify that all gear return to the "down and locked" position, with "down" latches engaged, taxi light illuminated, heater fan on.
- (m) Taxi light to "OFF" position.
- (n) Gear Selector Switch "DOWN". (See NOTE below.)
- (o) Free-fall knob "IN". (See NOTE below.)

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- (p) "Landing Gear Pump" Circuit Breaker "IN". (See NOTE below.) Verify the following:
- 1 Three green safe lights on.
 - 2 Red unsafe light off.
 - 3 Warning horn does not sound.
- (q) Partially compress the left main gear shock absorber so that the squat switch operating tang is free. Re-install jumpers on LH & RH manifold pressure switches per Item 3 and 4. (See NOTE below.)
- (r) Gear selector switch "UP". (See NOTE below.) Verify the following:
- 1 Pump does not run.
 - 2 Three green safe lights remain on.
 - 3 Red unsafe light off.
 - 4 Gear warning horn sounds.
- NOTE:** Acceptable alternatives for steps (n) thru (r) are as follows:
- a - Remove the torque link connecting bolt and rotate the upper half so the switch tang is free.
 - b - Loosen the squat switch adjustment screws and rotate the switch until the tang is free.
- (s) Remove jumpers on both LH & RH manifold pressure switches. Verify the following:
- 1 Red unsafe light stays on.
 - 2 Gear warning horn does not sound.
- (t) Gear selector switch "DOWN". Verify the following:
- 1 Red unsafe light off.
 - 2 Gear warning horn does not sound.
- (u) Release left main gear shock absorber.
- (v) "Break" left main gear down lock manually. Verify the following:
- 1 Pump motor operates.
 - 2 Correct green safe light out.
 - 3 Red gear unsafe light on.
 - 4 Horn does not sound.
- (w) Repeat the above step at the right gear down lock.
- (x) Gear selector switch "UP" and taxi light switches on. Verify the following:
- 1 Pump motor operates.
 - 2 Three green safe lights out.
 - 3 Red unsafe light on until all gear are up; then off.
 - 4 All gear retract fully in less than 10 seconds.
 - 5 Pump motor stops operating after gear is up.
 - 6 Warning horn does not sound.
 - 7 Taxi light off in full retracted position.

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(y) Gear selector switch "DOWN". Verify the following:

- 1 Pump motor operates.
- 2 All gear return to the "down and locked" position in 15 seconds or less.
- 3 Pump motor stops operating after all gear are in the "down and locked" position.
- 4 Three green safe lights on.
- 5 Red unsafe light off.
- 6 Warning horn does not sound.

NOTE: Any momentary "Blinking" of the red/green gear lights after the down locks are engaged indicates an improperly adjusted microswitch.

(z) Annunciator panel day-night switch in "NIGHT" position.

Verify that three green safe lights remain on, but become dim.

(aa) Rig squat switch on LH main gear so that the switch actuates when the oleo is 7.75-8.00 extended (see Squat Switches Adjustment, 32-60-00).

(bb) Master switch "OFF".

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WHEELS AND BRAKES

1. Nose Wheel

A. Removal and Disassembly (See Figure 1.)

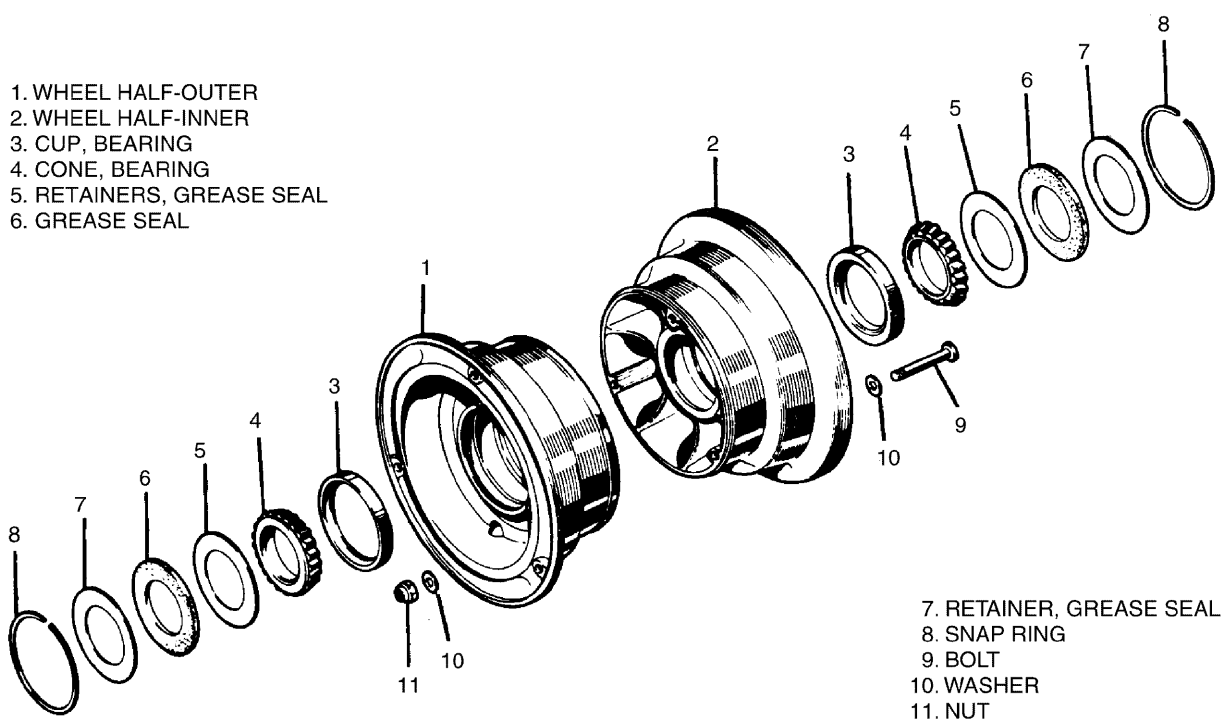
- (1) Jack the airplane enough to raise the nose wheel clear of the ground.
- (2) To remove the nose wheel, first remove the nut from one end of the axle rod and slide out the rod and axle plugs.

CAUTION: EXERCISE CARE TO AVOID DAMAGING AXLE TUBE ENDS. THIS WILL MAKE REMOVAL AND INSTALLATION EXTREMELY DIFFICULT.

- (3) Lightly tap the axle tube out from the center of the wheel assembly by use of an object of near equal diameter.
- (4) Remove spacer tubes and wheel assembly.

WARNING: FAILURE TO DEFLATE TIRE PRIOR TO WHEEL DISASSEMBLY MAY CAUSE INJURY.

- (5) Deflate the tire. Remove wheel bolts. Pull wheel halves from the tire by removing the wheel half opposite the valve stem first and then the other half.
- (6) Remove snap ring, grease seal, seal retainers and bearing cones. Remove bearing cup by tapping evenly from the inside.



Nose Wheel Assembly (Typical)
Figure 1

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B. Inspection

- (1) Visually check all parts for cracks, distortion, defects and excess wear.
- (2) Check wheel bolts for stripped or damaged threads.
- (3) Check internal diameter of felt grease seals. Replace the felt grease seal if surface is hard or gritty.
- (4) Check tire for cuts, internal bruises and deterioration.
- (5) Check bearing cones and cups for wear and pitting and relubricate.
- (6) Replace any wheel casting having visible cracks.

C. Assembly and Installation (See Figure 1.)

- (1) Carefully install bearing cups into each wheel half.
- (2) Install the inner tube in the tire, making certain to align the index marking on the tire with the index marking on the tube, to ensure proper wheel balance.
- (3) Install the tire and tube on the wheel half with the valve stem hole, inserting the valve stem through the valve hole.
- (4) Place the opposite wheel half inside the tire. Align the wheel bolt holes, install the wheel bolts with washers and nuts to the valve stem side and tighten (draw up) the bolts in a criss-cross fashion. Torque the nuts to 90 inch-pounds and inflate the tire to 46 psi to seat the tire bead, then deflate the tire to proper inflation.
- (5) Lubricate bearing cones and install cones, inner seal retainers and grease seals. Secure outer seal retainers with snap rings.
- (6) Place one spacer tube in each side of wheel and position wheel in fork. Align and slide axle tube through spacer tubes and wheel assembly. Install axle plugs and tie rod and secure with nuts. Tighten the nuts until no side play is felt, yet allowing the wheel to rotate freely.

2. Main Wheels

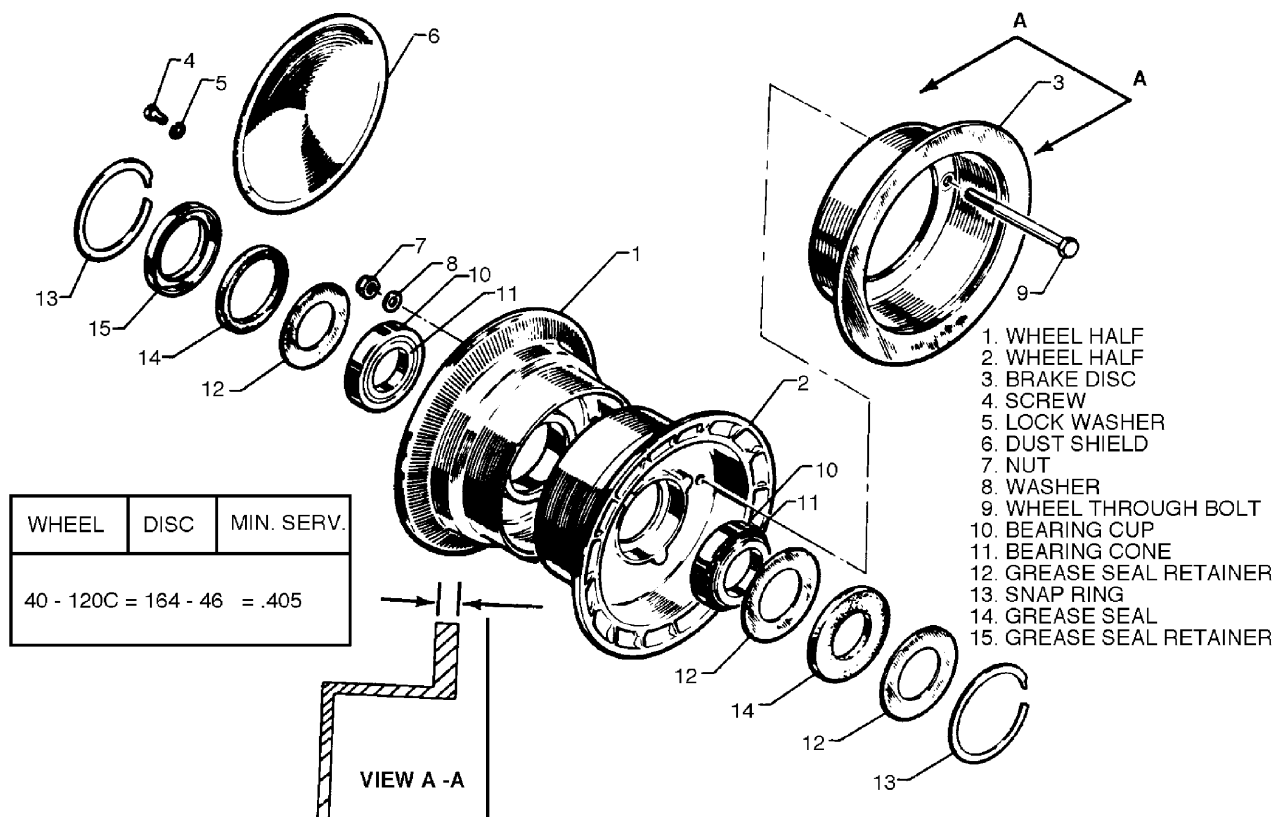
A. Removal and Disassembly (See Figure 2.)

- (1) Place airplane on jacks.
- (2) To remove main wheel, remove cap bolts joining brake cylinder housing and back plate lining assemblies. Remove back plate from between brake disc and wheel.
- (3) Remove the dust cover and cotter pin that safeties axle nut; remove axle nut and bushing and slide wheel from the axle.

WARNING : FAILURE TO DEFLATE TIRE PRIOR TO WHEEL DISASSEMBLY MAY CAUSE INJURY.

- (4) The wheel halves may be separated by first deflating the tire. With tire deflated, remove bolts. Pull wheel halves from tire by first removing inner half from the tire then the outer half.
- (5) Wheel bearing assemblies may be removed from each wheel half by removing snap rings, grease seal rings, felt grease seals and bearing cone. Bearing cups should not be removed unless in need of replacement. To remove bearing cups, tap evenly from the inside.

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Main Wheel Assembly
Figure 2

B. Bearing Cup Replacement

(1) Removal:

- (a) Insert wheel half into boiling water for 15 minutes or place in an oven not exceeding 250°F (121°C) for 15 minutes.
- (b) Remove from source of heat and invert wheel half. If the cup does not drop out, tap the cup evenly from the axle bore with a fiber drift pin or suitable arbor press.

(2) Installation:

- (a) To replace a new cup, apply one coat of zinc chromate primer to wheel half bearing bore.

NOTE: Never paint working surfaces of the bearing cups.

- (b) Insert wheel half into boiling water for 15 minutes or place in an oven not exceeding 250°F (121°C) for 15 minutes. Chill new bearing cup in dry ice for a minimum of 15 minutes.
- (c) Remove wheel half from source of heat and bearing cup from the dry ice. Install the chilled bearing cup into the bearing bore of the heated wheel half. Tap gently to seat evenly in place, using a fiber drift pin or suitable arbor press.

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C. Inspection

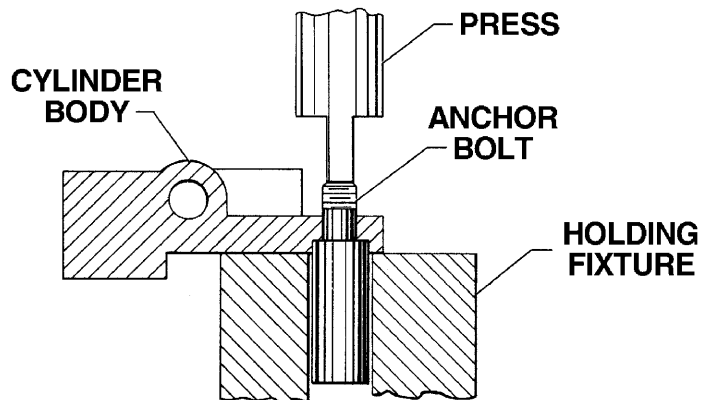
Inspection of the main assembly is the same as that given for the nose wheel. See Inspection of Nose Wheel.

D. Assembly and Installation (See Figure 2.)

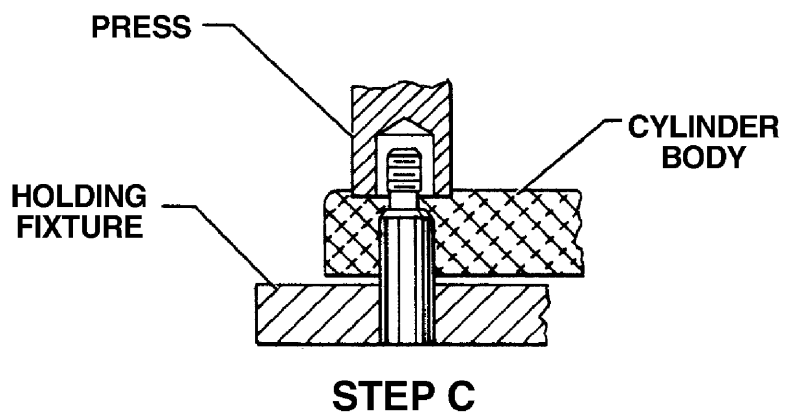
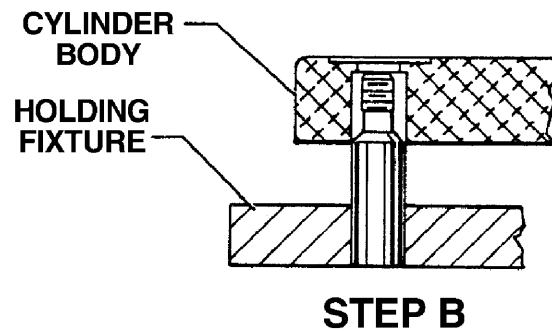
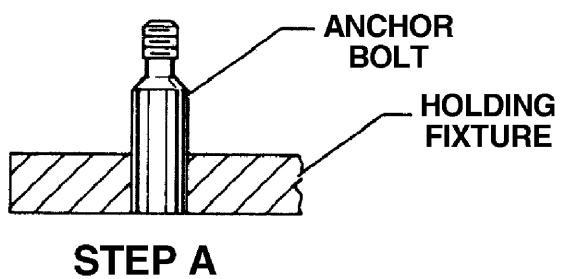
- (1) Determine that the bearing cup is properly installed in each wheel half.
- (2) Install the inner tube in the tire, making certain to align the index marking on the tire with the index marking on the tube, to ensure proper wheel balance.
- (3) Install the tire and tube on the wheel half with the valve stem hole, inserting the valve stem through the valve hole.
- (4) Place the opposite wheel half inside the tire. Align the wheel bolt holes. Position the brake disc in the inner wheel half and install the wheel bolts with nuts on the valve stem side. Tighten (draw up) the bolts in a criss-cross fashion. Torque the nuts to 150 inch-pounds and inflate the tire to 70 psi to seat the tire bead, then deflate the tire to proper inflation.
- (5) Lubricate bearing cones and install cones, felt grease seals and grease seal rings. Secure with snap rings.
- (6) Slide wheel on the axle and secure with axle nut. Tighten nut sufficiently to prevent side play, yet allow the wheel to rotate freely. Reinstall the dust cover.
- (7) Position brake lining back plates between the wheel and brake disc and the brake cylinder on the torque plate. Insert spacer blocks between the back plates and cylinder and install four bolts to secure the assembly. If the brake line was disconnected, reconnect the line and bleed the brakes.

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REMOVAL



INSTALLATION



Removal and Installation of Anchor Bolts
Figure 4

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- (7) The following procedure should be used when removing anchor bolts:
 - (a) Position cylinder assembly on a holding fixture. (See Figure 4.)
 - (b) Use a suitable arbor press and remove the anchor bolt from the cylinder body.
- B. Cleaning, Inspection, and Repair
 - (1) Clean the assembly with a suitable solvent and dry thoroughly.
 - (2) Check the wall of the cylinder housing and piston for scratches, burrs, corrosion, etc, that may damage O-rings.
 - (3) Check the general condition of the brake bleeder screw and lines.

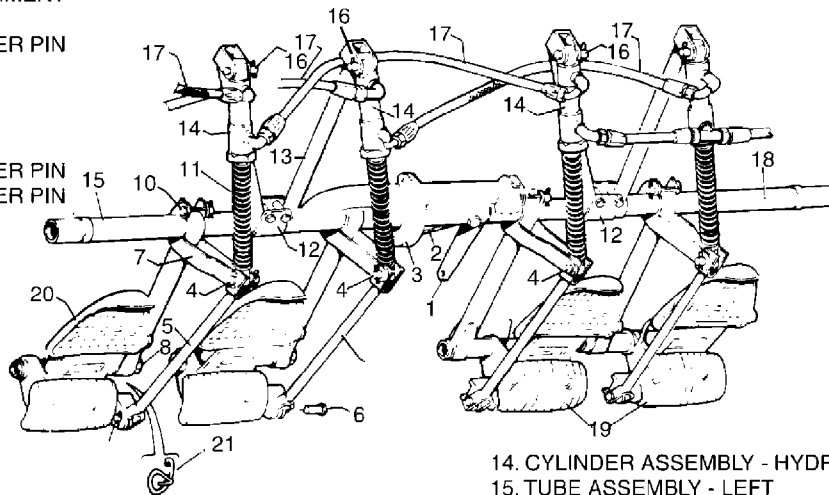
NOTE: Heavy duty wheel assemblies and brake discs may be easily identified by six bolt hole pattern. Standard wheel assemblies and disc brakes have a three bolt hole pattern.
 - (4) Check the brake disc for wear, grooves, scratches, or pits. The minimum disc thickness of Disc 164-46 used on heavy duty Wheel Assembly 40-120 is 0.405. A single groove or isolated grooves up to 0.031 of an inch deep would not necessitate replacement, but a grooving of the entire surface would reduce lining life and would indicate that the disc should be replaced. Should it be necessary to remove the wheel disc, See "Main WheelS, Removal and Disassembly."
 - (5) At each periodic maintenance inspection, visually inspect both wearing surfaces of the brake disc for heat checks. Replace brake disc if crack length exceeds 0.800 or crack depth exceeds 0.210. If crack depth is not measurable, replace disc if crack length exceeds 0.400.

NOTE: Any crack, regardless of length and/or depth, extending into the welded seam between the flange and cup, is cause for immediate replacement.
 - (6) The riveted type lining may be removed from the backing plates by drilling out the old rivets using a 5/32 drill bit. Install a new set of linings using the proper rivets and a rivet set that will properly stake the lining and form a correct flair of the rivet. The snap-on type lining used on optional heavy duty assemblies may be removed by prying loose with a screwdriver or a thin flat wedge. Install the snap-on type by positioning onto the pins and applying pressure to snap into position.

NOTE: After replacing the brake linings on Cleveland 30-83 brakes, execute two consecutive full stop braking applications from 30 to 35 kts. Do not allow brake discs to cool substantially between stops.
- C. Rebuilding and Installation (See Figure 3.)
 - (1) If anchor bolts have been removed, they should be reinstalled as follows:
 - (a) Support anchor bolt in a holding fixture. (See Figure 4, Step A.)
 - (b) Align cylinder body over anchor bolt. (See Figure 4, Step B.)
 - (c) Using a suitable arbor press, apply pressure on the spot face directly over the anchor bolt. (See Figure 4, Step C.)
 - (2) Lubricate piston O-rings with hydraulic fluid (MIL-H-5606) and install on pistons. Slide piston into cylinder housing until flush with surface of housing.
 - (3) Slide pressure plate onto anchor bolts of housing.
 - (4) Slide cylinder housing on torque plate.
 - (5) Position back plate between wheel and brake disc. Install bolts and torque to 40 inch-pounds to secure the assembly.
 - (6) Connect brake line to cylinder housing and bleed brake system as described in this section.

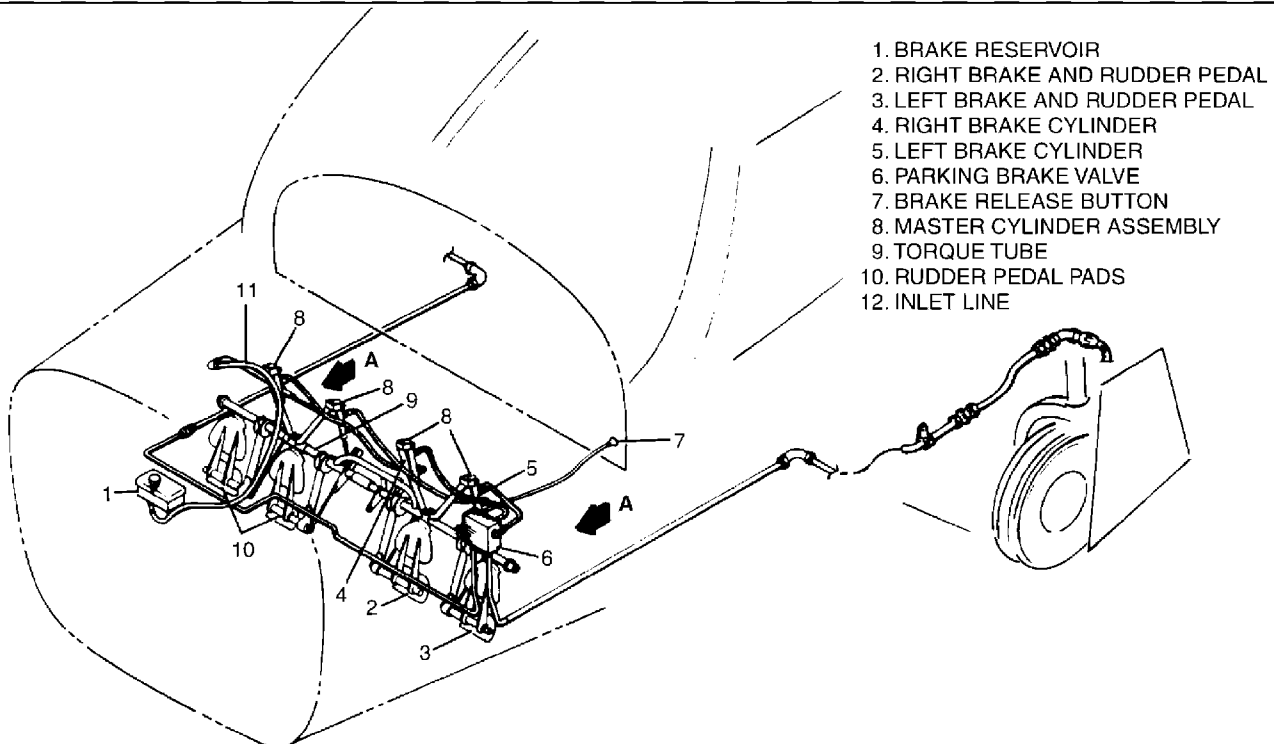
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1. ARM, RUDDER CABLE ATTACHMENT
2. ARM, RUDDER CABLE ATTACHMENT
3. ARM, RUDDER STEERING
4. CLEVIS PIN, WASHER & COTTER PIN
5. CLEVIS ASSEMBLY
6. CLEVIS PIN
7. IDLER ARM
8. NUT
9. CLEVIS PIN, WASHER & COTTER PIN
10. CLEVIS PIN, WASHER & COTTER PIN
11. SPRING, RETURN
12. BRACKET
13. BRACE ASSEMBLY



VIEW A-A

14. CYLINDER ASSEMBLY - HYDRAULIC
15. TUBE ASSEMBLY - LEFT
16. CLEVIS PIN & COTTER PIN
17. HOSE ASSEMBLY
18. TUBE ASSEMBLY
19. PEDAL PADS
20. TOE BRAKE PEDAL
21. SPRING CLIP



Toe Brake Installation
Figure 5

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4. Toe Brake Cylinder (See Figure 5.)

A. Removal

- (1) Disconnect upper and lower lines from the cylinder being removed. Cap lines to prevent fluid leakage or drain fluid from brake reservoir and master cylinder.
- (2) Remove cotter pins and clevis pins securing brake cylinder in position; then remove brake cylinder.

B. Installation

- (1) Position brake cylinder at its mounting points and secure in position with clevis pin. Safety clevis pins with cotter pins.
- (2) Connect brake lines to cylinder fittings. Bleed brakes as explained in the following paragraphs.

C. Toe Brake Cylinder Service (Cleveland cylinder number 10-30, see Figure 6.)

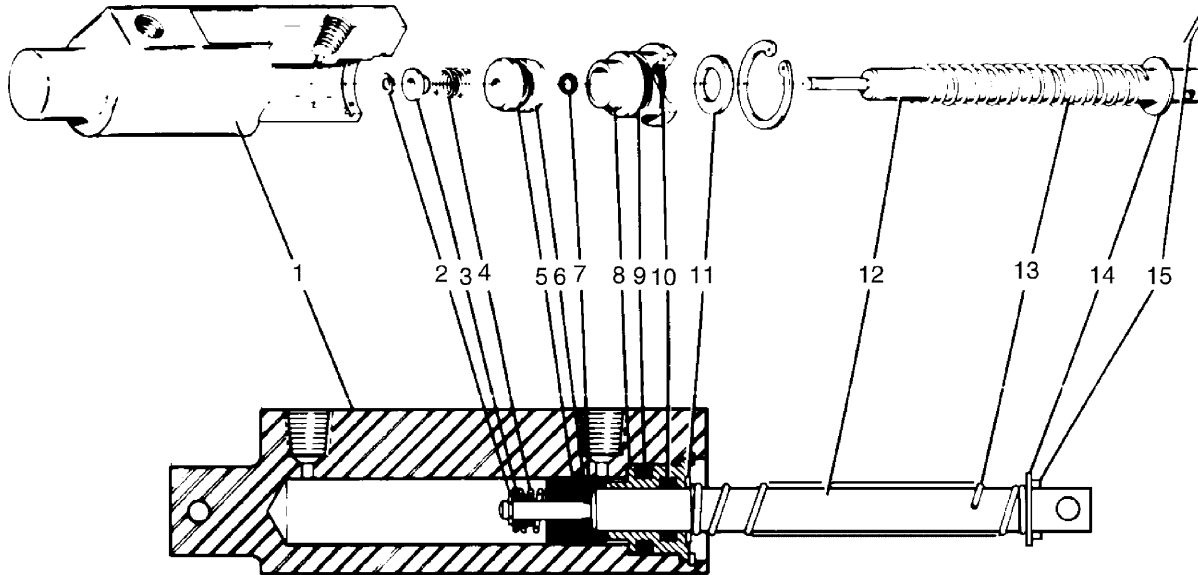
- (1) Remove the cylinder, per Removal, above.
- (2) Disassembly
 - (a) To disassemble the cylinder, first remove the piston rod assembly by removing the retaining ring from the annular slot in the cylinder housing. Draw the piston rod assembly from the cylinder.
 - (b) The piston rod assembly may be disassembled by first removing the retaining ring, sleeve, spring, and then the piston assembly, O-ring, and gland, and if desired, the return spring.
 - (c) Remove the O-rings from the piston and packing gland.
- (3) Cleaning, Inspection, and Repair
 - (a) Clean cylinder components with a suitable solvent and dry thoroughly.
 - (b) Inspect interior walls of cylinder for scratches, burrs, corrosion, etc.
 - (c) Inspect general condition of fitting threads.
 - (d) Inspect piston for scratches, burrs, corrosion, etc.
 - (e) Repairs to the cylinder are limited to polishing out small scratches and burrs, and replacing seal and O-rings.

(4) Assembly

NOTE: Rub a small amount of hydraulic fluid (MIL-H-5606) on all O-rings and component parts for ease of handling during reassembly and to prevent damage.

- (a) Install new O-rings on the inside and outside of the packing gland and on the outside of the piston.
 - (b) To assemble the piston rod assembly, install on the rod, in order, the roll pin, washer, spring, washer, packing gland with O-rings, seal, piston assembly with O-ring, spring, and roll pin.
 - (c) Insert the piston rod assembly in the cylinder and secure with the retaining plug.
- (5) Install the cylinder, per Installation, above.

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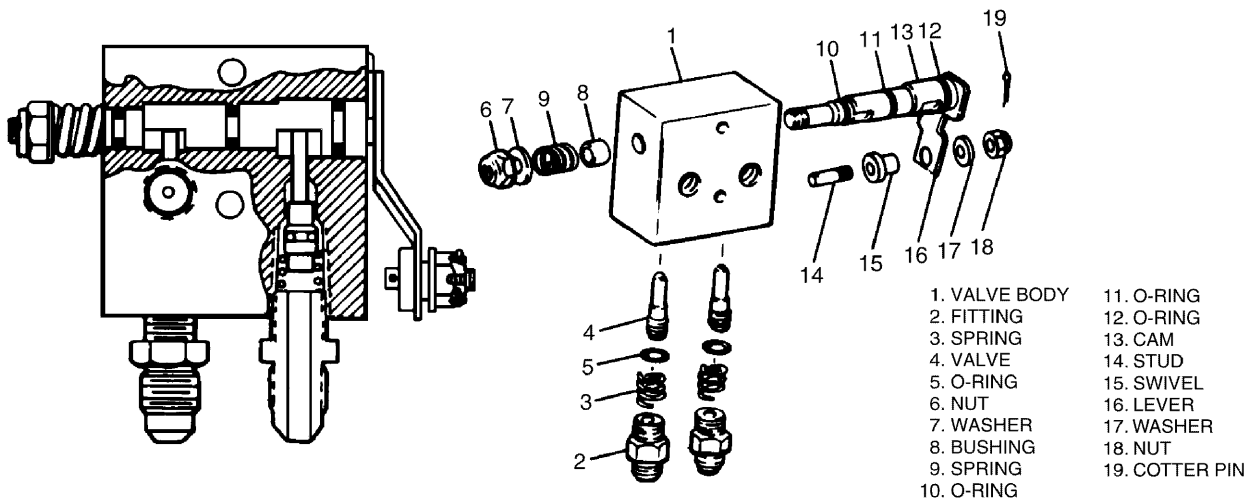


- 1. HOUSING
- 2. RETAINING RING
- 3. SLEEVE
- 4. SPRING
- 5. O-RING

- 6. PISTON
- 7. O-RING
- 8. GLAND
- 9. O-RING
- 10. O-RING

- 11. WASHER WIPER
- 12. ROD
- 13. SPRING
- 14. WASHER
- 15. ROLL PIN

Cleveland 10-30 Toe Brake Cylinder
Figure 6



- 1. VALVE BODY
- 2. FITTING
- 3. SPRING
- 4. VALVE
- 5. O-RING
- 6. NUT
- 7. WASHER
- 8. BUSHING
- 9. SPRING
- 10. O-RING
- 11. O-RING
- 12. O-RING
- 13. CAM
- 14. STUD
- 15. SWIVEL
- 16. LEVER
- 17. WASHER
- 18. NUT
- 19. COTTER PIN

Parking Brake Valve Assembly
Figure 7

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5. Parking Brake Valve (See Figure 7.)

A. Removal

- (1) Disconnect the parking brake cable from the valve actuating arm.
- (2) Disconnect the fluid lines from the valve.
- (3) Remove the screws that attach the valve to its mounting bracket.
- (4) Place a protective material over the line openings to prevent contamination of the system.

B. Installation

- (1) Attach the valve to the bulkhead mounting bracket with screws.
- (2) Connect the fluid lines to the valve.
- (3) Connect the control cable to the valve lever and determine that when valve lever fits in the closed detent, parking brake handle is .03 to .06 inch of being full in against stop.

C. Parking Brake Valve Service (See Figure 7.)

Remove valve before servicing.

(1) Disassembly

- (a) Remove the two fittings from the outside of the valve body. A valve spring is held in place by the fittings. Use caution not to loosen these when removing the fittings.
- (b) From the valve body, remove the valve spring and valve.
- (c) To remove the valve cam, remove the nut, washer, bushing and spring and pull the cam from the valve body.

(2) Cleaning, Inspection, and Repair

- (a) Clean the valve parts with a suitable solvent and dry thoroughly.
- (b) Inspect valve and seat surfaces of valve body for excessive wear and corrosion.
- (c) Inspect the cam assembly for burrs, scratches, excess wear, loose operating lever, etc.
- (d) Check general condition of valves and springs.
- (e) Repair to the valve is largely limited to smoothing burred or scratched surfaces and replacing O-ring.

(3) Assembly

- (a) Install O-rings on valve cam.
- (b) Lubricate O-rings with fluid (MIL-H-5606), insert cam into valve body and secure with spring, bushings, washer and self-locking nut.
- (c) Install O-ring on the valve, insert valve in hole of out port, install valve spring and secure with outlet fitting.

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6. Brake Bleeding

A. Gravity Procedure

- (1) On both main landing gear wheel brake assemblies, attach a clear plastic hose to the brake bleeders and extend into container partially filled with hydraulic fluid, MIL-H-5606. The ends of this hose should be submerged in the fluid. Open both bleeders approximately one and one-half to two turns.
- (2) Fill the brake reservoir on the firewall with hydraulic fluid, MIL-H-5606.
- (3) Disconnect the toe brake cylinders from the pedal connection by removing clevis pin, washer and cotter pin.
- (4) Invert toe brake cylinder to aid in releasing trapped air in the top of the cylinder.
- (5) Check toe brake pedals in the cockpit to ensure pedals are pulled full aft.
- (6) Pull the hand brake handle, pumping the master cylinder very slowly approximately 25 times until fluid is observed passing through the clear plastic hoses at the wheel cylinder.

NOTE: Fluid level in the reservoir must be maintained to prevent air from entering the line.

- (7) Tighten both wheel bleeders.
- (8) Pull hand brake until a firm handle is maintained.

B. Pressure Procedure (See Figures 8 and 9.)

- (1) Place a small clear plastic hose on the vent tube of the brake reservoir and place a second small clear plastic hose on the bleeder fitting on one main landing gear. Place the open ends of these tubes in a suitable container to collect the fluid overflow. Open the bleeder fitting one to two turns.
- (2) On the other main gear, slide the hose of the pressure unit over the bleeder fitting then open the fitting one or two turns and pressure fill the brake system with MIL-H-5606 fluid.
- (3) With fluid continually flowing through the brake system, SLOWLY and together actuate the hand brake and the toe brake pedal of the side being bled, several times, to purge the cylinders of air. On dual brake installations, both right and left pedals must be actuated.

NOTE: By watching the fluid pass through the plastic hose at the fluid reservoir and the bleeder fitting on the gear being bled, it can be determined whether any air is left in the system. If air bubbles are evident, filling of the system shall be continued until all the air is out of the system and a steady flow of fluid is obtained. Should the brake handle remain spongy, it may be necessary to disconnect the bottom of the toe brake cylinders (next to the pedal) and, rotating the cylinder horizontally or even above horizontal, and by use of the hand brake alone, purge the air from the system.

- (4) Close the open bleeder fitting on the gear being bled. Close the open bleeder fitting to which the pressure hose is attached; then close the pressure unit and remove the hoses from the bleeder fittings. Check the brakes for proper pedal pressure. Replace the caps over the bleeder fittings.

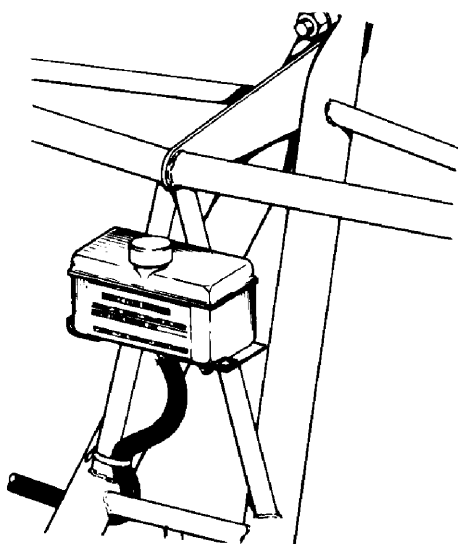
NOTE: It may be necessary to remove any trapped air in the top of the wheel brake unit by applying pressure to the system with the brake hand lever and slowly opening the bleeder and releasing the hand lever.

- (5) Repeat this procedure, if necessary, on the other gear.
- (6) Drain excess fluid from the reservoir to fluid level line with a syringe.

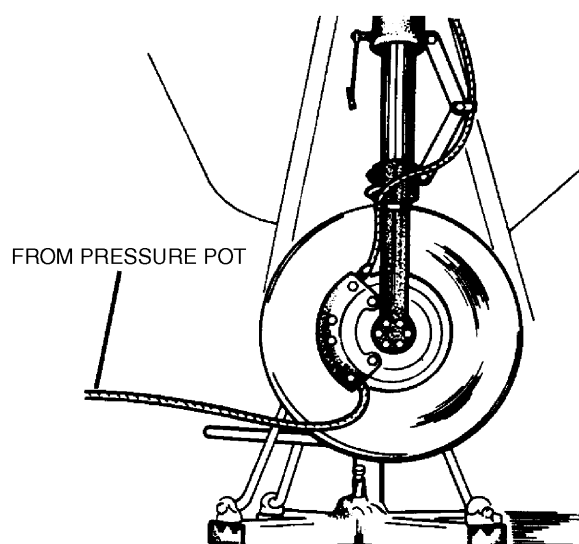
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7. Brake System Leak Check

- A. Pull firmly on the hand brake until resistance has built up and actuate the locking mechanism.
- B. After the system has stood for approximately 10 minutes, the handle should be checked for the same resistance.
- C. If the handle is able to be pulled easily or feels spongy, check the system for leaks. Especially check line joints. It is also possible the master cylinder or wheel brake assemblies may have internal leaks.



Brake Reservoir Bleeding
Figure 8



Bleeding Brake
Figure 9

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POSITION AND WARNING

1. Nose Landing Gear Limit Switches

NOTE: All limit switches adjustments should be made with airplane on jacks. Do not bend actuator springs mounted on the limit switches.

A. Up Limit Switch Adjustment

The gear up limit switch is mounted on a bracket attached to the lower inner left tubular member of the nose gear mount, adjacent to the gear roller track assembly or mounted on the stop assembly. (See Figure 2, 32-00-00.)

- (1) To facilitate adjustment of the limit switch, disconnect gear doors.
- (2) Turn the master switch on; move gear selector switch to the gear up position and raise the landing gear. Turn the master switch OFF.
- (3) Block the nose gear in the up position and slowly pull the free fall knob away from the instrument panel. This will relieve hydraulic pressure and permit the main gear to drop.
- (4) Loosen the attachment screws of the switch and rotate the switch toward the actuator tang until the switch is heard to actuate. Move the up limit switch upward .02 to .04 inches after actuation. Retighten the switch attachment screws. Remove the block from under the gear and allow it to extend slowly.
- (5) Turn master switch on; raise gear and determine that gear limits function properly.

B. Down Limit Switch Adjustment (See Figure 1.)

The nose gear down limit switch is mounted on a bracket located on the forward side of the cabin bulkhead.

- (1) With landing gear in the retracted position, pull the free fall valve knob permitting the gear to extend.
- (2) Check to determine that the down lock spring returns the body end of the actuating cylinder aft.
- (3) Ascertain that the down lock link assembly is fully retracted and that the drag link arms are over center.
- (4) In this position, the nose gear green down lock light should energize when the master switch is turned on and the gear selector lever is in the down position.
- (5) If the nose gear green down lock light does not energize, loosen the attachment screws of the switch and rotate the switch toward the actuator tang until it is heard to actuate. Tighten the adjustment screws.

2. Main Landing Gear Limit Switches

NOTE: All limit switches adjustments should be made with airplane on jacks. Do not bend actuator springs mounted on the limit switches.

A. Up Limit Switches Adjustment

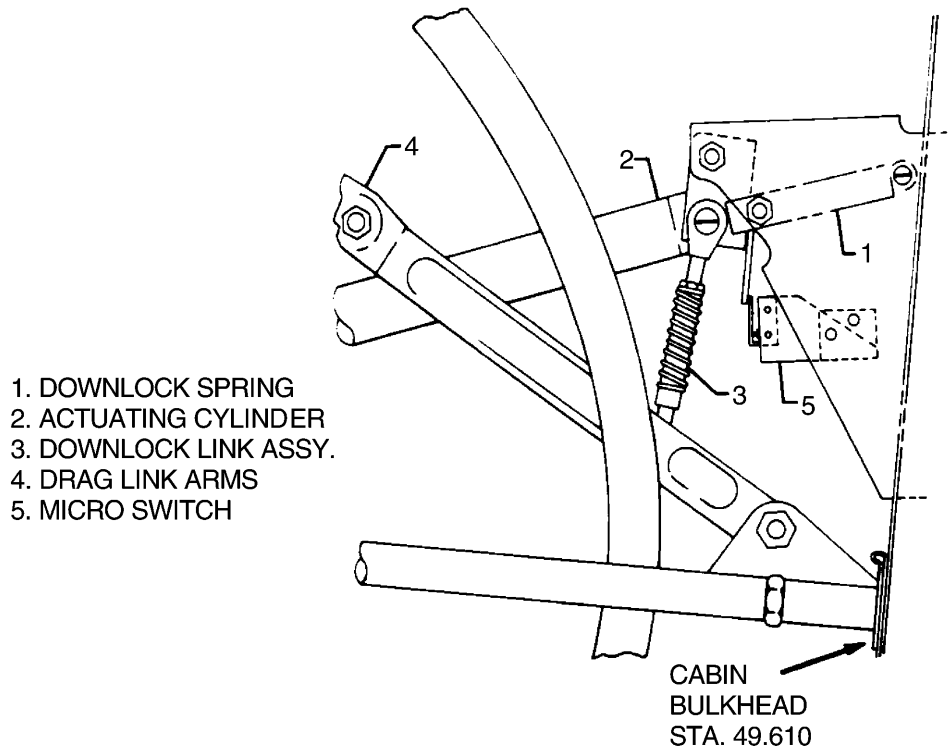
Up limit switches are mounted in the outboard interior of each wheel well. Included in the right side installation is also an up limit or "Flight Switch" for the heater circuit.

The up limit switches are incorporated in the circuit such that the red Gear Unsafe light is extinguished when the switches are activated and the gear selector is in the up position.

The up limit or "Flight Switch" that is included with the right installation is tied into the heater circuit and is described in Chapter 21.

Adjustment of the up limit switches should be made by loosening the aft bolt and rotating the unit(s) in the correct direction to permit activation of the switches when the fork is 0.88 of an inch from full up.

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Adjust Nose Gear Down Limit Switch
Figure 1

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B. Down Limit Switch Adjustment (See Figure 2.)

The gear down limit switch is mounted on the lower drag link of each main gear. The switch should be adjusted to allow it to actuate when the down lock hook has entered the locked position and is contacting the pin, thus turning the green light on in the cockpit. Adjustment, if necessary, should be made as follows:

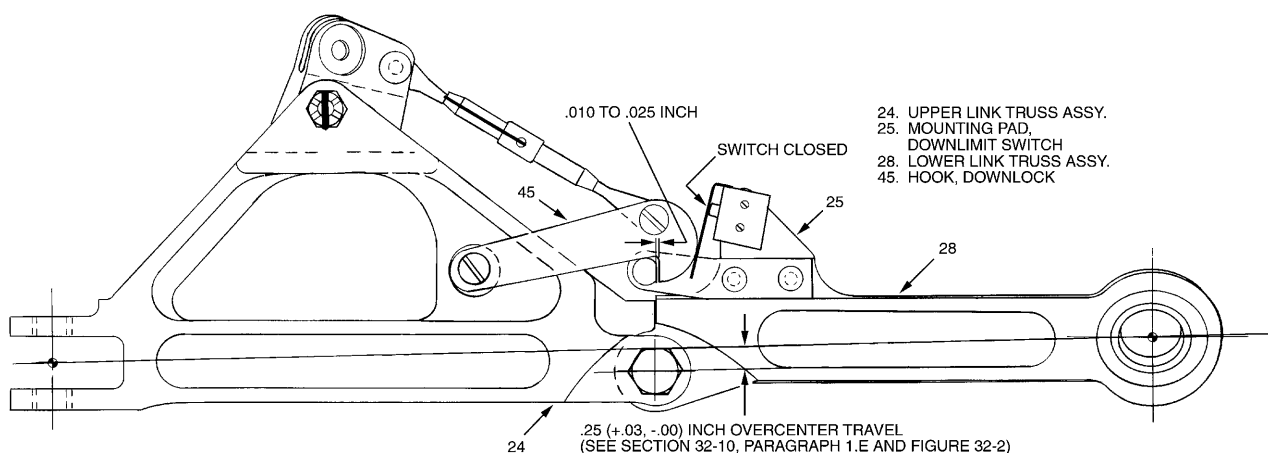
- (1) Bend/Adjust "Gear Down" micro switch support bracket to clear trunnion as required, ensuring engagement of micro switch tang when gear is extended.
- (2) Rig down lock switch to remain actuated when the gear is in the down and locked position.

3. Squat Switches Adjustment

The squat switches are mounted to a bracket at the upper torque link attachment of the left gear and consists of two microswitches which control gear operation and stall warning. Each specific microswitch can be identified by the wire coding as referenced in the specific wiring schematic (See 91-32-60 for Electrical Schematic).

Adjust the squat switches as follows:

- A. Compress the strut until the gap between the trunnion housing and fork mating surfaces is 7.75 to 8.00 inches. Retain the strut at this position.
- B. Adjust the switches on their mounting bracket to actuate at this point.
- C. Extend and compress gear to ensure proper operation.



Adjust Main Gear Down Limit Switch
Figure 2

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4. Gear Warning Switches

A. Throttle Micro-switch (See Figure 3.)

(Seneca IV's and Seneca V S/N's 3449001 thru 3449300, less 3449161)

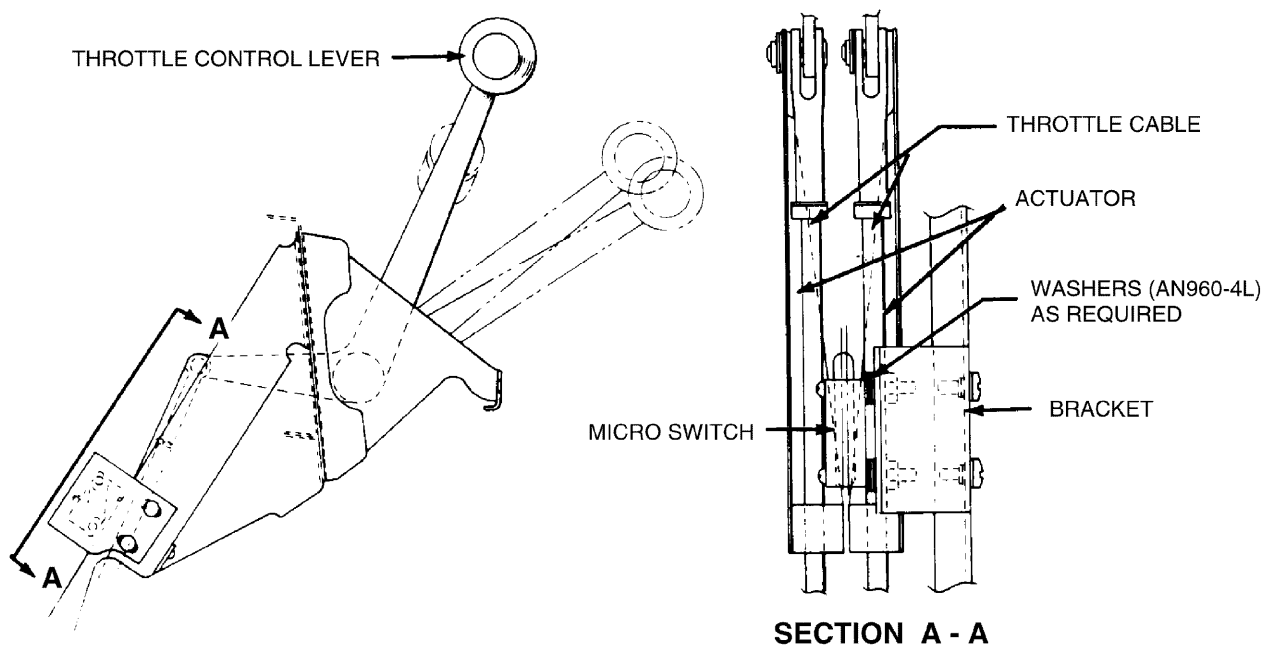
The throttle switch is utilized to activate the gear up warning horn if the gear is still up when the throttles are pulled below 14 ± 2 inches manifold pressure.

The microswitch is located in the control quadrant behind the throttle levers. Access to the switch can be made from below and behind the quadrant. The electrical schematic for the landing gear can be found in 91-32-60.

(1) Adjustment

Initially, the Gear Warning Throttle Switch is set for the airplane flying at approach speed and a relative altitude of 1000 feet agl. When using the following procedures, the same limits should be used. Make sure that during this procedure the airplane is flown at or above 1000 feet agl in case any problems should develop.

- (a) With the aid of a qualified pilot, fly the airplane to an elevation of 1000 feet above the ground and come to approach speed with propellers set for high rpm. Retard the throttles to 14 ± 2 inches of manifold pressure and mark the quadrant cover adjacent to the throttle levers in such a manner so that the levers can be returned to the same position after the airplane is landed and the engines shut down.
- (b) Place the airplane on jacks and retract the landing gear.
- (c) Reposition the throttle levers at the location which gave the 14 ± 2 inches of manifold pressure per step (1).
- (d) With the master switch turned on, loosen the two mounting screws securing the micro switch to the bracket. Move the switch in the direction necessary to make the warning horn operate and tighten the mounting screws.



Throttle Warning Switch
Figure 3

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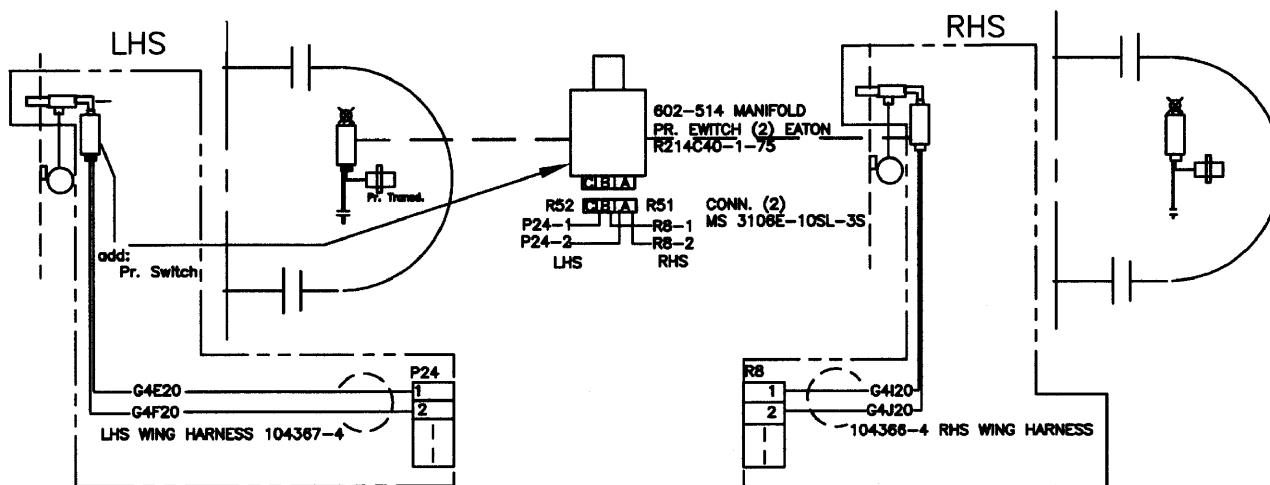
- (e) With the warning horn operating, lower the landing gear to determine whether the horn ceases to operate when the gear are down and locked. Turn OFF master switch and remove airplane from jacks.
- (f) Flight test the airplane to ensure proper operation of the gear warning horn with the gear up and power reduced below 14 ± 5 inches of manifold pressure.
- (2) Replacement
 - (a) Determine and take note of how many washers are between the microswitch and the bracket.
 - (b) Disconnect electrical wires and mark microswitch position.
 - (c) Remove screws and install new switch in same position making sure to use same amount of washers.

B. Manifold Pressure Switches (See Figure 4.)

[\(Seneca V S/N's 3449161 and 3449301 & up\)](#)

The Manifold Pressure Switches activate the gear up warning horn if the gear is still up when the throttles are pulled below 14 ± 2 inches manifold pressure.

These switches are located on the back side of the engine firewall (FW) as shown. Remove the left or right nacelle skin for access to the appropriate switch. The electrical schematic for the landing gear can be found in 91-32-60.



Gear Warning Manifold Pressure Switches
Figure 4

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CHAPTER

33

LIGHTS

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FLIGHT COMPARTMENT

This airplane is equipped with pilot and copilot overhead instrument panel/map lights, instrument post lights, switch lights, and avionics lights. The instrument post lights, switch lights, and avionics lights are controlled by independent dimmer controls located on the lower left instrument panel just below the remote compass switches. The two overhead instrument panel/map lights are each controlled by its own dimmer control.

An annunciator panel, located on the upper left side of the instrument panel ([Seneca IV](#)) or upper center of the instrument panel ([Seneca V](#)), provides a visual warning of possible malfunctions, including failure alert and precautionary warnings. See 31-50-00 for a complete description of its operation.

1. Troubleshooting

When checking any of these light systems the BATT switch must be ON in order to operate the lights. Ensure that the circuit breaker of the affected system is activated.

2. Dome Panel Flood/Map Lights

Two overhead instrument panel/map lights are mounted in the overhead forward fresh air vent panel adjacent to the speaker. A slide control incorporated in the forward part of each fixture may be utilized to expose a small square hole, which directs a beam of light onto the respective pilot's seat area. The light is controlled by a rheostat.

A. Bulb Replacement

- (1) Ensure BATT switch is off. Disengage (pull OUT) FLOOD circuit breaker.
- (2) Remove three screws retaining lens cover to light fixture.

NOTE: Observe there are two sets of three screws associated with each fixture; one set in an outer ring or circle and one set in an inner ring or circle. Be sure to remove screws from inner ring or circle.

- (3) The light bulb is of a bayonet type and removed accordingly.
- (4) Replace the bulb. Engage (push IN) FLOOD circuit breaker. Ensure correct operation of light.
- (5) If bulb does not light up, check the following.
 - (a) Proper circuit breaker mode.
 - (b) Continuity between housing socket and its electrical leads.
 - (c) Proper dimmer operation.
- (6) Clean lens as necessary.
- (7) Install light fixture and secure with three screws previously removed.

B. Rheostat Replacement

- (1) Ensure BATT switch is off. Disengage (pull OUT) FLOOD circuit breaker.
- (2) Loosen allen screw and remove switch knob.
- (3) Loosen (do not remove) nut securing rheostat to dome panel.

CAUTION: PERMITTING DOME PANEL TO "FLIP" FRONT END DOWN DURING REMOVAL MAY RESULT IN TEARS OR RIPS IN HEADLINER.

- (4) Remove and support dome panel. Drop panel just enough to gain access to rheostat. Do not permit panel to hang by electrical wires.
- (5) Remove nut from rheostat. Remove rheostat from panel. Remove wires from rheostat.
- (6) Install wires on new rheostat. Install rheostat in panel. Install security nut and finger tighten.

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- (7) Engage FLOOD (push IN) circuit breaker and check correct operation of light. Disengage FLOOD (pull OUT) circuit breaker.
- (8) Install dome panel. Tighten nut securing rheostat to panel
- (9) Install rheostat knob and tighten allen nut.
- (10) Engage (push IN) FLOOD circuit breaker.

3. Instrument Post Lights

The primary means of illuminating flight and engine instruments is with post lights.

A. Bulb Replacement

- (1) Ensure BATT MASTR switch is OFF and INST. PNL. circuit breaker is disengaged (pulled out).
- (2) Remove light cover/shade by pulling straight out. If cover/shade is tight, a slight twisting or turning motion may be required.
- (3) Bulb is located in cover/shade. Pull bulb out of cover. Insert new bulb into cover/shade.
- (4) Push cover/shade into socket. Turn cover/shade as necessary so that light is directed onto associated instrument.
- (5) Engage (push IN) INST. PNL. circuit breaker in.

B. Socket

(1) Removal

- (a) Ensure BATT MASTR switch is OFF and INST. PNL. circuit breaker is disengaged (pulled out).
- (b) Gain access to back of instrument panel in vicinity of socket to be replaced.
- (c) Unscrew wire from machine threaded brass extension on rear of socket.
- (d) Remove small copper nut and lock washer from threaded brass extension on rear of socket.
- (e) Remove socket from mounting hole through front of instrument panel panel

(2) Installation

- (a) Ensure BATT MASTR switch is OFF and INST. PNL. circuit breaker is disengaged (pulled out).
- (b) Inserting end with threaded brass extension through hole in panel
- (c) Securing with lock washer and nut.
- (d) Snug nut just enough to flatten lock washer against panel to ensure proper ground.
- (e) Install wire by screwing onto end of threaded brass extension.
- (f) Engage (push IN) INST. PNL. circuit breaker in.

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4. Switch Lights

All rocker type switches are internally lit with two miniature bulbs installed behind the switch cap.

CAUTION: BEFORE WORKING ON ANY SWITCH OR DIMMER CONTROL, ENSURE BATT SWITCH IS OFF AND BATTERY CIRCUIT BREAKER IS PULLED OUT.

A. Bulb Replacement

- (1) Ensure BATT switch is OFF, and BATTERY and INST. PNL. circuit breakers are OUT.
- (2) Position switch with bad bulb in ON position to expose small slit type notch in bottom of cap.
- (3) Using finger nail or small screw driver, gently pull switch cap straight out.

NOTE: Top bulb is easier to replace with switch in ON position

- (4) Pull bulb(s) to be replaced straight out.
- (5) Push replacement bulb(s) into socket.
- (6) Install switch cap by placing in position, with slot toward bottom of switch. Using a slight pressure, push cap onto switch.
- (7) Position switch in OFF position. Push BATTERY and INST. PNL. circuit breakers IN.

B. Switch Replacement

- (1) Ensure BATT switch is OFF.
- (2) Disengage (pull OUT) the following circuit breakers:
 - (a) BATTERY.
 - (b) INST. PNL.
 - (c) Accessory operated by switch. (Example: If replacing NAV LIGHT switch also pull NAV circuit breaker OUT.)
- (3) Remove and save switch cap and bulbs. See To Replace Bulbs above.
- (4) Gain access to back of instrument panel or overhead switch panel in vicinity of switch to be replaced.
- (5) Remove switch from panel by pushing forward on back of switch, using a gentle wiggling motion, until free.
- (6) Mark wire locations for later installation. Remove accessory wires from switch by removing screws. Remove lighting wires by unsoldering.
- (7) Solder lighting wires to appropriate posts on new switch. Attach accessory wires to appropriate posts by installing screws (supplied with switch).
- (8) Place switch in proper position in face of instrument panel. Using a slight pressure, press in on switch until spring clip engages panel.
- (9) Install bulbs and switch cap.
- (10) Engage (push IN) the BATT, INST. PNL, and any required accessory circuit breakers.

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5. Dimmer Controls

There are three dimmer control potentiometers; one each for switch lights, instrument post lights, and avionics. The potentiometers operate individual control boxes located forward of the instrument panel.

Replace Dimmer Potentiometer

- (1) Ensure BATT switch is OFF and BATTERY circuit breaker is disengaged (pulled OUT).
- (2) If SWITCH or PANEL dimmer potentiometer is to be replaced, disengage (pull OUT) INST PNL circuit breaker.
- (3) If AVIONICS dimmer potentiometer is to be replaced, disengage (pull OUT) AVIONICS circuit breaker.
- (4) Remove dimmer potentiometer control knob by loosening set screw with appropriate size allen wrench.
- (5) Remove nut securing dimmer potentiometer to instrument panel. Potentiometer should now hang down below bottom of panel.
- (6) Mark wires attached to back of dimmer potentiometer for proper location. Unsolder wires from back of dimmer control.
- (7) Solder wires to proper contacts on back of new dimmer potentiometer.
- (8) Position potentiometer in proper location and insert from back of instrument panel. Check that key lugs on switch align with key holes in back of panel.
- (9) Install nut securing potentiometer to face of instrument panel.
- (10) Install control knob. Check that knob pointer is in appropriate position. Tighten allen screw.
- (11) Engage (push IN) BATTERY, INST PNL and/or AVIONICS circuit breakers, as appropriate.

6. Annunciator Panel Lamp Replacement

It is not necessary to remove the annunciator panel assembly to replace lamp bulbs. Simply "PUSH-IN" on the function light until it "clicks", and release pressure. The cover assembly will be partially ejected from the lamp base assembly. Pull the cover from the base and rotate to expose the lamp bulb. Replace defective bulb and reverse removal procedure. Depress "Test" function to verify lamp function.

NOTE: Test function only tests the bulbs, not the circuit.

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PASSENGER COMPARTMENT

The three reading lights and both the forward and aft courtesy lights are standard equipment. They are each operated by individual switches.

The courtesy lights are wired directly to the battery so that they may be turned ON with the BATT switch OFF.

1 Courtesy and Reading Lights

Courtesy lights are designed to light up each of the entrances. The lights are individually operated and located above the right forward entrance door and the left aft passenger/baggage doors. The left rear passenger light is designed to serve as a courtesy light.

The courtesy lights are powered off the battery bus. This enables illumination of both lights when the battery switch is off. The circuit is protected by a 5 amp fuse.

The aft courtesy light is operated by a switch on the left rear entrance door.

Reading lights are controlled by rocker type switches located in each seat's armrest.

In addition to the aft courtesy light, three reading lights are installed in the passenger cabin that are powered through a five amp CABIN circuit breaker. Each light is independently controlled by a rocker type switch installed in the chair arm rest.

Bulb Replacement (Aft Courtesy or Reading Light)

- (1) Ensure BATT switch is off. Disengage (pull OUT) CABIN circuit breaker.
- (2) Remove entire light unit from the overhead by removing two attachment screws in bezel.
- (3) Carefully withdraw unit from overhead.
- (4) Disconnect the lamp holder from the cup. Twist bayonet bulb counterclockwise until it is released.
- (5) Install new bulb. Engage (push IN) CABIN circuit breaker. Position BATT and light switches ON. Ensure correct operation of light.
- (6) If bulb does not light up, check the following.
 - (a) Proper circuit breaker mode.
 - (b) Use voltmeter to check that power is reaching bulb.
 - (c) Check the continuity of the ground lead.
 - (d) When light is operating satisfactorily, position the light and BATT switches OFF.
- (7) Install light unit.

2. Troubleshooting

When checking any of these light systems, other than the courtesy lights, the BATT switch must be ON in order to operate the lights. Ensure that the circuit breaker of the affected system is activated.

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CARGO AND SERVICE COMPARTMENTS

The forward baggage compartment lighting system is standard equipment. The light is activated automatically when the door is unlatched. The forward baggage compartment light is wired directly to the battery so that it will be activated when the baggage door is open.

NOTE: The light will remain on with the door closed, if the door latch is not engaged, resulting in battery depletion.

1. **Forward Baggage Compartment Lamp**

The forward baggage compartment light illuminates automatically whenever the baggage compartment door is open.

This automatic system is operated by a switch installed on the forward door latch pin recess. When the forward pin is inserted into the latch recess hole, the switch is positioned OFF.

NOTE: The light will be on with the door closed, if the forward door latch pin is not engaged, resulting in battery depletion.

The circuit is protected by a 5 amp fuse.

Refer to 91-33-30 for electrical schematics.

2. **Removal and Installation of Baggage Light Bulb**

NOTE: Observe the baggage light fixture has two sets of three screws; one set in an outer ring or circle and one set in an inner ring or circle. Be sure to remove screws from inner ring or circle.

- A. Remove the lens cover by removing the three attaching screws.
- B. Remove bayonet type bulb.
- C. Install new bulb and ensure its operation.
- D. Install lens cover by installing the three attaching screws.

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EXTERIOR

Exterior lighting consists of navigation (position) lights, anti-collision (strobe) lights, wing ice light, recognition lights and landing lights. With the exception of the wing ice light, switches for external lighting can be found on the main switch cluster on the instrument panel ([Seneca IV](#)), or on the overhead switch panel ([Seneca V](#)).

The wing ice light switch is located among the deice switch group located on the instrument panel above the throttle quadrant.

1. Troubleshooting

When checking any of these light systems the BATT switch must be ON in order to operate the lights. Ensure that the circuit breaker of the affected system is activated.

2. Navigation Lights

A. Removal

NOTE: The wing tip must be removed in order to remove the complete lamp assembly.

- (1) Remove screw securing the lens retainer.
- (2) Remove lens and bulb.

B. Installation

- (1) Install bulb, lens and lens retainer.
- (2) Secure with appropriate screws.

3. Anti-Collision Strobe Lights

A. Wing Tip Strobe Light Lamp

The lights are located in both wing tips next to the navigational lights.

(1) Removal

- (a) Remove the screw securing the navigational light cover and remove cover.
- (b) Remove the three screws securing navigational light bracket assembly and remove light assembly.
- (c) Remove the strobe lamp by cutting the wires on the lamp beneath the mounting bracket.
- (d) Remove the defective lamp.
- (e) Remove and discard the plug with the cut wires from the electrical socket.

(2) Installation

- (a) Route the wires from the new lamp down through the hole in the navigational light bracket.
- (b) Insert the wire terminals in the plastic plug supplied with the new lamp. Wire according to Figure 1 and the appropriate schematic in Chapter 91.
- (c) Position strobe lamp on navigational light bracket.
- (d) Secure navigational light assembly and bracket with appropriate screws.
- (e) Install navigational light cover and secure with appropriate screws.

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B. Vertical Stabilizer Strobe Light Lamp

The light is located on the upper section of the vertical stabilizer.

(1) Removal

- (a) (Seneca IV) Loosen the screw in the clamp securing the light cover. (Seneca V) Remove four screws from mounting cover bracket.
- (b) Remove the light cover.
- (c) Remove the defective lamp from the socket.

(2) Installation

- (a) Plug in new lamp using correct number.
- (b) Replace light cover.
- (c) (Seneca IV) Tighten screw in clamp to secure light cover. (Seneca V) Install mounting cover bracket screws.

C. Troubleshooting

The strobe light assembly functions as a condenser discharge system. A condenser in the power supply is charged to approximately 450-volts dc, then discharged across the Xenon flash tube at intervals designed to hold off the 450-volts dc applied until the flash tube is triggered by an external pulse. This pulse is generated by a solid state timing circuit in the power supply.

When troubleshooting the strobe light system, it must first be determined if the trouble is in the flash tube or the power supply. Replacement of the flash tube will confirm if the tube is defective. A normal operating power system will emit an audible tone of 1 to 1.5 kHz. If there is no sound emitted, check the system according to the following instructions. When troubleshooting the system, utilize Figure 1 and the appropriate schematic in Chapter 91.

CAUTION: WHEN DISCONNECTING AND CONNECTING THE POWER SUPPLY INPUT CONNECTIONS, DO NOT GET THE CONNECTION REVERSED. REVERSED POLARITY OF THE INPUT VOLTAGE FOR JUST AN INSTANT WILL PERMANENTLY DAMAGE THE POWER SUPPLY. THE REVERSED POLARITY DESTROYS A PROTECTIVE DIODE IN THE POWER SUPPLY, CAUSING SELF-DESTRUCTION FROM OVERHEATING OF THE POWER SUPPLY. THIS DAMAGE IS SOMETIMES NOT IMMEDIATELY APPARENT, BUT WILL CAUSE FAILURE OF THE SYSTEM IN TIME.

(1) Ensure that the input voltage at the power supply is 28 volts.

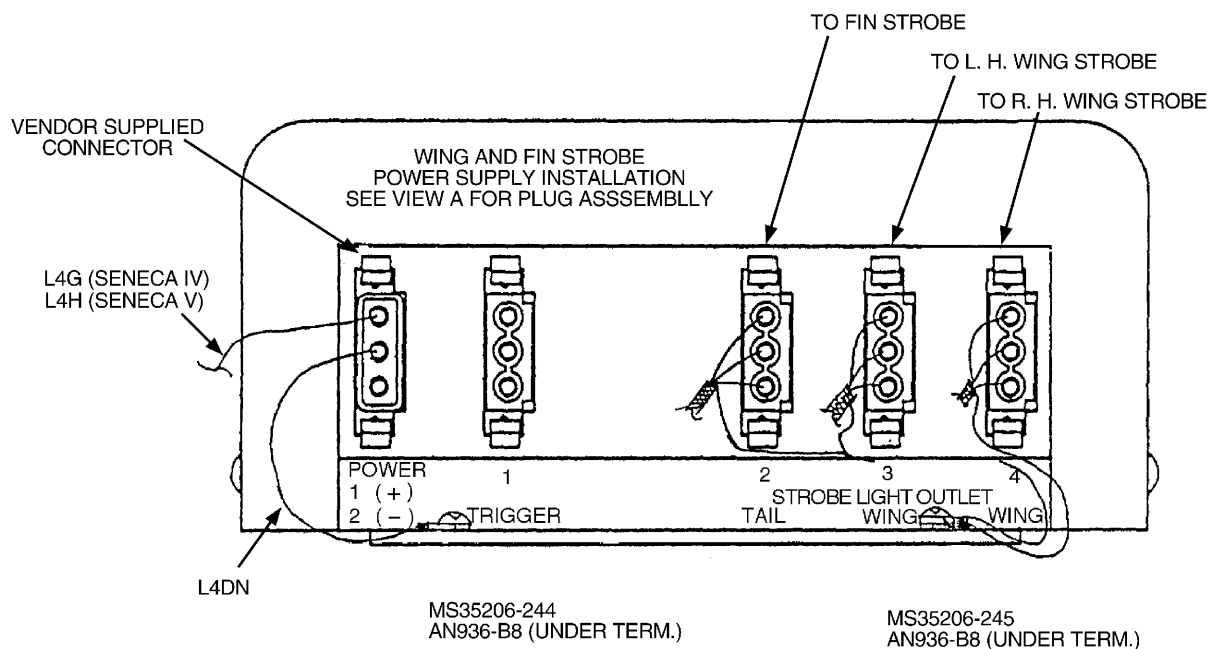
(2) Check for malfunction in interconnecting cables.

- (a) Ensure BATT and other appropriate switches are OFF.
- (b) Disengage (PULL) appropriate circuit breakers.

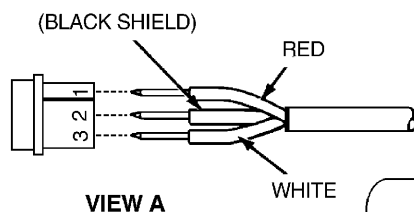
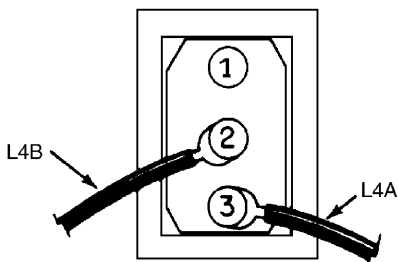
NOTE: A short of the type described in Steps (2), (c) and (d) will not cause permanent damage to the power supply but the system will be inoperative if such a short exists. Avoid any connection between pins 1 and 3 of the interconnecting cable as this will discharge the condenser in the power supply and destroy the trigger circuit.

- (c) Ensure that pins 1 and 3 of interconnecting cable are not reversed.
- (d) Using an ohmmeter, check continuity between pins 1 and 3 of interconnecting cable. If you obtain a reading on the meter, the cable is shorted and should be replaced.

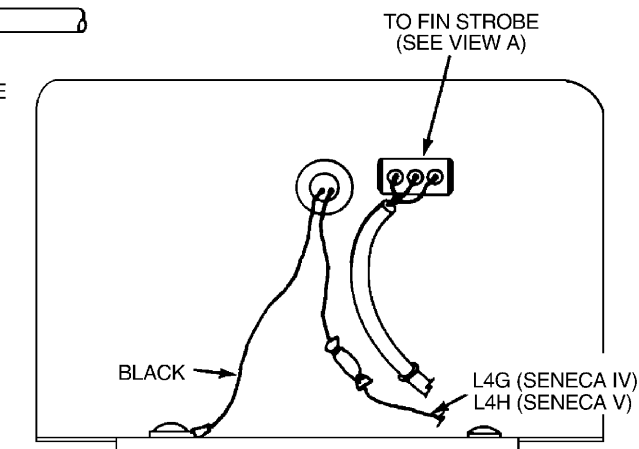
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INSTRUMENT PANEL
SWITCH FOR ANTI-
COLLISION LIGHTS.



FIN STROBE ONLY
POWER PACK INSTALLATION



Strobe Installation Connections
Figure 1

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- (3) Check interconnecting cables for shorts.

CAUTION: WHEN DISCONNECTING THE POWER SUPPLY, ALLOW FIVE MINUTES OF BLEED DOWN TIME PRIOR TO HANDLING THE UNIT.

- (a) Disconnect the output cables from the power supply outlets.
- (b) Using an ohmmeter, check for continuity between the connectors of each interconnecting cable by checking from pin 1 to pin 1, pin 2 to pin 2, and pin 3 to pin 3. If no continuity exists, the cable is broken and should be replaced.
- (c) Using an ohmmeter, check for continuity between pins 1 and 2, 1 and 3, and 2 and 3 of the interconnect cable. If continuity exists between any of these connections, the cable is shorted and should be replaced.
- (d) Check for continuity from pins 1, 2, and 3 to airplane ground. If continuity exists, the cable is shorted and should be replaced.

- (4) Engage (push IN) all appropriate circuit breakers.

4. Recognition Lights ([Seneca IV only](#))

Recognition lights are installed in the leading edge of both wing tips.

Lamp Replacement

CAUTION: TO AVOID CRACKING OR DAMAGING, DO NOT USE POWER TOOLS TO REMOVE OR INSTALL LENS.

- (1) Ensure BATT and RECOG LIGHT switches are set to OFF.
- (2) Disengage (pull OUT) RECOG 7.5 amp circuit breaker.
- (3) Remove five lens attachment screws from bottom of wing.
- (4) Remove five lens attachment screws from top of wing.
- (5) Remove lens. Remove lamp from bayonet base by pulling straight out.
- (6) Install replacement bulb. Engage (push IN) appropriate circuit breaker. Check lamp illuminates when BATT and RECOG LIGHT switches are positioned to ON. If lamp does not illuminate, check wiring. Refer to Chapter 91 for schematic.
- (7) Turn switches OFF and disengage circuit breakers.
- (8) Position lens in recess in wing tip. Install all attachment screws and finger tighten.
- (9) Ensuring lens is properly aligned in wing tip recess, tighten all attachment screws with a hand screwdriver.
- (10) Engage (push IN) appropriate circuit breaker.

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5. Landing and Taxi Lights

On [Seneca IV](#) models, the landing and taxi lights consist of two 100 watt lamps which are located on a mounting fixture secured to the nose gear oleo strut housing. Both lamps are used for landing and one lamp is used while taxiing. Each lamp is controlled by a separate switch mounted on the switch panel. (Refer to 39-10-00.) The lamps are wired to separate 10 amp circuit protectors mounted in the circuit protector panel. There is a safety switch mounted on the nose gear strut which will break the circuit to the lights when the nose gear is retracted in case the pilot forgets to turn the switches off.

On [Seneca V](#) models, the landing and taxi lights consist of four 100 watt lamps, two of which are located on a mounting fixture secured to the nose gear oleo strut housing, and one landing light assembly located on each wing tip. The landing lights on the wing tips also serve as recognition lights.

In [S/N's 3449001 thru 3449096](#), the lights are controlled by a three-position, rocker-type switch located on the overhead switch panel. When the switch is in the up (taxi) position, the two lights on the nose gear illuminate. When the switch is in the center (off) position, all taxi and landing lights will be off. When the switch is in the down (landing) position, all nose gear lights and wing tip lights will illuminate.

In [S/N's 3449097 and up](#), two rocker-type switches in the overhead switch panel control these four lights. A two-position (on/off) Taxi lights switch allows the two nose gear mounted lights to be controlled independently for ground operation. A three-position Landing/Pulse lights switch controls all four lights in flight. When the switch is in the up (landing) position, all four lights (two on the nose gear and one on each wing tip) illuminate. When the switch is in the center (off) position, all four lights are off. When the switch is in the down (pulse) position, the two nose gear mounted lights are off and wing tip lights will illuminate alternately (i.e. - pulse) at 55 pulses-per-minute. (See Figure 2.)

In all [Seneca V's](#), there is a safety switch mounted on the nose gear strut which will break the circuit to the nose gear lights when the nose gear is retracted, in case the pilot forgets to turn the switches off. The landing/taxi lights are wired to two separate 10 amp Landing/Taxi Lights circuit breakers.

A. Nose Gear Mounted Landing and Taxi Lights (Refer to Figure 3.)

(1) Removal

- (a) Ensure that the master switch is off prior to doing any work on the landing lights.

CAUTION: WHEN REMOVING THE ATTACHMENT PLATE, USE CAUTION NOT TO DROP THE LAMPS.

- (b) Removal of either lamp from the landing light mounting fixture is accomplished by removing the screws securing the front lamp attachment plate and removing the attachment plate.
- (c) Disconnect the electrical leads from the lamp being removed.
- (d) To remove the complete assembly from the gear strut, disconnect the electrical leads from both lamps and release the clamps that secure the assembly to the strut housing.

(2) Installation

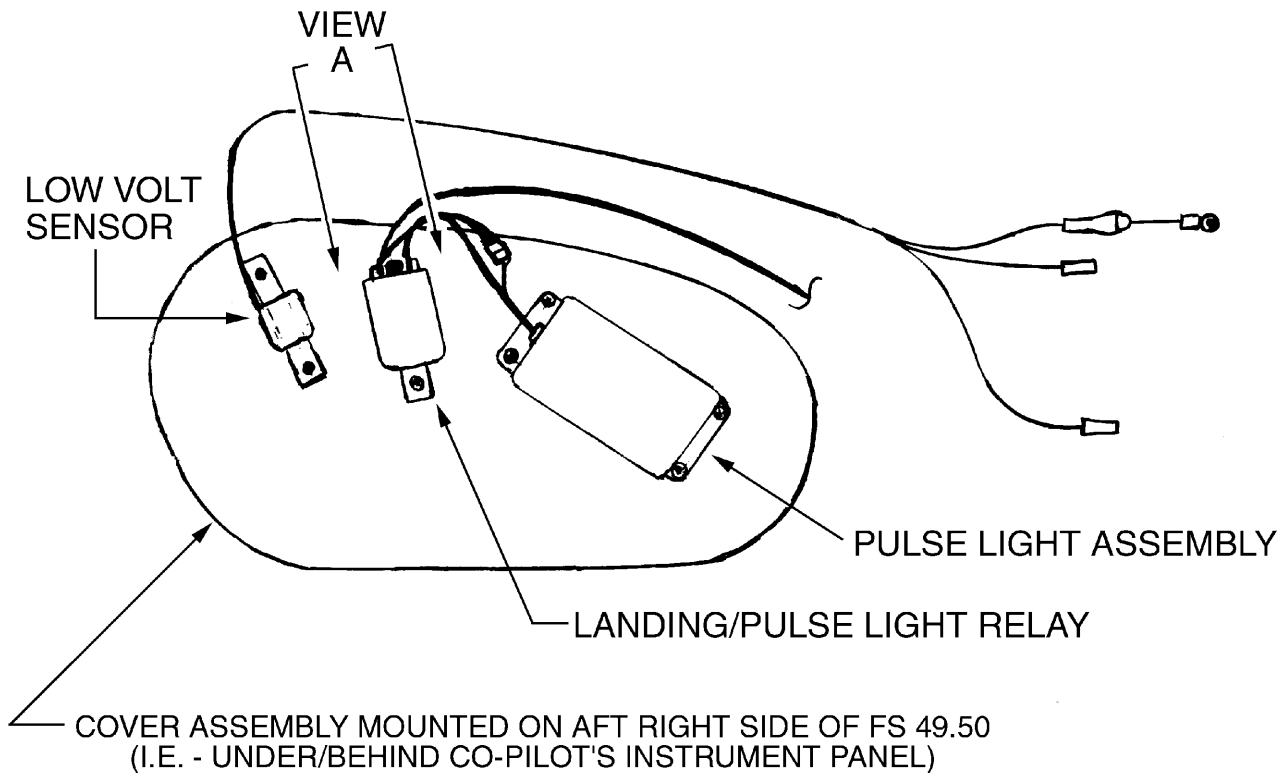
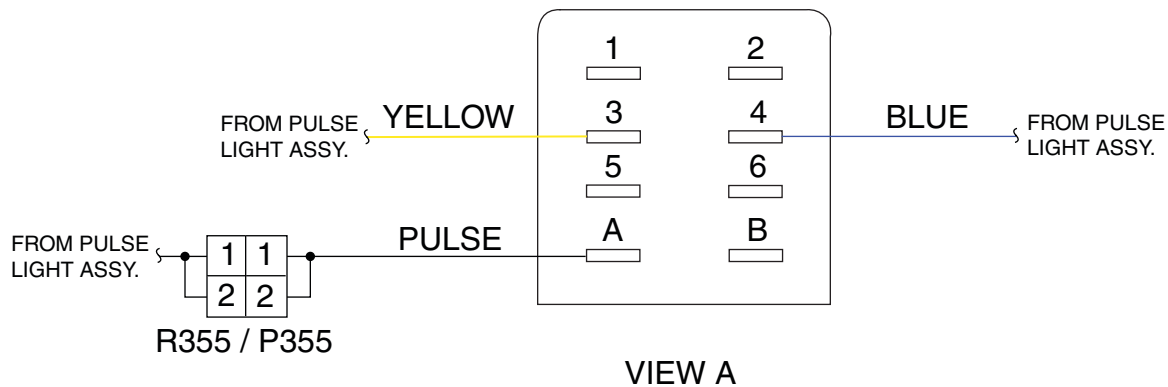
- (a) To install the landing lamps, attach the electrical leads to the lamp or lamps.
- (b) Place the lamp or lamps against the mounting pad and position the attachment plate on the mounting fixture and secure with appropriate screws.

CAUTION: TIGHTEN THE SCREWS JUST ENOUGH TO ALLOW THE LAMPS TO FIT SNUG IN THE MOUNTING FIXTURE.

- (c) To install the landing light assembly to the strut, position the assembly against the strut housing with the bottom of the mounting fixture 2.9 inches up from the bottom of the strut housing.

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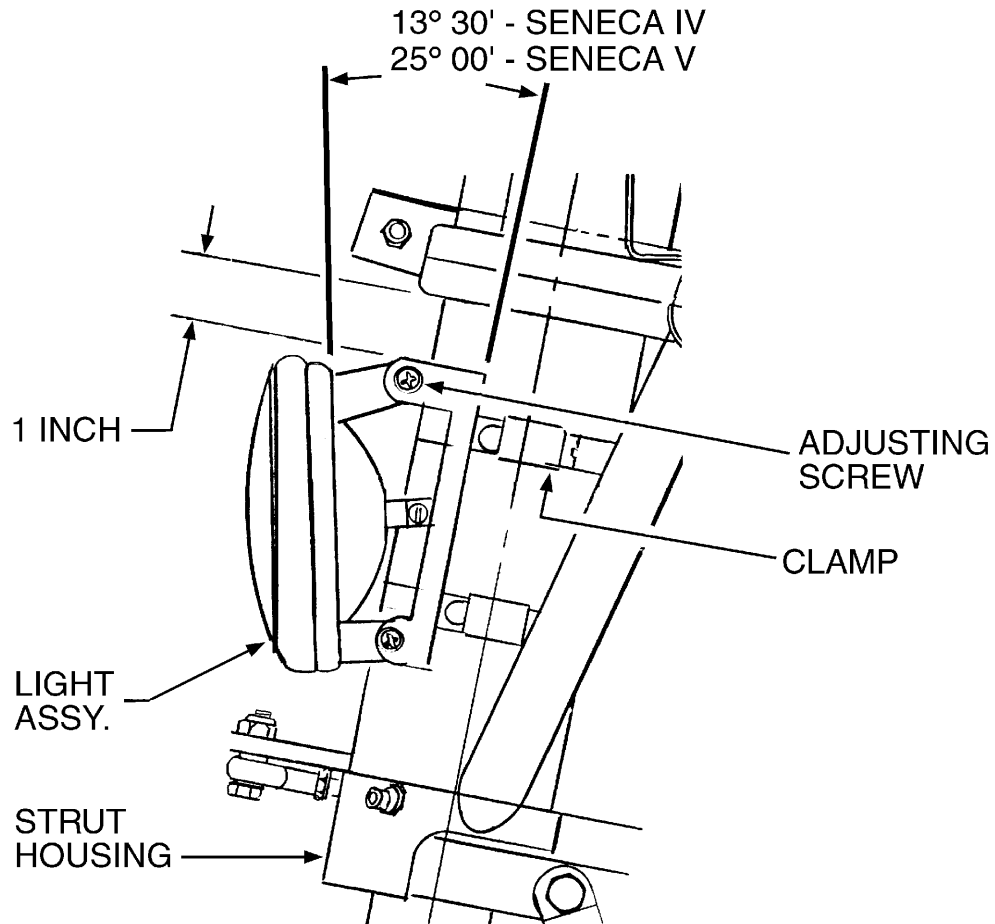
- (d) Align the bracket longitudinally and secure in place with clamps.
 - (e) The light beam angle may be adjusted by the adjustment screws at the sides of the bracket and tilting the mounting fixture as desired.
- (3) Adjustment
See Figure 3.



Landing (Pulse) Lights Relay
Figure 2

[Effectivity](#)
3449097 & up

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Nose Gear Mounted Landing/Taxi Light Adjustment
Figure 3

B. Wing Tip Mounted Landing Lights ([Seneca V only](#)) (See Figure 4.)

(1) Removal

- (a) Remove the appropriate Plexiglas lens.

NOTE: Use care not to disturb adjustment bolts when removing landing light bulb(s). Should adjustment bolt settings be disturbed, check light alignment after installing new bulb.

- (b) Remove the three lamp retaining screws. Remove retaining ring
- (c) Pull lamp forward far enough to gain access to the electrical connection tabs on back of the lamp.
- (d) Remove the two brass screws connecting the electrical leads to the lamp.
- (e) Remove and discard defective bulb.

(2) Installation

- (a) Connect electrical leads to replacement bulb using two brass screws.
- (b) Position lamp in place and install retainer ring.

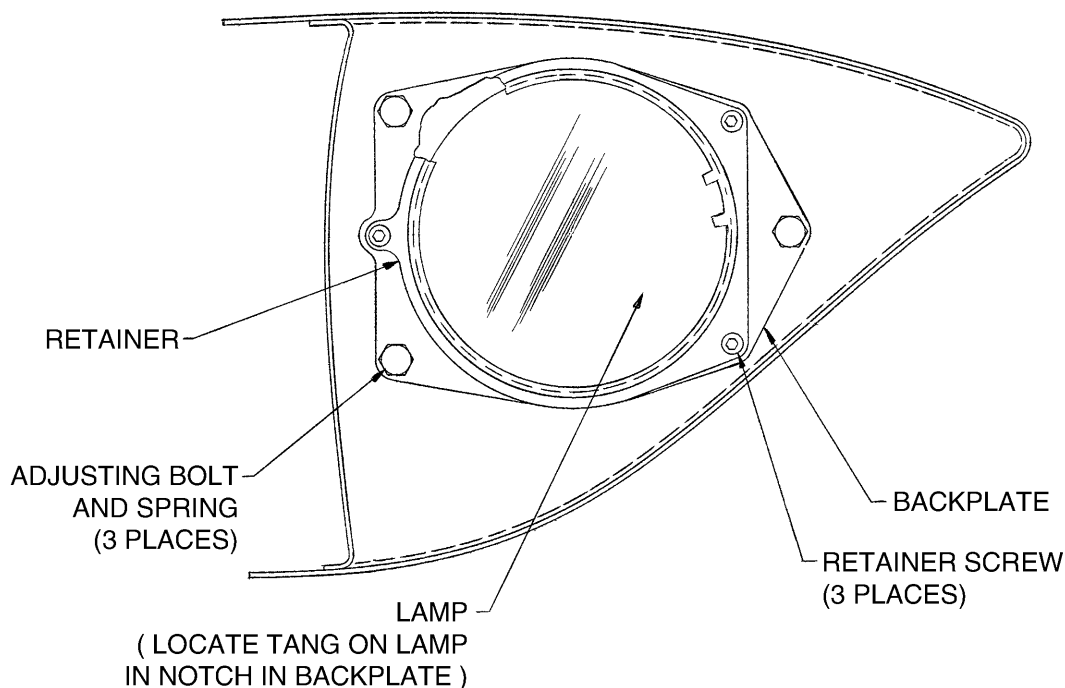
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- (c) Install the three lamp retaining screws.
- (d) Check lamp function by turning BATT MAST switch on and selecting LNDG LIGHT switch on.
- (e) Place BATT MAST and landing light switch in OFF position.
- (f) Install Plexiglas lens.

E. Adjustment (Alignment) (See Figures 4 and 5.)

- (1) Locate airplane 20 feet from a target wall as shown in Figure 4.
- (2) Level airplane both vertically and horizontally. (Refer to 8-20-00.)
- (3) Remove the appropriate Plexiglas cover lens.
- (4) Connect airplane to a 28 Vdc external power supply.
- (5) Position the BATT MAST and LDG LIGHT switches ON.
- (6) Adjust the three landing light adjustment bolts as necessary to move the landing light housing so that the center of the light beam illuminates the target wall at the following locations.
 - (a) The left wing tip landing light beam is centered at a point 32 ± 1 inches up from the floor.
 - (b) The left wing tip landing light beam is centered at a point 17 feet \pm 3 inches outboard from the airplane's centerline.
 - (c) Center the right wing tip landing light beam at a point 32 ± 1 inches up from the floor.
 - (d) The right wing tip landing light beam is centered at a point 17 feet \pm 3 inches outboard from the airplane's centerline.
- (7) Position the BATT MAST and LDG LIGHT switches OFF.
- (8) Disconnect 28 Vdc external power supply.
- (9) Install Plexiglas cover lens.
- (10) Remove devices used to level airplane. (Refer to Chapter 8.)

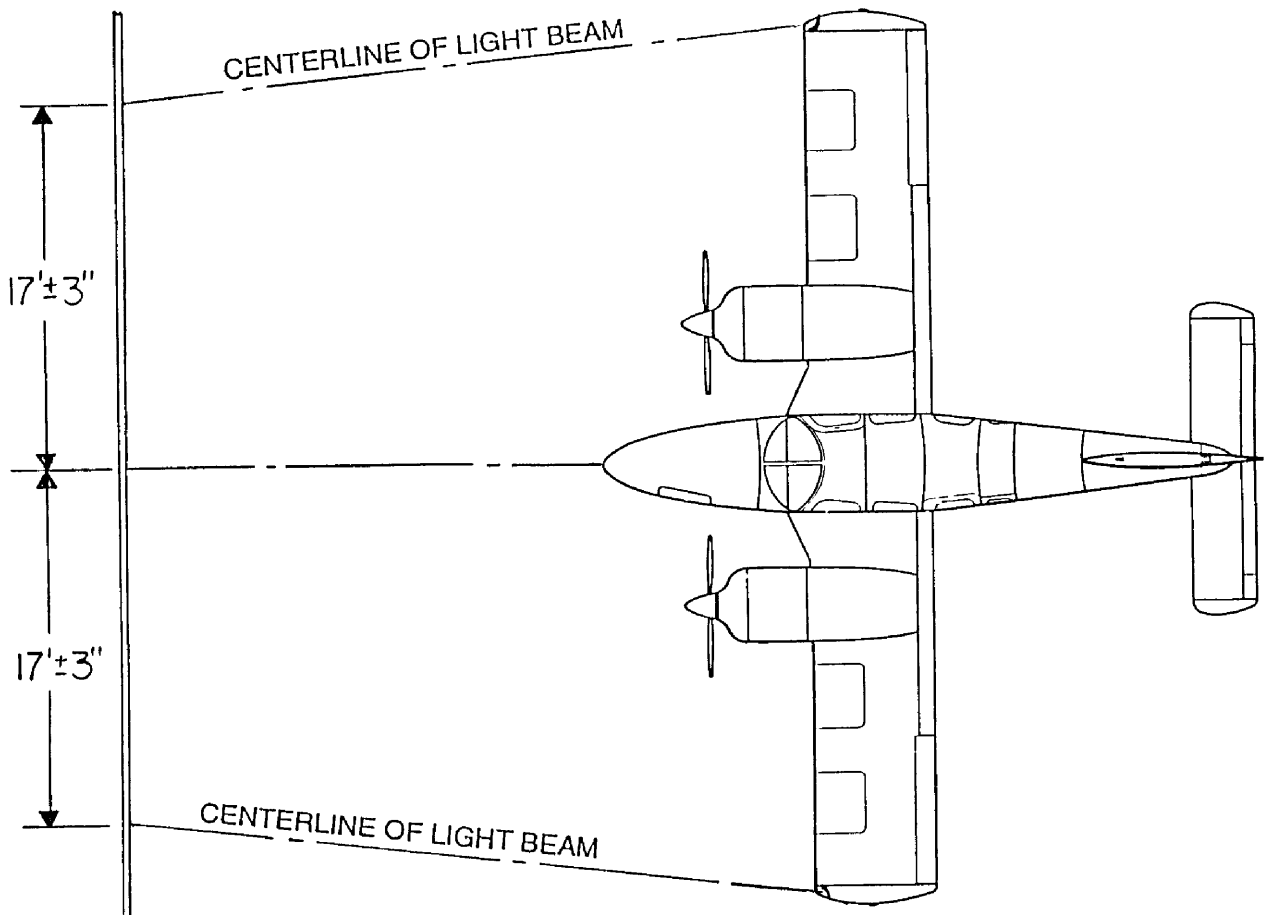
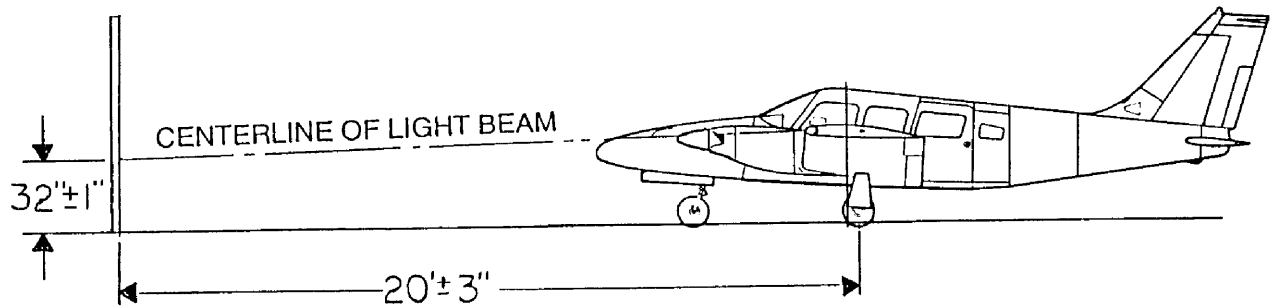
36761 Y



Wing Tip Landing Light
Figure 4

[Effectivity](#)
[Seneca V](#)

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Wing Tip Landing Light Adjustment
Figure 5

[Effectivity](#)
[Seneca V](#)

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CHAPTER

34

NAVIGATION

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GENERAL

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

1. Standard

Traditional 3.25 inch flight instruments are installed as standard equipment. These instruments are face mounted, see 39-10-00 for removal and installation.

2. Single-side (Meggitt) EFIS Option

The Meggitt Avionics next Generation Integrated Cockpit (MAGIC) Electronic Flight Instrument System (EFIS) is available as an option on the pilot's side only. When installed, it's the primary flight and navigation instrumentation. The MAGIC EFIS consists of three primary components:

- A. Primary Flight Display (PFD) [i.e. - Electronic Attitude Director Indicator (EADI)],
- B. Navigation Display (NAV) [i.e. - Electronic Horizontal Situation Indicator (EHSI)], and
- C. Air Data & Attitude Heading Reference System (ADAHRS) [i.e. - Attitude Heading Reference System (AHRS)].

Line maintenance of this system is limited to basic troubleshooting and that is addressed in 34-20-00.

3. Avidyne EFIS Option

The Avidyne FlightMax Entegra Electronic Flight Instrument System (EFIS) is available as an option. When installed, it's the primary flight and navigation instrumentation. This system uses two large 10.4-inch diagonal, high-resolution, sunlight-readable full color displays (PFD and MFD), to provide primary flight and engine information

Line maintenance of this system is limited to basic troubleshooting and that is addressed in 34-20-00.

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FLIGHT ENVIRONMENT DATA

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The instrument air system consists of pitot air and static air sources. The system supplies both pitot and static air pressure for the airspeed indicator, and static pressure for the altimeter, vertical speed indicator, and the triple indicator (cabin pressure differential, vertical speed, and altitude). When installed, pitot and static air pressure is also provided for the Single-side (Meggitt) or Avidyne EFIS Air Data and Attitude Heading Reference System (ADAHRS).

1. Pitot and Static System

A. Description and Operation (Refer to Figure 1.)

The pitot air system consists of a pitot mast located on the underside of the left wing, with its related plumbing. Impact air pressure entering the pitot is transmitted from the pitot inlet through hose and tubing routed through the wing to the airspeed indicator on the instrument panel and, if installed, to the ADAHRS unit located on the aft equipment shelf (Meggitt) or in the PFD (Avidyne). A partially or completely blocked pitot head will give erratic or zero reading on the instruments.

Static air system consists of two static ports located on the sides of the aft fuselage just forward of station 220.164. The static ports are directly connected to the airspeed indicator, altimeter and vertical speed indicator on the instrument panel and, if installed, to the ADAHRS unit located on the aft equipment shelf (Meggitt) or in the PFD (Avidyne) by means of hose and tubing routed along the top of the fuselage center line to station 138.627, where it is then routed to, down and along the left side of the fuselage to the back side of the instrument panel. An alternate static air source is located below the instrument panel to the right of the power quadrant. The alternate static source is part of the standard system and has a shutoff valve which closes the port when it is not needed. A placard giving instructions for use is located on the instrument panel near the control. Pitot and static lines can be drained through separate drain valves located on the left lower side of the fuselage interior.

The holes in the sensors for pitot and static pressure must be fully open and free from blockage. Blocked sensor holes will give erratic or zero readings on the instruments.

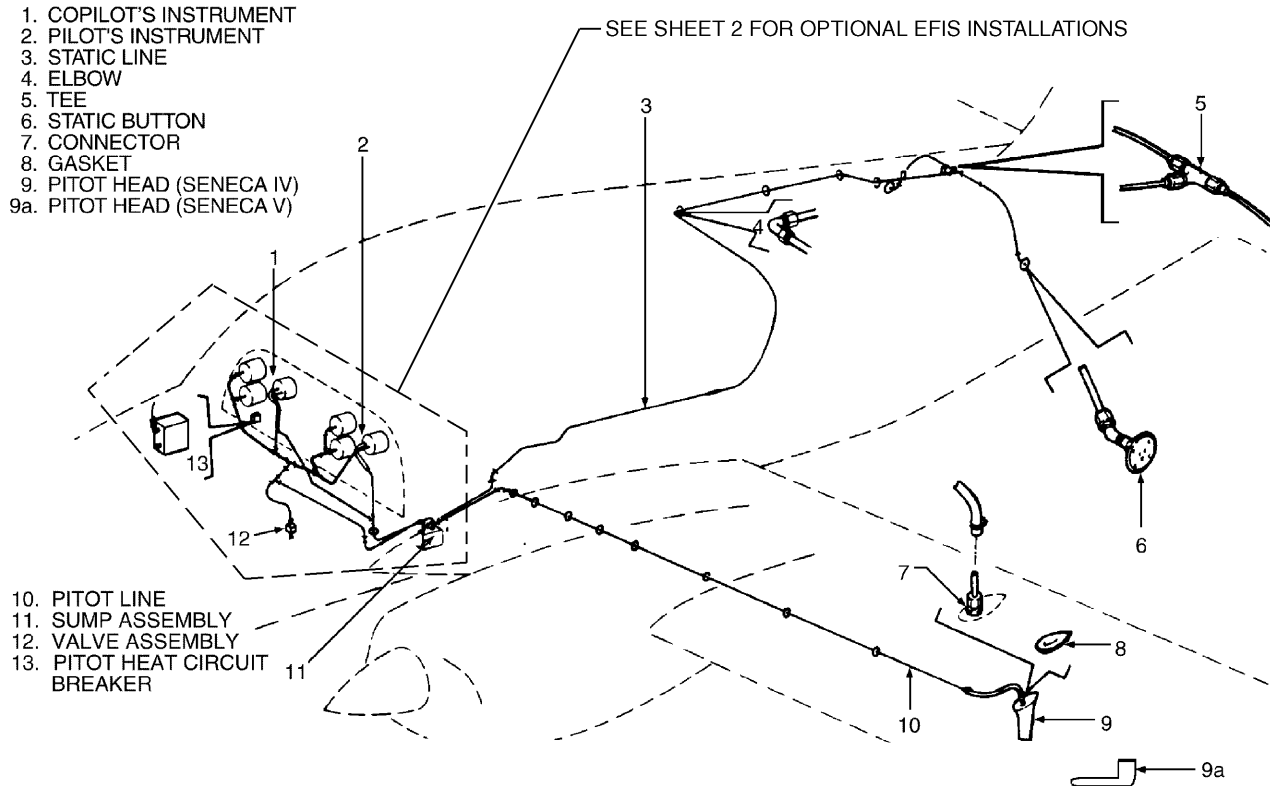
The heated pitot head is standard equipment. The pitot heat switch is located on the right overhead switch panel. Static source pads have been demonstrated to be non-icing; however, in the event that icing does occur, selecting the alternate static source will alleviate the problem.

B. Troubleshooting

See Chart 1.

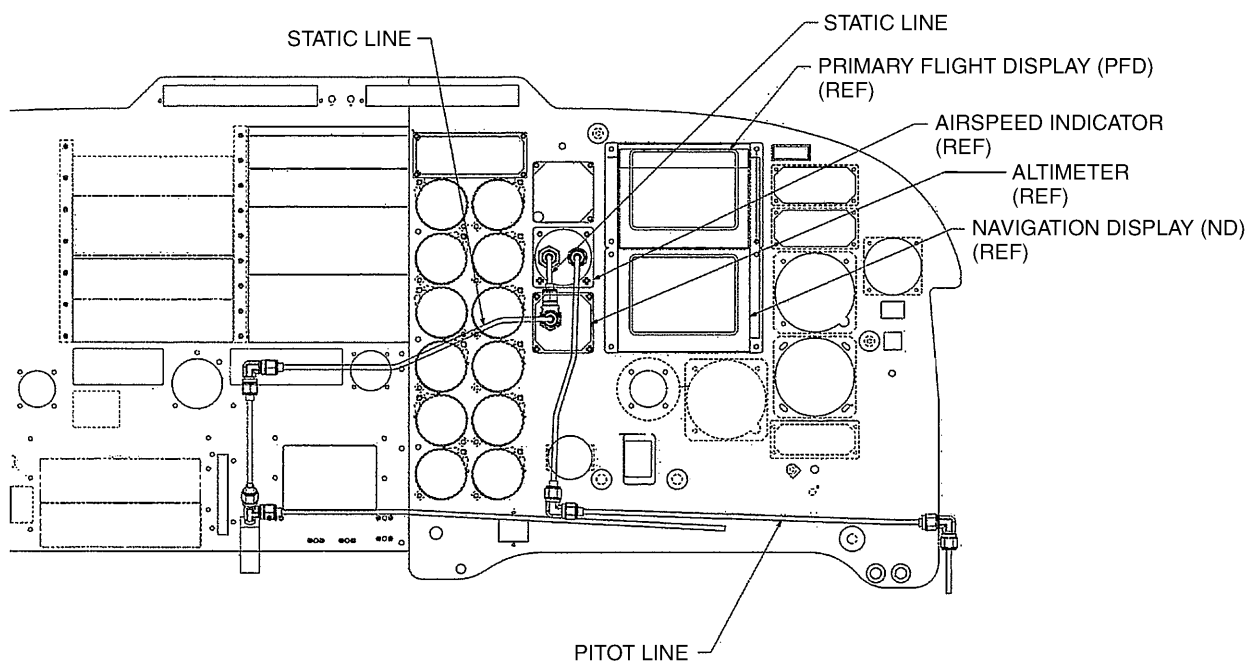
NOTE: If any connections in the static system are opened for maintenance, the entire system must be rechecked per FAR 23.1325. With the optional Single-side EFIS (Meggitt) installed, see also Appendix 1 (grid 4K1).

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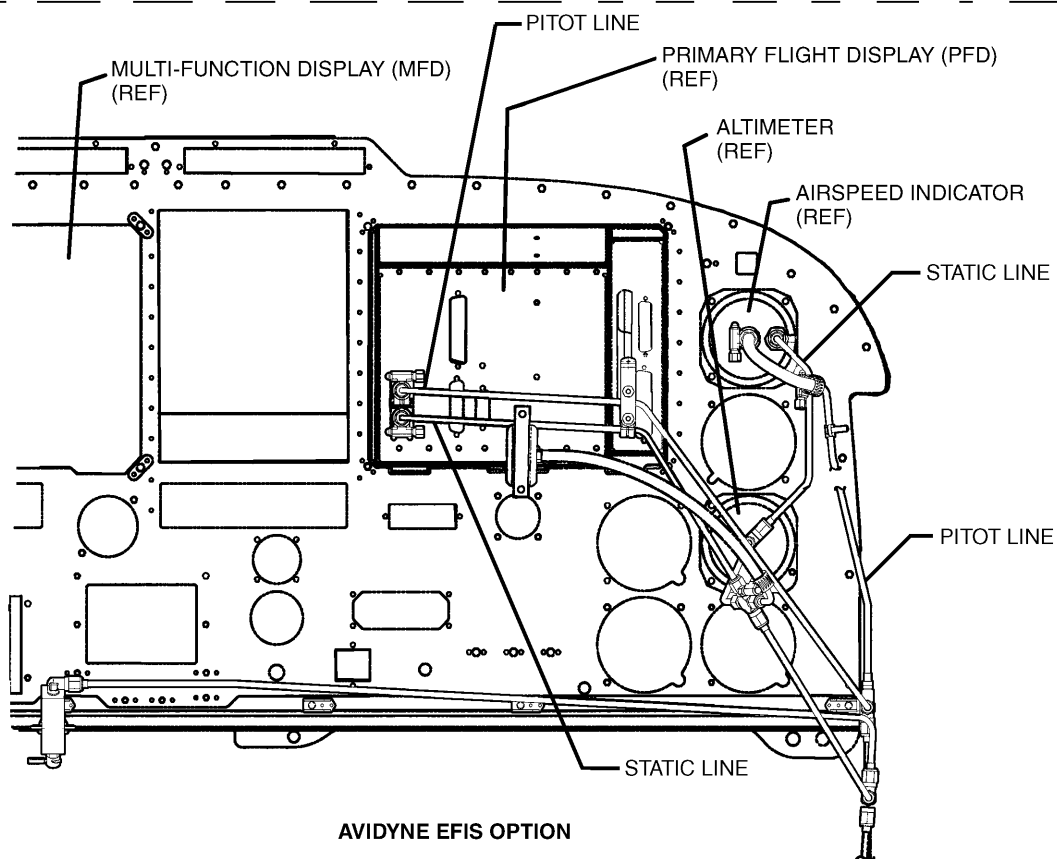


Pitot-Static System
Figure 1 (Sheet 1 of 2)

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SINGLE-SIDED EFIS OPTION (MEGGITT)



AVIDYNE EFIS OPTION

Pitot-Static System
Figure 1 (Sheet 2 of 2)

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**CHART 1
TROUBLESHOOTING PITOT AND STATIC SYSTEM**

Trouble	Cause	Remedy
Heating element inoperative.	Defective switch.	Replace the switch.
	Grounded or open circuit.	Check for continuity and repair.
	Defective heating element in pitot head.	Replace the pitot-static mast.
Circuit breaker keeps tripping.	Grounded wire.	Check for continuity and repair.
Instruments inoperative or erratic in operation.	Lines clogged.	Disconnect lines at instruments and blow out with low pressure air.
	Line leaks.	Check lines for loose connections at all connection points.

C. Test

(PIR-PPS 60035, Rev. L / FTP201-8, Rev. E.)

This test requires a pitot/static test fixture (i.e. - Aerosonic Air Data Test Set - Model 90000-0168 or equivalent) and calibrated air source (i.e. - airspeed simulator) and should be performed at any time an instrument, fitting, line, pitot head, or static button is disconnected. The test should be performed prior to the next flight.

NOTE: Ensure the lines and fittings are free of any entrapped moisture or restrictions.

- (1) Attach the test fixture to the pitot head. Align the holes in the fixture with the holes in the head.
- (2) Attach the airspeed simulator hose to the pitot (pressure) port of the fixture.
- (3) When equipped with the optional Meggitt or Avidyne EFIS, turn ON the PFD (i.e. - EADI).
- (4) Operate the simulator to obtain a reading of 75 knots on the airplane airspeed indicator(s).
- (5) Check that the airspeed indicator needles follow in the same direction as the simulator airspeed indicator needle.
- (6) Raise airspeed to 204 knots and wait 15 seconds to allow the airplane airspeed indicators to stabilize.
- (7) Observe the simulator and airplane airspeed indicators for 15 seconds. If a leak is present, the indicator needles will move toward zero.
- (8) If a leak is present, check the fixture installation, hose connections, and pitot system lines and fittings. Repair the leak when found, then repeat steps (1) - (7), above.
- (9) Operate the simulator to indicate 140 knots on the airspeed indicators (including the PFD, if so equipped). Verify that the airspeed indicators (including the PFD, if so equipped) show within three (3) knots of the simulator indication.

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- (10) When equipped with the optional Meggitt or Avidyne EFIS: turn OFF the PFD (i.e. - EADI).
- (11) Remove the test fixture from the pitot head.
- (12) Attach static test fixture to the static port and pitot test port of the aircraft. Tape over the other static button.
- (13) When equipped with the optional Meggitt or Avidyne EFIS, turn ON the PFD (i.e. - EADI).
- (14) Set the aircraft altimeter needles to read zero altitude. Operate the static simulator to cause the aircraft altimeter needles to read 1,000 feet altitude. Momentarily open the alternate static port. There should be a decrease in altimeter indication. If no change occurs the system is blocked and must be repaired prior to further testing.
- (15) Increase altitude to 1,050 feet.
- (16) Check that the aircraft altimeter shows an increase.
- (17) Observe the aircraft altimeter. Loss of indicated altitude shall not exceed 100 feet in one minute.
- (18) Increase altitude to 12,700 feet.
- (19) Check that the aircraft altimeter shows an increase.
- (20) Observe the aircraft altimeter. Loss of indicated altitude shall not exceed 254 feet in one minute.
- (21) If a leak exceeds the tolerances in step (17) or (20), check the fixture installation, plumbing and fittings. Repair the leak when found and repeat the static system checks above.
- (22) When equipped with the optional Meggitt or Avidyne EFIS, turn OFF the PFD (i.e. - EADI).
- (23) Remove the test fixture and tape from the static button.

2. Pitot Head

A. Removal

The pitot head is located on the lower side of the left wing.

- (1) Remove the four screws which secure the pitot tube to the mast assembly.
- (2) Carefully pull the pitot tube from the mast assembly.
- (3) Remove the hose from the elbow on top of the pitot tube.
- (4) Disconnect the electrical leads at the connector.

B. Installation

- (1) Reconnect the electrical leads to the heating elements.
- (2) Install the pitot tube into the mast assembly.
- (3) Secure the pitot tube to the mast assembly with the four screws.
- (4) Reconnect the electrical leads to the gauge.

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3. Vertical Speed Indicator

The vertical speed indicator measures the rate of changes in static pressure when the airplane is climbing or descending. By means of a pointer and dial, this instrument will indicate the rate of ascent or descent of the airplane in feet per minute. But due to the lag of the instrument, the aircraft will be climbing or descending before the instrument starts to read and the instrument will continue to read after the aircraft has assumed level flight. In rough air, this should not be considered a malfunction.

NOTE: If any connections in the static system are opened for maintenance, the entire system must be rechecked per FAR 23.1325. With the optional Single-side EFIS (Meggitt) installed, see also Appendix 1 (grid 4K1).

A. Troubleshooting

See Chart 2.

B. Removal and Installation

See 39-10-00, Face Mounted Instruments - Removal and Installation.

CHART 2
TROUBLESHOOTING VERTICAL SPEED INDICATOR

Trouble	Cause	Remedy
Pointer does not set on zero.	Aging of diaphragm.	Reset pointer to zero by means of setting screw. Tap instrument while resetting.
Pointer fails to respond.	Obstruction in static line.	Disconnect all instruments connected to the static line. Clear line.
	Water in static line.	Check individual instruments for obstruction in lines.
Pointer oscillates.	Leaks in static lines.	Disconnect all instruments connected to the static line. Check individual instruments for leaks. Reconnect instruments static line and test installation for leaks.
Vertical Speed indicates when aircraft is banked.	Water in static line.	Disconnect static lines blow out lines from cockpit out toward static vents.
Pointer indicates a descent when airplane is "slipped"	Static vent on side opposite slip is blocked.	Disconnect static line at aft "T" connection (Figure 1, #5) and blow out line.
Pointer has to be set before every flight.	Instrument malfunction.	Replace instrument.
Pointer cannot be reset to zero.	Diaphragm distorted.	Replace instrument.
Instrument reads very low during climb or descent.	Case of instrument broken or leaking.	Replace instrument.

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4. Sensitive Altimeter

The altimeter indicates pressure in feet above sea level. The indicator has three pointers and a dial scale. The longer pointer is read in hundreds of feet, the middle pointer in thousandths of feet and the short pointer in ten thousandths of feet. A barometric pressure window indicating inches of mercury is located on the right side of the indicator dial and is set by the knob located on the lower left corner of the instrument. On the left side of the indicator is a window which indicates pressure in millibars. The altimeter consists of a sealed diaphragm that is connected to the pointers through a mechanical linkage. The diaphragm mounting is made of bi-metallic temperature sensitive strips that compensate for variations from standard temperatures. The instrument case is vented to the static air system and as static air pressure decreases, the diaphragm expands, causing the pointers to move through the mechanical linkage. Altitude encoding altimeters are standard.

NOTE: If any connections in the static system are opened for maintenance, the entire system must be rechecked per FAR 23.1325. With the optional Single-side EFIS (Meggitt) installed, see also Appendix 1 (grid 4K1).

A. Troubleshooting

See Chart 3.

B. Removal and Installation

See 39-10-00, Face Mounted Instruments - Removal and Installation.

5. Radar Altimeter

The King KRA-10A radar altimeter system may be installed as optional equipment. The system makes use of an indicator, on/off switch, transmitter, and antenna, and provides above ground level (AGL) altitude information from 20 feet up to a maximum of 2500 feet.

NOTE: On some installations, if the air conditioning and radar altimeter are both functioning at the same time, the actual AGL should be relied on for accuracy only up to 1500 feet.

The King KRA-10A system utilizes a KA-131 antenna, KRA-10 receiver/transmitter, and KI-250 indicator. For further information, contact Allied Signal Inc., Commercial Avionics Systems, Olathe, KS.

The receiver, as well as the converter (when required) for the King system, is mounted on a panel in the tail of the aircraft near Fuselage Station 222.437 and the antenna to the rear of that near Fuselage Station 229.0.

CAUTION: DO NOT ALTER THE CABLE OR CONNECTOR PROVIDED WITH THE ANTENNA. SYSTEM PERFORMANCE IS DEPENDENT ON PROPER CABLE LENGTH FROM THE ANTENNA TO THE RECEIVER-TRANSMITTER UNIT.

The antennas are skewed internally to permit mounting on an inclined surface. This requires that each be mounted in a specific manner. During removal, take note of the relationship of the cable attachment to the tail of the aircraft and install the new antenna in the same manner.

NOTE: The KI-250 indicator is a face-mounted instrument. See 39-10-00 for removal/installation.

A. King KA-131 Antenna (Refer to Figure 1.)

(1) Removal.

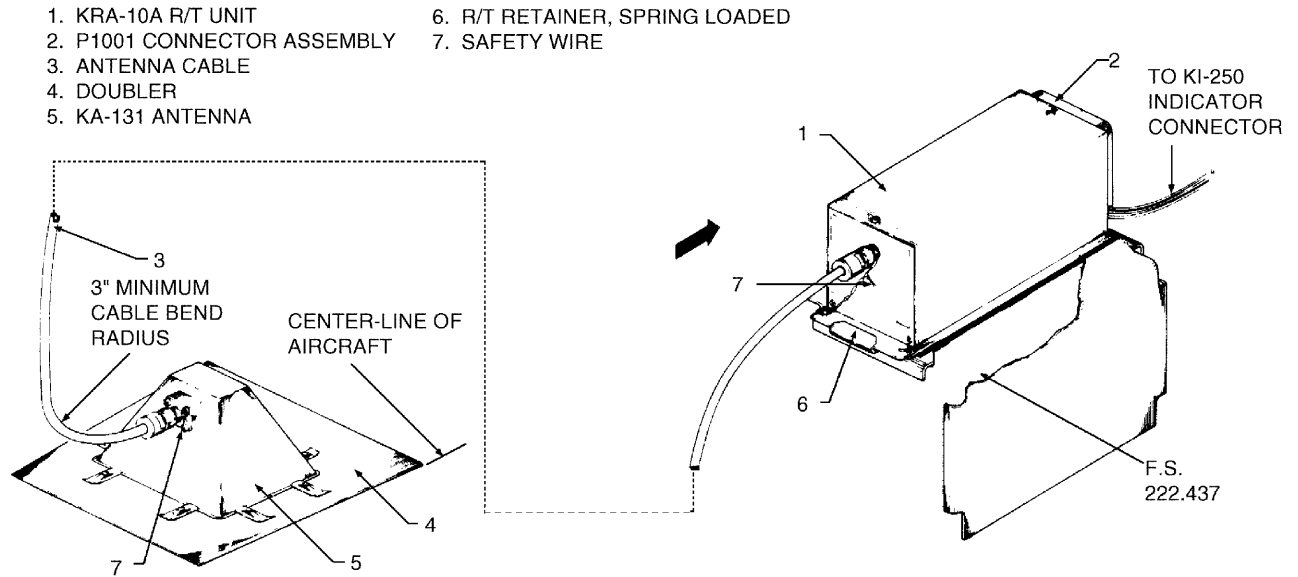
- (a) Support the antenna and remove the eight screws securing it to the belly of the aircraft.
- (b) Carefully let the antenna drop from its opening in the belly. Take note of the cable attachment plug position relative to the tail of the aircraft.
- (c) Remove the safety wire and plug.

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**CHART 3
TROUBLESHOOTING ALTIMETER**

Trouble	Cause	Remedy
Excessive scale error.	Improper calibration adjustment.	Replace instrument.
Excessive pointer oscillation.	Defective mechanism.	Replace instrument.
High or low reading.	Improper venting.	Eliminate leak in static pressure system and check alignment of airspeed tube.
Setting knob is hard to turn.	Wrong lubrication or lack of lubrication.	Replace instrument.
Inner reference marker fails to move when setting knob is rotated.	Out of engagement.	Replace instrument.
Setting knob set screw loose or missing.	Not tight when altimeter was reset.	Tighten instrument screw, if loose. Replace instrument, if screw is missing.
Cracked or loose cover glass.	Case gasket hardened.	Replace instrument.
Dull or discolored markings.	Age.	Replace instrument.
Barometric scale and reference markers out of synchronism.	Slippage or mating parts.	Replace instrument.
Altimeter sticks at altitude or does not change with change of altitude.	Water or restriction in static line.	Remove static lines from all instruments, blow line clear from cockpit to static vents.
Altimeter changes reading as aircraft is banked.	Water in static line.	Remove static lines from all instruments and blow line clear from cockpit cockpit to static vents.

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King Radar Altimeter Installation
Figure 1

- (2) Installation
 - (a) Install gasket in place on antenna ensuring metal portions of gasket will contact airframe for good bonding.
 - (b) Install antenna cable finger tight and secure with safety wire.
 - (c) With the cable attachment facing aft, position the antenna on the fuselage and install the eight screws.

B. King KRA-10A Receiver/Transmitter (R/T) Unit (Refer to Figure 1.)

CAUTION: BEFORE ENTERING THE AFT FUSELAGE SECTION, MAKE CERTAIN THE AIRCRAFT IS SUPPORTED AT THE TAIL SKID.

- (1) Removal
 - (a) Remove the close-out panel at the rear of the baggage compartment.
 - (b) Remove the safety wire and unscrew the antenna cable from the KRA-10A R/T unit.
 - (c) Remove the screw securing the P1001 connector assembly to the KRA-10A R/T and remove the connector assembly from the R/T unit.
 - (d) Loosen the screw on the spring loaded R/T retainer and lift the R/T unit from the mounting rack.
- (2) Installation
 - (a) Position the R/T unit on the mounting rack and secure by tightening the screw on the spring loaded R/T retainer.
 - (b) Attach the P1001 connector to the R/T unit and secure with screw.
 - (c) Install antenna cable finger tight and secure with safety wire.
 - (d) After checking security of installation, reinstall baggage compartment close-out panel.

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6. Airspeed Indicator

The airspeed indicator provides a means of indicating the speed of the airplane passing through the air. Airspeed indicators are sensitive pressure gauges which measure the difference between the pitot and static pressures, and present such difference in terms of indicated airspeed. This instrument has the diaphragm vented to the pitot air source and the case is vented to the static air system. As the airplane increases speed, the pitot air pressure increases, causing the diaphragm to expand. A mechanical linkage picks up this motion and moves the instrument pointer to the indicated speed. The instrument dial is calibrated in knots. Colored arcs and radial lines are used to mark the operating speed ranges necessary for safe operation of the airplane.

NOTE: If any connections in the static system are opened for maintenance, the entire system must be rechecked per FAR 23.1325. With the optional Single-side EFIS (Meggitt) installed, see also Appendix 1 (grid 4K1).

A. Troubleshooting

See Chart 4.

B. Removal and Installation

See 39-10-00, Face Mounted Instruments - Removal and Installation.

**CHART 4
TROUBLESHOOTING AIRSPEED TUBES AND INDICATOR**

Trouble	Cause	Remedy
Pointers of stick instruments do not indicate properly.	Leak in instrument case or in pitot lines.	Check for leak and seal.
Pointer of instrument oscillates.	Defective mechanism.	Replace instrument.
Instrument reads high.	Pointer not on zero.	Replace instrument.
	Leaking static system.	Find leak and correct.
Instrument reads low.	Pointer not on zero.	Replace instrument.
	Leaking pitot system.	Find leak and correct.
	Pitot head not aligned correctly.	Realign pitot head.
Airspeed changes as aircraft is banked.	Water in pitot line or static line.	Remove lines from static instruments and blow out lines from cockpit to pitot head.

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7. Outside Air Temperature Gauge (OAT)

A. **Seneca IV**

The OAT is internally lit. The only maintenance required is replacing a faulty instrument or a bad light bulb. The gauge must be removed to replace the light bulb.

Removing and Installing

CAUTION: DURING INSTALLATION OF ALL OAT'S, ONLY FINGER TIGHTEN GAUGE AND EXTERNAL THREADED HEX TUBE (SUNSHIELD). OVER TORQUING WILL DAMAGE INSTRUMENT.

- (a) Remove pilot's window close out panel.
- (b) Disconnect power wire.
- (c) Remove external sunshield.
- (d) Unscrew instrument from support bushing. Note position of any washers or spacers.
- (e) Install new gauge in reverse sequence. Check gauge position before tightening sunshield.
- (f) Install pilot's window close out pane

B. **Seneca V**

- (1) The OAT Probe is located in the under the rear facing seats below the floor at F.S.128.73

NOTE: On Seneca V models, the outside air temperature gauge is displayed on the Digital Display Monitoring Panel or, with the Avidyne option installed, on the MFD. See 77-40-00 for information.

- (2) Removal and Installing
 - (a) Remove rear seats.
 - (b) Remove center console.
 - (c) Remove floor panel.
 - (d) Remove probe.
 - (e) Installation is the reverse of the above steps.

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ATTITUDE AND DIRECTION

1. Attitude Deviation Indicators (ADI) - (Gyro Horizon)

The ADI is essentially an air driven gyroscope rotating in a horizontal plane and is operated by the same principle as the directional gyro. The pilot and copilot's (if installed) ADI's are King KI-256 Flight Director Attitude Indicators that combine air driven gyros with electrical pitch and roll inputs and outputs to the autopilot/flight director. The gyroscopes rotate in a horizontal plane and are operated by vacuum provided by engine driven pumps. A bar across the face of the indicator represents the horizon and aligning the miniature airplane to the horizon bar simulates the alignment of the airplane to the actual horizon. Any deviation simulates the deviation of the airplane from the true horizon. The ADI is marked for different degrees of bank.

A. Troubleshooting

See Chart 1.

B. Removal and Installation

See 39-10-00, Face Mounted Instruments - Removal and Installation.

2. Standby Attitude Indicator

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

With the optional Avidyne Entegra Electronic Flight Instrument System installed; an electric standby attitude indicator is installed to the left of the Primary Flight Display (PFD).

Other than removing and replacing the unit itself (see 39-10-00), the only line replaceable part is the emergency power battery which is located in the rear of the instrument's case.

Required periodic maintenance is listed in 5-20-00 and 5-30-00. Checkout and test procedures and Instructions for Continued Airworthiness are provided in Mid-Continent Instruments Manual No. 9015762.

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**CHART 1
TROUBLESHOOTING ATTITUDE DEVIATION INDICATOR**

Trouble	Cause	Remedy
Bar fails to respond.	Observe vacuum gauge for insufficient vacuum.	If insufficient vacuum exist, check pump and tubing.
	Filter dirty.	Clean or replace filter.
	Defective instrument.	Replace gyro instrument.
Bar does not settle.	Insufficient vacuum.	Check line and pump. Adjust valve.
	Incorrect instrument.	Check part number.
	Defective instrument.	Replace.
Bar oscillates or shimmies continuously.	Instrument loose in panel.	Tighten mounting screws.
	Vacuum too high.	Adjust vacuum regulators.
	Defective mechanism.	Replace instrument.
Instrument does not indicate level flight.	Instrument not level in panel.	Loosen screws and level instrument.
	Aircraft out of trim.	Trim aircraft.
Bar high after 180° turn.	Normal, if it does not exceed 1/16 inch.	
Instrument tumbles in flight.	Observe vacuum gauge for low vacuum.	If vacuum is low, reset regulator.
	Dirty filter.	Clean or replace filter.
	Line to filter restricted.	Replace line.
	Plug missing or loose in instrument.	Replace or tighten plug.

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3. Air Driven Heading Indicator (Directional Gyro)

The gyro stabilized heading indicator is a flight instrument incorporating an air driven gyro stabilized in the vertical plane. The gyro is rotated at high speed by lowering the pressure in the airtight case and simultaneously allowing filtered atmospheric air pressure to enter the instrument against the gyro buckets. Due to gyroscopic inertia, the spin axis tends to continue pointing in the same direction, even though the aircraft yaws, turns, pitches or rolls. This relative motion between the gyro and the instrument case is shown on the instrument dial which is similar to a compass card. The gyroscopic heading indicator has no sense of direction and must be set to the magnetic compass. The dial, when set to agree with the airplane's magnetic compass, provides a positive heading indication free from acceleration/deceleration and turning errors. However, precession forces applied to the gyro during turns may cause the gyro to "drift", and, upon completion of the turn, result in a difference in readings between the directional gyro and the magnetic compass, necessitating resetting the gyro. Even while maintaining a given heading, the gyro compass tends to precess (drift) due to internal friction, spin axis error, air turbulence and airflow. Therefore, the gyro should be checked against the magnetic compass, and reset as necessary, at least every 15 minutes. Maximum acceptable precession is 5° in 0:15 minutes.

Some heading indicators are limited to 55° of roll and pitch. Should these limits be exceeded, the gyro will "tumble". This is evidenced by a rapid spinning of the compass card. The gyro in a properly operating instrument can be reerected, after returning to straight and level flight, by caging the gyro and resetting it.

A. Troubleshooting

See Chart 2.

B. Removal and Installation

See 39-10-00, Face Mounted Instruments - Removal and Installation.

**CHART 2
TROUBLESHOOTING HEADING INDICATOR (DIRECTIONAL GYRO)**

Trouble	Cause	Remedy
Excessive precession (drift) in either direction.	Setting error.	Review paragraph titled AIR DRIVEN HEADING INDICATOR above.
	Defective instrument.	Replace instrument.
	High or low vacuum. If vacuum is not correct, check for the following:	
	a. Relief valve improperly adjusted. b. Incorrect gauge reading. c. Pump failure. d. Vacuum line kinked or leaking.	a. Adjust. b. Replace gauge. c. Repair or replace. d. Check and repair. Check for collapsed inner wall of hose.
Card spins during turn.	Gimbal limits of (55° bank or pitch) exceeded.	Recage gyro in level flight.
Card spins continuously.	Defective mechanism.	Replace.

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4. Horizontal Situation Indicator (HSI)

The King Horizontal Situation Indicator (HSI) is installed as standard equipment on the pilot's instrument panel.

The HSI receives heading information from a remote electrically operated gyro installed in the tail section ([Seneca IV](#)) or nose section ([Seneca V](#)) of the airplane. When operating normally, the gyro is slaved to the Earth's magnetic field by the Magnetic Slaving Transmitter installed in the left wing tip. Thus, the remote gyro is continuously precessed to align itself with the Earth's magnetic field which, in effect, enables the HSI to provide the pilot with gyro stabilized magnetic heading information.

In the event of erroneous input from the Magnetic Slaving Transmitter, the gyro can be deslaved from the Earth's magnetic field by a switch located on the pilot's instrument panel. Once deslaved, the gyro is subject to precession. A second switch on the pilot's instrument panel permits resetting the gyro by driving it electrically. Maintenance of the HSI, and its related components, should be referred to an authorized avionics repair shop.

5. Electronic Flight Instrument System (EFIS) - [Single-side \(Meggitt\) Option](#)

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A. Electronic Attitude Director Indicator (EADI) [i.e. - Meggitt MAGIC EFIS Primary Flight Display (PFD)]

The Primary Flight Display (PFD) is a microprocessor-based color, liquid crystal (LCD) display system. Information displayed includes Airspeed, Altitude, Attitude, Vertical Speed, Heading and Instrument Landing System data. The information is conveyed via predefined display formats. In addition, the PFD includes built-in test, performance and health monitoring functions and display brightness control. The PFD provides Gillam Code Altitude Output for the transponder (Mode C altitude).

Descriptions of the operator controls and basic operating modes and screens are in the appropriate Pilot's Operating Handbook Supplement.

(1) Troubleshooting

See Chart 3. See also Appendix 1 (grid 4K1).

(2) Basic Functional Test

CAUTION: IF, DURING THE FOLLOWING TEST, ANY COMPONENT DOES NOT PRODUCE THE EXPECTED RESULTS, THAT COMPONENT MUST NOT BE USED IN FLIGHT UNTIL THE PROBLEM IS CORRECTED.

- (a) Before applying power, verify proper voltage inputs and ground connections as well as all system interfaces.
- (b) Start the PFD in Test Mode by pressing and holding the Baro Push button while applying power until the Initialization page is shown. Verify that the Initialization page displays "Seneca Primary Flight Display" at the top of the screen and is replaced by the Configuration Data page after approximately five (5) seconds.
- (c) Verify that the Configuration Data page Configuration Discrete Parity Status and Power On Self Test results both show results of Pass. If the result is FAIL, further diagnostic effort is required to determine if the failed indication is the result of improper installation, a faulty PFD, or both.
- (d) Verify that the Configuration Data page displays the correct installation location (primary or secondary).

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- (e) Remove power from the PFD to terminate Test Mode. Re-apply power to the PFD and start the display in Mission Operational Mode.
 - (f) Verify that the PFD displays the Initialization page for approximately five (5) seconds prior to displaying the PFD Screen Format. If power has not been applied to the ADAHRS then the PFD screen format will be replaced by failure indications.
 - (g) Apply power to the Air Data Attitude Heading Reference System (ADAHRS) (i.e. - AHRS).
 - (h) Verify that the PFD Screen Format is displayed (if the ADAHRS is performing initialization then the ADAHRS Initialization screen will replace the attitude sphere). If any of the failure indications are displayed refer to Chart 3.
 - (i) Verify that the ADAHRS has completed initialization by observing that the attitude sphere replaces the ADAHRS Initialization screen. If the ADAHRS has not completed initialization within 180 seconds after application of power to the ADAHRS refer to Chart 4.
 - (j) Apply power to the Navigation Display (ND) (i.e. - EHSI).
 - (k) If installed, apply power to the Radar Altimeter. Perform a functional test on the Radar Altimeter system and verify that the PFD Rad Alt Indication and Decision Height Annunciation are displayed correctly.
 - (l) Apply power to the VOR radio. Perform a functional test on the VOR Radio system and verify that the PFD Localizer/Glideslope and Backcourse/Localizer Sensing Indications are displayed correctly.
 - (m) Apply power to the Marker Beacon system. Perform a functional test on the Marker Beacon system and verify that the PFD Marker Beacon indications are displayed correctly.
 - (n) Apply power to the Autopilot system. Place the Autopilot Master Switch in the Flight Director position and verify that the flight director bars are displayed correctly.
 - (o) Press the Baro Push button and verify that the barometric correction displays 'STD'. Rotate the Baro Rotary Control clockwise and verify that the barometric correction increases. Rotate the Baro Rotary Control counter-clockwise and verify that the barometric correction decreases.
 - (p) On the overhead switch panel, decrease the Panel LCD's dimmer switch and verify that the PFD brightness decreases.
 - (q) On the overhead switch panel, increase the Panel LCD's dimmer switch and verify that the PFD brightness increases.
 - (r) Press the EADI Display Down switch. Verify that the PFD screen blanks and that the PFD screen format is displayed on the Navigation Display (ND) (i.e. - EHSI) .
 - (s) Press the EADI Display Down switch again. Verify that the PFD screen format is displayed on the PFD and that the PFD screen format is removed from the ND.
- (3) Removal and Installation
See 39-10-00.

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**CHART 3 (Sheet 1 of 3)
TROUBLESHOOTING EADI (i.e. - MEGGITT PFD)**

Trouble	Cause	Remedy
No display visible at power up.	+28 VDC power missing.	Check wiring & bus voltage.
	+28 VDC Return missing.	Check wiring.
	Failed PFD.	Replace PFD.
	EADI Display Down mode selected.	Check EADI Display Down switch.
Test mode visible at power up.	Stuck Baro Push button.	Check Baro Push button.
	PFD failed self test.	Replace PFD.
Display brightness does not change when PFD brightness control operated.	28 VDC lighting bus not connected or not functional.	Check wiring and 28 VDC lighting bus.
	Brightness control not functional.	Check Brightness control.
	Failed PFD.	Replace PFD.
Barometric correction does not change when BARO Rotary control is rotated.	PFD in test mode.	Ensure PFD in mission operational mode.
	Failed PFD.	Replace PFD.
Barometric correction does not change to standard setting when Baro Push button is pressed.	PFD in test mode.	Ensure PFD in mission operational mode.
	Failed PFD.	Replace PFD.
Unable to enter test mode when Baro Push button is pressed.	Airspeed equal to or greater than 40 knots detected.	Ensure airspeed is less than 40 knots.
	Unit not powered off before Baro Push button is pressed.	Ensure unit is powered off before Baro Push button is pressed.
	Baro Push button pressed and held for insufficient time.	Ensure Baro Push button is pressed and held until initialization page displays.
	Failed PFD.	Replace PFD.
Test page does not change when Baro Rotary Control is rotated.	PFD in mission operational mode.	Ensure PFD in test mode.
	Failed PFD.	Replace PFD.
Power on self test status on Configuration Data page is indicated as FAIL.	Failed PFD.	Replace PFD.
Configuration discrete parity status on Configuration Data page is indicated as FAIL.	Parity input (Configuration Discrete 7) not wired correctly.	Check configuration discrete setting.
	Failed PFD.	Check wiring. Replace PFD.

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CHART 3 (Sheet 2 of 3)
TROUBLESHOOTING EADI (i.e. -MEGGITT PFD)

Trouble	Cause	Remedy
Installation location on Configuration Data page incorrect.	Configuration discretes 0 and 1 not wired correctly. Failed PFD.	Check configuration discrete setting. Check wiring. Replace PFD.
ADAHRS initialization screen is not removed from the display after 3 minutes have elapsed since ADAHRS power on.	ADAHRS not completing initialization.	Perform ADAHRS test.
Rad Alt indication and/or decision height annunciation are not displayed correctly.	Failed Radar Altimeter. Failed PFD.	Perform Rad Alt test. Replace PFD.
localizer/Glideslope and/or Backcourse/localizer sensing indications not displayed correctly.	Failed VOR radio. Failed PFD.	Perform VOR radio test. Replace PFD.
Marker beacon indications not displayed correctly.	Failed marker beacon system. Failed PFD.	Perform marker beacon system test. Replace PFD.
Flight director bars not displayed correctly.	Failed Autopilot system. FD/AP switch not functional/wired correctly. Failed PFD.	Perform Autopilot system test. Check FD/AP switch and wiring. Replace PFD.
Full Field Red, Green, Blue, Black, and White pages are not displayed correctly.	Failed PFD.	Replace PFD.
ND Interface Data page shows valid data is not being transmitted.	Failed PFD.	Replace PFD.
ND Interface Data page shows valid data is not being received.	RS422 Receive A and B lines are not connected or are wired incorrectly. Failed ND.	Check wiring. Replace ND.
ADAHRS Interface Data pages show valid data is not being received.	ARINC IN A and B lines are not connected or are wired incorrectly. Failed ADAHRS. Failed PFD.	Check wiring. Replace ADAHRS. Replace PFD.

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**CHART 3 (Sheet 3 of 3)
TROUBLESHOOTING EADI (i.e. - MEGGITT PFD)**

Trouble	Cause	Remedy
Selecting the EADI Display Down switch to EADI Display Down does not remove the PFD display.	EADI Display Down switch not functional/wired correctly. Failed PFD.	Check EADI Display Down switch and wiring. Replace PFD.
PFD screen format not displayed on the PFD when the EADI Display Down switch selected to normal.	EADI Display Down switch not functional/wired correctly. Failed PFD.	Check EADI Display Down switch and wiring. Replace PFD.

B. Electronic Horizontal Situation Indicator (EHSI) [i.e. - Meggitt MAGIC EFIS Navigation Display (ND)]

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

The Navigation Display (ND) is, like the Meggitt Primary Flight Display (PFD), a microprocessor-based color, liquid crystal (LCD) display system. Information displayed includes Navigation Data, Autopilot Data, Radio Tuning, Airspeed, Altitude, Attitude, Vertical Speed, Heading and Instrument Landing System data. The information is displayed via a series of predefined display formats (HSI, ARC, MAP). In addition, the ND includes built-in test, performance and health monitoring functions and display brightness control.

Descriptions of the operator controls and basic operating modes and screens are in the appropriate Pilot's Operating Handbook Supplement.

(1) Troubleshooting

See Chart 4. See also Appendix 1 (grid 4K1).

(2) Basic Functional Test

The following test procedure should be performed with the aircraft in a suitable position to receive valid VOR/ILS/GPS/DME signals. If this is not possible, then use the appropriate test sets to simulate the signals as required.

CAUTION: IF, DURING THE FOLLOWING TEST, ANY COMPONENT DOES NOT PRODUCE THE EXPECTED RESULTS, THAT COMPONENT MUST NOT BE USED IN FLIGHT UNTIL THE PROBLEM IS CORRECTED.

- (a) Before applying power, verify proper voltage inputs and ground connections as well as all system interfaces.
- (b) Start the ND in Test Mode by pressing and holding the MENU Push button while applying power until the Initialization page is shown. Verify that the Initialization page displays "Seneca Navigation Display" at the top of the screen and is replaced by the Configuration Data page after approximately five (5) seconds.
- (c) Verify that the Configuration Data page Configuration Discrete Parity Status and Power On Self Test results both show results of Pass. If the result is FAIL, further diagnostic effort is required to determine if the failed indication is the result of a fault in the wiring, a faulty ND, or both.

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**CHART 4 (Sheet 1 of 3)
TROUBLESHOOTING EHSI (i.e. - MEGGITT ND)**

Trouble	Cause	Remedy
No display visible at power up.	+28 VDC power missing.	Check wiring & bus voltage.
	+28 VDC Return missing.	Check wiring.
	Failed ND.	Replace ND.
Display powers-up in EADI Display Down mode.	EADI Display Down mode selected.	Check EADI Display Down switch.
	Failed ND.	Replace ND.
Test mode visible at power up	Stuck MENU button	Check MENU button
	ND failed self test	Replace ND
Display brightness does not change when Panel LCD's dimmer switch operated	28 VDC lighting bus not connected or not functional	Check wiring and 28 VDC lighting bus
	Panel LCD's dimmer module not functional	Check/replace module
	Panel LCD's dimmer switch not functional	Check/replace switch.
	Failed ND	Replace ND
Menu does not appear when MENU button is pressed	Stuck MENU button	Check MENU button
	Failed ND	Replace ND
Menu cursor does not change when ↑ and/or ↓ buttons are pressed	Stuck ↑ and/or ↓ buttons	Check ↑ and ↓ buttons
	Failed ND	Replace ND
Unable to select menu options when SEL button is pressed	Stuck SEL button	Check SEL button
	Failed ND	Replace ND
Unable to enter Test mode when MENU button is pressed	Airspeed equal to or greater than 40 knots detected	Ensure airspeed is less than 40 knots
	Unit not powered off before MENU button is pressed	Ensure unit is powered off before MENU button is pressed
	MENU button pressed and held for insufficient time	Ensure MENU button is pressed and held until initialization page displays
	Failed ND	Replace ND
Test menu does not change when the ↑ and/or ↓ buttons are pressed	ND in mission operational mode	Ensure ND in test mode
	Stuck ↑ and/or ↓ buttons	Check ↑ and/or ↓ buttons
	Failed ND	Replace ND
Unable to select Test pages when the SEL button is pressed	Stuck SEL button	Check SEL button
	Failed ND	Replace ND

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**CHART 4 (Sheet 2 of 3)
TROUBLESHOOTING EHSI (i.e. - MEGGITT ND)**

Trouble	Cause	Remedy
Barometric setting does not change in EADI Display Down mode when the ↑ and/or ↓ buttons are pressed	Stuck ↑ and/or ↓ buttons	Check ↑ and ↓ buttons
	Failed ND	Replace ND
Selected CRS does not change when CSR knob rotated	Stuck CRS knob	Check CRS knob
	Failed ND	Replace ND
Selected HDG does not change when HDG knob rotated	Stuck HDG knob	Check HDG knob
	Failed ND	Replace ND
Selected CRS does not align with present heading when CSR knob pushed	Stuck CRS knob	Check CRS knob
	Failed ND	Replace ND
Selected HDG does not align with present heading when HDG knob pushed	Stuck HDG knob	Check HDG knob
	Failed ND	Replace ND
Failure flags present on display	Equipment supplying relevant data to ND failed	Check status of equipment supplying data to ND
	Failed ND	Check data on relevant ND test page
Power on self test status on Configuration Data page is indicated as FAIL	Failed ND	Replace ND
Configuration discrete parity status on Configuration Data page is indicated as FAIL	Parity input (Configuration Discrete 7) not wired correctly	Check configuration discrete setting
	Failed ND	Check wiring Replace ND
Installation location on Configuration Data page incorrect	Configuration discretes 0 and 1 not wired correctly	Check configuration discrete setting
	Failed ND	Check wiring Replace ND
PFD Interface Data Page shows valid data is not being received/transmitted	RS422 Receive and/or Transmit lines are not connected or wired correctly	Check wiring
	Failed ND	Replace ND
	Failed PFD	Replace PFD
ADAHRS Interface Data pages show valid data is not being received	ARINC IN A and B Bus 1 lines are not connected or are wired incorrectly	Check wiring
	Failed ADAHRS	Replace ADAHRS
	Failed ND	Replace ND

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**CHART 4 (Sheet 3 of 3)
TROUBLESHOOTING EHSI (i.e. -MEGGITT ND)**

Trouble	Cause	Remedy
NAV Interface Data Page shows valid data is not being Received	ARINC In A and B Bus 2 lines are not connected or are wired incorrectly	Check wiring
	Failed ND	Replace ND
	Failed Nav radio	Replace Nav radio
GPS Interface Data Pages show valid data is not being Received	ARINC In A and B Bus 4A and/or 4B lines are not connected or are wired incorrectly	Check wiring
	Failed ND	Replace ND
	Failed GPS Receiver	Replace GPS Receiver
Cross Side Input Interface Data Page shows valid data is not being Received	ARINC In A and B Bus 3 lines are not connected or are wired incorrectly	Check wiring
	Failed ND	Replace ND
	Failed cross-side ND	Test cross-side ND
Cross Side Output Interface Data Page shows valid data is not being Transmitted	ARINC Out A and B Bus 2 lines are not connected or are wired incorrectly	Check wiring
	Failed ND	Replace ND
NAV/GPS Output Interface Data Page shows valid data is not being transmitted	ARINC Out A and B Bus 1 lines are not connected or are wired incorrectly	Check wiring
	Failed ND	Replace ND
Analog Interface Data Page shows valid data is not being Received or Transmitted	Failed ND	Replace ND
	Failed Autopilot Input	Perform Autopilot Test
	Failed DME Input	Perform DME Test
	Failed Audio Panel Input	Perform Audio Panel Test
	Failed Rad Alt Input	Perform Rad Alt Test
	Failed ADF Input	Perform ADF Test
Discrete Interface Data Page shows valid data is not being Received or Transmitted	Failed ND	Replace ND
	Failed Autopilot Input	Perform Autopilot Test
	Failed DME Input	Perform DME Test
	Failed Rad Alt Input	Perform Rad Alt Test
	Failed DAU output	Check GPS inputs
	Failed Autopilot output	Check Nav inputs

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- (d) Verify that the Configuration Data page displays the correct installation location (primary or secondary).
- (e) Remove power from the ND to terminate Test Mode. Re-apply power to the ND and start the display in Mission Operational Mode.
- (f) Verify that the ND displays the Initialization page for approximately five (5) seconds prior to displaying the HSI Screen Format. If power has not been applied to the ADAHRS then the HSI screen format will display the heading failure indication.
- (g) Apply power to the Air Data Attitude Heading Reference System (ADAHRS) (i.e. - AHRS).
- (h) Apply power to the Primary Flight Display (PFD) (i.e. - EADI).
- (i) Verify that the HSI Screen Format is displayed and the installation specific defaults as shown in Chart 5 apply. If any of the failure flags are displayed refer to Chart 4.
- (j) Enable the Mission Operational Mode/Rev Mode menu by pressing the bezel mounted 'MENU' button. Verify that the menu is displayed correctly.
- (k) Ensure that the Nav Radios are selected off. Use the bezel mounted “↑, ↓” and “SEL” buttons to navigate through the menu, selecting RMI1 to display VOR1 and RMI2 to display VOR2. Verify that the RMI1 and RMI2 second level menus are displayed correctly and the RMI1 and RMI2 source annunciations match the selections.
- (l) Verify that the RMI1, RMI2 and CDI source annunciations are amber in color. Verify that the associated frequency annunciations are replaced with amber dashes. Verify that both RMI pointers and the CDI pointer are removed from the display.
- (m) Apply power to the Nav radios. Select valid VOR frequencies on the Nav Radios and verify that the RMI1, RMI2 and CDI source and frequency annunciations are displayed in the correct colors (see Chart 6). Verify that the ND displayed frequencies match the Nav radio frequencies (i.e. RMI1 frequency matches Nav Radio 1 and RMI2 frequency matches Nav Radio 2. The CDI frequency should match the currently selected CDI source frequency). Verify that both RMI pointers and the CDI pointer are displayed correctly.
- (n) Select valid ILS frequencies on the Nav Radios and verify that the RMI1, RMI2 and CDI source annunciations display VOR1, VOR2 and ILS1/ILS2 (dependent on current selected CDI source) respectively in the correct colors (see Chart 6). Verify that the ND displayed frequencies match the Nav radio frequencies (i.e. RMI1 frequency matches Nav Radio 1 and RMI2 frequency matches Nav Radio 2. The CDI frequency should match the currently selected CDI source frequency). Verify that both RMI pointers are removed and the CDI pointer is displayed correctly.
- (o) Apply power to the GPS Receivers. Use the bezel mounted “↑, ↓” and “SEL” buttons to navigate through the menu, selecting RMI1 and RMI2 to display GPS and CDI (verify that the CDI second level menu is displayed correctly) to display GPS (GPS1 or GPS2 will be available dependent on GPS source selection). Verify that the RMI1, RMI2 and CDI source annunciations reflect the selections.
- (p) Refer to the GPS Installation Manual and display the self test page on the on-side GPS. Verify that the applicable ND parameters display the correct self test values as listed in the GPS Installation Manual during the display of the self test page.
- (q) Verify that the GPS source annunciation displays the currently selected GPS source in white. Use the bezel mounted “↑, ↓” and “SEL” buttons to navigate through the menu, selecting the GPS source to the off-side GPS. Verify that the GPS second level menu is displayed correctly. Verify that the GPS source annunciation displays the currently selected GPS source in white.
- (r) Refer to the GPS Installation Manual and display the self test page on the off-side GPS. Verify that the applicable ND parameters display the correct self test values as listed in the GPS Installation Manual during the display of the self test page.

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**CHART 5
NAVIGATION DISPLAY (ND) DEFAULT SETTINGS (MEGGITT)**

Screen Format	HSI
Element	Setting
CDI	VOR1
RMI1	OFF
RMI2	OFF
RANGE	2.5NM
GPS SEL	GPS1
APOINTS	Disabled
NAVAIDS	Disabled
WPTS	Disabled
NDB	Disabled
Selected Heading	Last Known Setting
Selected Course / Desired Track	Last Known Setting
Barometric Setting	Last Known Setting

**CHART 6
NAVIGATION DISPLAY (ND) COLOR CODING (MEGGITT)**

Display Parameter		
Color	Mission Operational Mode	EADI Display Down Mode
White	A/C Symbol, Scales, Range Rings, Digital Readouts, RMI1 Pointer and Annunciation	Scales, Digital Readouts
Grey	N/A	Scale Tapes
A/C Symbol	N/A	Aircraft Symbol, Lubber Line
Amber	Failures and Annunciation's	Stall Warning, Failures and Annunciation's
Red	N/A	Airframe Limits
Sky	N/A	Sky
Ground	N/A	Ground and Radar Altimeter ground reference
Green	N/A	Baro Correction
Magenta	Deviation Bar, Sel HDG/CRS Bugs, CDI Pointer and Annunciation	Flight Director Command Bars and Deviation Pointers
Cyan	RMI2 Pointer and Annunciation	N/A

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- (s) Press the EADI Display Down switch to select EADI Display Down mode and verify that the ND displays the PFD (i.e. - EADI) screen format. Verify that the PFD screen blanks.
 - (t) If installed, apply power to the Radar Altimeter. Perform a functional test on the Rad Alt system and verify that the ND Rad Alt Indication and Decision Height Annunciation are displayed correctly.
 - (u) Perform a functional test on the VOR Radio system and verify that the ND Localizer / Glideslope and Backcourse / Localizer Sensing indications are displayed correctly.
 - (v) Apply power to the Marker Beacon system. Perform a functional test on the Marker Beacon system and verify that the ND Marker Beacon indications are displayed correctly.
 - (w) Apply power to the Autopilot system. Place the Autopilot Master Switch in the Flight Director position and verify that the flight director bars are displayed correctly.
 - (x) Press the bezel mounted “↑” button once and verify that the barometric correction increases by 0.01in Hg/1hPa. Press and hold the bezel mounted “↑” button and verify that the barometric correction continuously increases in increments of 0.01in Hg/1hPa until the button is released or the maximum barometric correction is reached.
 - (y) Press the bezel mounted “↓” button once and verify that the barometric correction decreases by 0.01in Hg/1hPa. Press and hold the bezel mounted “↓” button and verify that the barometric correction continuously decreases in increments of 0.01in Hg/1hPa until the button is released or the minimum barometric correction is reached.
 - (z) Press the EADI Display Down switch to shift back to normal mode and verify that the HSI screen format is displayed on the ND. Verify that the PFD screen format displays on the PFD.
 - (aa) Use the bezel mounted “↑”, “↓” and “SEL” buttons to navigate through the menu, selecting the Arc screen format. Verify that the Arc screen format is displayed correctly.
 - (bb) Use the bezel mounted “↑”, “↓” and “SEL” buttons to navigate through the menu, selecting the Map screen format. Verify that the Map screen format is displayed correctly.
 - (cc) Use the bezel mounted “↑”, “↓” and “SEL” buttons to navigate through the menu, selecting the HSI screen format. Rotate the CRS Rotary Control clockwise and verify that the selected CRS pointer rotates clockwise around the compass card and the selected course digital readout increases and mirrors the pointer heading. Rotate the CRS Rotary Control anti-clockwise and verify that the selected CRS pointer rotates anti-clockwise around the compass card and the selected course digital readout decreases and mirrors the pointer heading. Push the CRS Push button and verify that the selected course pointer and digital readout align to the current aircraft heading.
 - (dd) Rotate the HDG Rotary Control clockwise and verify that the selected HDG bug rotates clockwise around the compass card and the selected heading digital readout increases and mirrors the bug heading. Rotate the HDG Rotary Control anti-clockwise and verify that the selected HDG bug rotates anti-clockwise around the compass card and the selected heading digital readout decreases and mirrors the bug heading. Push the HDG Push button and verify that the selected heading bug and digital readout align to the current aircraft heading.
 - (ee) On the overhead switch panel, decrease the Panel LCD’s dimmer switch and verify that the ND brightness decreases.
 - (ff) On the overhead switch panel, increase the Panel LCD’s dimmer switch and verify that the ND brightness increases.
- (3) Removal and Installation
See 39-10-00.

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- C. Air Data & Attitude Heading Reference System (ADAHRS) [i.e. - Attitude Heading Reference System (AHRS)].

The ADAHRS unit is located on the aft equipment shelf behind the cabin rear closeout panel.

NOTE: When installing the ADAHRS unit; first, level the airplane per 8-20-00; and then, use NAS 1149FN816P washers as required to level the ADAHRS unit.

- (1) Magnetic Heading Compensation / Calibration Perform the Magnetic Heading Compensation/Calibration procedure in Magnetic Heading Systems, below, whenever the ADAHRS unit is installed or replaced.

- (2) Ground Test Procedure

This test procedure (included as Appendix 1 - grid 4K1) verifies the integrity and accuracy of the air data and pitot-static systems and shows that these systems comply with the applicable airworthiness regulations. Perform this procedure:

- (a) Each 24-months,
- (b) To proof test the static system in accordance with FAR 23.1325 each time any connections in static system are opened for maintenance, or
- (c) Following installation or maintenance on the ADAHRS unit, the primary flight display (PFD), or the transponder Mode C interface.

6. Electronic Flight Instrument System (EFIS) - Avidyne Option

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.

The Avidyne FlightMax Entegra Electronic Flight Instrument System (EFIS) is available as an option.

- A. Description (See Figures 1 and 2.)

This system uses two large 10.4-inch diagonal, high-resolution, sunlight-readable full color displays (PFD and MFD), to provide primary flight and engine information as well as a wide variety of other data. Standard primary flight instruments (i.e. - airspeed, electric attitude indicator, and altimeter) provide redundancy.

The EFIS installation consists of the following components: Primary Flight Display (PFD), Multifunction Display (MFD), Data Acquisition Unit (DAU) and associated sensors, and Magnetometer/OAT Sensor Assembly.

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B. Maintenance

The Instructions for Continued Airworthiness (ICA) published by Avidyne provide the necessary information for maintaining this system as installed in Piper airplanes, except as noted below.

(1) Primary Flight Display (PFD)

(PIR-PPS60219, Rev. A)

Use 700-00006-0XX PFD & 700-00011-000 Mag/OAT ICA, Avidyne Document No. AVPFD-174, Revision 00-C, or latest revision, with the following exceptions:

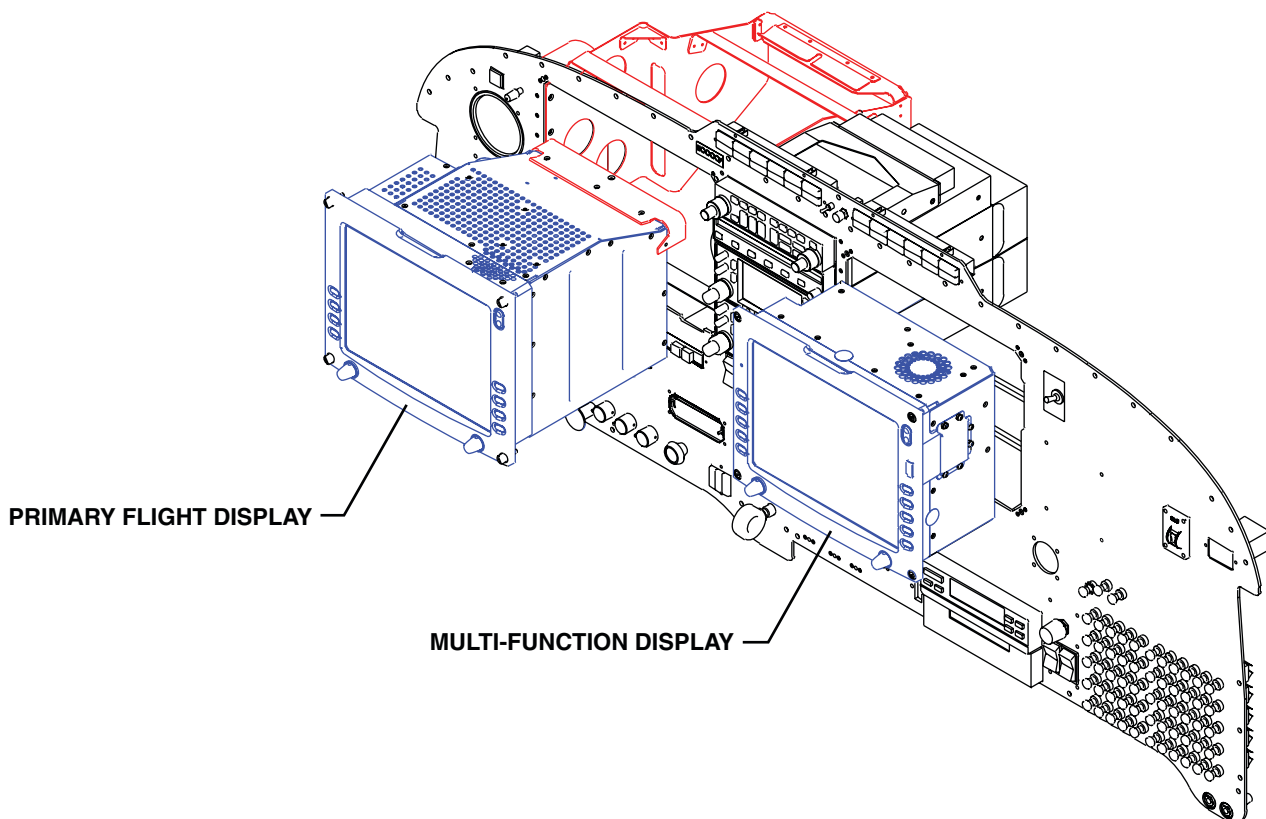
- (a) In para 6, Troubleshooting Information, in the chart where it says "OAT (Optional)," cross out "optional." The OAT is standard in the Piper installation.
- (b) In para 7.2 and Figure 7, where the standard Avidyne installation describes alignment pins and retaining clips on the sides of the PFD, the Piper installation uses a single alignment pin on the top of the PFD engaging a slot in the upper rear cross bracket.
- (c) In para 7.5.4.2, in the "Main RS232 Configuration Page" chart, for CHNL 3 under GNS-430 No 2, both Input and Output should read "Crossfill" instead of "Off."
- (d) Replace paragraph 7.5.3, Aircraft Model Setup, with the following:
 - 1 Depress the "Aircraft Model" Line Select Key (R4) until the aircraft selection displays "34-220T" in the "A/C Model" LSK Label Window.
 - 2 Verify the System Setup indicates the following:

Aircraft Make:	Piper
Model:	PA34-220T (Seneca V)
Pitch Offset:	0.0
- (e) Replace paragraph 7.5.2.1, GNS 430 Nav/Com Setup, PFD Unit, with the following:
 - 1 Select the Avionics Setup page by highlighting the "Avionics" tab at the bottom of the screen by rotating the lower left control knob.
 - 2 Depress the "NAV 1" LSK (R1) until the NAV 1 LSK Label Window displays "430/530."
 - 3 Depress the "NAV 2" LSK (R2) until the NAV 2 LSK Label Window displays "430/530."
 - 4 Depress the "A/P Type" LSK (R3) until the A/P Type LSK Label Window displays "STEC 55X."
 - 5 Depress the "ADF" LSK (R3) until the ADF LSK Label Display Window displays "NONE."
- (f) In para 7.5.6.2, below the heading "Magnetometer Calibration Procedure," insert the following:

"Complete the IRU calibration procedure before proceeding."

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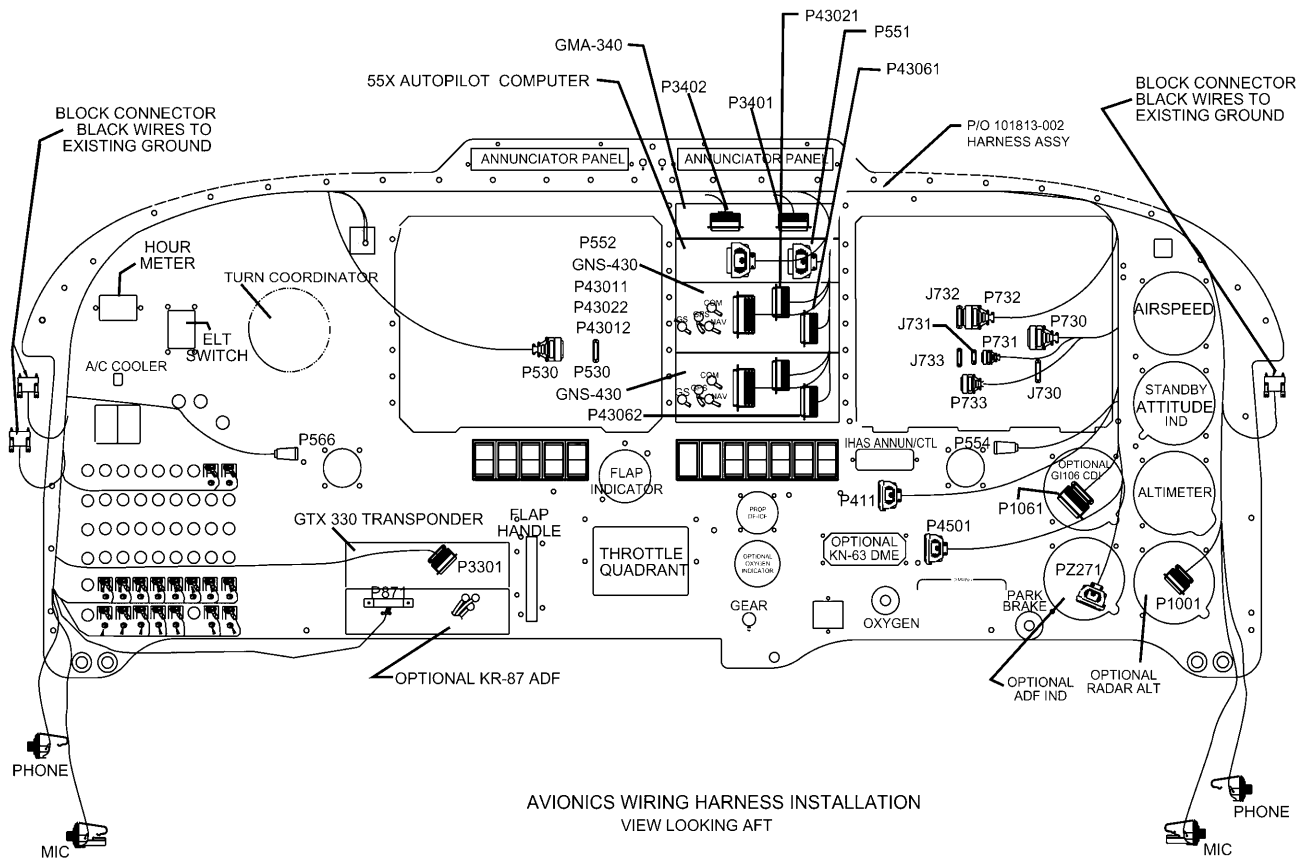
- (g) Next, Complete the following procedures:
- 1 Select the Display Setup page by highlighting the “Display” tab at the bottom of the screen by rotating the lower left control knob.
 - 2 Depress the “Trim Ann” LSK (L1) until the Trim Ann LSK Label Window displays “SHOW.”
 - 3 Depress the “A/P Annun” LSK (L2) until the A/P Ann LSK Label Window displays “SHOW.”
 - 4 Depress the “V-Speeds” LSK (L3) until the V-Speeds LSK Label Window displays “SHOW.”
 - 5 Depress the “Horiz Marks” LSK (R1) until the Horiz Marks LSK Label Window displays “SHOW.”
 - 6 Depress the “ARS” (Aircraft Reference Symbol) LSK (R4) until the ARS LSK Label Window displays “Delta.”
 - 7 Depress the “Baro-Unit” LSK (R1) until the Baro-Unit LSK Label Window Displays “In Hg” for U.S. registered aircraft. Depress the “Baro-Unit” LSK (R1) until “hPa” or “Mb” appears in the window for foreign registered aircraft if other than “In Hg” is required for the aircraft APO.
- (h) Disregard paragraph 7.5.5.1, Barometric Units Setting, as it is covered in step 7, above.



Avidyne Entegra Installation
Figure 1

[Effectivity](#)
[Seneca V](#)
[with Avidyne Option](#)

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Effectivity Seneca V with Avidyne Option

Avidyne Entegra Wiring Installation
Figure 2

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(2) Multifunction Display (MFD)

(PIR-PPS60218, Rev. A)

Use 700-00004-0XX-() Multifunction Display ICA, Avidyne Document No. AVMFD-167, with the following exceptions:

- (a) In para 2, items 7 and 8 are standard in the Piper installation.
- (b) Replace items 3 and 4 in paragraph 7.3.1, Maintenance Mode Access with the following:
 - 1 At the prompt "Press any bezel key to continue", press any LSK. This places the screen at the exceedance page. Press O.K. to acknowledge exceedances and to continue to the Initial Usable Fuel page. Depress the "Fuel Done" LSK (R4).
 - 2 Rotate the right outer concentric knob clockwise until the AUX page is displayed.
- (c) Replace paragraph 7.3.2.1, GAMA 429 Graphics Setup (EX5000 only), with the following:
 - 1 From the Maintenance page, depress the LSK (L1) to access the GPS/FMS Setup page.
 - 2 Using the right outer concentric knob to select the configuration field and the right inner concentric knob to select the desired configuration; configure the GPS/FMS Setup page for the following conditions:

Receiver 1:	GAMA 429 FORMAT
Port:	ARINC 429 RX 1
Speed:	LOW
Receiver 2:	GAMA 429 FORMAT
Port:	ARINC 429 RX 2
Speed:	LOW
 - 3 Press the SAVE button.
- (d) Replace paragraph 7.3.5.1, TAS (SkyWatch & Bendix King) Setup, with the following:
 - 1 If equipped with SKY-497, configure the Traffic Setup page for the following conditions (otherwise not installed):

Sensor:	TAS
Port:	ARINC 429 TX 3
TAS Type:	SKYWATCH
External Controller Box:	NOT CHECKED
 - 2 Press the SAVE button.
- (e) Replace paragraph 7.3.4, Lightning Sensor Interface and Setup, with the following:
 - 1 From the Maintenance Setup page depress the LSK (L3) to access the Lightning Setup page.
 - 2 Using the right outer concentric knob to select the configuration field and the right inner concentric knob to select the desired configuration. Configure the Lighting Setup page for the following condition:

Sensor	WX-500
Operating Mode:	Weather
Port:	RS232-3-(Lightning Default)
Stabilization Type:	Use Map Heading/Track
Enable Lightning Ahead:	Box CHECKED
Antenna on Top:	Box NOT CHECKED
 - 3 Press the SAVE button.

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- (f) Replace paragraph 7.3.10.1, Engine Sensor Setup, with the following:
- 1 From the Maintenance Page, depress the LSK (L4) to access the Traffic Setup page.
 - 2 Using the right outer concentric knob to select the configuration field and the right inner concentric knob to select the desired configuration. Configure the Engine Setup page for the following conditions:

Aircraft Model:	PA34-220T (Seneca V)
Left Engine Serial Port:	RS232 4
Right Engine Serial Port:	RS232 2
Vacuum System Installed:	Box CHECKED if aircraft is deice equipped, NOT CHECKED if aircraft is not deice equipped
 - 3 Press the SAVE button.
 - 4 When configuring a MFD for the first time only, the following setup box appears: "Select ACFT Model and Port(s)." Select "Resync."
- (g) Replace paragraph 7.3.8, Map Setup, with the following:
- 1 From the Maintenance Setup page, depress the LSK (R1) to access the MAP Setup page.
 - 2 Using the right outer concentric knob to select the configuration field and the right inner concentric knob to select the desired configuration; configure the Map Heading Setup page for the following conditions:

Map Heading:	FMS/GPS
--------------	---------
 - 3 Press the SAVE button.
- (h) After completing the previous procedures, complete the Aircraft Setup procedure as follows:
- 1 From the Maintenance page, depress the LSK (R2) to access the AIRCRAFT Setup page.
 - 2 Using the right outer concentric knob to select the configuration field and the right inner concentric knob to select the desired configuration; configure the AIRCRAFT Setup page for the following conditions:

Narrowcast:	Quake SC
Port:	RS232 6 (Datalink Default)
Broadcast:	XM Radio
Port:	ARINC 429 RX 4
Dimming Bus Voltage:	No setting required
Brightest Dimming Voltage:	24.0 Volts
Darkest Dimming Voltage:	5.0 Volts
 - 3 Press the SAVE button.
- (i) See 28-40-00 for Fuel Quantity Indicator calibration.

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- (3) Data Acquisition Unit (DAU)
 - (a) Use 200-00041-000 DAU ICA, Avidyne Document No. AVSIU-011, with the following exceptions:
 - 1 In para 6, in "Table 2 - DAU Pinout," pins J1-2 and J1-21 have "No Connection" in the Piper installation.
 - 2 In para 6, in "Table 4 - DAU Sensor Compatibility," parameter "VAC" is not used in the Piper installation.
 - (b) Removal and Installation
The DAU's are mounted on the forward side of the nacelle bulkhead assembly for each engine. Maintenance is on condition.
 - (4) Magnetometer/OAT Sensor Assembly
See information under Primary Flight Display, above. Removal and installation instructions are provided under "Magnetometer/OAT Sensor Assembly," below.
- C. Component Locator
See Figures 1, 2, and 6.

7. Magnetic Heading Systems

A. Flux Detector (See Figure 3.)

A flux detector installed in the wing tip of the left wing is used to provide heading data to the HSI/EHSI and, if installed, the ADAHRS.

CAUTION: PERFORM MAGNETIC HEADING COMPENSATION / CALIBRATION, BELOW, WHENEVER THE FLUX DETECTOR IS CHANGED.

(1) Removal

- (a) Remove the left wing tip fairing to expose the flux detector.
- (b) Disconnect the wiring harness(es) from the top of the flux detector to be removed.
- (c) Unscrew and remove the three brass screws and washers and remove the flux detector.

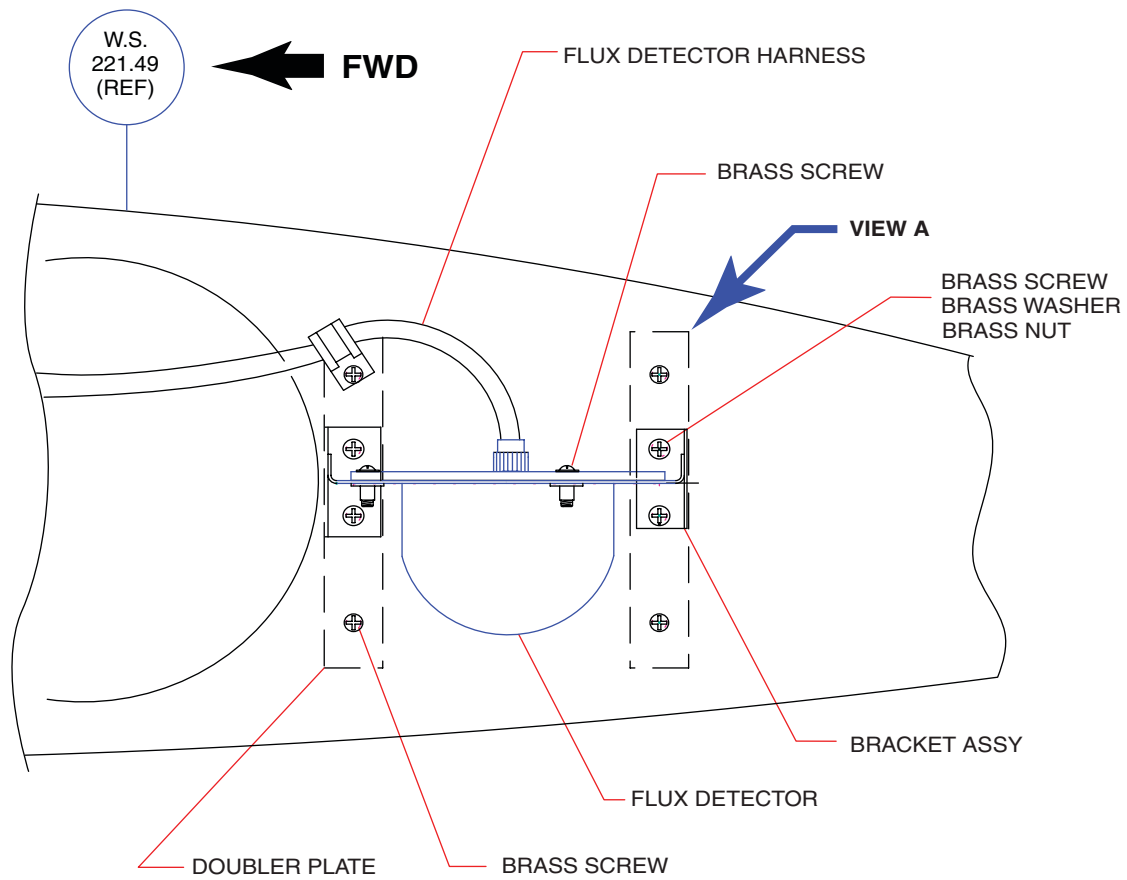
(2) Installation

CAUTION: THE FLUX DETECTOR IS SECURED TO THE MOUNTING BRACKET WITH BRASS SCREWS. ENSURE ONLY BRASS SCREWS ARE USED WHEN REINSTALLING.

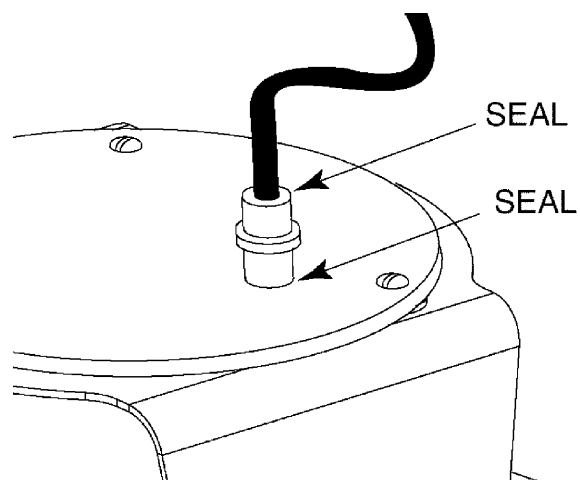
- (a) Place the flux detector into position on its mounting bracket and secure with brass screws and washers (3 ea.)
- (b) Connect wiring harness to the connector on top of the flux detector.
- (c) Seal the connector backshell and base as shown in Figure 3 with DOW Corning 4 Electrical Insulating Compound.
- (d) Reinstall the Left wing tip.

NOTE: Ensure correct hardware is used when reinstalling wing tip over flux detector.

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LOOKING INBOARD



VIEW A

Flux Detector Installation
Figure 3

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B. Magnetic Heading Compensation / Calibration

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION SUPPLEMENTARY PUBLICATIONS.)

(1) Standard Installation (S/N's 3449001 thru 3449151 only)

Slaving compasses installed in these airplanes are part of the installed King/Allied Signal (now Honeywell) Autopilot System. King/Allied Signal technical support, parts support, and service literature can be obtained from:

Honeywell
One Technology Center
23500 W.105th St., M/D #45
Olathe, Kansas 66061-1950
<http://www.bendixking.com/>

(2) Standard Installation S-TEC ST-180 (S/N's 3449152 thru 3449323 only)

(PIR-PPS60191, Rev. New.)

Accuracy of the entire heading system is dependent on the location of the flux detector and proper calibration. Accuracies of plus or minus one degree are possible when care is taken during installation and calibration. To obtain such results:

The flux detector must be positioned so that it points in the direction of aircraft flight; and, The north-south and east-west correctors must be adjusted to compensate for extraneous magnetic fields near the location of the flux detector.

(a) Required Equipment

Instrument Flight Research Corp. RF signal generator NAV-40IL or equivalent. Characteristics of the signal generator include: Frequency ranges 108 to 118 MHz, 117 to 136 Mhz, 328 to 336 MHz; +1/-0.01% accuracy, output level continuously adjustable from 1 .0uV to 0.1V into a 50 ohm load; 50 ohm output impedance; and internal adjustable or stepped VOR, LOC, and GS modulation. The RF signal generator should be portable and convenient for use while sitting in the aircraft cockpit.

(b) Procedure

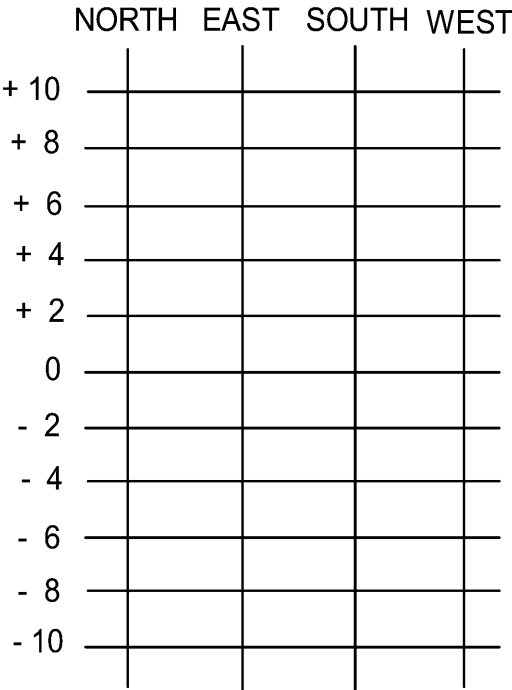
- 1 Apply power to the Model ST-180 HSI System. Allow at least three (3) minutes for the gyro to erect and synchronize.
- 2 Prior to actual alignment of the flux sensor, turn the aircraft to both north and east headings. Apply power to electrical equipment such as navigation and beacon lights and verify that the compass system is not affected.
- 3 Align the aircraft to an approximate magnetic north heading. On Chart 7, record the actual magnetic heading and the HSI heading card reading.
- 4 Determine and record on Chart 7 the deviation between the actual magnetic heading and the heading card heading. If the heading card reads high, the deviation is a plus.
- 5 Repeat steps (3) and (4) for east, south, and west headings. Record actual magnetic headings, heading card readings, and deviations on Chart 7.
- 6 Plot deviations on the initial deviation graph in Figure 4.
- 7 Realign the aircraft to north. Adjust the north-south corrector on the Slaving Panel, for one half of the difference between the north and south deviations. Record the new deviation for north and south on the initial deviation graph in Figure 4.
- 8 Realign the aircraft to east. Adjust the east-west corrector on the Slaving Panel, for one half the difference between the east and west deviations. Record the new deviation for east and west on the initial deviation graph in Figure 4.

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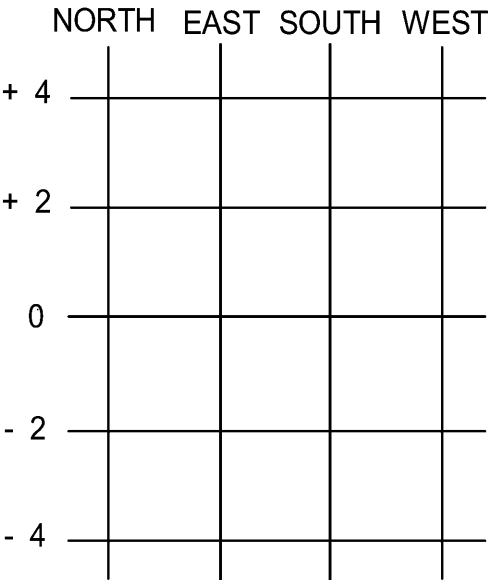
CHART 7
DEVIATION CHART

Approx. Magnetic Heading	Actual Magnetic Heading	Heading Card Reading	Deviation
North			
East			
South			
West			

INITIAL DEVIATION GRAPH



FINAL DEVIATION GRAPH



ST-180 Deviation Graphs
Figure 4

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- 9 If the pattern is not centered around zero, rotate the flux sensor clockwise to correct for minus deviations or counterclockwise for plus deviations. Plot final deviations on the final deviation graph in Figure 4.
 - 10 The deviations should now center around the zero reference line of the graph. If the error exceeds the specified system error limits ($\pm 3^\circ$), repeat the complete procedure.
- (3) Standard Installation King KCS- 55A. (S/N's 3449324 & up) (PIR-PPS60081, Rev. C)

Before attempting to compensate compass place the aircraft in simulated flight conditions. Check to see that the doors are closed, flaps in retracted position, engine running, throttle set at 1000 rpm or low idle, and aircraft in level flight attitude. Aircraft master switch, alternator switch and all radio switches should be in the ON position. All other cockpit controlled electrical switches should be in the OFF position. Use a brass or other non-magnetic screwdriver to make adjustments to compensator screws.

(a) Flux Detector index error

- 1 Place the aircraft on a compass rose in each of the four cardinal headings.
- 2 At each cardinal heading, with the slaving control in the "Free Gyro" position, center the slave meter with the manual slave buttons on the slaving control, and record the (plus or minus) difference between the cardinal heading and the indicator heading.
- 3 Add the four differences found, then divide the result by four, this is the index error.
- 4 Loosen the mounting screws on the flux detector, and rotate the unit as required, to cancel the index error. (If the index error is $+2^\circ$, set the indexing device at -2°).
- 5 Retighten the mounting screws.

(b) Slaving control compensator check and adjustment. Check and adjust the slaving set up place the aircraft in simulated flight conditions Engine running, Battery master ON, Alternators ON, All radios ON, recognition lights ON, Instrument panel lights ON, Navigation, position & strobe lights ON, Power the KCS-55A ON (allow to synchronize), and Place the slaving control in the "Free Gyro" position.

- 1 Place the aircraft on the North compass rose heading. Rotate the indicator card to North using the manual slave buttons on the slaving control. With a non-magnetic screwdriver in the N/S opening on the slaving control, center the slave meter.
- 2 Place the aircraft on the East compass rose heading. Rotate the indicator card to East using the manual slave buttons on the slaving meter. With a non-magnetic screwdriver in the E/W opening on the slaving control, center the slave meter.
- 3 Place the aircraft on the South compass rose heading. Rotate the indicator card to South using the manual slave buttons on the slaving control. With a non-magnetic screwdriver in the E/W opening on the slaving control, adjust to remove one-half of the existing deviation shown by the slave meter.
- 4 Place the aircraft on the West compass rose heading. Rotate the indicator card to West using the manual slave buttons on the slaving control. With a non-magnetic screwdriver in the E/W opening on the slaving control, adjust to remove one-half of the existing deviation shown by the slave meter.
- 5 If deviations (difference between actual magnetic heading and what compass indicates on that particular heading) exceeds $\pm 10^\circ$ on any heading:
 - a Check to be sure no magnetic metals are near compass (tools, flashlights, pocket knives, wristwatches etc.)
 - b Check to be sure screwdriver being used to make adjustments is either fiber or non-magnetic metal, such as brass.

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- 6 When satisfied that errors in excess of 10° is fault of the instrument, replace instrument. After installing new instrument, repeat setup
- 7 After all adjustments are completed, the indicator shall read within $\pm 2^\circ$ of any compass rose heading on which the aircraft is placed.

(4) Optional Single-side (Meggitt) EFIS Installation

(PIR-PPS 60195-1, Rev. New.)

The Air Data & Attitude Heading Reference System (ADAHRS) unit mounted on the aft equipment shelf provides the other components of the Meggitt Magic EFIS system with magnetic heading data derived from the flux detector installed in the wing tip of the left wing. The ADAHRS unit should be swung (checked for changes in deviation) whenever the ADAHRS unit, flux detector, or either cabin recirculation blower is changed, and at least once a year.

Use the following procedure to compensate and calibrate the magnetic heading indication portion of the Meggitt Magic EFIS installation:

(a) Setup

- 1 Level the airplane within ± 1 degree laterally and longitudinally at the top surface of the seat rails.
- 2 Configure the airplane as follows:

Generator/ Alternator - ON	Avionics - ON
Instrument Panel Lights - Full Bright	LCD Displays - Full Bright
Day/Night Switch - Day	Navigation Lights - ON
Strobe Lights - ON	Pitot Heat - OFF
Windshield Heat - OFF	Air conditioning - OFF
Cabin Blower Fan - Low	Vent Blower - OFF

(b) Adahrs Unit Alignment Procedure

- 1 Place the EHSI in the "TEST MODE" by applying power with the "MENU" button held in the depressed position until the initialization page is displayed.
- 2 Select ADAHRS test page 2 from the EHSI menu selections.
- 3 Allow the ADAHRS to complete the initialization period and display an attitude sphere on the EADI.
- 4 Verify that the pitch and roll errors, as displayed on the EHSI test page, are less than ± 0.5 degrees in either axis.
- 5 If required for ADAHRS leveling, install shims under the ADAHRS mounting feet and re-secure the unit to the mounting structure.
- 6 Repeat the alignment procedure until the minimum acceptable criteria is met.

(c) Compass System Calibration Procedure

- 1 Flux Detector Indexing

CAUTION: THE TEST CABLE P/N 101453-002 IS REQUIRED EQUIPMENT. NO OTHER TEST CABLE IS AUTHORIZED. SEE PIPER SERVICE LETTER NO. 1085.

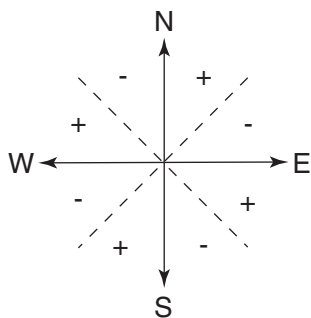
- a Install the ADAHRS test cable and verify that the ADAHRS test cable calibration switch is in the "NORMAL" (open) position.
- b Place the EHSI in the "TEST MODE" by applying power with the "MENU" button held in the depressed position until the initialization page is displayed.
- c Select the ADAHRS interface test page 2 from the Navigation Display (ND) menu selection. The ADAHRS must be in the "INITIALIZATION" mode for the indexing procedure.

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- d Place the ADAHRS test cable calibration switch in the "CAL" (closed) position. Insure that the heading system flag comes into view on the EADI, replacing the heading scale tape and the digital readout.

NOTE: If no calibration has ever been entered into the ADAHRS memory, a heading flag will be in view at the time of the unit initial power-up.

- e Position the aircraft on the NORTH heading of the compass rose and record the indicated "MAGHDG" as displayed on the ND. Record the heading indication in Chart 8. (This is the raw data output from the flux detector). Repeat this step for EAST, SOUTH, and WEST headings.
- f After recording the raw heading information, calculate and record the index heading errors in Chart 8. Refer to Figure 6 to calculate the errors. The following logic applies to calculating heading errors:



Calculating Heading Error
Figure 5

For N, if indication is +, then error is +
For N, if indication is -, then error is -
For E, if indication is more than 90, then error is +
For E, if indication is less than 90, then error is -
For S, if indication is - and less than 180, (i.e. -179) then error is +
For S, if indication is + and less than 180, (i.e. +179) then error is -
For W, if indication is - and less than 90, (i.e. -89) then error is +
For W, if indication is - and greater than 90, (i.e. -91) then error is -

Enter the errors for the four cardinal headings in Chart 8. Add the errors and enter the sum in the "TOTAL ERROR" block in Chart 8. Divide the Total Error by 4 and enter the result in the "INDEX ERROR" block in Chart 8. This result is the "Index Error" of the flux detector.

- g If the index error is greater than one (1) degree, loosen the flux detector and adjust out the index error by rotating the flux detector.
- h Repeat steps (e) through (g) until the index error is less than one (1) degree.

NOTE: Upon completion of the flux detector indexing procedure, apply torque stripe to each of the flux detector mounting screws.

- i This completes flux detector indexing, proceed to Heading System Calibration / Compensation, below.

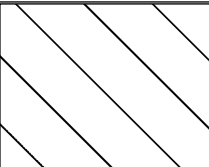
2 Heading System Calibration / Compensation

- a Heading system calibration / compensation should be performed upon completion of flux detector indexing, above, and using the same aircraft configuration specified in setup, above.
- b Place the Navigation Display (ND) in the "NORMAL" or mission operational mode (normal power-up).

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- c With the ADAHRS test cable installed, and the calibration switch in the "CALIBRATE" (closed) position, slowly taxi the aircraft in two (2) complete 360-degree turns. The direction of the turn does not matter; however, a minimum time of one (1) minute for each 360-degree turn (two (2) minutes minimum for the full 720 degrees) is required for the calibration process. The slow turn rate permits more data point samples for constructing the compensation curve. Make sure that the turns are continued until the heading flag is replaced by a normal heading indication.
- d Upon completing the two turns, the magnetic heading will automatically be displayed on both the EADI and EHSI. Place the ADAHRS test cable calibration switch in the "NORMAL" (open) position. Allow the compass system to stabilize for one (1) minute.
- e With the ADAHRS test cable calibration switch in the NORMAL (open) position, perform a complete heading system "swing". A settling time of two (2) minutes must be used at each heading to ensure heading stabilization. After two (2) minutes of settling, record the indicated heading against the known compass rose heading for all twelve compass rose points in Chart 9. The heading system error should not exceed ± 3 degrees on any compass point.

**CHART 8
INDEXING DATA**

Aircraft S/N:		Registration No.:	
ND Error (\pm)	ND Heading	Compass Rose	
		N	
		E	
		S	
		W	
	Total Error (N+E+S+W)		
	Index Error (Total Error \div 4)		

**CHART 9
HEADING SYSTEM CALIBRATION**

ND Heading	Compass Rose
	N
	30
	60
	E
	120
	150
	S
	210
	240
	W
	300
	330

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C. Magnetometer/OAT Sensor Assembly (See Figure 6.)

The Magnetometer / OAT Sensor Assembly (Mag/OAT) is mounted on a wing access cover plate in the underside of the outboard left wing and supplies magnetic heading information to the Primary Flight Display (PFD). The cover plate - Mag/OAT sensor assembly is removed and installed as a unit.

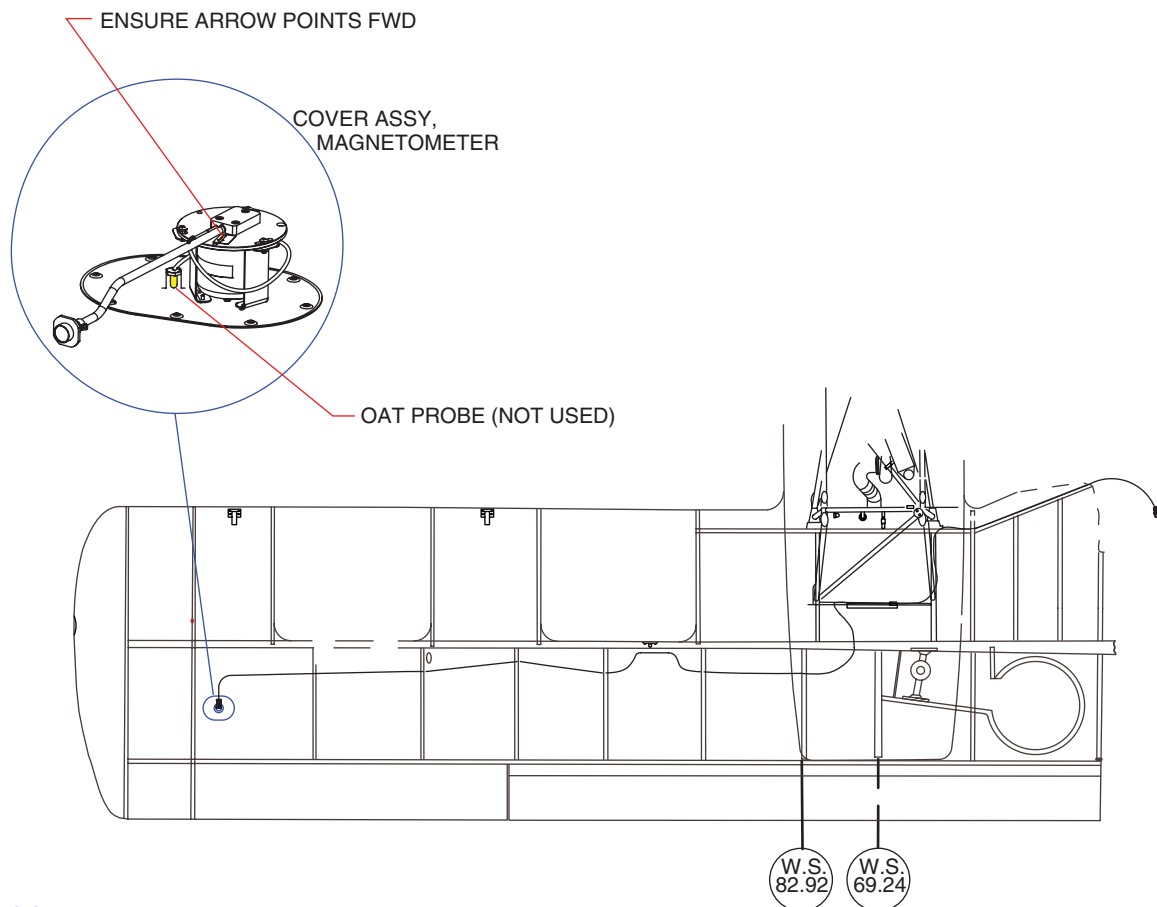
NOTE: The OAT sensor probe is disconnected and not used. See OAT in 34-10-00.

(1) Removal

- (a) Remove eight (8) screws and support cover plate with your hand.
- (b) Drop cover plate down sufficient to reach inside and disconnect the wiring harness.
- (c) Remove cover plate - Mag/OAT sensor assembly.

(2) Installation

- (a) Connect the Mag/OAT sensor assembly wiring harness.
- (b) Position the cover plate - Mag/OAT sensor assembly in the access hole with the arrow on the magnetometer pointing forward.
- (c) Secure with screws (8).



Effectivity
Seneca V
with Avidyne Option

Magnetometer / OAT Installation
Figure 6

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D. Magnetic Compass

The magnetic compass is a self-contained instrument. This instrument has an individual light which is connected to the instrument lighting circuit. The compass correction card is located in the card holder mounted on the instrument. The compass should be swung (checked for changes in deviation) whenever instruments or radios are changed, and at least once a year.

(1) Troubleshooting

See Chart 10.

(2) Adjustment

Before attempting to compensate compass, every effort should be made to place the aircraft in simulated flight conditions; check to see that the doors are closed, flaps in retracted position, engine running, throttle set at cruise position and aircraft in level flight attitude. Aircraft master switch, alternator switch, and all radio switches should be in the ON position. All other cockpit controlled electrical switches should be in the OFF position.

- (a) Set adjustment screws of compensator on zero. Zero position of adjusting screws is when the dot of the screw is lined up with the dot of the frame.
- (b) Head aircraft on a magnetic North heading. Adjust N-S adjustment screw until compass reads exactly North.
- (c) Head aircraft on a magnetic East heading and do the same as step (2), adjusting E-W adjusting screw.
- (d) Head aircraft on a magnetic South heading and note resulting South error. Adjust N-S adjusting screw until one-half of this error has been removed.
- (e) Head aircraft on magnetic West and do same as step (4), adjusting E-W adjustment screw.
- (f) Head aircraft in successive magnetic 30° degree headings and record compass readings on appropriate deviation card. Deviations must not exceed +10° on any heading.

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**CHART 10
TROUBLESHOOTING MAGNETIC COMPASS**

Trouble	Cause	Remedy
Excessive card error.	Compass not properly compensated.	Compensate instrument.
	External magnetic interference.	Locate magnetic interference and eliminate if possible.
Excessive card oscillation.	Insufficient liquid.	Replace instrument.
Card sluggish.	Weak card magnet.	Replace instrument.
	Excessive pivot friction or broken jewel.	Replace instrument.
Liquid leakage.	Loose bezel screws.	Replace instrument.
	Broken cover glass.	Replace instrument.
	Defective sealing gaskets.	Replace instrument.
Discolored markings.	Age.	Replace instrument.
Defective light.	Burned out lamp or broken circuit.	Check and replace lamp. Check continuity of wiring.
Card sticks.	Altitude compensating diaphragm collapsed.	Replace instrument.
Card does not move when compensating screws are turned.	The gears that turn compensating magnets are stripped.	Replace instrument.
Compass swings erratically when radio transmitter is keyed.	Normal.	

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8. Turn Coordinator

Unlike the conventional turn and slip indicator, the electrically operated gyroscope in the turn coordinator is canted. However, like conventional turn and slip indicator, it works on the principal of precession. By canting the gyro, the instrument not only measures rate of turn, but also measures rate of roll. With this indicator, if the aircraft is rolled right and left rapidly, the indicator will move, measuring the rate at which the airplane is rolled by indicating a turn in the direction of the roll. If the aircraft is held in a bank, and rudder is applied (such as when slipping), the needle indicator will come back to neutral, indicating no turn. The slip/skid portion of the indicator is a ball sealed in a curved glass tube filled with damping fluid. In the previous example, It would indicate the airplane is slipping. By utilizing rudder and aileron to establish the airplane in a desired rate of turn will eventually establish the airplane in a coordinated turn at the desired rate.

A. Troubleshooting

See Chart 11.

B. Removal and Installation

See 39-10-00, Face Mounted Instruments - Removal and Installation.

**CHART 11
Troubleshooting TURN COORDINATOR**

Trouble	Cause	Remedy
Instrument fails to respond when power is being applied to instrument.	Foreign matter lodged in instrument.	Replace instrument.
Incorrect sensitivity.	Out of calibration.	Replace instrument.
Incorrect turn rate.	Out of calibration.	Replace instrument.
Ball sticky.	Flat spot on ball.	Replace instrument.
Ball not in center when aircraft is correctly trimmed in wings level flight.	Instrument not level in panel.	Level instrument.
Instrument will not run.	No power to instrument.	Check appropriate circuit breaker on pilot's circuit breaker panel. Check circuit and repair.
	Instrument malfunction.	Replace instrument.

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DEPENDENT POSITION DETERMINING

1. COM/NAV/GPS (S/N's 3449269 and up.)

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

A. Description

Garmin GNS-430/530 COM/NAV/GPS systems are installed as standard equipment. the installation consists of the GNS-430/530 transceiver/display unit, associated wiring, and antennas.

Maintenance of the GNS-430/530 is "on condition" only and, with the exception of swapping complete units, should be performed only by a qualified avionics shop in accordance with the GARMIN Series 400 & 500 Maintenance Manual (Garmin P/N - 190-00140-05 & P/N - 190-00181-05).

Information provided in this manual is intended solely to aid the removal and installation of the GNS-430/530 transceiver/display units, their associated wiring and antennas.

Removal and Installation

See 39-10-00.

B. Post Installation Setup Procedure

(PIR-PPS60199-2, Rev. G.)

(1) Aircraft Preparation and Configuration

Setup and preliminary checks may be made using the aircraft battery or external power supplied by an external power cart. Final checks (OBS/CDI or HSI accuracy) should be made with the engine running and the aircraft configured as in Chart 1.

(2) Configuration Setup Procedure

Access the Configuration Mode of the unit by depressing and holding the ENT key while applying power to the unit. Release the ENT key when the display activates. After the database pages, press the ENT key twice to display the MAIN ARINC 429 CONFIG page. Pages may be selected by ensuring the cursor is off and rotating the inner concentric knob on the right side of the unit.

**CHART 1
FINAL CHECK CONFIGURATION**

Engine running, alternators	On	Avionics	On
Instrument Panel Lights	Full Bright	Day/Night Switch	Day
Navigation Lights	On	Strobe Lights	On
Pitot Heat	Off	Air Conditioning	Off
Cabin Blower Fan	Low	Vent Blower	Off

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To change data on the displayed Configuration Page, the cursor must be selected. Press the inner concentric knob on the right side of the unit to activate the cursor. Rotating the outer concentric knob on the right side of the unit changes the selected data field. Rotating the inner concentric knob changes the data within the selected field. To accept entry of the desired selection, press the ENT key.

- (a) Press the ENT key twice to display the MAIN ARINC 429 CONFIG page. Setup per Chart 2, 3, or 4, as applicable.
- (b) Deselect the cursor and rotate the inner concentric knob on the right side of the unit to display the MAIN RS232 CONFIG page. Configure per Chart 5
- (c) Deselect the cursor and rotate the inner concentric knob on the right side of the unit to display the MAIN LIGHTING page. Configure per Chart 6.
- (d) Deselect the cursor and rotate the inner concentric knob on the right side of the unit to display the MAIN CDI/OBS CONFIG page. Setup is only required for selected course calibration.

Adjust the OBS or HSI course needle to indicate a selected course of 150 degrees. The SELECTED COURSE field on the GNS unit should indicate very close to 150 degrees. Select the "Calibrate to 150?" field and press ENT. Verify the OBS (or HSI course) operation by checking that the course displayed on the GNS unit is within 2° of the selected course. Verify the accuracy at cardinal headings around the OBS card.

- (e) Deselect the cursor and rotate the inner concentric knob on the right side of the unit to display the COM SETUP page. Change only the "SPACING" setting to display "Select 25.0 KHz".
- (f) Deselect the cursor and rotate the inner concentric knob on the right side of the unit to display the VOR/LOC/GS/CDI page. Change only the "DME CHNL MODE" setting to display "Parallel 2x5".
- (g) VOR/LOC/GS ARINC 429 CONFIG Page Setup per Chart 7 or 8.

**CHART 2
MAIN ARINC 429 CONFIG PAGE - WITH MECHANICAL INDICATORS**

MAIN ARINC 429 CONFIG Page	#1 GNS 530		#2 GNS 430	
BUS	SPEED	DATA	SPEED	DATA
GPS ARINC IN 1	HIGH	GARMIN GTX 330	HIGH	GARMIN GTX 330
	HIGH	"AIRDATA" W/IHAS	HIGH	"AIRDATA" W/IHAS
GPS ARINC IN 2	HIGH	OFF	HIGH	OFF
GPS ARINC OUT	HIGH	GAMA 429	HIGH	OFF
		GRAPHICS W/INT		
SDI	LNAV 1		LNAV 2	

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**CHART 3
MAIN ARINC 429 CONFIG PAGE - WITH MEGGITT EFIS**

MAIN ARINC 429 CONFIG Page	#1 GNS 530		#2 GNS 430	
BUS	SPEED	DATA	SPEED	DATA
GPS ARINC IN 1	HIGH	GARMIN GTX 330	HIGH	GARMIN GTX 330
	HIGH	"AIRDATA" W/IHAS	HIGH	"AIRDATA" W/IHAS
GPS ARINC IN 2	HIGH	SANDEL EHSI	HIGH	SANDEL EHSI
GPS ARINC OUT	HIGH	GAMA 429	HIGH	GAMA 429
		GRAPHICS W/INT		GRAPHICS W/INT
SDI	LNAV 1		LNAV 2	

**CHART 4
MAIN ARINC 429 CONFIG PAGE - WITH AVIDYNE ENTEGRA**

MAIN ARINC 429 CONFIG Page	#1 GNS 430		#2 GNS 430	
BUS	SPEED	DATA	SPEED	DATA
GPS ARINC IN 1	LOW	"SANDEL EHSI"	LOW	"SANDEL EHSI"
GPS ARINC IN 2	LOW	"EFIS/AIRDATA	LOW	"EFIS/AIRDATA
GPS ARINC OUT	LOW	GAMA 429	LOW	GAMA 429
		GRAPHICS		GRAPHICS
SDI	LNAV 1		LNAV 2	

**CHART 5
MAIN RS-232 CONFIG PAGE**

MAIN RS232 CONFIG page	#1 GNS 530/430		#2 GNS 430	
	INPUT	OUTPUT	INPUT	OUTPUT
CHNL 1	OFF	AVIATION NO ALT *	OFF	OFF **
CHNL 2	OFF	OFF	OFF	OFF
		"HW EGPWS"		
		W/IHAS		
CHNL 3	CROSSFILL	CROSSFILL	CROSSFILL	CROSSFILL
CHNL 4	OFF	OFF	OFF	OFF
CHNL 5	OFF	OFF	OFF	OFF
CHNL 6	OFF	OFF	OFF	OFF
* "OFF" with Avidyne Entegra / ** "AVIATION NO ALT" with dual GNS-430 install with mechanical indicators				

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**CHART 6
MAIN LIGHTING PAGE**

MAIN LIGHTING PAGE	DISPLAY		KEY	
LIGHTING	NO SETTING		NO SETTING	
SOURCE	PHOTO		PHOTO	
RESP TIME/MIN	4	80	4	40
SLOPE/OFFSET	50	50	50	50

**CHART 7
VOR/LOC/GS ARINC 429 CONFIG PAGE - **WITHOUT AVIDYNE ENTEGRA****

#1 GNS	RX	TX
SPEED	HIGH	HIGH
SDI	VOR/ILS 1	
DME MODE	DIRECTED FREQ 1	
#2 GNS	RX	TX
SPEED	HIGH	HIGH
SDI	VOR/ILS 2	
DME MODE	DIRECTED FREQ 2	

**CHART 8
VOR/LOC/GS ARINC 429 CONFIG PAGE - **WITH AVIDYNE ENTEGRA****

#1 GNS	RX	TX
SPEED	LOW	LOW
SDI	VOR/ILS 1	
DME MODE	DIRECTED FREQ 1	
#2 GNS	RX	TX
SPEED	LOW	LOW
SDI	VOR/ILS 2	
DME MODE	DIRECTED FREQ 2	

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2. Transponder (S/N's 3449301 and up)

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

A. Description.

A Garmin GTX-330 Transponder is installed as standard equipment. Maintenance of the GTX-330 is "on condition" only and, with the exception of swapping complete units, should be performed only by a qualified avionics shop in accordance with the GARMIN GTX-330 Maintenance Manual (Garmin P/N - 190-00207-02).

Information provided in this manual is intended solely to aid the removal and installation of the GTX-330 transceiver/display unit, its associated wiring and antenna.

Removal and Installation

See 39-10-00.

B. Post Installation Setup Procedure

(PIR-PPS60206, Rev. H.)

Access the Configuration Mode of the unit by depressing and holding the FUNC key while applying power to the unit. Release the FUNC key when the display activates. The FUNC key sequences forward through the configuration pages. The START/STOP key reverses through the pages, stopping at the Menu page. The CRSR key highlights selectable fields on each page. When a field is highlighted, the 0-9 keys enter numeric data and the 8 or 9 keys move through list selections. Press the CRSR key to accept changes. When a field is highlighted, pressing the FUNC key moves to the next configuration page without saving the changes. To exit the configuration pages, turn the power off and then turn the unit on again without holding the FUNC key for normal operation.

NOTE: When the unit is turned on for the first time, or an invalid address is recognized, the unit will prompt the user to enter a valid aircraft address. See Mode S Address paragraph, below.

(1) Configuration Menu

The JUMP TO menu page provides the capability to select a configuration mode starting page without having to step through all of the pages. Press the CRSR key and sequence through to the desired section with the 8 and 9 keys. Jump to the selection by pressing the CRSR key again with the desired selection highlighted. The FUNC key steps to the next configuration page, after which the START/STOP key reverses until stopping at the JUMP TO menu page. Following is a list of selections and their descriptions:

SELECTION	DESCRIPTION
DIAGNOSTICS	Jumps to Gray Code Input Page
DISPLAY/AUDIO	Jumps to Audio Volume Page
I/O CONFIG	Jumps to ARINC INPUT #1 Page
ACFT CONFIG	Jumps to Operation Configuration #1 Page

(2) See Charts 9 thru 15 for required settings on the configuration pages.

(3) On the TEMPERATURE Page, select "NO" for SENSOR INSTALLED.

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**CHART 9
VOICE AND VOLUME**

Function	Selection	Description
VOLUME	MAX	Selected Audio Tones and Messages 0= Toggle a continuous tone on and off 1= Attention Tone, precedes voice messages to attract the pilot's attention. 2= "Leaving Altitude", when altitude monitor is active and the altitude deviation is exceeded. 3= "Traffic", when a TIS traffic alert is received. 4= "Time Expired", when the countdown expires. 5= "Traffic Not Available", when TIS service is not available or out of range of an operating TIS MODE S site. 6-9 are not used.
VOICE	MALE	
MESSAGE (0-5)		
ALTITUDE MONITOR	OFF	When Altitude Pre-Select is installed. When Altitude Pre-Select is not installed.
	TONE	
PAGE CHANGE	ENABLE	
COUNTDOWN TIMER	TONE	

**CHART 10
DISPLAY MODE AND KEY LIGHTING**

DISPLAY MODE	AUTO
LEVEL	75
BKLT	AUTO
LVL	Not Selectable
RSP TIME	4
MIN	8
BKLT SRCE	PHOTO
SLOPE	50
OFFSET	50
KEY	AUTO
LVL	Not Selectable
RSP TIME	4
MIN	5
KEY SRCE	28V
SLOPE	20
OFFSET	30
CONTRAST MODE	AUTO

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**CHART 11
ARINC 429 CONFIGURATION PAGE - WITH MECHANICAL INDICATORS**

429 INPUT	GTX 330 SPEED	DATA
CHANNEL 1	HIGH	GPS/FMS
CHANNEL 2	HIGH	OFF
CHANNEL 3	LOW	OFF
CHANNEL 4		OFF
429 OUTPUT		DATA
CHANNEL 1		OFF
CHANNEL 2		GARMIN W/TIS GARMIN W/IHAS

**CHART 12
ARINC 429 CONFIGURATION PAGE - WITH MEGGITT EFIS**

429 INPUT	GTX 330 SPEED	DATA
CHANNEL 1	HIGH	GPS/FMS
CHANNEL 2	HIGH	ADC W/ALT
CHANNEL 3	LOW	OFF
CHANNEL 4		OFF
429 OUTPUT		DATA
CHANNEL 1		OFF
CHANNEL 2		GARMIN W/TIS GARMIN W/IHAS

**CHART 13
ARINC 429 CONFIGURATION PAGE - WITH AVIDYNE INTEGRA**

429 INPUT	GTX 330 SPEED	DATA
CHANNEL 1	LOW	GPS/FMS
CHANNEL 2	HIGH	ADC W/ALT
CHANNEL 3	LOW	OFF
CHANNEL 4		OFF
429 OUTPUT		DATA
CHANNEL 1		OFF
CHANNEL 2		"GARMIN W/TIS" "OFF" W/IHAS

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**CHART 14
RS-232 INPUT AND OUTPUT**

RS-232 CONFIG Page	GTX	
232 INPUT	INPUT	OUTPUT
CHANNEL 1	OFF	OFF
CHANNEL 2	OFF	OFF

**CHART 15
OPERATION CONFIGURATION**

VS RATE	500
FORMAT	FEET
VFR ID	1200
ALTITUDE ALERT DEVIATION	200
SQUAT SWITCH	"YES"
"SENSE"	"LOW"
DELAY TIME	24
AUTO FLIGHT TIMER	MANUAL

**CHART 16
HEXADECIMAL CONVERSION**

Binary	Hexadecimal	Decimal	Binary	Hexadecimal	Decimal
/0000	0	0	/1000	8	8
/0001	1	1	/1001	9	9
/0010	2	2	/1010	A	10
/0011	3	3	/1011	B	11
/0100	4	4	/1100	C	12
/0101	5	5	/1101	D	13
/0110	6	6	/1110	E	14
/0111	7	7	/1111	F	15

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(4) MODE S Address (ICAO Aircraft Address Code) and FLIGHT ID Entry Page

When the unit is turned on for the first time, or an invalid address is recognized, the unit will prompt the user to enter a valid aircraft address.

NOTE: U.S. registered aircraft ICAO Aircraft Address Code (ADDRESS HEX) is the "N number" and is displayed as such on the ATC-601. On Non-U.S. registered aircraft, verify only that the hexadecimal code displayed on ATC-601 matches the "ADDRESS HEX" code programmed on the GTX-330.

(a) U.S. Registered Aircraft

- 1 To highlight the "U.S. Tail #" address field, press the CRSR key one time.
- 2 Enter the registration number using the number keys. Press the CRSR key to select the numeric entry field. Press a key repeatedly to scroll through the digit/alpha characters for that entry field.
- 3 Repeat step 2 until the complete number is entered.
- 4 When finished, press the CRSR key to accept the number entry.
- 5 For entering the Flight ID number, press the CRSR key one time.
- 6 Repeat steps 2 and 3.
- 7 When finished, press the CRSR key to accept the number entry.

(b) Non-US Registered Aircraft

- 1 For entering Non-U.S. Aircraft Registration, press the CRSR key one time, then 8 or 9 to select ADDRESS HEX.
- 2 Non-U.S. Aircraft Registry normally supplies a 24 bit binary code, known as the ICAO Aircraft Code for the Mode S address in lieu of directly entering the N# for U.S. registered aircraft.
- 3 The GTX 330 only accepts a hexadecimal format for the Non-U.S. Registered Aircraft, so the 24 bit binary code must be converted to a hexadecimal format.
- 4 Convert the 24 bit binary code to hexadecimal as follows:
 - a 24 bit binary code: 1110010001111101101101
 - b Separate for hex conversion: 1110/0100/0111/1110/1110/1101
 - c Apply the hexadecimal values found in Chart 16.

E	4	7	E	E	D
1110/	0100/	0111/	1110/	1110/	1101
- 5 Enter the hexadecimal address using the number keys. Press the CRSR key to select the numeric entry field. Press a key repeatedly to scroll through the digit/alpha characters for that entry field.
- 6 Repeat step 5 until the complete number is entered.
- 7 for FLIGHT ID select "CONFIG ENTRY" and enter the Hex code or select "POWER UP ENTRY".
- 8 When finished, press the CRSR key to accept the number entry.

(5) On the "MODE S Aircraft Type" Page, select "<15.5k Lb" for AC TYPE, and "<=300 kt" for MAX AIRSPEED.

(6) When entries are complete, cycle unit power and check for entries.

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APPENDIX

1

GROUND TEST PROCEDURE

MEGGITT MAGIC AIR DATA & HEADING REFERENCE SYSTEM (ADAHRS) AND PITOT-STATIC SYSTEM

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APPENDIX 1

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1. Reference Regulations and Guidance

Title 14 of the Code of Federal Regulations (14 CFR), Part 43 Appendix E, 23.1301(d), 23.1323(a)(c), 23.1325(b), 91.411, Advisory Circular AC 43-6B, and Advisory Circular AC 43.13-1B CHG 1 (or later) Chapter 12, Section 4.

2. Reference Documents

- Applicable Airplane Flight Manual (AFM)
- Applicable Airplane Maintenance Manual
- Applicable Meggitt Avionics/S-TEC MAGIC Pilot's Operating Handbook (POH)
- Meggitt Avionics/S-TEC Airspeed Configuration Data document (if applicable) for the airplane under test.

3. System Description

Each Meggitt MAGIC Electronic Flight Instrument System (EFIS) consists of the following components related to the Air Data and Pitot-Static systems:

- Primary Flight Display (PFD) with primary altimeter
- Navigation Display (ND) with reversionary altimeter
- Air Data/Attitude and Heading Reference System (ADAHRS)
- Standby Altimeter
- Standby Airspeed Indicator
- ATC Transponder (if installed)

Refer to the appropriate installation drawings or Instructions for Continued Airworthiness (ICA) document to determine the specific part numbers and locations of these components.

4. General

Purpose. This test procedure verifies the integrity and accuracy of the air data and pitot-static systems on the aircraft under test and shows that these systems comply with applicable airworthiness regulations. No bench testing or field repairs are included in this procedure. Any unsatisfactory findings should be repaired in accordance with other acceptable means.

Use this on-aircraft ground test procedure (GTP) to inspect and test each Meggitt Avionics/S-TEC MAGIC Air Data and Pitot-Static system, under the following conditions:

- In accordance with 24-month static system test; or
- To proof test static systems following any opening and closing of the pitot-static plumbing, except for the use of system drain and alternate static pressure valves (§ 23.1325(b)(2); or
- Following installation or maintenance on Air Data/Attitude and Heading Reference System (ADAHRS), Primary Flight Display (PFD), or Transponder Mode C interface.

5. Effectivity

This GTP is effective to aircraft with Meggitt Avionics/S-TEC MAGIC EFIS and pneumatic standby instruments.

6. Prior to testing

Conduct this GTP after the following has been accomplished:

- Continuity testing of new or altered electrical wiring
- Power and ground testing of new or altered electrical wiring
- Electrical bonding testing of new equipment
- Installation of equipment

9. Precautions

This section contains precautions that should be taken during tests to avoid damage to the sensitive instruments.

Damage can occur to instruments that are connected to both the static system and pitot system when only the static system is evacuated. The maximum design differential pressure of these instruments may be exceeded. This GTP requires that both the pitot and static ports be connected to the pitot-static tester.

Safeguards should be taken to prevent accidental disconnection of the test equipment plumbing from the aircraft or the test equipment while the static system is evacuated. The resultant sudden pressure change may damage both the test instruments and the aircraft instruments. The aircraft static system should be returned to ambient pressures before disconnecting static test equipment from the system.

If static ports are blocked for the purpose of testing, use a long piece of brightly colored tape (red or orange) forming a streamer or similar method of warning be attached to the blockage device.

Damage may occur to other aircraft instruments if the altitude rate is changed faster than the limit of instruments.

10. Calibration of equipment

Conformity aircraft. Unless otherwise specified, test instruments used to calibrate or verify calibration in a certification project should be calibrated by an approved instrument repair inspector prior to FAA testing. Test instruments should be calibrated within 3 months of FAA testing. Reference AC 21-40, Section 8-4(h).

Follow-on installations and maintenance. In accordance with § 145.47 (b), the repair station shall ensure that all inspection and test equipment is tested at regular intervals to ensure correct calibration to a standard derived from the National Bureau of Standards or to a standard provided by the equipment manufacturer.

- Required test equipment, technical data, and rated personnel are available to perform a static system check as required by § 91.411(a)(2).
- Calibrated pitot-static tester and transponder ramp tester is available to determine the pressure altitude transmitted by the transponder in accordance with § 91.217(b).
- Completion of appropriate EFIS Post-Installation GTP.

NOTE

This Pitot-Static GTP is to be accomplished after MAGIC EFIS Post-Installation GTP and after leveling of the ADAHRS, which may require that the pitot-static lines to be temporarily disconnected.

7. After testing

Ensure that an appropriately rated person returns the aircraft to service following the alteration or maintenance in accordance with § 43.9.

8. Standard atmospheric ambient conditions and tolerances

Unless otherwise specified, testing shall be performed during the following standard atmospheric ambient conditions:

- Temperature: $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$
Record temperature if outside of range: _____

Avoid calibrating air data systems at extreme temperatures.

Ground Test Procedure (Sheet 2 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

4. Barometer (pressurized aircraft only). A calibrated barometer may be used to determine the "station pressure" at the field where the aircraft will be tested. Station pressure will be used to calculate the MAX DIFF test altitude, which is the test altitude where the pitot-static system will be tested for leaks. *(Do not use altimeter setting barometric pressure for the MAX DIFF calculation.)*

CAUTION

Remove all tape and thoroughly clean ports to remove any adhesive resins after testing.

11. Ground Equipment

Use the following ground equipment for this GTP.

1. Ground Power Unit (GPU). Conduct this test procedure using a GPU that will provide sufficient regulated electrical power to the aircraft.
2. Pitot-Static tester. Use a calibrated pitot-static tester to simulate airspeed and altitudes on the aircraft. It is recommended to use a tester with a remote electronic control panel to facilitate the verification of the instruments in the aircraft.
3. ATC Transponder Ramp Tester. Use a calibrated ATC Transponder ramp tester to interrogate and verify proper Mode C (altitude) altitude reporting.

12. Ground Equipment ID

Record in Table I below the specific ground equipment used during this GTP:

Table I — Test Equipment

TEST EQUIPMENT	MANUFACTURER	MODEL	S/N	CAL DATE	CAL DUE
Ground Power Unit (GPU)					
Pitot-Static Tester					
ATC Transponder Tester					
Barometer					

13. Local information

Field elevation. Record the field elevation (H_a) where the aircraft is being tested, as a reference.

Field Elevation (H_a) feet

14. Proof Test Parameters (Pressurized Aircraft Only)

MAX DIFF test altitude (computation). For pressurized aircraft only, determine the equivalent altitude of the maximum cabin pressure differential (MAX DIFF test altitude).

This is the test point at which the proof test will be accomplished. The test altitude will vary depending on the current station barometer and the cabin pressurization limit of the aircraft under test. The following steps are provided to compute the MAX DIFF test altitude:

Step 1 (Station Pressure): Obtain the current local barometric pressure (station pressure) within 25 miles. (*Note that the station barometer is the true barometric pressure, unlike altimeters settings, which are "reduced" to sea level pressure:*)

Station Barometer (Inches of Mercury) In Hg

Step 2 (Barometer Conversion): Convert the station barometric pressure to PSI, by dividing the barometric pressure by 2.036:

Station Barometer (Pounds per Square Inch) PSI

Step 3: (Cabin Pressurization Limit). Obtain the approved maximum cabin differential pressure for the aircraft under test, which is usually found in the AFM Limitations:

Maximum Cabin Differential Pressure 5.5 PSI

Step 4 (MAX DIFF test pressure). Subtract Step 3 from Step 2 to determine the MAX DIFF test pressure:

MAX DIFF test pressure PSI

Step 5 (MAX DIFF test altitude). Use Table IX at the end of this document to approximate the test pressure of Step 4 to an equivalent altitude, by selecting the next lower number in the PSI column and recording its corresponding altitude below:

Equivalent Altitude of Maximum Cabin Pressure Differential (MAX DIFF test altitude) feet

EXAMPLE:

Step 1. Local station pressure: 25.39 Inches of Mercury

Step 2. PSI = $\frac{25.39}{2.036} = 12.47$ PSI

Step 3: Cabin pressurization limit: 5.3 PSI

Step 4: $12.47 - 5.3 = 7.17$ PSI

Step 5: 7.17 PSI = 19000 feet

The MAX DIFF test altitude of 19000 feet was estimated by rounding 7.17 PSI to the next lower value of 7.0412, as shown in Table IX at the end of this document.

MAX DIFF test altitude (alternate method). An alternate method to determine MAX DIFF test altitude on aircraft with an approved maximum differential cabin pressure indicator is to use the redline mark on this indicator. By this method, use the pitot-static tester to increase the altitude of the static system until the cabin differential pressure indicator reaches redline. Record the corresponding altitude as the MAX DIFF test altitude.

16. Hysteresis Test

Dive (hysteresis) test points. Calculate required hysteresis test points from the maximum operating altitude.

50% test point. Multiply the maximum operating altitude by **0.5**. From this value, select the closest test point from the altitudes listed in Table V as the 50% test point:

50 % test point: feet

40% test point. Multiply the maximum operating altitude by **0.4**. From this value, select the closest test point from the altitudes listed in Table V as the 40% test point:

40 % test point: feet

Record the 50% and 40% test points in the "*Calculated Test Point Altitude*" column of Table VI.

MAX DIFF tolerance. Calculate the MAX DIFF tolerance of 2% of MAX DIFF test altitude. Multiply MAX DIFF test altitude by **0.02** to obtain the tolerance. Insert this value into Table IV also.

MAX DIFF Tolerance = (0.02) x (MAX DIFF): ± feet

15. Airspeed and Altitude Limits

Record the airspeed and altitude design limits of the aircraft under test, as specified in the appropriate Airplane Flight Manual (AFM) or Type Certificate Data Sheet (TCDS). Use these figures to determine the limits of testing. Do not exceed the airspeed limit by more than 10 knots or the altitude limit by more than 2500 feet.

Airspeed limit. Record the maximum operating airspeed of the aircraft under test. Also make a note of the maximum airspeed in the margin of Table VIII for the Indicated Airspeed Test.

Maximum Operating Airspeed: * knots

Altitude limits. Record the maximum operating altitude of the aircraft under test. Also make a note of the maximum altitude in the margin of Table V for the Scale Error Test and Table VII for the Friction Test.

Maximum Operating Altitude: ** feet

* 188 KIAS - PA-46-500TP
198 KIAS - PA-46-350P

** 30,000 FT - PA-46-500TP
25,000 FT - PA-46-350P

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPILOT Pass/Fail	STBY Pass/Fail
1.	Before Applying Electrical Power				
2.	GROUND SAFETY INSPECTION Conduct a ground safety inspection in accordance with the appropriate Airplane Maintenance Manual prior to applying electrical power to the aircraft under test.	Check that master switches are OFF. Pull circuit breakers for engine start and fire control OUT.			
3.	Remove pitot-static covers (if installed)	Check that pitot-static ports are clear.			
4.	Inspection				
5.	<i>The following inspections are in compliance with § 23.1325(b)(1) and § 43 Appendix E(a).</i>				
6.	<p><i>Note: Whenever blockage of the static lines is suspected, they should be purged before the static pressure system test is performed. Purging may keep objects from entering the test equipment and instruments. Since purging applies positive pressure to lines, the following precautions should be taken:</i></p> <p><i>(1) Disconnect all instruments, sensors, and ADAHRS from the pitot-static lines.</i></p> <p><i>(2) Secure a cloth bag over the end of the lines to catch any debris.</i></p> <p><i>(3) Clean drains after purging as they can act as a sump for foreign material.</i></p>				
7.	Inspect and operate the pitot-static drains.	Verify drains operate normally and that positive drainage of moisture is provided in all pitot-static lines.			
8.	Inspect installation of the pitot-static lines.	Verify that chafing of the tubing and excessive distortion or restriction at bends in the tubing is avoided.			

Ground Test Procedure (Sheet 6 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPILOT Pass/Fail	STBY Pass/Fail
9.	Inspect the ports, tubing, accessories, and instruments connected to the static system to identify any parts that might be defective (e.g., broken "B" nuts, cracked flare sleeves, deteriorated flexible tubing, bad valves, etc.).	Verify that the materials used are durable, suitable for the purpose intended, and protected against corrosion.			
10.	Inspect static ports.	Verify static ports are free of debris and corrosion.			
		Verify that no alterations or deformations of the airframe surface have been made in the areas near the static ports.			
11.	Inspect alternate static ports.	Verify alternate static port is free of debris or corrosion.			
12.	Inspect pitot probes.	Verify inlet is free of debris or damage.			
		Verify that the pitot probe does not have any corrosion within ½-inch of probe tip.			
		Ensure that no alterations or deformations of the airframe surface have been made in the areas near the pitot probes.			
13.	Inspect transponder antennas. <i>Note: Oil, exhaust, and dirt buildup on a transponder antenna may attenuate and shift frequency out of tolerance.</i>	Verify transponder antennas are clean and not damaged.			
14.	Set up ground equipment				
15.	Set up Transponder ramp tester with the test antenna near the transponder antenna.				
16.	Connect Ground Power Unit to aircraft.				

Ground Test Procedure (Sheet 7 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPILOT Pass/Fail	STBY Pass/Fail
17.	Apply electrical power to aircraft				
18.	Activate ground power in accordance with the Airplane Maintenance Manual procedures and turn on electrical buses.				
19.	Turn on cabin lights to verify electrical power is applied to the aircraft.				
20.	Turn on EFIS power. <i>Check that PFD is not in reversionary mode.</i>	Verify normal PFD screen after PFD initialization screen. Verify ADAHRS initializes after normal countdown.			
21.	Turn on static port heat (if installed).	Verify either increased ammeter current or that static port becomes hot to the touch.			
22.	Turn off static port heat (if installed).	Verify either reduced ammeter current or that static port returns to ambient.			
23.	Turn on pitot heat.	Verify either increased ammeter current or that pitot probe becomes hot to the touch.			
24.	Turn off pitot heat.	Verify either reduced ammeter current or that pitot probe returns to ambient.			

Ground Test Procedure (Sheet 8 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPLOT Pass/Fail	STBY Pass/Fail
25.	Alternate Static (if installed) Test at Field Elevation				
26.	Purpose. This test will verify that the altimeters do not change more than 50 feet between normal and alternate static sources at field elevation, in compliance with § 23.1325(b)(3). → A functional flight check of the alternate static selector is recommended.				
27.	Press BARO knob on PFD 1 and 2.	Verify PFD indicates STD.			
28.	Set BARO on standby altimeter to 29.92 .	Verify dial rotates normally.			
29.	Inspect the alternate static source selector.	Verify alternate static selector is clearly marked and can be switched freely between normal and alternate sources.			
30.	Switch alternate static to NORMAL.	Record results in the NORMAL row in Table II below.			
31.	Switch alternate static to ALTERNATE.	Record results in the Alternate row in Table II below.			
32.	Return alternate static to NORMAL.	Compute the difference between normal and alternate in Table II below. Verify that the altitude does not differ by more than 50 feet, IAW § 23.1325(b)(3).			

Table II — Alternate Static Test

Alternate Static Switch	Pilot's Altimeter (feet)	Copilot's Altimeter (feet)	Standby Altimeter (feet)	Tolerance (feet)	Pass/Fail
Normal					
Alternate					
Difference				±50	

Ground Test Procedure (Sheet 9 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pilot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPILOT Pass/Fail	STBY Pass/Fail
33.	Barometric Scale Error Test				
34.	Purpose. This test verifies the accuracy of the barometric scale on each altimeter, in compliance with § 43 Appendix E, Table IV.				
35.	Set the BARO knob on each altimeter to standard pressure 29.92 in order to determine the pressure altitude (Pa) at field elevation.	Record the pressure altitude (Pa) in the first row of Table III below. Use this altitude as the reference point.			
36.	Adjust the BARO knob on each altimeter to the specified settings, record the new indicated altitudes, and compute the difference between the indicated altitudes from pressure altitude.	Verify that the change in altitude on each altimeter is within ± 25 feet of the expected change from pressure altitude at field elevation.			

Table III — Pressure-Altitude Difference

BARO Setting	Expected Change from Pressure Altitude (Pa)	Tolerance	PFD 1 Altimeter (feet)		PFD 2 Altimeter (feet)		Standby Altimeter (feet)		Pass/Fail
			Indication	Altitude change from Pa	Indication	Altitude change from Pa	Indication	Altitude change from Pa	
29.92	Pressure Altitude (PA)								
29.50	-392	±25 ft							
29.00	-863	±25 ft							
28.50	-1,340	±25 ft							
28.10	-1,727	±25 ft							
30.50	+531	±25 ft							
30.90	+893	±25 ft							
30.99	+974	±25 ft							

37.	Press BARO knob on PFD 1 and 2.	Verify PFD indicates STD.			
38.	Reset BARO on standby altimeter to 29.92 .				

Ground Test Procedure (Sheet 10 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPLOT Pass/Fail	STBY Pass/Fail
39.	Pitot-Static Tester Set Up				
	<p>Test Points. Connect the pitot-static test equipment directly to the pitot-static ports on the aircraft, if practicable. Otherwise, connect to a static system drain or tee connection and seal off the static ports. If the test equipment is connected to the static system at any point other than the static port, it should be made at a point where the connection may be readily inspected for system integrity after the system is returned to its normal configuration.</p> <p>Seals. Block unconnected ports with brightly colored tape long enough to have a streamer.</p> <p style="text-align: center;">Note: Remove all static port seals after completion of this test procedure.</p>				
40.	<p>Separation. If the aircraft under test has more than one pitot-static system, test each system separately to ensure their independence and that the leak rate for each is within tolerance.</p> <p>Vibration. Unless otherwise specified, each test may be conducted with vibration applied to pneumatic standby instruments.</p> <p style="text-align: center;">Note: When applying vibration, lightly tapping the standby instrument face with a finger should suffice. DO NOT install a shaker or vibrator on the instrument panel.</p> <p style="text-align: center;">Caution: Secure pitot-static test connections carefully. Avoid circumstances that would result in a test line disconnecting unintentionally while test pressure is being applied.</p>				

Ground Test Procedure (Sheet 11 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPILOT Pass/Fail	STBY Pass/Fail
41.	Proof Test				
	<p>Purpose. This test will verify the integrity of the pitot-static system(s), including the lines and components, in compliance with § 23.1325(b)(2) and § 91.411(a)(2). Procedures are included for both pressurized and non-pressurized aircraft, with the allowable tolerance of each type shown. Use one or the other as appropriate for the aircraft under test.</p> <p>Method. Each pitot-static system shall be tested separately to verify that it can hold the test pressure for 1 minute without support from the vacuum pump in the tester. The pitot and static ports of each system shall be connected to the pitot-static tester to verify both lines.</p> <p style="text-align: center;">Note: On aircraft with multiple pitot systems using a single static system, connect all pitot systems to the pitot-static tester to avoid damage to instruments.</p> <p style="text-align: center;">Caution: Monitor all air data instruments during testing to ensure that none are operated beyond limitations.</p> <p><i>All instruments in the aircraft under test shall be connected to their normal lines to assure that no leaks occur within the instruments or their connections.</i></p> <p><i>The primary altimeter in the aircraft under test or that in the pitot-static tester may be used as a vacuum gauge for the proof test.</i></p> <p><i>Use Table IV to record readings, calculations, and pass/fail results.</i></p>				
42.					

Ground Test Procedure (Sheet 12 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPILOT Pass/Fail	STBY Pass/Fail
43.	<p><u>Unpressurized Airplanes.</u> With the pitot-static tester connected to each pitot-static system separately, simulate a test altitude of 1,000 feet above field elevation at 0 knots airspeed.</p> <p>Upon reaching the test altitude, record the indicated altitude displayed on the specified altimeter as the <i>Initial Altitude</i> in Table IV.</p> <p><i>After 1 minute</i> without additional vacuum being applied to the aircraft, record the second altitude from the same altimeter.</p>	<p>Compute the <i>Altitude Loss</i> in Table IV by subtracting the <i>Initial Altitude</i> from the <i>Altitude After 1 Minute</i>.</p> <p>Verify that the <i>Altitude Loss</i> is less than the unpressurized proof test tolerance of ± 100 feet.</p>			
44.	<p><u>Pressurized Airplanes.</u> With the pitot-static tester connected to each system separately, simulate MAX DIFF test altitude, as computed in Section 14: ► _____ feet</p> <p>Upon reaching the MAX DIFF altitude, record the indicated altitude displayed on the specified altimeter as the <i>Initial Altitude</i> in Table IV.</p> <p><i>After 1 minute</i> without additional vacuum being applied to the aircraft, record the second altitude from the same altimeter.</p>	<p>Compute the <i>Altitude Loss</i> in Table IV by subtracting the <i>Initial Altitude</i> from the <i>Altitude After 1 Minute</i>.</p> <p>Verify that the <i>Altitude Loss</i> is less than the Pressurized MAX DIFF Tolerance (2% of MAX DIFF altitude).</p>			
45.	Return pitot-static tester to atmospheric conditions on conclusion of proof test.				

Table IV — Proof Test

Parameter	Pilot's Altimeter (feet)	Copilot's Altimeter (feet)	Standby Altimeter (feet)	Unpressurized Proof Test Tolerance(feet)	Pressurized MAX DIFF Tolerance(feet)	Pass/Fail
1 st reading → <i>Initial Altitude</i>						
2 nd reading → <i>Altitude After 1 Minute</i>						
Calculate → $1^{st} - 2^{nd} = \text{Altitude Loss}$				± 100	► \pm	

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPLOT Pass/Fail	STBY Pass/Fail
46.	Scale Error and Altitude Reporting Test				
47.	<p>Purpose. This test will verify the accuracy of the altimeters and altitude-reporting devices during a 4000--6000 FPM climb between test points, in compliance with Part 43 Appendix E, Table I and § 91.217(b).</p> <p>Method. Each static system may be tested separately or together. The pitot and static ports of each system shall be connected to the pitot-static tester.</p> <p style="text-align: center;">Caution: Monitor all air data instruments during testing to ensure that none are operated beyond limitations.</p> <p><i>All instruments in the aircraft under test shall be connected to their normal lines.</i></p> <p><i>Each altimeter in the aircraft under test will be compared to the altitude of the tester at test point altitudes, as specified in Table V.</i></p> <p><i>Use Table V to record readings, calculations, and pass/fail results.</i></p>				
48.	Set pitot-static tester altimeter to 29.92 and airspeed to 0.				
49.	Press the BARO knob on PFD 1 and 2 for STD (29.92) setting.				
50.	Set the BARO on standby altimeter to 29.92.				
51.	Set up the transponder ramp tester to interrogate the transponder(s) on the aircraft.				
52.	Turn on transponder 1 in Mode 3/A with altitude (Mode C) off.	Verify on the ramp tester that the transponder is NOT transmitting altitude information.			
53.	Turn on altitude (Mode C) on transponder 1.	Verify proper altitude pulse train or decoded altitude on the ramp tester.			

Ground Test Procedure (Sheet 14 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPILOT Pass/Fail	STBY Pass/Fail
54.	Turn on transponder 2 (if installed) in Mode 3/A with altitude (Mode C) off.	Verify on the ramp tester that the transponder is NOT transmitting altitude information.			
55.	Turn on altitude (Mode C) on transponder 2 (if installed).	Verify proper altitude pulse train or decoded altitude on the ramp tester.			
56.	Continue to interrogate each transponder with the ramp tester through the remainder of the scale test, up to the maximum altitude.	Record the altitude reporting of each transponder at each test point in Table V and verify that the reported altitude is within MODE C tolerance of ± 125 feet.			
57.	<i>Use the pitot-static tester to apply suction to the static system in accordance with the test points listed in Table V up to the maximum operating altitude of ► ^{**} feet for the aircraft. NOTE: Do not exceed the maximum altitude of the aircraft by more than 2500 feet.</i>				
58.	Adjust the pitot-static test set vertical speed to climb at 4000–6000 FPM between test points. Stop when the tester reaches each test point and record the indicated altitude on each altimeter.	Verify that the indicated altitude on each altimeter is within the SCALE tolerance specified in Table V.			
59.	Turn off transponder(s) after reaching maximum altitude.				
60.	Turn off transponder ramp tester after reaching maximum altitude.				
61.	End of Scale Error and Altitude Reporting Test. <i>Begin the hysteresis (dive) test from the maximum altitude within 15 minutes of reaching the maximum altitude.</i>				

^{**} 30,000 FT - PA-46-500TP
25,000 FT - PA-46-350P

Ground Test Procedure (Sheet 15 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

Table V — Scale Error and Altitude Reporting Test (Climb at 4000–6000 FPM)

TEST POINTS Test Set Altitude	Pilot PFD Altimeter	Copilot PFD Altimeter (if installed)	Standby Altimeter (if installed)	SCALE Tolerance ±(feet)	Transponder1 Mode C Altitude (if installed)	Transponder2 Mode C Altitude (if installed)	MODE C Tolerance ±(feet)	Pass/Fail
-1,000				±20			±125	
0				±20			±125	
500				±20			±125	
1,000				±20			±125	
1,500				±25			±125	
2,000				±30			±125	
3,000				±30			±125	
4,000				±35			±125	
6,000				±40			±125	
8,000				±60			±125	
10,000				±80			±125	
12,000				±90			±125	
14,000				±100			±125	
16,000				±110			±125	
18,000				±120			±125	
20,000				±130			±125	
22,000				±140			±125	
25,000				±155			±125	
30,000				±180			±125	
35,000				±205			±125	
40,000				±230			±125	
45,000				±255			±125	
50,000				±280			±125	

Ground Test Procedure (Sheet 16 of 24)
Megitt MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPILOT Pass/Fail	STBY Pass/Fail
62.	Hysteresis (Dive) and After Affect Test				
63.	<p>Purpose. This test will verify the accuracy of the altimeters after a simulated dive from maximum altitude, to 50% of maximum, to 40%, to Atmospheric Pressure, in compliance with § 43 Appendix E, Table II.</p> <p>!! Begin dive test at maximum altitude within 15 minutes of reaching maximum altitude.</p> <p>Use Table VI to record readings, calculations, and pass/fail results.</p>				
64.	Descend to 50% test point. Adjust test set to descend to the 50% test point at greater than or equal to 6000 FPM until within 3000 feet. Approach at 3000 FPM. Hold at test point for 5 minutes before taking a reading.	Verify indicated altitude is within ± 75 feet of the value recorded in Table V at the same altitude after holding at the 50% test point for 5 minutes.			
65.	Descend to 40% test point. Adjust test set to descend to the 40% test point at greater than or equal to 6000 FPM until within 3000 feet. Approach at 3000 FPM. Hold at test point for 1 minute before taking a reading.	Verify indicated altitude is within ± 75 feet of the value recorded in Table V at the same altitude after holding at the 40% test point for 5 minutes.			
66.	Descend to test point. Adjust test set to descend to Atmospheric Pressure at greater than or equal to 6000 FPM until within 3000 feet. Approach at 3000 FPM and hold.	Within 5 minutes of reaching Atmospheric Pressure, verify indicated altitude is within ± 30 feet of the pitot-static test set.			

Table VI — Hysteresis Test (dive from MAX ALT at greater than or equal to 6000 FPM)

TEST POINT	Calculated Test Point Altitude (from Section 16)	Pilot PFD Altimeter	Copilot PFD Altimeter (if installed)	Standby Altimeter (if installed)	Tolerance (\pm feet) from the value recorded in Table V	Pass/Fail
50% test point	▶				± 75 after 5 min	
40% test point	▶				± 75 after 1 min	
Atmospheric Pressure	▶				± 30 within 5 min	

Ground Test Procedure (Sheet 17 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPILOT Pass/Fail	STBY Pass/Fail
67.	Friction Test (750 FPM Climb)				
68.	<p>Purpose. This test will verify the accuracy of the altimeters during a 750 FPM climb, in compliance with § 43 Appendix E, Table III.</p> <p>Method. Each static system shall be tested separately. Both the pitot and static ports of each system shall be connected to the pitot-static tester.</p> <p>All instruments in the aircraft under test shall be connected to their normal lines.</p> <p>Each altimeter in the aircraft under test will be compared to the altitude of the tester at test point altitudes, as specified in Table VII.</p> <p>Use Table VII to record all readings, calculations, and pass/fail results.</p>				
69.	Set pitot-static tester altimeter to 29.92 and airspeed to 0.				
70.	Press the BARO knob on PFD 1 and 2 for STD (29.92) setting.				
71.	Set the BARO on standby altimeter to 29.92.				
72.	Use the pitot-static tester to apply suction to the static system in accordance with the test points listed in Table VII up to the maximum operating altitude of ► _____ feet for the aircraft. NOTE: Do not exceed the maximum altitude of the aircraft by more than 2500 feet.				
73.	Adjust the pitot-static test set vertical speed to climb at 750 FPM between test points. Stop when the tester reaches each test point and record the indicated altitude on each altimeter.	Verify that the indicated altitude on each altimeter is within the FRICTION tolerance specified in Table VII.			
74.	<p>End of Friction Test</p> <p>Adjust pitot-static tester to descend to atmospheric conditions.</p>				

Ground Test Procedure (Sheet 18 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

Table VII — Friction Test (Climb at 750 FPM)

TEST POINTS Test Set Altitude	Pilot PFD Altimeter	Copilot PFD Altimeter (if installed)	Standby Altimeter (if installed)	FRICTION Tolerance ±(feet)				Pass/Fail
1,000				±70				
2,000				±70				
3,000				±70				
6,000				±70				
10,000				±80				
16,000				±90				
20,000				±100				
25,000				±120				
30,000				±140				
35,000				±160				
40,000				±180				
50,000				±250				

Ground Test Procedure (Sheet 19 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPLOT Pass/Fail	STBY Pass/Fail
75.	Airspeed Test				
76.	<p>Purpose. This test will verify the accuracy of the airspeed indicators at pressure altitude, in compliance with § 23.1323(a).</p> <p>Method. Each pitot-static system may be tested separately or together. The pitot and static ports of each system shall be connected to the pitot-static tester.</p> <p>All instruments in the aircraft under test shall be connected to their normal lines.</p> <p>Each airspeed indicator in the aircraft under test will be compared to the airspeed Indicator of the tester at various test point speeds, as specified in Table VIII.</p> <p>Use Table VIII to record readings, calculations, and pass/fail results.</p>				
77.	Set pitot-static tester altimeter to 29.92.				
78.	Press the BARO knob on PFD 1 and 2 for STD (29.92) setting.				
79.	Set the BARO on standby altimeter to 29.92.				
80.	Use the pitot-static tester to apply pressure to the pitot system in accordance with the test points listed in Table VIII up to the maximum operating speed of ► _____ knots for the aircraft. NOTE: Do not exceed the maximum airspeed of the aircraft by more than 10 knots.				
81.	Adjust the pitot-static test set to attain the speeds specified in Table VIII. Stop when the tester reaches each test point and record the indicated airspeed.	Verify that the indicated airspeed on each indicator is within the tolerance specified in Table VIII.			
82.		Verify redline displayed at the maximum airspeed per AFM at ► _____ kts			
83.		Verify overspeed alerter (if installed) activates within ±2 knots of redline.			
84.	Decrease pitot-static tester to atmospheric conditions.				

Ground Test Procedure (Sheet 20 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

Table VIII — Indicated Airspeed (at field elevation)

Test Set Indicated Airspeed	Pilot PFD Indicated Airspeed	Copilot PFD Indicated Airspeed	Standby Airspeed Indicator	Tolerance \pm KIAS	Pass	Fail
40				± 5		
50				± 5		
60				± 5		
70				± 5		
80				± 5		
90				± 5		
100				± 5		
110				± 5		
120				± 5		
130				± 5		
140				± 5		
150				± 5		
160				± 5		
170				± 5		
180				± 6		
190				± 6		
200				± 6		
210				± 6		
220				± 7		
230				± 7		
240				± 7		
250				± 7		
260				± 8		

Ground Test Procedure (Sheet 21 of 24)

Megitt MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

NO	PROCEDURE	RESULTS	PILOT Pass/Fail	COPLOT Pass/Fail	STBY Pass/Fail
85.	Shut Down				
86.	Select EFIS off.				
87.	Shut down electrical power.				
88.	Select cabin lights off.				
89.	Disconnect Ground Power Unit from aircraft.				
90.	Disconnect pitot-static tester from aircraft.				

Note:

Remove any seals or adhesive from pitot-static ports upon completion of this test procedure.

Ground Test Procedure (Sheet 22 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

Table IX — Pressure-to-Altitude Conversion Chart

Altitude (ft)	Pressure (PSI)	Altitude (ft)	Pressure (PSI)	Altitude (ft)	Pressure (PSI)	Altitude (ft)	Pressure (PSI)
-1000	15.2348	17500	7.4915	36000	3.2966	54500	1.3549
-500	14.9634	18000	7.3389	36500	3.2183	55000	1.3227
0	14.6959	18500	7.1888	37000	3.1419	55500	1.2913
500	14.4323	19000	7.0412	37500	3.0673	56000	1.2606
1000	14.1726	19500	6.8961	38000	2.9945	56500	1.2307
1500	13.9166	20000	6.7534	38500	2.9234	57000	1.2015
2000	13.6644	20500	6.6131	39000	2.854	57500	1.173
2500	13.4159	21000	6.4752	39500	2.7862	58000	1.1451
3000	13.1711	21500	6.3397	40000	2.72	58500	1.1179
3500	12.9299	22000	6.2064	40500	2.6554	59000	1.0914
4000	12.6923	22500	6.0754	41000	2.5924	59500	1.0655
4500	12.4583	23000	5.9466	41500	2.5308	60000	1.0402
5000	12.2277	23500	5.8201	42000	2.4707	Refer to Table IV GEOPOTENTIAL ALTITUDE, ENGLISH UNITS, contained in the document titled "U.S. Standard Atmosphere, 1976 (Stock No. 003-017-00323-0)"	
5500	12.0007	24000	5.6958	42500	2.4121		
6000	11.777	24500	5.5736	43000	2.3548		
6500	11.5567	25000	5.4536	43500	2.2989		
7000	11.3398	25500	5.3356	44000	2.2443		
7500	11.1262	26000	5.2197	44500	2.191		
8000	10.9159	26500	5.1059	45000	2.139		
8500	10.7088	27000	4.9941	45500	2.0882		
9000	10.5049	27500	4.8843	46000	2.0386		
9500	10.3041	28000	4.7764	46500	1.9902		
10000	10.1065	28500	4.6705	47000	1.9429		
10500	9.9119	29000	4.5665	47500	1.8968		
11000	9.7204	29500	4.4644	48000	1.8518		
11500	9.5319	30000	4.3641	48500	1.8078		
12000	9.3464	30500	4.2657	49000	1.7649		
12500	9.1638	31000	4.1691	49500	1.723		
13000	8.9841	31500	4.0742	50000	1.682		
13500	8.8072	32000	3.9811	50500	1.6421		
14000	8.6332	32500	3.8898	51000	1.6031		
14500	8.462	33000	3.8001	51500	1.565		
15000	8.2935	33500	3.7121	52000	1.5279		
15500	8.1278	34000	3.6258	52500	1.4916		
16000	7.9648	34500	3.5411	53000	1.4562		
16500	7.8044	35000	3.458	53500	1.4216		
17000	7.6466	35500	3.3765	54000	1.3878		

Refer to Table IV GEOPOTENTIAL ALTITUDE, ENGLISH UNITS, contained in the document titled "U.S. Standard Atmosphere, 1976 (Stock No. 003-017-00323-0)"

Ground Test Procedure (Sheet 23 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

17. Ground Test Witness

I certify that I have performed or witnessed this Ground Test Procedure on the following aircraft:

TEST LOCATION			
TYPE AIRCRAFT	SERIAL No.	REGISTRATION No.	MODE S ADDRESS (if applicable).
WITNESS NAME	SIGNATURE		DATE

Comments:

Ground Test Procedure (Sheet 24 of 24)
Meggit MAGIC Air Data and Heading Reference System (ADAHRS) and Pitot-Static System

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AIRPLANE MAINTENANCE MANUAL

CARD 5 OF 7

PA-34-220T

Seneca IV

(SN's 3447001 THRU 3447029)

SENECA

(SN's 3449001 AND UP)

THE NEW PIPER AIRCRAFT, INC.

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AEROFICHE REVISION STATUS

Revisions to Maintenance Manual (P/N 761-888) issued July 12, 1995, are as follows:

<u>Revision</u>	<u>Publication Date</u>	<u>Aerofiche Card Effectivity</u>
ORG950712	November 7, 1996	1, 2, 3, 4 and 5
PR980415	April 15, 1998	1, 2, 3, 4 and 5
PR981115	November 15, 1998	1, 2, 3, 4 and 5
PR020531	May 31, 2002	1
CR050819	August 19, 2005	1, 2, 3, 4, 5, 6 and 7
PR051107	November 7, 2005	1, 2, 4 and 5
PR060428*	April 28, 2006	1, 2, 3, 4, 5, 6 and 7

*** PARTIAL REVISION OF MAINTENANCE MANUAL 761-888**

Revisions appear in Aerofiche Cards 1, 2, 3, 4, 5, 6, and 7. Accordingly, discard your existing Aerofiche Cards and replace them with the cards dated April 28, 2006.

Consult the Customer Service Information Aerofiche (P/N 1753-755) for current revision dates for this manual.

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INTRODUCTION

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INTRODUCTION

1. Instructions for Continued Airworthiness

WARNING: INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA) FOR ALL NON-PIPER APPROVED STC INSTALLATIONS ARE NOT INCLUDED IN THIS MANUAL. 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 ICA 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, THE PIPER PROVIDED ICA MAY NOT BE VALID FOR AIRPLANES SO MODIFIED.

The PIPER PA-34-220T Seneca IV / V Maintenance Manual constitutes the Instructions for Continued Airworthiness (ICA) as required by Federal Aviation Regulations (FAR) Part 23, Appendix G. Chapter 4 contains the Airworthiness Limitations section (4-00-00) and the Inspection Program is in Chapter 5 (5-20-00).

2. General

This publication is prepared in accordance with the General Aviation Manufacturers Association (GAMA) Specification No. 2, with respect to the arrangement and content of the System/Chapters within the designated Chapter/Section-numbering system.

WARNING: USE ONLY GENUINE PIPER AIRCRAFT PARTS OR PIPER AIRCRAFT APPROVED PARTS OBTAINED FROM PIPER APPROVED SOURCES, IN CONNECTION WITH THE MAINTENANCE AND REPAIR OF PIPER AIRPLANES.

This manual generally does not contain hardware callouts for installation. Hardware callouts are only indicated where a special application is required. To confirm the correct hardware used, refer to the PA-34-220T Parts Catalog, P/N 761-887, and FAR 43 for proper use.

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.

THE NEW PIPER AIRCRAFT, INC. expressly disclaims any responsibility for malfunctions, failures, damage or injury caused by use of non-PIPER approved parts.

NOTE: THE NEW PIPER AIRCRAFT, INC. expressly reserves the right to supersede, cancel and/or declare obsolete any part, part numbers, kits or publication that may be referenced in this manual without prior notice.

In any question concerning the care of your airplane, be sure to include the airplane serial number in any correspondence.

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3. Effectivity

This maintenance manual is effective for PA-34-220T Seneca IV airplanes, serial numbers 3447001 thru 3447029, and Seneca V airplanes, serial numbers 3449001 and up.

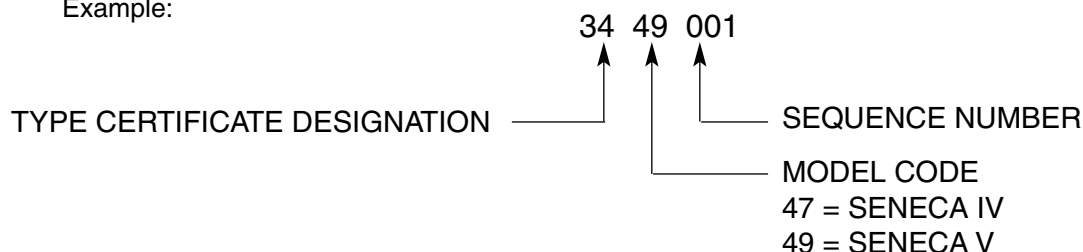
This encompasses the following model years:

NOTE: The following is provided as a general reference only.

<u>Model</u>	<u>Serial Numbers</u>	<u>Model Year</u>
Seneca IV	3447001 thru 3447012	1995
	3447013 thru 3447029	1996
Seneca V	3449001	Prototype
	3449002 thru 3449041	1997
	3449042 thru 3449096	1998
	3449097 thru 3449151	1999
	3449152 thru 3449195	2000
	3449196 thru 3449231	2001
	3449232,	2002
	3449237 thru 3449239, and	
	3449241 thru 3449268	
	3449269, 3449273, and	2003
	3449275 thru 3449300	
	3449301 thru 3449310	2004
	3449311 thru 3449322	2005
	3449323 and Up	2006

4. Serial Number Explanation

Example:



5. Assignment of Subject Material

This publication is divided into industry standard, three element, numeric subject groupings as follows:

- A. System/Chapter - The various groups are broken down into major systems such as Environmental Systems, Electrical Power, Landing Gear, etc. They are assigned a number, which becomes the first element of the standardized numbering system. Thus, the element "28" of the number 28-40-01 refers to the chapter "Fuel". Everything concerning the fuel system will be covered in this chapter.
- B. Sub-System/Section - The major systems/chapters of an airplane are broken down into subsystems. These sub-systems are identified by the second element of the standard numbering system. The element "40" of the number 28-40-01 concerns itself with the indicating section of the fuel system.

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- C. Unit/Subject - The individual units within a sub-system/section may be identified by the third element of the standard numbering system. The element "01" of the number 28-40-01 is a subject designator. This element is assigned at the option of the manufacturer and is normally zeroed out by PIPER.

Refer to paragraph 14, Chapter/Section Index Guide, for a complete breakdown and list. The material is arranged in ascending numerical sequence.

6. Pagination

The Chapter - Section (i.e. - 28-40-00) numbering system (explained above) forms the primary page numbering system for this manual. Within each Section, pages are numbered consecutively beginning with Page 1 (i.e. - 28-40-00, Page 1). Additionally, the aerofiche grid numbering system (explained below) is also used to indicate location within the manual.

7. Aerofiche Effectivity

- A. The General Aviation Manufacturers Association (GAMA) has developed specifications for microfiche reproduction of aircraft publications. The information compiled in this Aerofiche Maintenance Manual will be kept current by revisions distributed periodically. These revisions will supersede all previous revisions and will be complete Aerofiche card replacements and shall supersede Aerofiche cards of the same number in the set. The "Aerofiche Effectivity" page at the front of this manual lists the current revision for each card in this set.

- B. Conversion of Aerofiche alpha/numeric grid code numbers:

First number is the Aerofiche card number.

Letter is the horizontal row reference per card.

Second number is the vertical column reference per card.

Example: 2J16 = Aerofiche card number two, row J, column 16.

- C. To aid in locating information, the following is provided at the beginning of each aerofiche card:

- (1) A complete Introduction containing the Chapter/Section Index Guide for all fiche in this set.
- (2) A complete subject Index for all fiche in this set.

8. Identifying Revised Material

A revision to a page is defined as any change to the printed matter that existed previously. Revisions, additions and deletions are identified by a vertical line (i.e. - change bar) along the left-hand margin of the page opposite only that portion of the printed matter that was changed.

A change bar in the left-hand margin opposite the footer (i.e. - chapter/section/subject, page number and date), indicates that the text was unchanged but the material was relocated to a different page.

Example.

NOTE: Change bars are not used in the title pages, list of effective pages, or index.

9. Indexing

An alphabetically arranged subject Index follows this introduction to assist the user in locating desired information. In addition, each System/Chapter begins with an individual Table of Contents.

10. List of Effective Pages

Each System/Chapter has a List of Effective Pages preceding the Table of Contents to identify the effective revision date for each page in that chapter.

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11. Warnings, Cautions and Notes

These adjuncts to the text are used to highlight or emphasize important points when necessary. **Warnings** call attention to use of materials, processes, methods, procedures or limits which must be followed precisely to avoid injury or death to persons. **Cautions** call attention to methods and procedures which must be followed to avoid damage to equipment. **Notes** call attention to methods which make the job easier. Warnings and Cautions shall be located directly above and Notes directly beneath the text and be in line with the paragraphs to which they apply.

12. Accident/Incident Reporting

To improve our Service and Reliability system and aid in our compliance with FAR 21.3, knowledge of all incidents and/or accidents must be reported to Piper immediately. To expedite and assist in reporting all incidents and accidents, Piper Form 420-01 has been created. See Service Letter 1041 for latest revision. This procedure is to be used by all Dealers, Service Centers and Repair Facilities.

13. Supplementary Publications

The following publications/sources provide servicing, overhaul and parts information for the PA-34-220T Seneca IV / V airplanes and their various components. Use them to supplement this manual.

A. Piper Publications: (by Part Number)	Seneca IV	Seneca V
(1) Parts Catalog:	761-887	761-887
(2) Periodic Inspection Report:	230-1061	767-012
(3) Progressive Inspection Manual (50 Hour):	761-753	767-006

B. Vendor Publications:

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY.

(1) AIR CONDITIONING COMPRESSOR:

Vendor:	Sanden International (USA), Inc. 601 South Sanden Blvd. Wylie, TX 75098-4999 http://www.sanden.com	PH: - (972) 442-8400
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(2) AUTOFLIGHT:

Vendor(s):	Honeywell One Technology Center 23500 W. 105th St., M/D #45 Olathe, Kansas 66061-1950 http://www.bendixking.com/	(or)	S-TEC Corporation One S-TEC Way Mineral Wells, Tx 76067 PH: - (940) 325-9406 www.s-tec.com
Flight Control:	Bendix/King		
System Flight Line Installation Manual:	KFC 150 P/N 006-0287-00		

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(3) BATTERY:

Vendor:	GILL Batteries	PH: - (800) 456-0070
	A Division of Teledyne Continental Motors	
	http://www.gillbatteries.com	

(4) BRAKES AND WHEELS:

Vendor:	Parker Hannifin Corp.	PH: - (800) 272-5464
	Aircraft Wheel and Brake Division	
	1160 Center Road	
	Avon, Ohio 44011	
	http://www.parker.com/cleveland/Universe/book.pdf	

(5) ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS):

Vendor:	Meggitt Avionics, Inc.	PH: - (603) 669-0940
	10 Ammon Drive	FAX: - (603) 669-0931
	Manchester, NH 03103-7406	
	http://www.meggittavi.com/	

Vendor:	Avidyne Corporation	PH - (800) 284-3963
	55 Old Bedford Road	
	Lincoln, MA 01773	
	http://www.avidyne.com/index.htm	

Instructions for Continued Airworthiness

Primary Flight Display and Magnetometer/OAT:	Document No. AVPFD-174
Multifunction Display:	Document No. AVMFD-167
Data Acquisition Unit:	Document No. AVSIU-011

(6) EMERGENCY LOCATOR TRANSMITTER:

Vendor:	Artex Aircraft Supplies	PH: - (800) 547-8901
	14405 Keil Road NE	
	Aurora, Oregon 97002	
	http://www.artex.net/	

(7) ENGINE:

Vendor:	Teledyne Continental Motors	PH: - (800) 718-3411
	Attn: Aircraft Products Division	FAX: - (251) 432-7352
	Mobile, Alabama 36601	

[SENECA IV](#)

Overhaul Manual =	CONTINENTAL - Form No. X-30030A
Parts Catalog =	CONTINENTAL - Form No. X-30031A
Operators Handbook =	CONTINENTAL - Form No. X-30553

[SENECA V](#)

Maintenance Manual =	CONTINENTAL - Form No. X-30645A
Overhaul Manual =	CONTINENTAL - Form No. X-30596A

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(8) FIRE EXTINGUISHER (PORTABLE):

Vendor:	H3R Inc. 43 Magnolia Ave # 4 San Francisco, California 94123-2911 http://www.h3r.com/index.htm	PH: - (800) 249-4289
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(9) FUEL CELLS:

Vendor:	Engineered Fabrics Corporation 669 Goodyear Street Rockmart, Georgia 30153-0548 http://www.kfefc.com/index.htm	PH: - (770) 684-7855 FAX: - (770) 684-7438
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(10) FUEL PUMP:

Vendor:	Weldon Pumps P.O. Box 46579 640 Golden Oak Parkway Oakwood Village, Ohio 44146 http://www.weldonpumps.com/index.html	PH: - (440) 232-2282 FAX: - (440) 232-0606
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(11) GEAR LOCKING ACTUATORS, HYDRAULIC PUMP, AND ALL HYDRAULIC COMPONENTS:

Vendor:	Parker Hannifin Corporation 6035 Parkland Boulevard Cleveland, OH 44124-4141 USA email: c-parker@parker.com	PH: - (800) C-PARKER (800) 272-7537 FAX: - (440) 266-7400
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(12) KEVLAR:

Vendor:	KEVLAR Special Products E.I. DuPont De Nemours & Co. Inc. Textile Fibers Department Centre Road Building Wilmington, Delaware 19898
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A Guide to Cutting and Machining Kevlar Aramid

(13) LIGHTS - NAVIGATION, STROBE, AND MAP LIGHTS:

Vendor:	Whelen Engineering Co. Inc. Route 145, Winthrop Rd. Chester, Connecticut 06412 http://www.whelen.com/	PH: - (860) 526-9504 FAX: - (860) 526-2009
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(14) MAGNETOS:

Vendor: TCM Aircraft Products PH: - (800) 718-3411
P. O. Box 90 FAX: - (251) 432-7352
Mobile, AL 36601
<http://www.tcmlink.com/>

Installation, Operation and Maintenance Teledyne Continental Motors (TCM)
Service Support Manual, P/N x42002

Instructions = S-20 / S-200 Series High Tension Magnetos

or,

Vendor: Slick Aircraft Products PH: - (904) 739-4000
Unison Industries FAX: - (904) 739-4006
Attn: Subscription Service
7575 Baymeadows Way
Jacksonville, FL 32256
http://www.unisonindustries.com/news/service_documents.html

Installation, Operation and Maintenance F1100 MASTER SERVICE MANUAL,
4300/6300 SERIES MAGNETO MAINTENANCE AND
Instructions: OVERHAUL MANUAL - L-1363

(15) NAVIGATION, COMMUNICATIONS, AND GPS (NAV/COM/GPS):

Vendor: Garmin International PH: - (913) 397-8200
1200 East 151ST Street
Olathe, KS 66062
<http://www.garmin.com>

(16) OXYGEN SYSTEM:

Vendor: Scott Aviation PH: - (716) 683-5100
2225 Erie Street
Lancaster, New York 14086
<http://www.scottaviation.com/>

(17) PROPELLER:

Vendor: Hartzell Propeller Inc. PH: - (937) 778-4379
One Propeller Place FAX: - (937) 778-4321
Piqua, OH 45356-2634
<http://www.hartzellprop.com/index2.htm>

Overhaul Instructions: Manual No. 117

or,

Vendor: McCauley Accessory Division
3535 McCauley Drive
P.O. Drawer 5053
Vandalia, Ohio 45377-5053

McCAULEY C500 SERIES SERVICE MANUAL - P/N 810915

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(18) STANDBY ATTITUDE INDICATOR:

Vendor Address: Mid-Continent Instruments Co., Inc. PH - (316) 630-0101
9400 E. 34 TH Street N. FAX - (316) 630-0723
Wichita, KS 67226
<http://www.mcico.com/index.html>

Installation Manual and
Operating Instructions: Manual No. 9015762

(19) STARTER:

Electro Systems, Inc.
(see "Voltage Regulator," below)

(20) VACUUM PUMP:

Vendor: Aero Accessories, Inc. PH: - (800) 822-3200
1240 Springwood Avenue
Gibsonville, NC 27249
<http://www.aeroaccessories.com/index.html>

(21) VACUUM REGULATOR:

Vendor: Parker Hannifin Corp. PH: - (800) 382-8422
Airborne Division
711 Taylor Street
Elyria, Ohio 44035
<http://www.parker.com/cleveland/Universe/book.pdf>

(22) VOLTAGE REGULATOR:

Vendor: Electro Systems, Inc. PH: - (888) 461-6077
Airport Complex
P. O. Box 273
Fort Deposit, Alabama 36032
<http://www.kellyaerospace.com/index.htm/>

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14. Chapter/Section Index Guide

NOTE: The following GAMA Specification No. 2 standard chapters are not included in this Maintenance Manual: 23, 36, 38, 49, 53, 54, 60, 72, 75, and 83. These chapters are omitted because the subject system is either: not installed in these airplanes; adequately covered in vendor or other manuals; or, for ease of use, has been combined with another chapter.

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		50 Unscheduled Maintenance Checks	
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		30 Interior Placards	
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		20 Distribution	
		40 Heating	
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		10 Autopilot	
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27	FLIGHT CONTROLS		3C1
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		40 Windows and Windshield	
		60 Propellers	
		80 Detection	
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		50 Central Warning Systems	
32	LANDING GEAR		4C17
		00 General	
		10 Main Gear and Doors	
		20 Nose Gear and Doors	
		30 Extension and Retraction	
		40 Wheels and Brakes	
		60 Position and Warning	
33	LIGHTS		4G5
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		20 Passenger Compartment	
		30 Cargo and Service Compartments	
		40 Exterior	
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55	STABILIZERS		5H21
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CREW/PASSENGER SYSTEMS

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

The following information is provided as supplemental information for the servicing of the oxygen systems. Major repairs to the oxygen system should be accomplished by an approved shop.

When refilling any oxygen cylinder make sure to use only aviation breathing oxygen as specified in MIL-O-27210C. The moisture content of aviation oxygen cannot exceed 0.005 milligrams of water vapor per liter of gas at 70°F (21°C) and 29.92 inches of mercury (760 mm Hg.).

1. Description and Operation

WARNING: DO NOT USE GREASE OR ANY TYPE OF GREASE FITTING ON ANY OXYGEN SYSTEM. WHEN WORKING WITH AN OXYGEN SYSTEM MAKE SURE HANDS, CLOTHING, TOOLS, AND IMMEDIATE AREA ARE FREE OF GREASE.

A fixed oxygen system is available. The major components for the fixed oxygen system are manufactured by Scott Aviation. Accordingly, contact Scott Aviation, as well as your Piper Dealer, for any required information not covered herein.

The fixed oxygen system cylinder is installed in the left side of the nose section aft of the closeout panel at station 31.04.

The ON-OFF push-pull control knob and pressure gauge are installed on the pilot's instrument panel below, and slightly to the right of, the control wheel. See Figure 1.

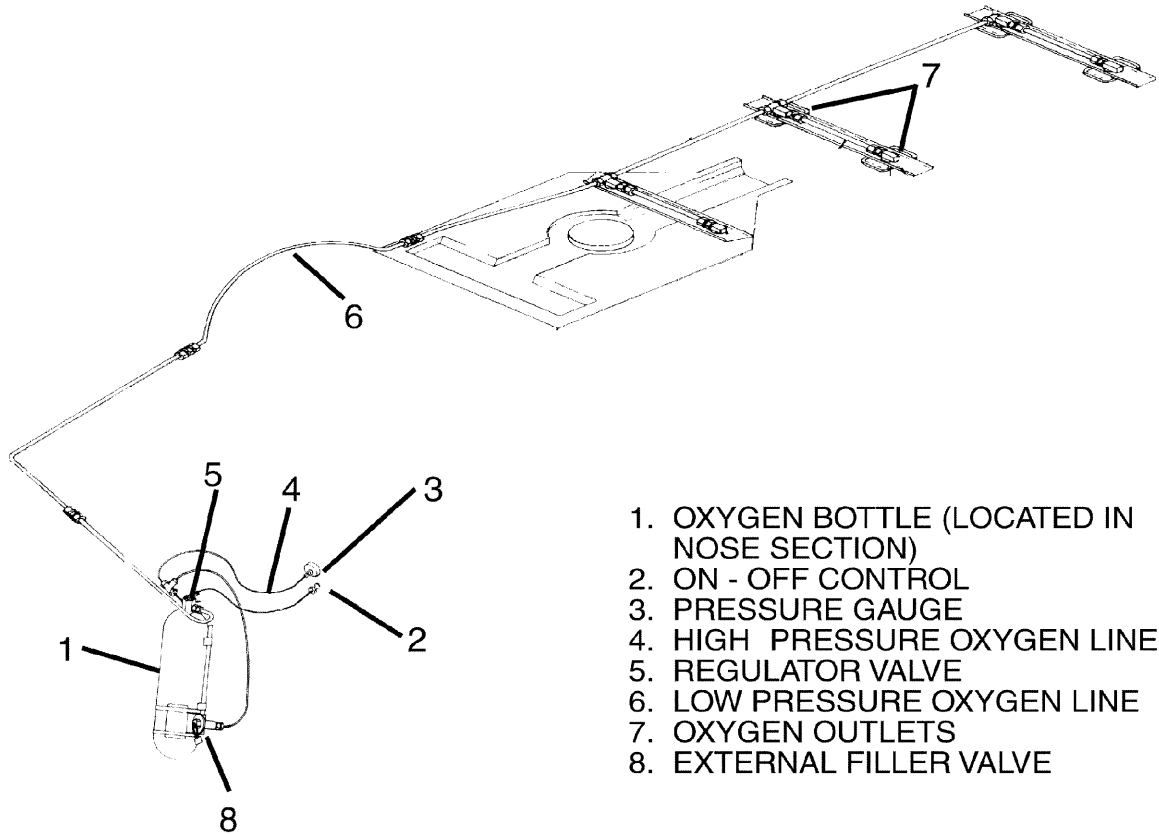
The low pressure feed for the outlets is arranged with the tank feed line entering the right side of the cabin at approximately Station 53.6, from where it is routed behind the right front window trim cover, windshield trim cover and overhead cover panel, and attached to tee fittings on the right side of each outlet from where the left outlets are also fed. See Figure 1.

NOTE: Oxygen cylinders are identified by the ICC or DOT identification stamped on the cylinder. On Seneca IV models, the standard weight cylinder (ICC or DOT 3AA1800) must be hydrostatically tested every 5 years. On Seneca V models, the lightweight cylinder of composite construction (DOT E8162), must be hydrostatically tested every 3 years, and the service life may not exceed 15 years. The month and year of the last test is stamped beneath the ICC/DOT identification.

2. Troubleshooting

See Chart 1.

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1. OXYGEN BOTTLE (LOCATED IN NOSE SECTION)
2. ON - OFF CONTROL
3. PRESSURE GAUGE
4. HIGH PRESSURE OXYGEN LINE
5. REGULATOR VALVE
6. LOW PRESSURE OXYGEN LINE
7. OXYGEN OUTLETS
8. EXTERNAL FILLER VALVE

Fixed Oxygen System Installation
Figure 1

**CHART 1
TROUBLESHOOTING OXYGEN SYSTEM**

Trouble	Cause	Remedy
No indication of pressure on pressure gauge.	Cylinder empty or leak in system has exhausted pressure.	Purge, charge, and check system for leaks.
	Pressure gauge or regulator defective.	Replace gauge.
Pressure indication normal but no oxygen flowing.	Oxygen cylinder regulator assembly defective.	Remove tank and have regulator removed.
Offensive odors in oxygen.	Cylinder pressure below 50 psi. Foreign matter has entered the system during previous servicing.	Purge the oxygen system.

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3. Precautions

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

CAUTION: DO NOT ATTEMPT TO TIGHTEN ANY CONNECTIONS WHILE THE SYSTEM IS CHARGED.

CAUTION: BOTTLES WHICH HAVE BEEN EVACUATED TO 200 PSI FOR A SIGNIFICANT LENGTH OF TIME, OR THOSE THAT DO NOT PRODUCE AN AUDIBLE HISsing SOUND WHEN THE VALVE IS CRACKED, SHOULD BE REMOVED AND HYDROSTATICALLY TESTED. IF EITHER OF THESE CONDITIONS HAS EXISTED FOR A SIGNIFICANT LENGTH OF TIME IT IS ALSO RECOMMENDED THAT THE SYSTEM BE PURGED.

CAUTION: MAKE SURE THERE IS NO OIL, GREASE, HYDRAULIC FLUID, OR FUEL IN THE VICINITY OF ANY FITTINGS BEING SERVICED.

CAUTION: DO NOT USE THREAD LUBRICANTS OF ANY KIND. USE TEFLON TAPE (3M NO. 48) ON TAPERED PIPE THREADS, WITHOUT TAPE EXTENDING BEYOND THE FIRST THREAD. REFER TO AFFECTIVE INFORMATION IN THIS CHAPTER.

CAUTION: BEFORE WORKING WITH THE SYSTEM, MAKE SURE AIRCRAFT IS ELECTRICALLY GROUNDED AND YOUR HANDS TOOLS, AND CLOTHES ARE FREE OF OIL, GREASE AND DIRT.

4. Inspection and Maintenance

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

Due to the nature of the process used to test compressed gas tanks, servicing and hydrostatic tests must be conducted by a DOT or manufacturer (Scott Aviation) approved shop. The following material gives recommended inspection and maintenance information for the various parts of the oxygen systems.

NOTE: Oxygen cylinders are identified by the ICC or DOT identification stamped on the cylinder. On Seneca IV models, the standard weight cylinder (ICC or DOT 3AA1800) must be hydrostatically tested every 5 years. On Seneca V models, the lightweight cylinder of composite construction (DOT E8162), must be hydrostatically tested every 3 years, and the service life may not exceed 15 years. The month and year of the last test should be stamped on the cylinder beneath the ICC, DOT identification.

- A. Check the outlets for leakage both in the use and non-use condition and for leakage around an inserted connector. For leak testing information, refer to the appropriate subject in this chapter.
- B. Check the high pressure gauge for accuracy by comparing its indicated pressure with that of a gauge of known accuracy connected to the fill port.
- C. Inspect tank for dents, bulges, corrosion, and major strap chaffing marks. Should any of these problems exist, the tank should be removed and hydrostatically tested.

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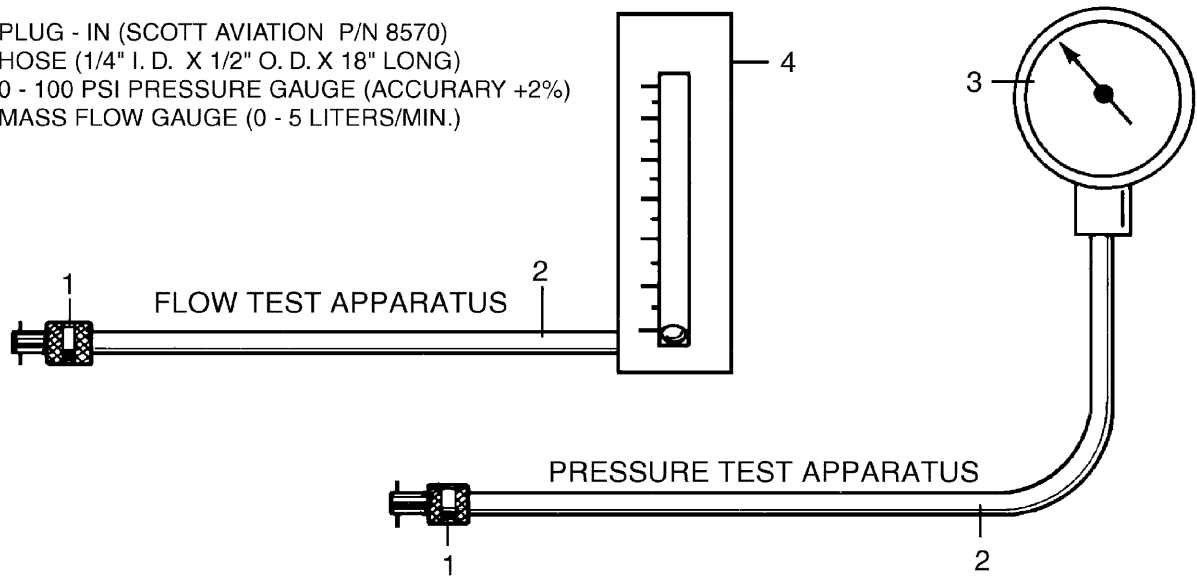
- D. An operational check of the regulator can be accomplished as follows: (Refer to Figure 1.)
- (1) Using an 18 inches (45.72 cm) long hose having a 1/4 in. (0.635cm) I.D. x 1/2 in. (1.27cm) O.D., attach a Scott Aviation 8570-00 plug-in to a sensitive pressure gauge having a range of 0 to 100 psi. Connect the apparatus to the pilot's outlet in the overhead panel.
 - (2) Using a second 18 inches long hose having a 1/4 in. (0.635cm) I.D. x 1/2 in. (1.27cm) O.D., attach a Scott Aviation 8570-00 plug-in to a pneumatic flow apparatus of having a range of 0-5 liters per minute. Connect the flow apparatus to the copilot's outlet.
 - (3) Insert a Scott plug-in in each of the other outlets and pull the oxygen control knob to the on position. The pressure and flow at sea level should be 55 to 80 psi and 3.3 to 5.3 liters per minute respectively.
- E. Check airframe logbook for last maintenance on oxygen system and perform as required per Chart 2.
- F. Test the oxygen for odor. Pure oxygen is odorless and tasteless. Any system having a significant odor present in the gas should be purged and the bottle replaced or removed and purged.
- G. Any fittings, connectors, and tubes which have imperfect threads, pitted or disfigured cones, or other damage should be replaced.
- CAUTION:** OXYGEN TUBES MUST NOT BE CLAMPED TO, OR SUPPORTED BY ELECTRICAL WIRE BUNDLES, HYDRAULIC, PNEUMATIC OR OTHER LINES.
- H. Check plumbing for kinking, cracks, gouges, dents, deep scratches, or other damage. Replace as necessary.

**CHART 2
FIXED OXYGEN SYSTEM COMPONENT LIFE LIMITS**

Component	Inspection	Overhaul
Cylinder	Weekly ¹	Each 3 Years
Regulator	On Condition / Each Use ²	5 Years (Sen IV) 6 Years (Sen V)
Pressure Gauge	On Condition / Each Use ²	Replace on Condition
High Pressure Lines	On Condition / Each Use ²	Replace on Condition
Low Pressure Lines	On Condition / Each Use ²	Replace on Condition
Outlets	On Condition / Each Use ²	Each 5 Years ³
External Recharge Valve	On Condition / Each Use ²	Replace on Condition ⁴
Masks	On Condition / Each Use ²	Each 5 Years
¹ . Visual inspection for dents, bulges, corrosion, or chafing. ² . Visual inspection in the normal course of use. ³ . On condition, replace the rubber components in the assembly or replace assembly. ⁴ . If the screen in front of valve is dirty, replace valve. Valve replacement is recommended every 5 years.		

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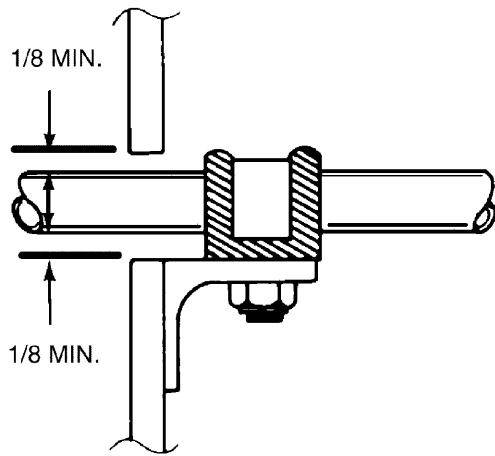
1. PLUG - IN (SCOTT AVIATION P/N 8570)
2. HOSE (1/4" I. D. X 1/2" O. D. X 18" LONG)
3. 0 - 100 PSI PRESSURE GAUGE (ACCURARY +2%)
4. MASS FLOW GAUGE (0 - 5 LITERS/MIN.)



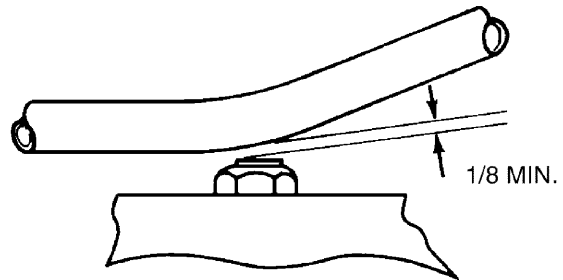
Oxygen System Test Apparatus
Figure 2

- I. Make sure to check the oxygen lines for proper clearance as follows: (Refer to Figure 3.)
 - (1) Two inch minimum between oxygen tubes and all flexible moving parts of the aircraft (flexible control cables, etc.). If enough space cannot be attained, protection from abrasion must be provided.
 - (2) At least 1/2 inch minimum between oxygen tubes and all rigid moving parts of the aircraft such as levers and rigid control rods.
 - (3) Six inch minimum separation between oxygen tubes and hydraulic, fuel and electrical system lines and components.
When the six inch requirement cannot be complied with, one inch is allowed as long as electrical cables and other lines are supported at least every two inches; and, the oxygen tube(s) is protected by rubber neoprene hose fastened in place with cable ties at the location the specific item crosses or is near the oxygen tube(s). If an item is near the oxygen tube for a certain distance the oxygen tube for that distance must be covered.
 - (4) A minimum of 1/8 inch between tubing and structure adjoining the supporting clamp as shown in Figure 3, Sketch A.
 - (5) Where a tube passes through a grommet, the tube must not bear on the grommet in any way that might cause cutting of the grommet in service as shown in Figure 3, Sketch D.
 - (6) While in service, items may receive vibrations causing them to come in contact with other parts of the aircraft. With this in mind, low pressure tubing that is supported well enough to prevent relative motion must have at least a minimum clearance of 1/8 inch from a projection (bolt, nut, etc). Low pressure tubing that cannot be supported well enough to prevent motion must have a minimum clearance of 1/8 inch allowed after the maximum travel of the tube. High pressure lines are affected similarly but require 1/2 inch minimum clearances. (See Figure 3, Sketch B.)
- J. Perform any other required maintenance as directed in AC43.13-1, latest revision, Chapter 8.
- K. Clean components as necessary per Oxygen System Components, Cleaning and Purging, below.

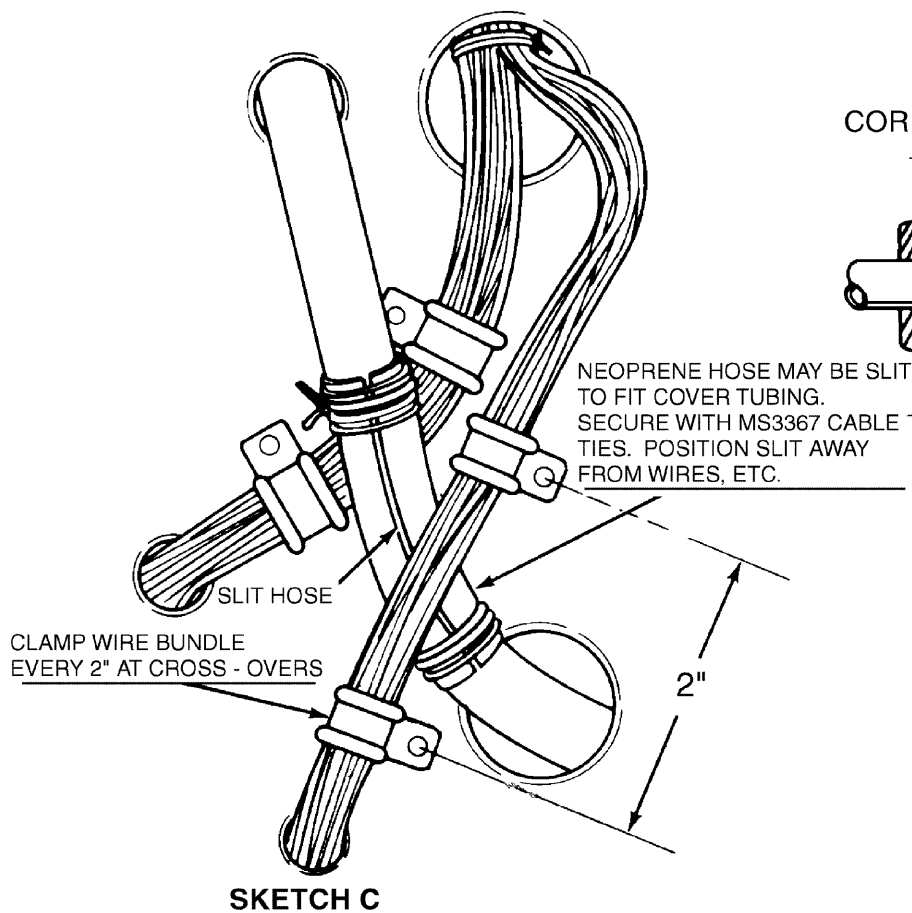
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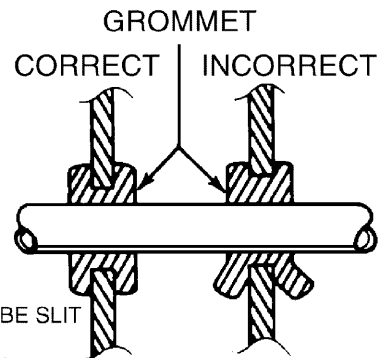
SKETCH A



SKETCH B



SKETCH C



SKETCH D

Oxygen Tubing Installation
Figure 3

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5. Swageloc Fitting Installation (See Figure 4.)

NOTE: The high pressure line fitting at the regulator should be tightened until it bottoms. Make sure to use teflon tape on all male pipe threads.

A. For swageloc fittings not preswaged or for in-aircraft installation, proceed as follows:

- (1) Turn the fitting nut onto the fitting finger tight and insert the tube until it bottoms firmly on the shoulder in the fitting.
- (2) Tighten the nut with a wrench until the tube will not turn by hand.
- (3) Mark the nut at the six o'clock position.
- (4) Hold the fitting body steady with a backup wrench and tighten as follows:
 - (a) On tubing with a diameter bigger than 3/16 inch, tighten 1 1/4 turns (to the nine o'clock position).
 - (b) On tubing of 1/16, 1/8, and 3/16 inch diameter, tighten only 3/4 turn.
- (5) If nut and tube must be disconnected from the fitting, reconnect by seating the tube on the shoulder of the fitting and tightening the nut finger tight. Follow up by tightening the nut with a wrench, one quarter turn (if absolutely necessary the original 1 1/4 or 3/4 tight position) and then snug with wrench.

B. Preswaged swageloc fittings are fabricated and installed as follows:

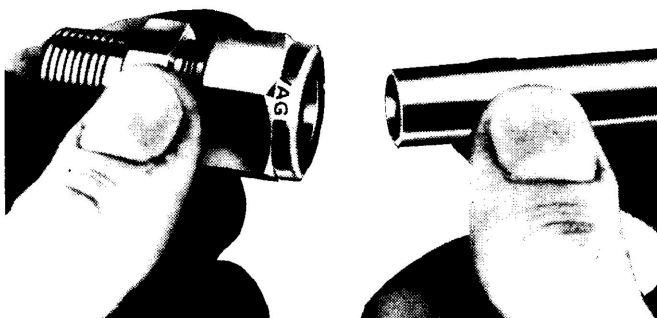
- (1) Assembly the nut and ferrules finger tight on the preswaging tool and insert the tube until it firmly bottoms on the shoulder in the tool. The preswaging tool can be attained from Crawford Fitting Company, refer to List of Consumable Materials in Chapter 91.
- (2) Tighten the nut on the fitting just enough that the tube within the fitting will not turn by hand.
- (3) With a wrench, tighten the nut as follows:
 - (a) On tubing with diameters over 3/16 inch, tighten 1 1/4 turns.
 - (b) On tubing with 1/16, 1/8, or 3/16 inch diameter, tighten 3/4 of a turn.
- (4) Unscrew the nut to release the ferrule-tube assembly from the tool.
- (5) The assembly is installed on the fitting as follows:
 - (a) Slide tube in fitting until it bottoms, turn nut to finger tight position and tighten one quarter turn with wrench.
 - (b) Snug slightly with wrench.

6. Teflon Tape Thread Sealant

All male pipe (tapered) threads of the oxygen system should be sealed with 3M No. 48 teflon tape. Teflon tape should not be used on straight threads. Do not use any other lubricants in place of the teflon or on any other threads.

- A. Wrap tape on the threads, starting with those farthest from the opening, in the direction of the thread spiral. Circle the threads, making sure that each side of the tape has a slight overlap.
- B. Wrap the tape such that it does not extend beyond the last thread on the fitting at the opening. The tape should then be pulled till it separates. Do not cut tape, it will not stick properly.

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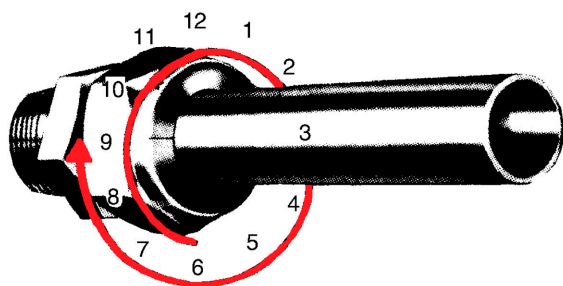
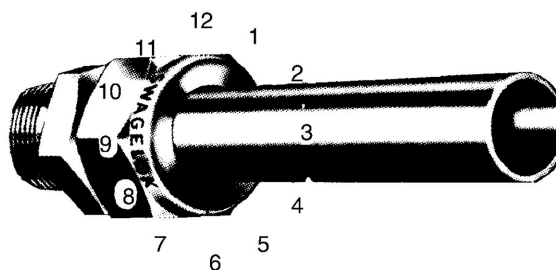


STEP 1

TURN THE FITTING NUT ONTO THE FITTING FINGER TIGHT AND INSERT THE TUBE UNTILL IT BOTTOMS FIRMLY ON THE SHOULDER IN THE FITTING

STEP 2

MARK THE NUT AT THE SIX O' CLOCK POSITION



STEP 3

HOLD THE FITTING WITH A WRENCH AND TIGHTEN THE FITTING NUT AS FOLLOWS:

- A. TUBING WITH A DIAMETER GREATER THAN 3/16 INCH SHALL BE TIGHTENED 1 - 1/4 TURNS (THE NINE O' CLOCK POSITION)
- B. TUBING WITH A DIAMETER OF 1/16, 1/8, OR 3/16 INCH SHALL BE TIGHTENED ONLY 3/4 TURN.

Swagelok Fitting Installation
Figure 4

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7. Leak Test

Solutions recommended for leak testing are Leak-Tec Formula #16-OX and is available from Scott Aviation. Refer to the List of Consumable Materials for consumer information.

- A. Remove the royalite covers in the baggage compartment and, with oxygen system turned off, disconnect the low pressure supply line and connect it to a regulated cylinder charged with dry nitrogen.

NOTE: Whenever a leak check is performed, all fitting connections as well as other questionable areas, should be inspected.

- B. Apply the leak detector solution to the test surface and watch for indication of leakage.
- C. Large leaks will produce bubbles immediately, but small leaks will form a white foam in 5 to 60 seconds.
- D. With outlets vacated of masks, connect a test pressure gauge to the copilot's outlet as described in the subject paragraph on Inspection and Maintenance, see Figure 1.
- E. Adjust the regulator on the dry nitrogen cylinder for 100 psi and check for leakage at the outlets.
- F. Correct any leaks and wipe off excess leak detector solution.
- G. Close the valve on the nitrogen gas tank and insert a Scott plug-in to relieve system pressure.
- H. Disconnect test gauge, plug-in, and nitrogen tank.
- I. If the oxygen cylinder is not to be hooked up or installed immediately, cap and cover the exposed fittings with new clean plastic bags. Temporarily support lines as needed to prevent damage. Make sure caps and coverings are as clean as possible.

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8. Oxygen System Components

Keeping in mind the effect of compressed oxygen on materials, oxygen system components must be handled carefully. Ports on regulators, indicators, and other opened components must also be kept capped or plugged to prevent ingestion of foreign material. Adjustments or modifications should only be initiated under the auspices of the FAA, Piper, or Scott Aviation.

NOTE: On Seneca IV models, replacement time for the recharge valve is every 5 years. If the cylinder is being removed for the 5 year test, it is recommended the valve be removed and/or replaced at the same time.

On Seneca V models, replacement time for the recharge valve is every 5 years, and the regulator requires overhaul every 6 years. The lightweight composite cylinder must be removed every 3 years for hydrostatic test.

A. Cleaning and Purging

CAUTION: CARE MUST BE EXERCISED TO PREVENT CONTAMINATION OF COMPONENTS BY OIL, GREASE, WATER, OR FOREIGN MATTER. COMPRESSED AIR USED IN CLEANING AND FLUSHING TUBES MUST BE CLEAN, DRY, FILTERED (OIL FREE) AIR ONLY.

Three methods are recommended for cleaning oxygen system components:

- (1) Method I.
 - (a) Vapor degrease part(s) with trichlorethylene.
 - (b) Blow part(s) dry with a stream of compressed air or dry nitrogen. Refer to previous caution.
- (2) Method II.
 - (a) For tubing, flush with naptha per specification TT-N-95.
 - (b) Blow clean and dry off all solvent with clean, dry, filtered air. Refer to previous caution.
 - (c) Flush with isopropyl alcohol.
 - (d) Rinse thoroughly with fresh water.
 - (e) Dry with air as described in previous caution or by heating at a temperature of 250° to 300°F for one-half hour.

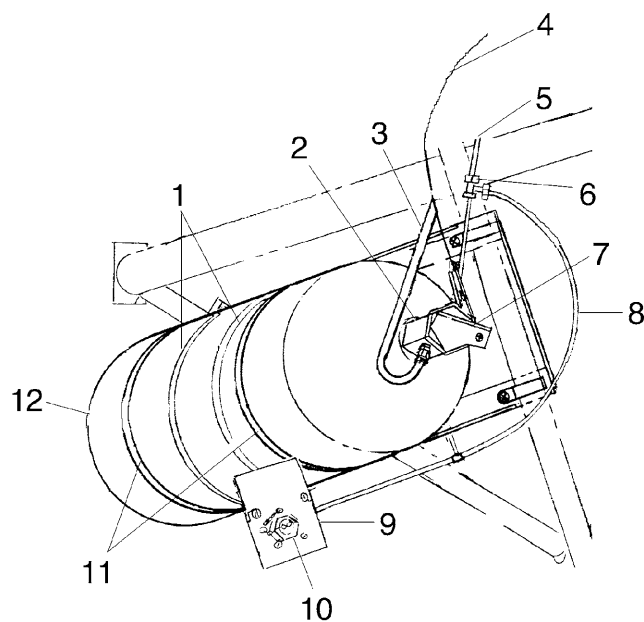
NOTE: Solvents can be reused provided they do not become badly contaminated with oil. This condition can be determined by thoroughly evaporating 100 millimeters of the liquid in a glass dish of a determined weight. Evaporation may be accomplished by heating the dish at 200°F (93°C) for one-half hour. If after evaporation and cool down, the residue exceeds 100 milligrams in weight, the solvent cannot be used for this purpose.

- (3) Method III.
 - (a) Flush with hot inhibited alkaline cleaner until free from oil and grease.
 - (b) Rinse thoroughly with fresh water.
 - (c) Dry thoroughly with a stream of clean air as described in the previous caution or by heating 250°F to 300°F (121°C to 149°C) for one-half hour minimum.

CAUTION: DO NOT USE ADHESIVE TAPE FOR ATTACHING OR SECURING PROTECTIVE COVERINGS ON OXYGEN COMPONENTS. USE WAXED LACING TWINE OR TIE RAPS.

- (4) After cleaning, all tubing must be protected by caps, plugs and/or plastic bags.
- (5) Before installation, make sure fitting, tube, and fixture threads are in good condition and that the cones do not exhibit pitting or disfigurement.

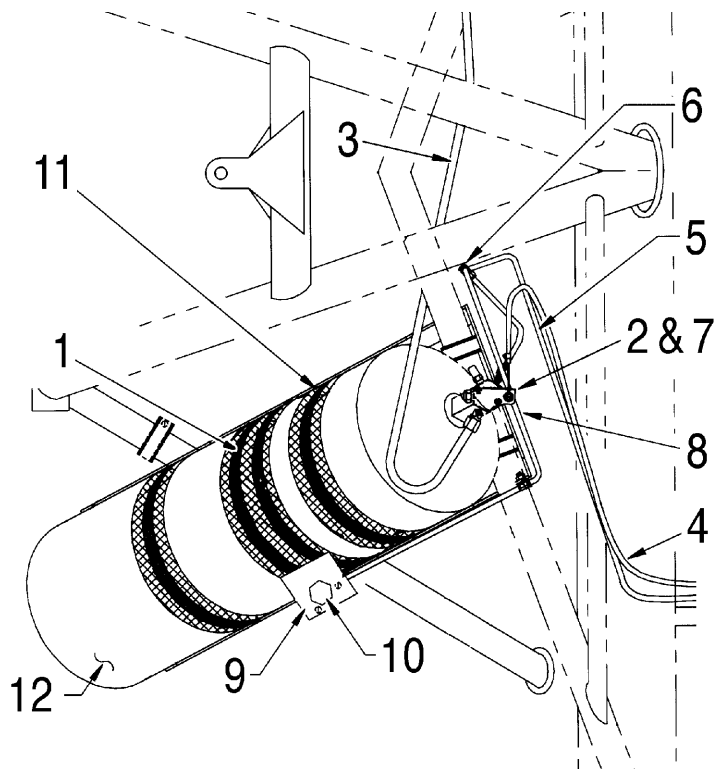
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1. FILLER VALVE CLAMPS
 2. REGULATOR VALVE
 3. DISTRIBUTION LINE (LP)
 4. ON - OFF VALVE CABLE
 5. GAUGE LINE (HP)
 6. HIGH PRESSURE LINE "T"
 7. ON - OFF LEVER
 8. FILLER LINE (HP)
 9. FILLER VALVE MOUNTING BRACKET
 10. FILLER VALVE
 11. CYLINDER CLAMPS
 12. OXYGEN CYLINDER
- HP = HIGH PRESSURE
LP = LOW PRESSURE

Effectivity
Seneca IV

Oxygen Cylinder and Regulator Valve
Figure 5



1. FILLER VALVE CLAMPS
 2. REGULATOR VALVE
 3. DISTRIBUTION LINE (LP)
 4. ON - OFF VALVE CABLE
 5. GAUGE LINE (HP)
 6. HIGH PRESSURE LINE "T"
 7. ON - OFF LEVER
 8. FILLER LINE (HP)
 9. FILLER VALVE
MOUNTING BRACKET
 10. FILLER VALVE
 11. CYLINDER CLAMPS
 12. OXYGEN CYLINDER
- HP = HIGH PRESSURE
LP = LOW PRESSURE

Effectivity
Seneca V

Oxygen Cylinder and Regulator Valve
Figure 6 (Sheet 1 of 2)

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B. Oxygen Cylinder (Refer to Figures 5 and 6.)

The fixed oxygen system cylinder is installed in the left side of the nose section aft of the closeout panel at station 31.04.

(1) Removal

- (a) From inside of forward baggage compartment:

- 1 Remove hydraulic reservoir cover located in rear top center of compartment by removing four attachment screws.
- 2 Remove left rear closeout panel by removing 11 remaining attachment screws.

- (b) Disconnect control cable from cylinder by removing screw from cable support bracket and cotter pin attaching cable to cylinder.

CAUTION: OPENING CONTROL VALVE DURING REMOVAL OF OXYGEN LOW PRESSURE LINE FROM CYLINDER WILL RESULT IN AN UNCHECKED FLOW OF OXYGEN INTO BAGGAGE COMPARTMENT UNTIL VALVE CAN BE CLOSED.

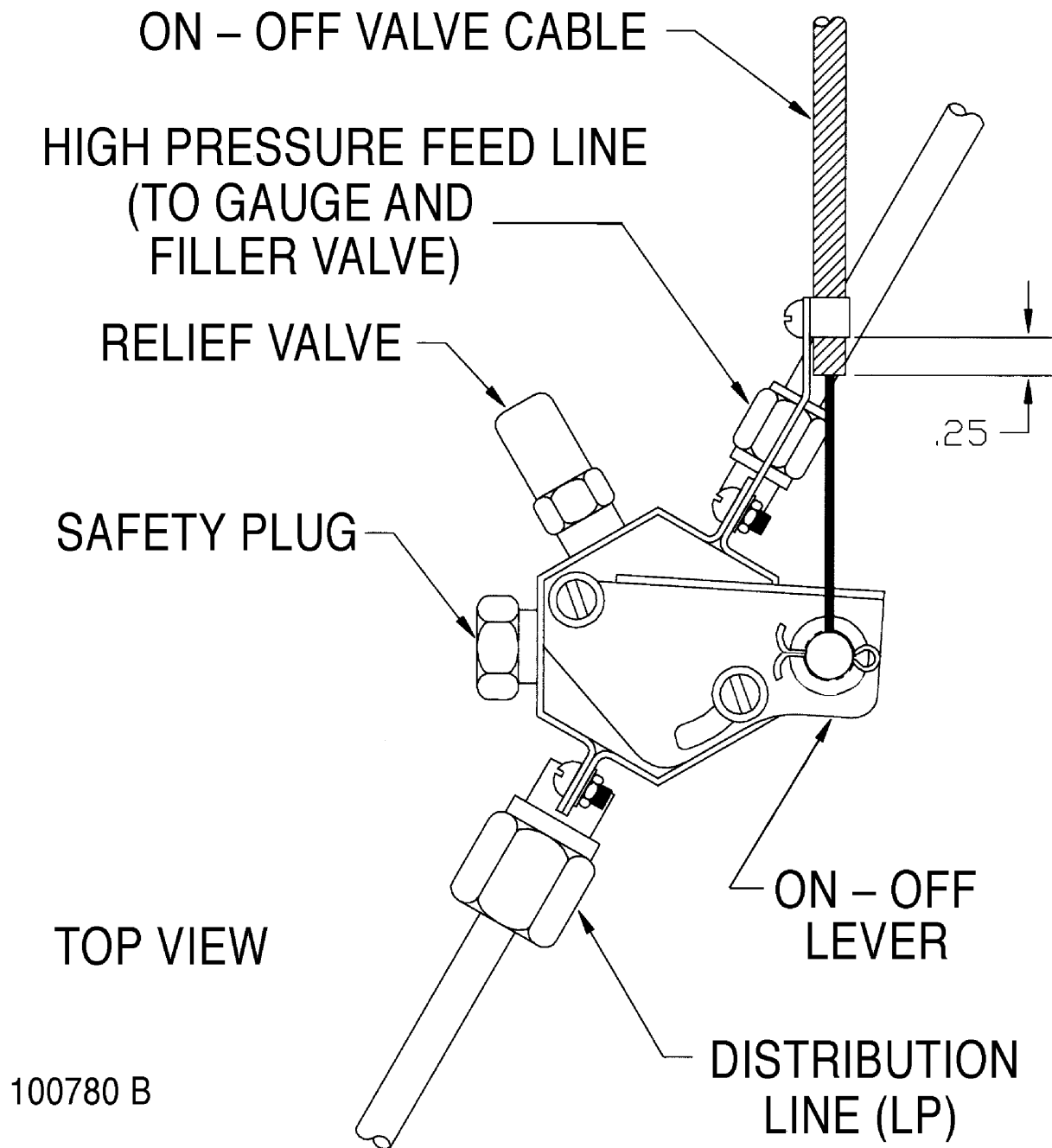
- (c) Safety valve on cylinder in the OFF position.
(d) Disconnect low pressure line from cylinder. Cap line immediately after removal.

NOTE: Continuous pressure is applied to high pressure line until it is disconnected from cylinder. A check valve will close when high pressure line is disconnected from cylinder. The closing of this valve is frequently accompanied by a loud popping sound.

- (e) Disconnect high pressure fitting at the cylinder valve. Cap line immediately after removal.
(f) Remove two filler valve clamps and two cylinder hold down clamps.
(g) Remove cylinder from airplane.

(2) Installation

- (a) Position cylinder in airplane as shown in Figure 6. Check to be sure that regulator and valve are free to move and do not contact surrounding area.
(b) Install two cylinder hold down clamps.
(c) Install two filler valve hold down clamps.
(d) Connect high pressure line to cylinder. Insert tubing into fitting until ferrule seats in fitting. Tighten the nut by hand and then one quarter turn with a wrench. If fitting is relatively new the nut might be turned 3/4 of a turn. Follow up by snugging the nut slightly with a wrench.
(e) Connect low pressure line to cylinder. Insert tubing into fitting until ferrule seats in fitting. Tighten the nut by hand and then one quarter turn with a wrench. If fitting is relatively new the nut might be turned 3/4 of a turn. Follow up by snugging the nut slightly with a wrench.
(f) Unsafety valve on cylinder. Check that valve remains in OFF position.
(g) Connect ON-OFF cable to cylinder valve. Secure with a new cotter pin.
(h) Position and attach cable support bracket.
(i) Check pressure and refill bottle as necessary.
(j) Inspect for leaks, especially at fittings that have been separated.
(k) Install forward baggage compartment left rear closeout panel. Secure by installing 13 of the 15 attachment screws.
(l) Insure of cylinder and cylinder valve ON-OFF control are clear of headliner and floor panel.
(m) Install hydraulic reservoir cover and secure with four screws. Note that two of these screws also secure closeout panel.
(n) Close and secure forward baggage door.



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C. Pressure Gauge

The oxygen pressure gauge and ON-OFF control knob are installed in the bottom center of the pilot's instrument panel below, and slightly right of, the control wheel. Access to either one is obtained from beneath the instrument panel.

The pressure gauge is tied into the same high pressure line as the recharge valve, through a tee fitting near the tank regulator-control valve. Continuous pressure is applied to high pressure line until it is disconnected from cylinder. A check valve will close when high pressure line is disconnected from cylinder. The closing of this valve is frequently accompanied by a loud popping sound.

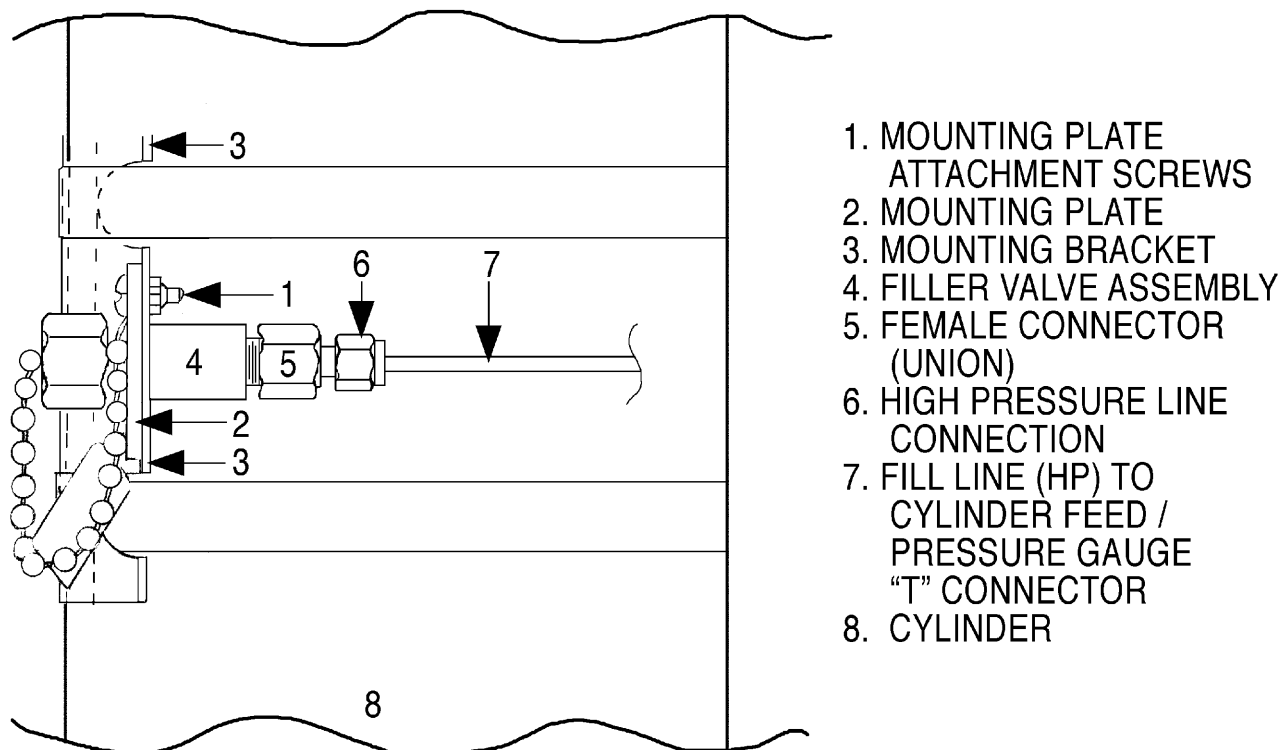
(1) Removal

- (a) From inside of forward baggage compartment:
 - 1 Remove hydraulic reservoir cover located in rear top center of compartment by removing four attachment screws.
 - 2 Remove left rear closeout panel by removing the 13 remaining attachment screws.
- (b) Disconnect high pressure fitting at the cylinder valve. Cap line immediately after removal.
- (c) Disconnect high pressure line from gauge and cap immediately.
- (d) Remove two nuts from brass studs securing gauge to bracket.
- (e) Remove gauge through pilot side of instrument panel.

(2) Installation

- (a) Insert pressure gauge into instrument panel.
- (b) Secure to mounting bracket by installing nuts on the two brass studs extending from gauge. Finger tighten, then snug with wrench. Be careful not to over torque; studs break off easily.
- (c) Connect high pressure line to gauge.
- (d) Connect high pressure fitting to cylinder valve.
- (e) Inspect fittings that have been separated for leaks.
- (f) Install forward baggage compartment left rear closeout panel. Secure by installing 13 of the 15 attachment screws.
- (g) Insure is clear of cylinder and cylinder valve ON-OFF control are clear headliner and floor panel.
- (h) Install hydraulic reservoir cover and secure with four screws. Note that two of these screws also secure closeout panel.
- (i) Close and secure forward baggage door.

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Oxygen System Fill Valve Installation
Figure 7

D. Fill Valve (See Figure 7.)

(1) Removal

(a) From inside of of forward baggage compartment:

- 1 Remove hydraulic reservoir cover located in rear top center of compartment by removing four attachment screws.
- 2 Remove left rear closeout panel by removing 11 remaining attachment screws.

NOTE: Continuous pressure is applied to high pressure line until it is disconnected from cylinder. A check valve will close when high pressure line is disconnected from cylinder. The closing of this valve is frequently accompanied by a loud popping sound.

- (b) Disconnect the high pressure fitting at the tank valve. Cap the line immediately after removal.
- (c) Disconnect high pressure line fitting from fill valve. Cap line immediately after removal.
- (d) Remove three screws from refill valve mounting plate.
- (e) Remove valve from airplane.

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(2) Installation

NOTE: Apply teflon tape to all tapered male threads as cautioned on page 1 of this section.

- (a) Insert valve assembly into mounting bracket.
- (b) Align screw holes in valve mounting plate with those in mounting bracket.
- (c) Install the three mounting screws. Attach cap chain, with information plate attached, to bottom screw.

CAUTION: CONNECT HIGH PRESSURE LINE TO VALVE BEFORE CONNECTING TO CYLINDER.

- (d) Connect high pressure line to valve.
- (e) Connect high pressure to cylinder. Torque fitting 30 to 50 inch-pounds.
- (f) Check all connections that had been separated for leaks.
- (g) Install close out panels.

E. Outlets

(1) Removal

- (a) Check that the oxygen system is completely turned off. Insert an oxygen mask to release pressure and ensure the system is off.
- (b) With a suitable spanner wrench, remove the outer half of the outlet.
- (c) If removing one or more of the four aft cabin outlets, also remove two sheet metal screws from bezel.
- (d) Remove or drop overhead panel sufficiently to gain access to low pressure line connections.
- (e) If removing right side outlet(s), disconnect two unions on low pressure oxygen supply feed line, and one union connecting outlet to left side feed line.
- (f) If removing left side outlet(s), disconnect one union connected to oxygen supply line from right side outlet.
- (g) Remove outlet from airplane.

(2) Installation

- (a) Position outlet in airplane.
- (b) If installing left side outlet, connect union to oxygen supply line from right side outlet
- (c) If installing right side outlet(s), connect two unions on low pressure oxygen supply feed line, and one union on outlet to left side feed line.
- (d) Inspect fittings that have been separated for leaks.
- (e) Replace overhead paneling and secure in place.
- (f) If installing one or more of the four aft cabin outlets, install two bezel sheet metal screws. Check that word OXYGEN on bezel ring faces aft if supplying forward facing seats; forward if supplying aft facing seats.
- (g) With a suitable spanner wrench, install the outer half of the outlet. If installing either one of the forward outlets, Check that word OXYGEN on bezel ring faces aft.

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F. Oxygen On/Off Control

The oxygen ON-OFF control knob is installed in the bottom center of the pilot's instrument panel below, and slightly right of, the control wheel. Access is obtained from beneath the instrument panel.

(1) Removal

To remove ON-OFF control knob and cable:

(a) From inside of forward baggage compartment:

- 1 Remove hydraulic reservoir cover located in rear top center of compartment by removing four attachment screws.
- 2 Remove left rear closeout panel by removing the 13 remaining attachment screws.
- (b)** Disconnect cable from regulator-control mechanism on cylinder by removing cotter pin and washer.
- (c)** Release cable from all clamps and cut the tie wrap securing cable to high pressure oxygen line. Note position of tie wraps for installation.
- (d)** Remove retaining nut from rear of control knob.
- (e)** Cut loop off end of cable core. Pull cable from airplane through instrument panel. When cable has cleared grommet in left side of station 44.5 bulkhead, slide retainer nut off cable.

(2) Installation

To install new control knob and cable:

- (a)** On **Seneca IV** models, trim cable shield to 33.0 inches (83.82 cm) long. On **Seneca V** models, trim cable so that 13.7 inches remains forward of bulkhead when cable is rigged to instrument panel.
Trim core to allow sufficient material to make a two turn loop, two inches (5.08 cm) from the end of the shield.
- (b)** Insert cable through instrument panel. Slide retainer nut onto cable and secure control knob to instrument panel.
- (c)** Route cable through grommet in station 44.5 bulkhead and along high pressure line to cylinder.
- (d)** Secure cable to high pressure line with same number of tie wraps, CR-2M ring connectors and clamps installed at same location as those cut or loosened to remove cable.
- (e)** Bend core wire end for 1 1/2 to 2 turns with 0.188 (0.478 cm) inside diameter.
- (f)** Place loop over pin on regulator lever and secure with washer and cotter pin provided by Scott.
- (g)** Check operation before installing closeout panel.
- (h)** Install closeout panel and hydraulic reservoir cover.
- (i)** Close and secure nose baggage compartment door.

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7. Refilling

CAUTION: BEFORE SERVICING THE OXYGEN SYSTEM, MAKE SURE THE AIRCRAFT IS SECURELY GROUNDED ELECTRICALLY.

CAUTION: DO NOT OPERATE ELECTRICAL EQUIPMENT WHILE SERVICING OXYGEN SYSTEM.

CAUTION: DO NOT ATTEMPT TO TIGHTEN ANY CONNECTIONS WHILE THE SYSTEM IS CHARGED.

Refilling of oxygen systems should be done by qualified personnel. For comparison of filling pressures to ambient temperatures refer to Chart 3. The following are parameters to be followed for filling.

- A. Only aviators breathing oxygen (MIL-0-27210) and appropriate filling equipment should be used to fill the system.
- B. If a cylinder has less than 5 psi pressure or has insufficient pressure to produce an audible hissing sound when the valve is cracked, it should be removed and/or purged, and if the condition has existed for a significant length of time, hydrostatically test cylinder.
- C. Make sure both the charge valve and recharge cart fittings are clean and free of contamination.

WARNING: BE CERTAIN THERE IS NO OIL OR OTHER PETROLEUM BASED MATERIAL ON THE FITTINGS OR NEAR THE IMMEDIATE VICINITY.

- D. Attach service cart hose to recharge port. Fill the system at a rate not exceeding 200 psig per minute proceeding as follows:
 - (1) To obtain the correct filling pressure for the oxygen system at various ambient temperatures, a table is included for your convenience. The pressures given are not exact, but sufficiently accurate for practical purposes of working pressures between 1800 and 2400 psig cylinders. The cylinder should be allowed to cool to a stabilized temperature after filling before checking against the values in Chart 3.
 - (2) When using a recharge unit consisting of one supply cylinder, slowly open the valve of the supply unit and allow the oxygen to transfer.

**CHART 3
FILLING PRESSURES FOR CERTAIN AMBIENT TEMPERATURES**

Ambient Temperature °F/°C	Filling Pressure	Ambient Temperature °F/°C	Filling Pressure
0/-17.78	1650 (PSI)	70/21	1975 (PSI)
10/-12.22	1700	80/27	2000
20/-6.67	1725	90/32	2050
30/-1.11	1775	100/38	2100
40/4.44	1825	110/43	2150
50/10	1875	120/49	2200
60/15.56	1925	130/54	2250

NOTE: Filling pressures are for 1850 PSI at 70°F (21.11°C). Table assumes 25°F (11.8°C) rise due to heat of compressor with max. fill rate.

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- (3) When using a recharge unit consisting of two or more supply cylinders (cascade storage system), it is recommended that the following procedure be used:
 - (a) Before opening any valves, check the pressure remaining in the airplane's oxygen cylinder. If it is still partly charged, note the pressure indicated on the cylinder gauge. Then open and close each valve on the cascade storage system and determine which cylinder has the lowest pressure. When found, if this cylinder has a pressure lower than the oxygen cylinder in the aircraft, do not attempt using it for filling; use the storage cylinder that has a pressure higher than the aircraft's cylinder but lower than the others.
 - (b) Open the valve on only the one storage cylinder with the lowest pressure. When the pressure indicated on the aircraft's oxygen gauge and charging gauge has become equal, close the valve of the storage cylinder, then go to the storage cylinder with the next higher pressure and repeat the procedure.
 - (c) If after using the last storage cylinder the aircraft's oxygen system is still not fully charged, a full storage cylinder should be put in place of a cylinder with the lowest pressure and used in the same manner.
 - (d) A good amount of oxygen will remain in the large cylinders used in the cascade system after filling only one of the cylinders. This remaining oxygen will be at a pressure something less than the 1850 psi. This is not sufficient pressure to completely refill another aircraft cylinder, although it will refill several small cylinders.
 - (e) It is not economical, even on a three or four cylinder cascade system, to begin recharging with oxygen at less than 300 psi pressure in the 300 cubic foot bank of cylinders. So use 300 cubic foot cylinders down to approximately 300 psi; then return for refilling. In two cylinder systems use to approximately 100 psi; then return for filling.
 - (4) When the pressure gauge on the recharge unit or in the aircraft reaches 1800 to 1850 psi, close the pressure regulator valve on the recharge unit. Disconnect the filler hose from the filler valve; replace the protective cap on the filler valve and close the access cover. Check the cylinder pressure according to Chart 3 after the cylinder temperature stabilizes.
- E. After detaching the service cart, cap hose and fittings to prevent contamination.
- F. Perform a leak check of the high pressure lines and clean off solution afterwards. If solution is not properly cleaned off, corrosion may result.

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CHAPTER

37

VACUUM

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GENERAL

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

1. Description and Operation (See Figure 1.)

The vacuum system uses two regulators, gyro inlet filters, and a manifold check valve. The regulators are mounted on the left side of their respective firewalls and are accessible after removing the nacelle hatch cover. The gyro filters and manifold are located in front of the instrument panel mounted to the Fuselage Station 49.50 bulkhead. When the optional copilot gyros are installed two gyro filters are utilized. The gyro filters, mounted to the 49.50 bulkhead, must be replaced regularly. The filters clean inlet air to the gyros. Each regulator, with an inlet filter, is connected in line between its pump and the manifold to control the vacuum pressure applied to the system, by permitting a metered amount of air to enter the system at that point.

The pneumatic deice installation is optional. Refer to 30-10-00 for more information.

A vacuum gauge installed in the instrument panel reads the amount of negative pressure being provided to the gyroscopic flight instruments in inches of mercury. Lights on the annunciator panel will illuminate to show if either pump fails.

2. Troubleshooting

See Chart 1.

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**CHART 1 (Sheet 1 of 2)
TROUBLESHOOTING VACUUM SYSTEM**

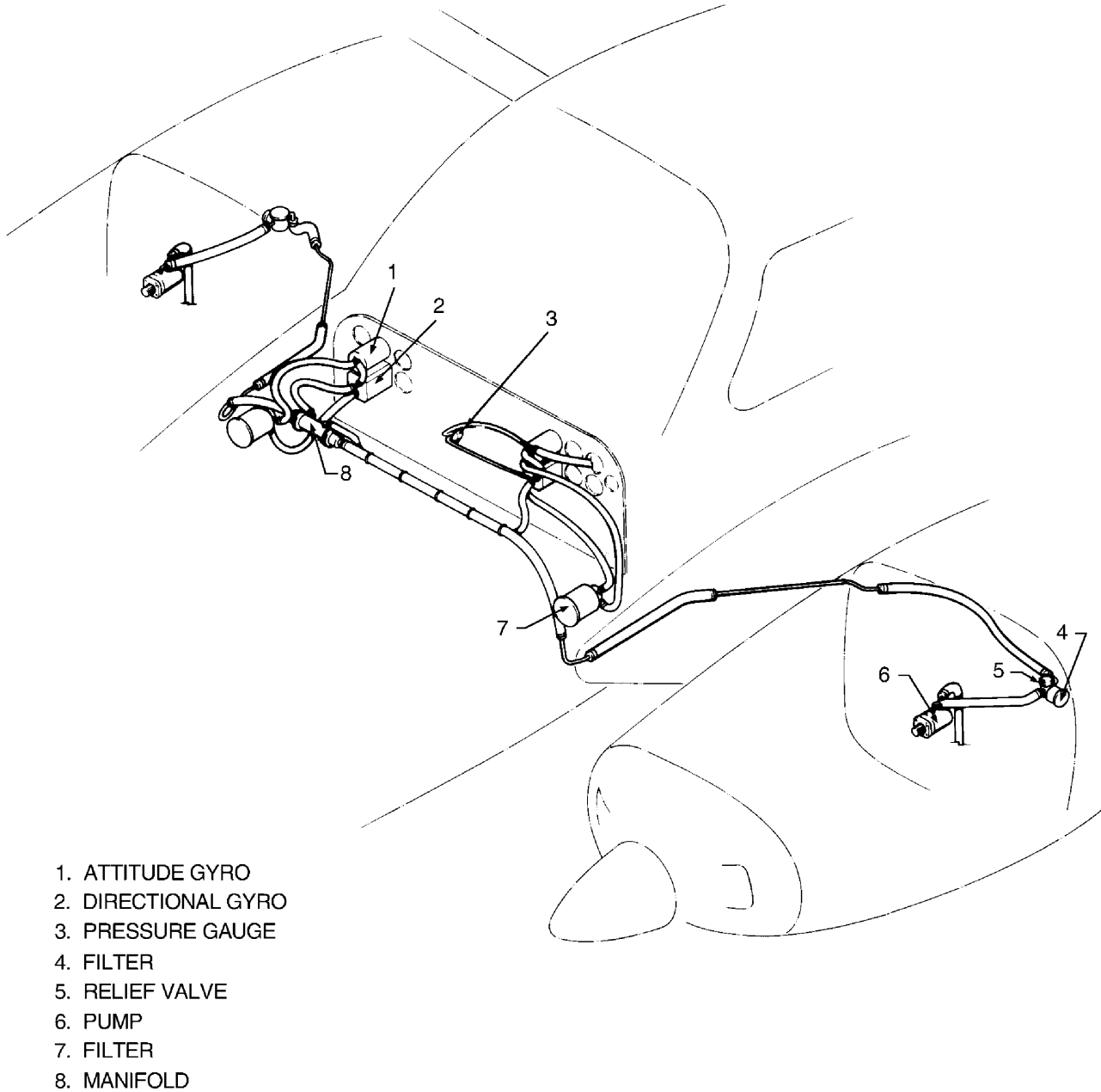
Trouble	Cause	Remedy
No vacuum gauge indication at instrument.	Gyro filter(s) clogged or dirty.	Clean or replace filter(s).
	Line(s) from gyro to gyro filter(s) restricted.	Check lines.
	Faulty gauge.	Replace gauge.
	Faulty transducer (Seneca V)	Replace transducer.
No vacuum gauge indication at instrument and/or source.	Malfunctioning pump(s).	Replace pump(s).
Low vacuum system pressure.	Gyro filter(s) dirty.	Clean or replace filter(s).
	Faulty air pump(s).	Replace pump(s).
	Vacuum regulator valve(s) incorrectly adjusted.	Adjust regulator valve(s) in accordance with adjustment in this section.
	Line from gyros to gyro filter(s) restricted.	Repair line.
	Lines between pumps and gyros leaking	Check all lines and fittings.
	Faulty transducer (Seneca V)	Replace transducer.
Normal vacuum indication but sluggish operation of instrument.	Faulty instrument.	Replace instrument.
	Faulty gauge.	Replace gauge.
	Faulty transducer (Seneca V)	Replace transducer
High system vacuum.	Vacuum regulator(s) incorrectly adjusted.	Adjust regulator(s).
	Vacuum regulator(s) sticking or dirty regulator filter(s).	Clean and check operation of regulator(s) and filter(s).
Regulator(s) cannot be adjusted to produce correct pressure. (Too low)	Leaking lines, fittings, instruments.	Check hardware to instruments.
	Air pump malfunctioning.	Replace pump.
Regulator(s) cannot be adjusted to produce correct pressure. (Too high)	Dirty or clogged regulator filter(s).	Clean or replace regulator filter(s).

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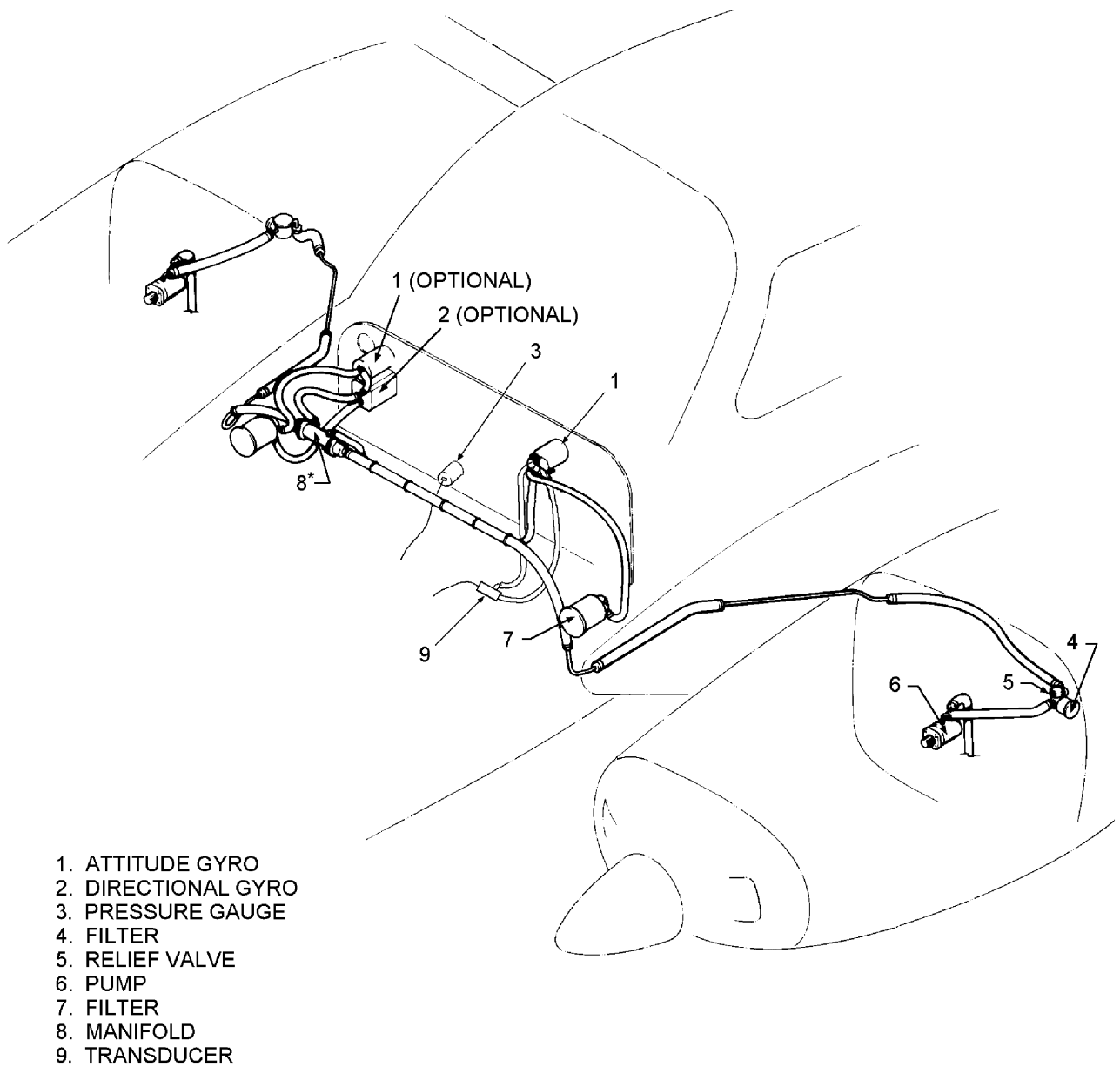
**CHART 1 (Sheet 2 of 2)
TROUBLESHOOTING VACUUM SYSTEM**

Trouble	Cause	Remedy
Vacuum correct on ground but will not maintain pressure at altitude.	Air pump malfunctioning.	Replace pump.
Vacuum correct but pilot reports pressure erratic or shows complete loss in flight.	Regulator sticky.	Clean regulator.
	Oil in pump due to leaky engine seal, or cleaning fluid blown into pump while cleaning engine.	Replace pump.
	Faulty transducer (Seneca V)	Replace transducer.
Pressure can only be maintained at full throttle on ground.	Leak in system.	Repair or replace lines.
	Worn pump.	Replace pump.
	Stuck regulator(s).	Clean or replace regulator.
Vacuum system inoperative during single engine operation.	Leaking manifold check valve.	Check operation of valve and replace if necessary.

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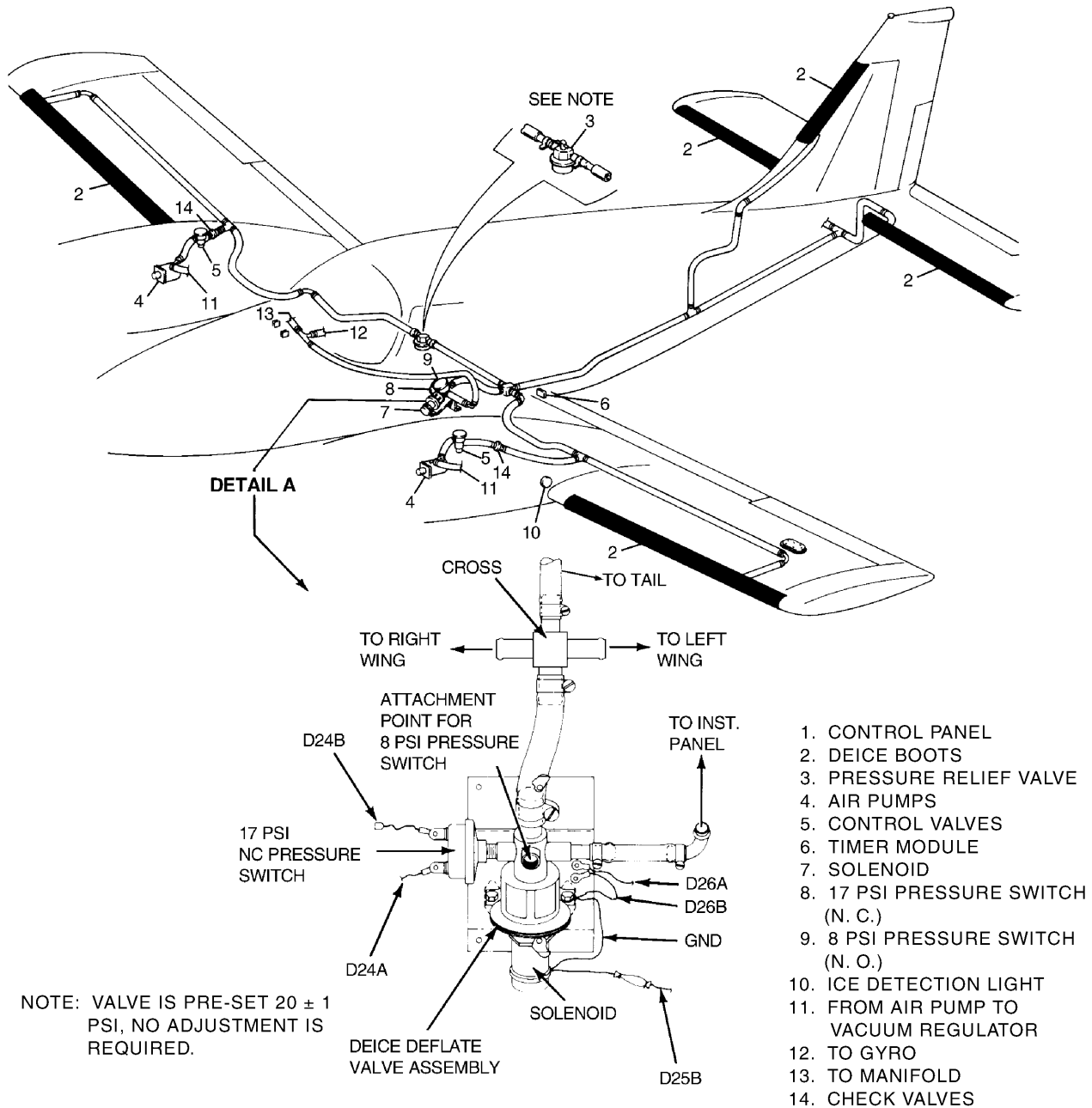
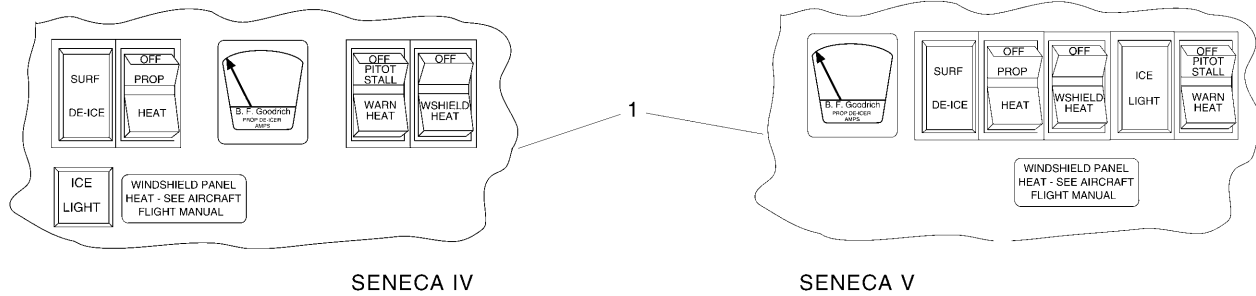


* 1998 AND LATER MAINIFOLD LOCATION SHOWN
1997 AND EARLIER SAME AS SENECA IV

Vacuum System Installation
Figure 1 (Sheet 2 of 4)

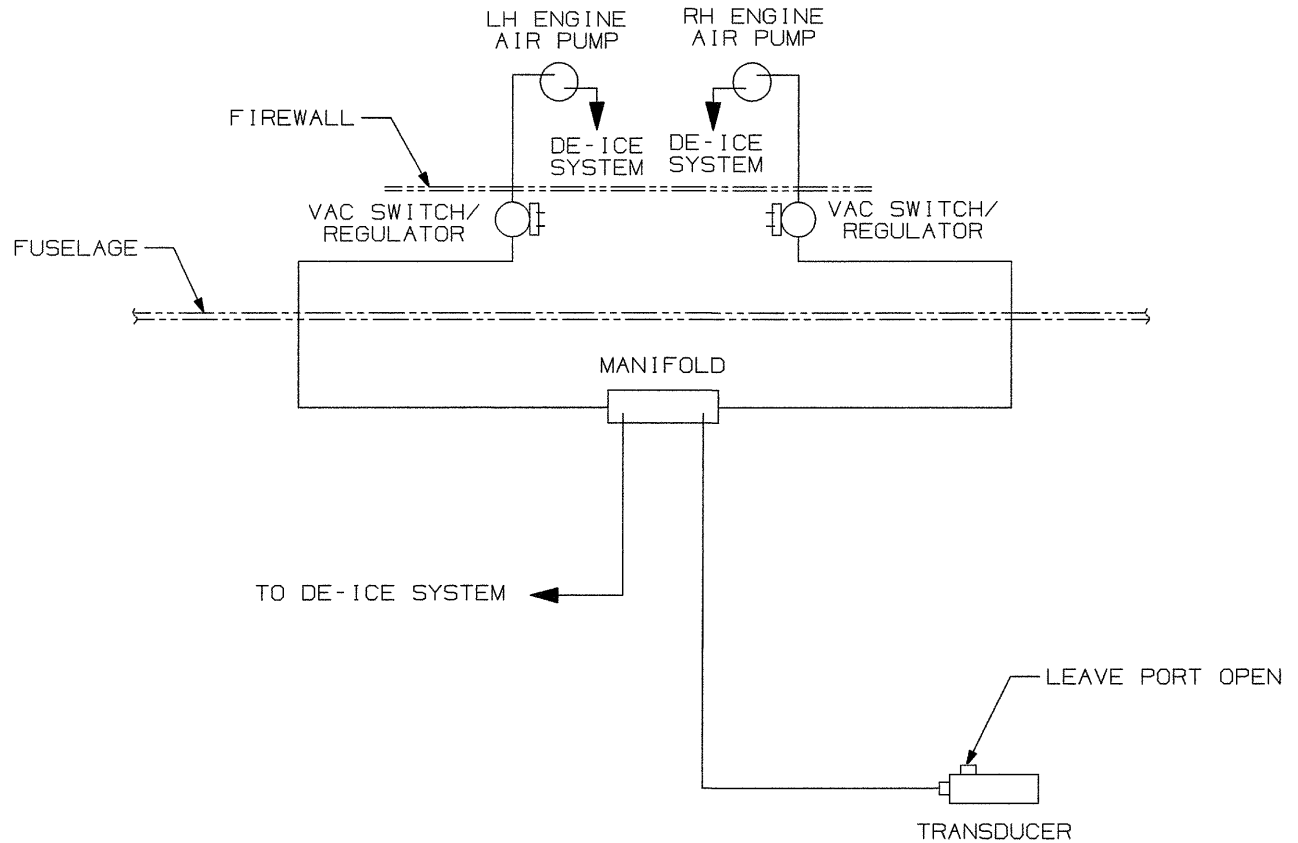
[Effectivity](#)
[Seneca V](#)

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[Effectivity](#)
Seneca V
with Avidyne EFIS

Vacuum System
Figure 1 (Sheet 4 of 4)

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DISTRIBUTION

The following information is intended to aid in diagnosing vacuum system service symptoms on those components which are serviced by removal and replacement - I.E. - hoses, clamps, gyro filters, vacuum pumps, and vacuum regulators.

1. Hoses and Clamps

- A. These items should be examined periodically and inspected carefully whenever maintenance activities cause hose disconnections to be made at the pumps, manifold, regulators, tube assemblies, gyros and/or vacuum gauge.
- B. Ends of hoses should be examined for rubber separation and slivers of rubber on inside diameter of hoses. These slivers can and do become detached. If this happens, the vacuum pump(s) will suck in the loose particles and eventually ingest them. This can cause pump failure.
- C. Replace old, hard, cracked or brittle hose. Sections of the inner layers may separate, causing pump failure.
- D. Ensure hoses are clear and clean by blowing them out with shop air. Remove from aircraft as required.

CAUTION: DO NOT WIGGLE HOSE FROM SIDE TO SIDE DURING INSTALLATION. WIGGLING COULD CAUSE PARTICLES TO BE CUT FROM INNER WALL OF HOSE WHICH WOULD DAMAGE THE PUMP.

- E. Where hose clearance is tight, making it difficult to reinstall it onto a fitting or barb, spray the fitting or barb with silicone. Let dry, then install hose by pushing it straight on.

CAUTION: WHEN REPLACING ANY OF THE THREADED FITTINGS, DO NOT USE PIPE DOPE, THREADLUBE, OR TAPE. PIPE DOPE / TAPE PARTICLES INGESTED BY THE VACUUM PUMP COULD CAUSE THE PUMP TO FAIL. USE ONLY SILICONE SPRAY, LETTING IT DRY BEFORE ASSEMBLY.

- F. Hose clamps and fittings should be replaced when broken, damaged or corroded.

2. Gyro Filter (See 37-00-00, Figure 1.)

- A. Gyro filters must be serviced on a scheduled basis, not to exceed 100 hours, and on condition.
- B. The system installation employs a large central filter (mounted on the upper left rear of the forward bulkhead (behind instrument panel)) and differential vacuum gauge that continuously monitors filter condition while indicating vacuum readings. A second filter will be installed on the right side, if optional co-pilot's instruments are installed.

NOTE: A decline in panel gauge reading indicates the filter is becoming clogged. Filters should be replaced when gauge reading declines; DO NOT adjust regulator(s).

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3. Vacuum Pumps

One (1) engine-driven dry-air pump is mounted on the accessory section at the rear of each engine. Each vacuum pump is a rotary vane, positive displacement type. These units consist of an aluminum housing, a carbon rotor and carbon vanes. They are driven by means of a coupling mated to an engine-driven gear assembly.

A. Removal

- (1) Remove engine cowling. (Refer to Chapter 71.)
- (2) Loosen hose clamp and remove hose from pump fittings.
- (3) Remove four retaining nuts, lock washers and plain washers used to secure pump to engine; then remove pump.

B. Installation

NOTE: Change the vacuum system filter when installing a new pump.

- (1) If required, install fittings on pump per Replacing Pump Fittings, below.

CAUTION: ONLY PUMP MOUNTING GASKET AUTHORIZED AND APPROVED FOR USE ON AIRBORNE VACUUM PUMP IS AIRBORNE GASKET B3-1-2, PIPER PART NUMBER 751-859. USE OF ANY OTHER GASKET MAY RESULT IN OIL SEEPAGE OR LEAKAGE AT MOUNTING SURFACE.

- (2) Place pump gasket in its proper place and align spline on pump drive with spline on engine drive assembly.
- (3) Secure pump to engine with four plain washers, lock washers and retaining nuts. Torque nuts 50 to 70 inch-pounds.
- (4) Connect hoses to pump and secure with hose clamps.
- (5) Reinstall engine cowling.

C. Replacing Pump Fittings

CAUTION: WHEN REPLACING ANY OF THE THREADED FITTINGS, DO NOT USE PIPE DOPE, THREADLUBE, OR TAPE. PIPE DOPE / TAPE PARTICLES INGESTED BY THE VACUUM PUMP COULD CAUSE THE PUMP TO FAIL. USE ONLY SILCONE SPRAY, LETTING IT DRY BEFORE ASSEMBLY.

- (1) Before installing any fittings on pump, check for any external damage. A pump that has been damaged or dropped should not be installed.

CAUTION: DO NOT APPLY VISE PRESSURE TO OUTSIDE DIAMETER OR OVERALL LENGTH OF PUMP.

- (2) When a vise is used to hold pump while installing fittings, suitable caution must be exercised to avoid pump damage. Square mounting flange must be held between soft wood blocks and only at right angles to vise jaws. Use only enough vise pressure to hold pump firmly.
- (3) The ports of AIRBORNE pumps have been treated with a dry film lubricant and AIRBORNE fittings are cadmium plated thus eliminating any need for thread lubricants. If thread lubricant is required, use only a silicone spray. Apply sparingly to external threads of fittings only and let dry before assembly.

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4. Vacuum Regulators (See Figure 1 and 37-00-00, Figure 1.)

Two (2) vacuum regulators are incorporated in the system to control vacuum pressure to gyro instruments. The regulators are located aft of each engine, on the rear of the firewall.

A. Removal

- (1) Remove inlet hose from aft side of valve.
- (2) Remove outlet hose from forward side of valve.
- (3) Remove nut that secures valve to firewall.
- (4) Pull valve rearward out of firewall.

B. Installation

- (1) Insert valve into hole in rear of firewall.
- (2) Secure valve to firewall with nut.
- (3) Attach inlet hose to forward fitting of valve.
- (4) Attach outlet hose to aft fitting of valve.

C. Service Tips

- (1) The vacuum regulating valve seldom needs replacement. Symptoms that suggest replacement are:
 - (a) Chatter as indicated by rapid fluctuation of the vacuum gauge needle or an audible sound.
 - (b) Non-repeatability of the vacuum gauge reading when the panel gauge is not suspect or has been checked against a known test gauge (cruise rpm only).
- (2) All modes of regulator malfunction tend to increase the vacuum power applied to the gyros. Thus, although excess vacuum is applied, a loss of vacuum does not occur.
- (3) The gyros themselves act as a limiting device to keep the vacuum power applied from exceeding safe levels.

NOTE: If the panel gauge has been checked and found "OK" and the vacuum gauge reading does not repeat within the normal operating range as marked on the gauge, then the regulating valve should be changed. Observe the usual precautions for maintaining system cleanliness to avoid premature pump service.

D. Adjustment

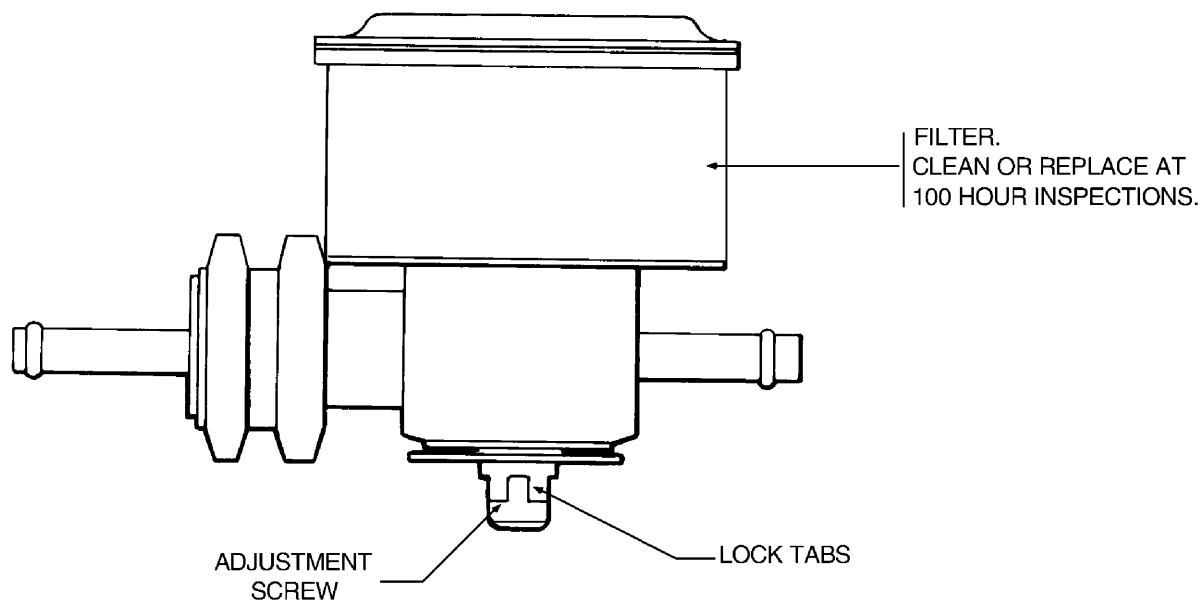
WARNING: DO NOT ATTEMPT ADJUSTMENT OF THIS VALVE WITH THE ENGINE IN OPERATION.

- (1) Bend locking tabs up to rotate adjustment screw.
- (2) Start the respective engine, after allowing time for warm-up, run the engine at medium rpm.

NOTE: Operation of engine at medium rpm is considered to be at magneto check rpm.

- (3) With appropriate engine running at medium rpm, the suction gauge should indicate 5.0 inches of mercury \pm 0.2 inches of mercury (Seneca IV); or within the normal operating range as marked on the vacuum gauge (Seneca V). If the pressure reading fails to fall within this range, shut down the engine and adjust the regulator valve by moving the valve adjustment screw clockwise to increase pressure, and counterclockwise to decrease pressure. Start the engine and repeat the check. Continue process until desired reading is obtained.
- (4) Restart the engine and repeat the check.
- (5) After the system pressure has been adjusted to recommended settings, bend locking tabs down to lock adjustment screw in place.

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Vacuum Regulator
Figure 1

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INDICATING

The following information is intended to aid in diagnosing vacuum system service symptoms on those components which are serviced by removal and replacement - I.E. - vacuum gauges and switches.

1. Vacuum (Suction) Gauge (See 37-00-00, Figure 1.)

A. **Seneca IV**

The vacuum gauge is mounted in the upper left section of the pilot's instrument panel above the ELT switch. The gauge is calibrated in inches of mercury and is connected across the pilot's gyros. The gauge indicates the differential pressure or actual pressure being applied to the gyro instruments. As the gyro filter(s) becomes clogged or lines obstructed, the gauge will show a decrease in pressure. Do not reset the regulator until the gyro filter(s) and lines have been checked.

B. **Seneca V**

The vacuum gauge is mounted in the lower right section of the pilot's instrument panel, just above the landing gear down annunciator lights. The gauge is calibrated in inches of mercury and measures the differential pressure across the gyros by use of a transducer. As the gyro filter(s) becomes clogged or lines obstructed, the gauge will show a decrease in pressure. Do not reset the regulator until the gyro filter(s) and lines have been checked.

C. Troubleshooting

See Chart 1, 37-00-00.

D. Service Tips

- (1) Vacuum gauges seldom require service and usually are replaced when malfunctions occur.

NOTE: Vacuum gauge failure in a properly operating vacuum system does not impair safety of flight.

- (2) If the vacuum gauge malfunctions in a manner to cause an incorrect reading in normal cruise conditions, the gauge must be checked by comparing its reading with a gauge of known accuracy. If the gauge is confirmed to be indicating correct values and system vacuum level is not in accordance with specified vacuum, then and only then should the vacuum regulators be reset/readjusted.
- (3) Visual examination of gauge performance should cover the following steps:
- (a) With engine stopped and no vacuum supplied to gauge, its pointer should rest against the the internal stop in the 9 o'clock position. Any other displacement from this position suggests need for replacement.
 - (b) A slight overshoot during engine startup, not to exceed half an inch of mercury, is normal and is not cause to replace gauge.
- (4) With engine operating at normal cruise RPM, gauge should read within the normal operating range as marked on the gauge.
- (5) At 1200 rpm, vacuum gauge reading should be more than four inches of mercury.

E. Removal and Installation

The vacuum gauge is a face-mounted instrument. See 39-10-00.

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2. Vacuum Switches (See 37-00-00, Figures 1 and 2.)

A vacuum switch is located on each vacuum regulator at the rear of each firewall. Each activates its associated VACUUM INOP annunciator light when the suction from the associated pump drops below $4 \pm .25$ psig.

A. Removal

- (1) Disconnect the two electrical leads.
- (2) Unscrew switch unit from vacuum regulator assembly boss.
- (3) Cap tube assembly boss to prevent foreign matter from entering system.

B. Installation

- (1) Uncap tube assembly boss.
- (2) Screw switch unit into vacuum regulator assembly boss.
- (2) Reconnect the two electrical leads.
- (3) Perform vacuum system operational check.

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CHAPTER

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ELECTRICAL / ELECTRONIC PANELS

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INSTRUMENT AND CONTROL PANELS

1. General

A. Face-Mounted Instruments

Most instruments are face-mounted and secured to the instrument panel by screws from the front of the panel. Most instruments are removed out the back of the panel, but a few are removed through the front of the panel. Take special care when any operation pertaining to the instruments is performed.

(1) Removal

- (a) Disconnect the plumbing and/or electrical connectors from the back of the instrument. Where two or more lines connect to an instrument, identify and tag each line to facilitate installation. Attach a dust cap to each fitting.

NOTE: For those instruments which remove through the front of the panel, disconnecting and tagging plumbing and/or electrical connectors can be done after the instrument retaining screws are removed and the instrument is slid gently forward to expose the connections at the rear.

- (b) Remove the screws that secure the instrument in the panel cutout.
- (c) Remove the instrument from the panel.

(2) Installation

- (a) Place the instrument in its proper panel cutout and secure with screws.

NOTE: For those instruments which install through the front of the panel, connecting plumbing and/or electrical connectors can be done from the front of the panel before the instrument retaining screws are installed. After the connections are secure, slide the instrument into place and install the retaining screws.

- (b) Connect the plumbing and/or electrical connectors to back of instrument.
- (c) Check instrument operation.

B. Rack-Mounted Avionics

Most avionics are rack-mounted front-removable units generally secured to the instrument panel tray/rack by a single jackscrew located in the center of their faceplate.

(1) Removal

- (a) Insert an appropriate size (generally 3/32 inch) allen wrench into the jackscrew access hole in the faceplate.
- (b) Unscrew the jackscrew in a counterclockwise direction.
- (c) Slide the avionics unit aft and out of the instrument panel tray/rack.

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(2) Installation

NOTE: Inspect the front of the panel-mounted avionics tray/rack to verify it is not significantly inset from the panel. If so, correct the tray/rack installation before proceeding.

NOTE: The high insertion forces required to seat a unit with “high density” connectors tend to limit the effectiveness of the first seating attempt. Accordingly, the following procedure requires sequential applications of force, and subsequent tightening of the jackscrew, to ensure all connectors seat properly.

- (a) Slide the avionics unit into the instrument panel rack and forward applying a moderate insertion force.
- (b) Insert an appropriate size (generally 3/32 inch) allen wrench into the jackscrew access hole in the faceplate and tighten to remove any slack, but do not try to “pull” unit into place with the jackscrew.
- (c) Apply additional insertion force to front of unit.
- (d) Tighten jackscrew again.
- (e) Apply additional insertion force to front of unit.
- (f) Finish tightening jackscrew.
- (g) Ensure that unit bezel is “tight” against panel.

2. Circuit Breaker Panel

Circuit breakers are installed in the lower right instrument panel and are of the single hole mounting, pushbutton type, with manual reset.

Should a circuit breaker be replaced or added, exercise extreme caution ensuring the breakers are in proper mechanical alignment, any insulators that are called out are installed correctly, and all electrical wiring and connections meet aviation standards. Do not deviate from the parts manual requirements when replacing circuit breakers.

NOTE: This type of circuit breaker can be used as a method of turning a system on and off.

A. Removal

- (1) Disconnect positive battery cable.
- (2) Remove knurled nut from circuit breaker face plate on front of instrument panel.
- (3) From behind instrument panel, disconnect electric bus bar from circuit breaker.
- (4) From behind instrument panel, remove circuit protector from instrument panel.

NOTE: Record placement of electrical leads to aid installation.

- (5) Disconnect electrical connections fastened with screws to circuit breaker.

B. Installation

- (1) Check circuit breaker amperage is correct.
- (2) Connect electrical leads to their proper screws on new breaker and secure.
- (3) From behind instrument panel, insert circuit protector into its proper hole on instrument panel.
- (4) From behind instrument panel, install electric bus bar to circuit breakers.
- (5) Reconnect positive battery cable.

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3. Switches

All switches are rocker-type and are located centrally in the instrument panel, and, in the [Seneca V](#), in the overhead switch panel.

CAUTION: ALTHOUGH SMALL SWITCH ASSEMBLIES ARE EASIER TO REMOVE IF WIRING IS FIRST DISCONNECTED, THE LIMITED WORK SPACE BEHIND THE PANEL CAN RESULT IN BURNED WIRE INSULATION. DO NOT ATTEMPT TO UNSOLDER THESE SMALL ELECTRICAL CONNECTIONS BEHIND THE INSTRUMENT PANEL UNDER ANY CONDITIONS. IF NECESSARY, CUT WIRES AT POINT OF CONNECTION. IN ANY CASE, IT'S BETTER TO DAMAGE THE SWITCH AND REPLACE IT, RATHER THAN DAMAGE THE WIRING HARNESS LEADS.

A. Removal

- (1) Disconnect positive battery cable.
- (2) Gain access to the switch from behind the instrument panel, or, in the [Seneca V](#), by removing the overhead switch panel.
- (3) Squeeze retainer blades on top and bottom of the switch together and push switch from the panel.
- (4) Make note of the placement of, and/or tag, wires on the switch to facilitate installation.
- (5) Disconnect wires from the switch. Remove switch.

B. Installation

- (1) Connect wires to the switch.
- (2) Squeeze retainer blades on top and bottom of the switch together and push switch into panel until retainer blades engage the panel.
- (3) Reconnect positive battery cable.

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ELECTRICAL AND ELECTRONIC EQUIPMENT

The following illustrations provide electrical and electronic equipment component locating information.

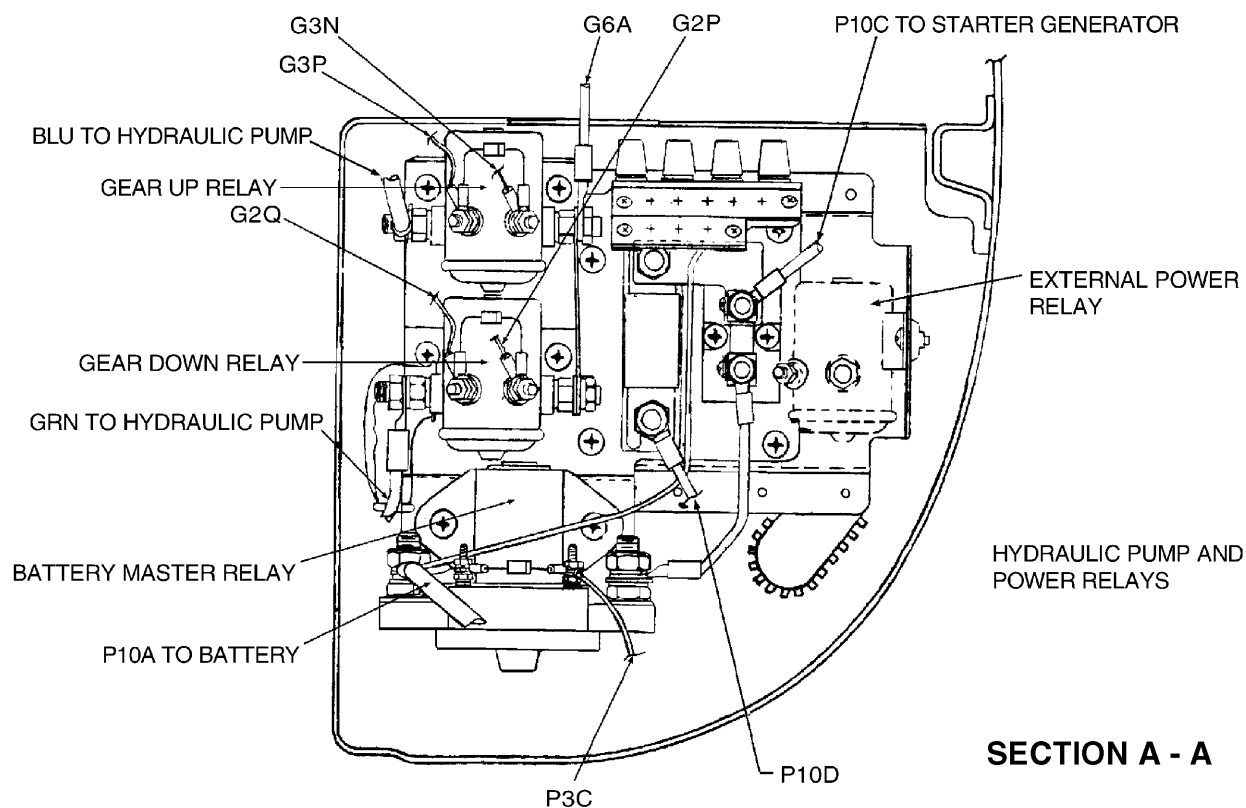
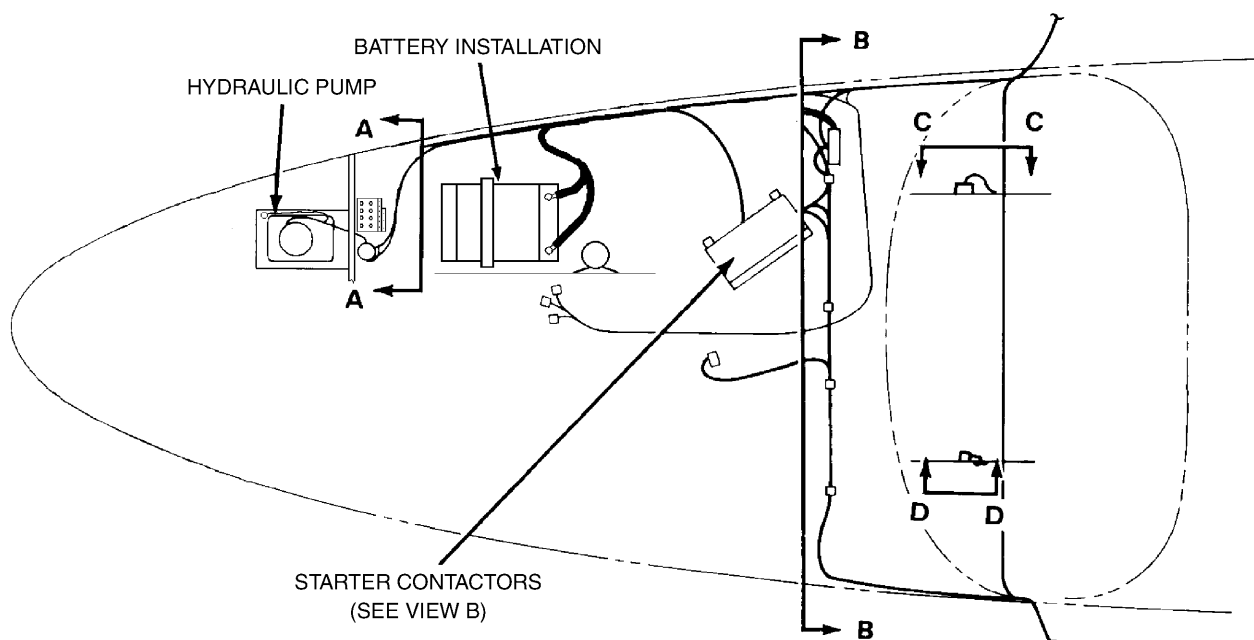
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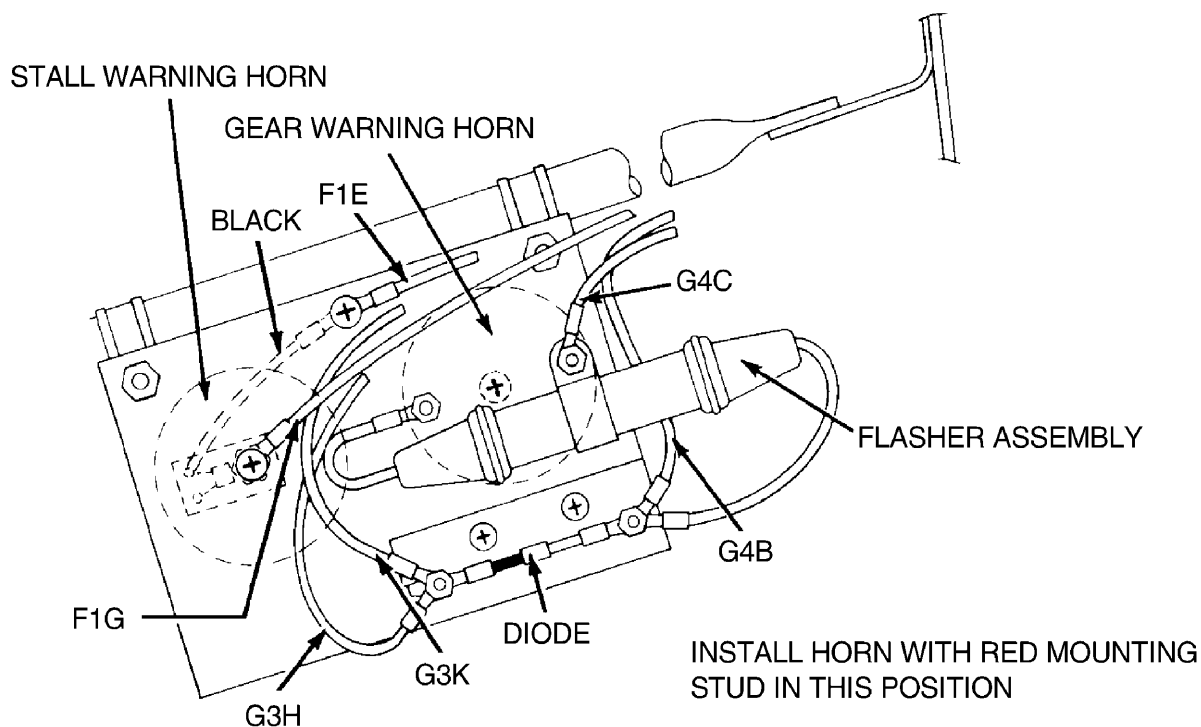
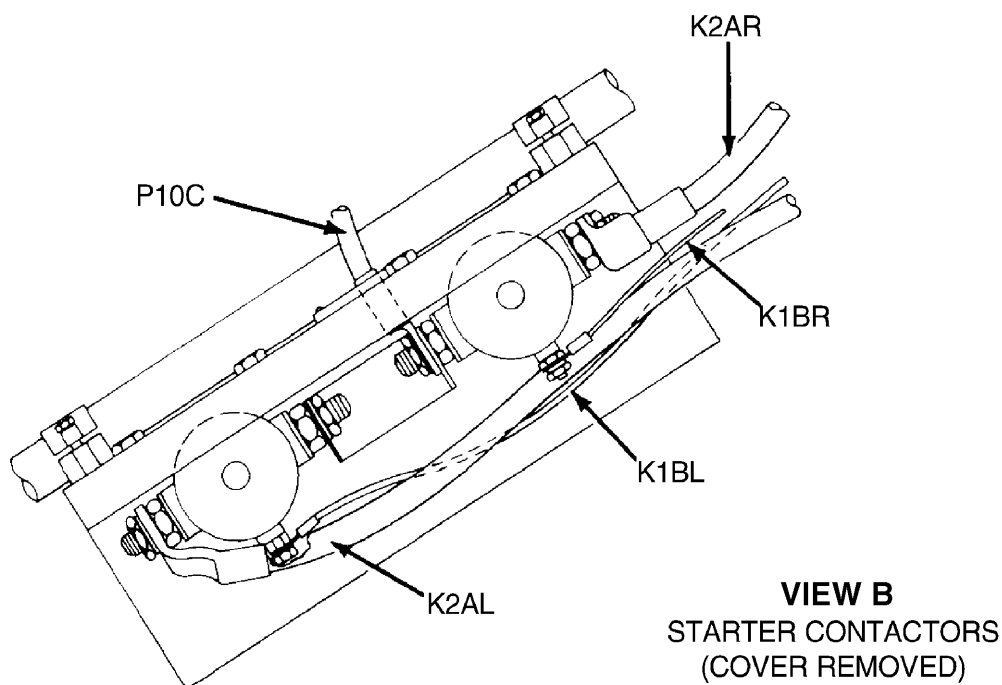
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Electrical / Electronic Equip. Component Locator
Figure 1 (Sheet 1 of 3)

Effectivity
Seneca IV

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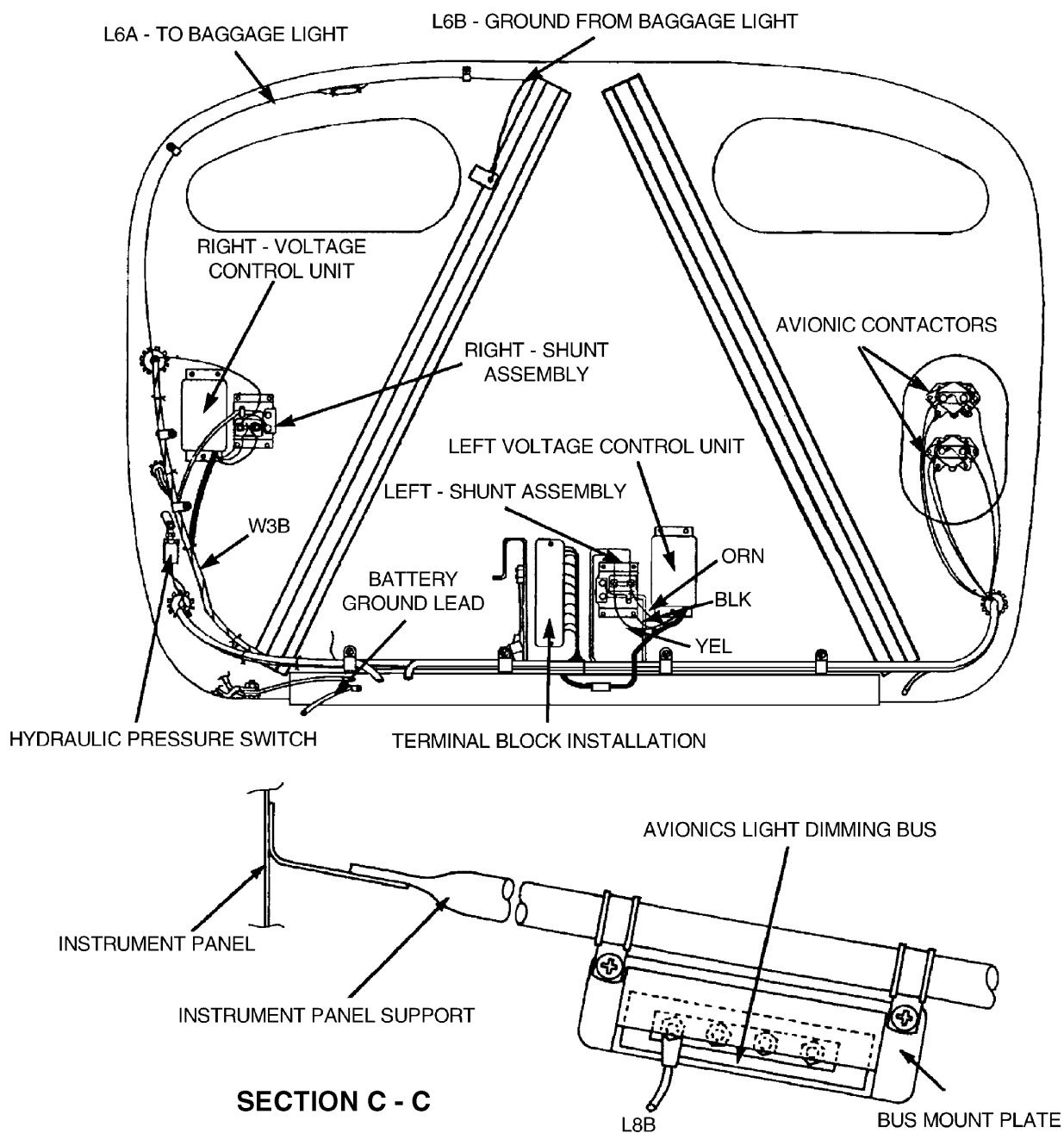


SECTION D - D

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Electrical / Electronic Equip. Component Locator
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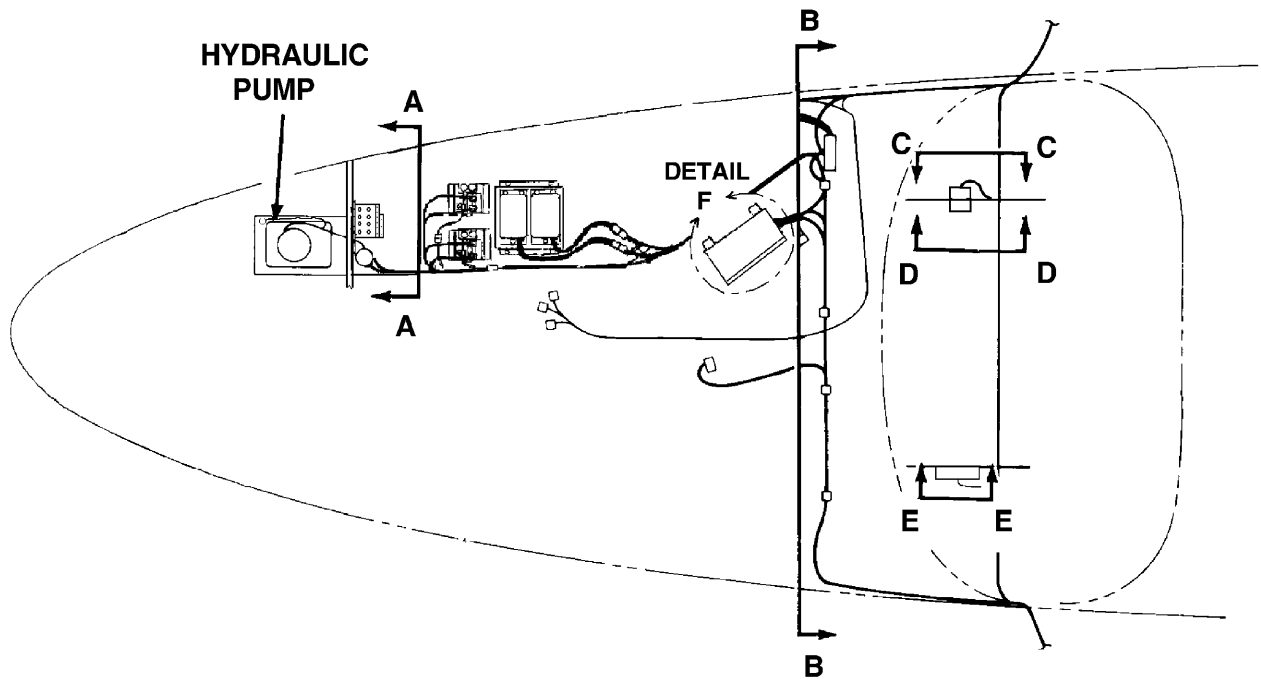
Electrical / Electronic Equip. Component Locator
Figure 1 (Sheet 3 of 3)

[Effectivity](#)
[Seneca IV](#)

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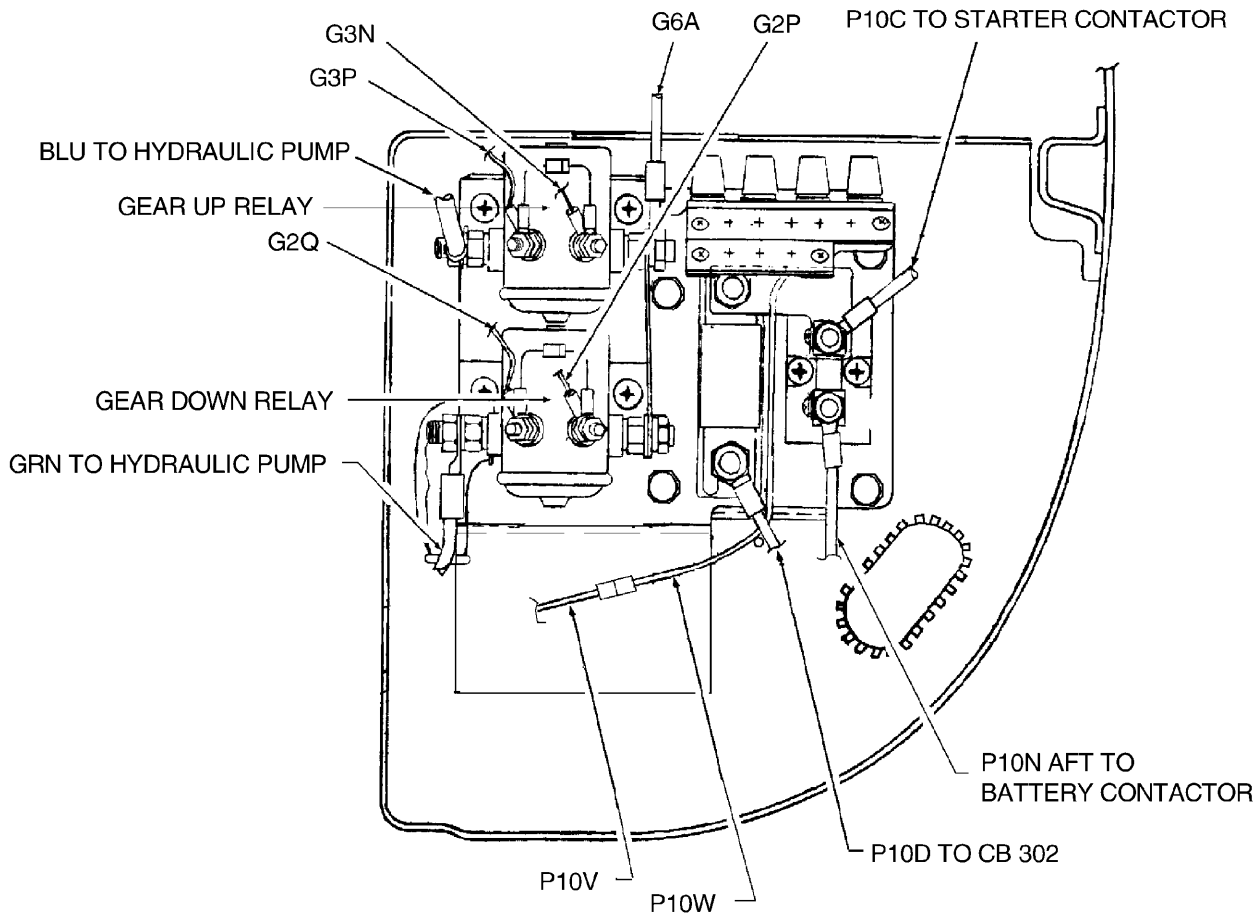


VIEW LOOKING DOWN ON NOSE SECTION

Electrical / Electronic Equip. Component Locator
Figure 2 (Sheet 1 of 6)

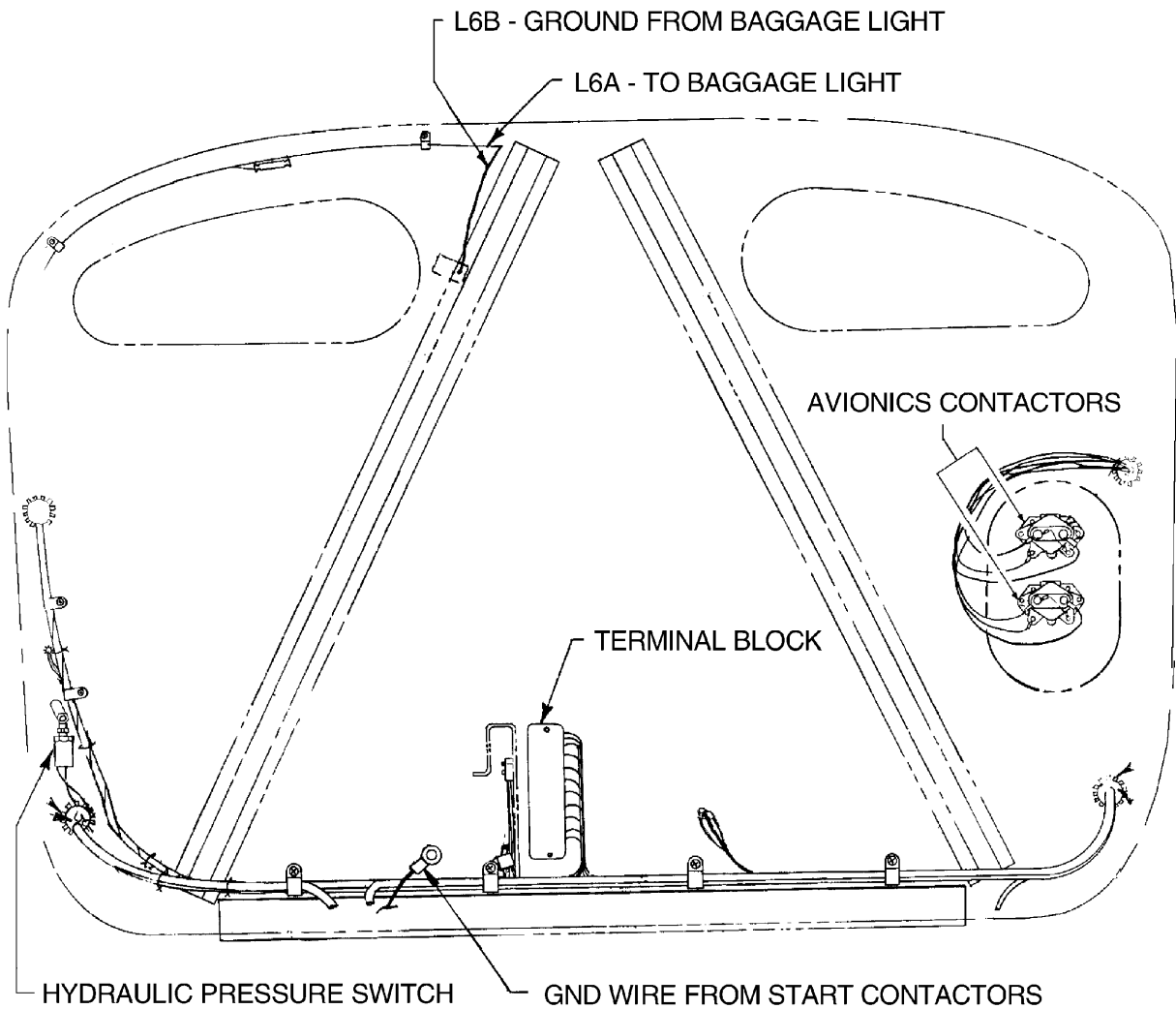
[Effectivity](#)
[Seneca V](#)

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VIEW A - A

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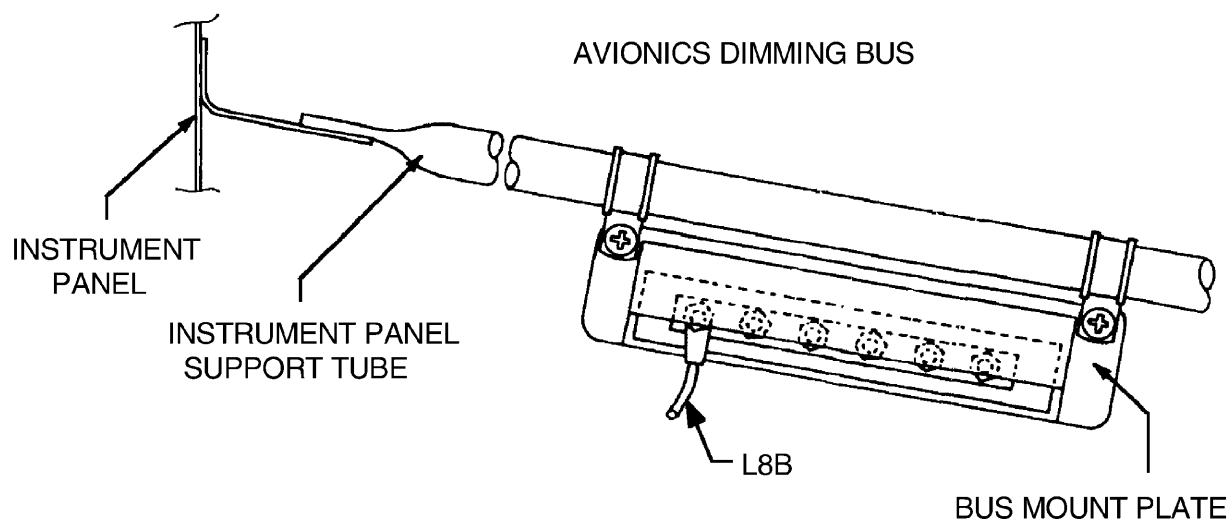


VIEW B - B

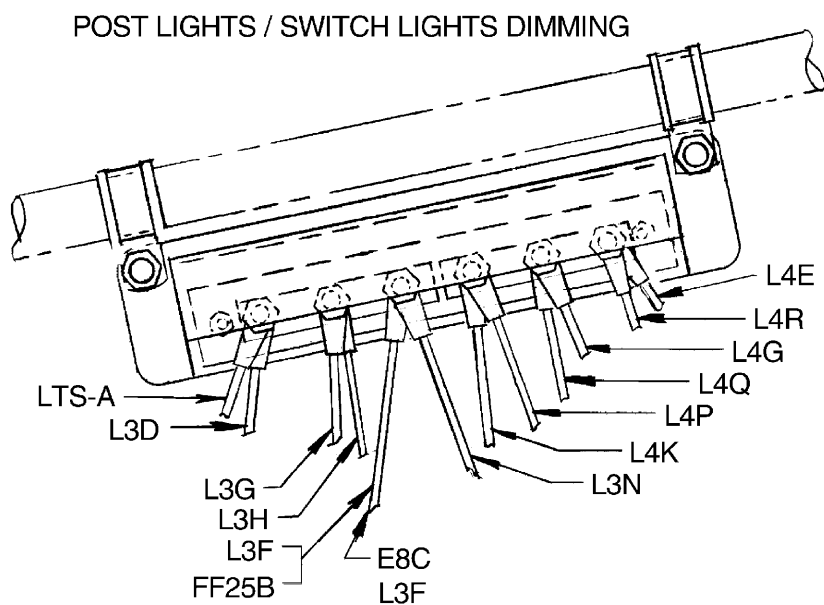
Electrical / Electronic Equip. Component Locator
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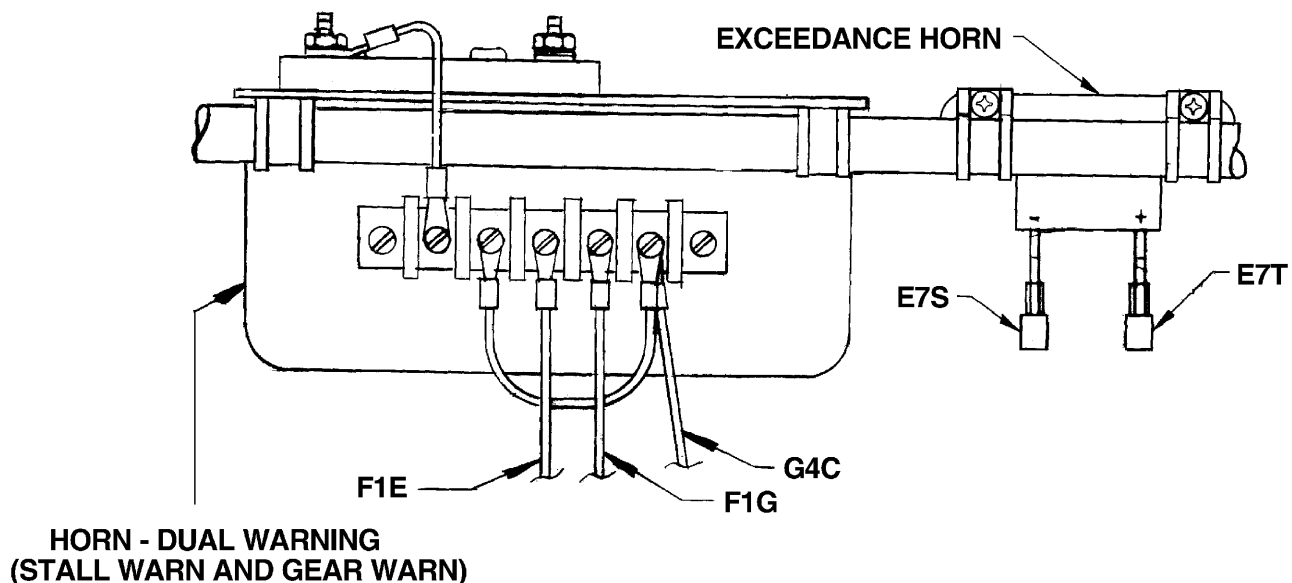


VIEW C - C

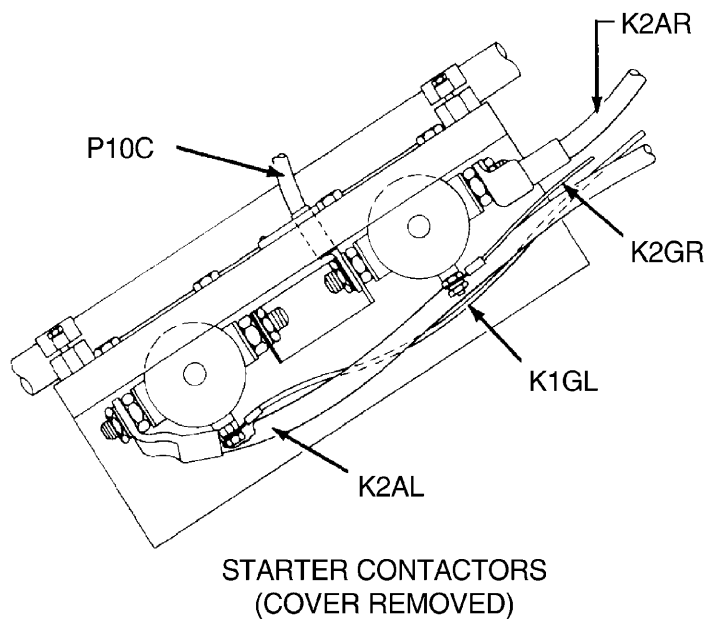


VIEW D - D

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VIEW E - E

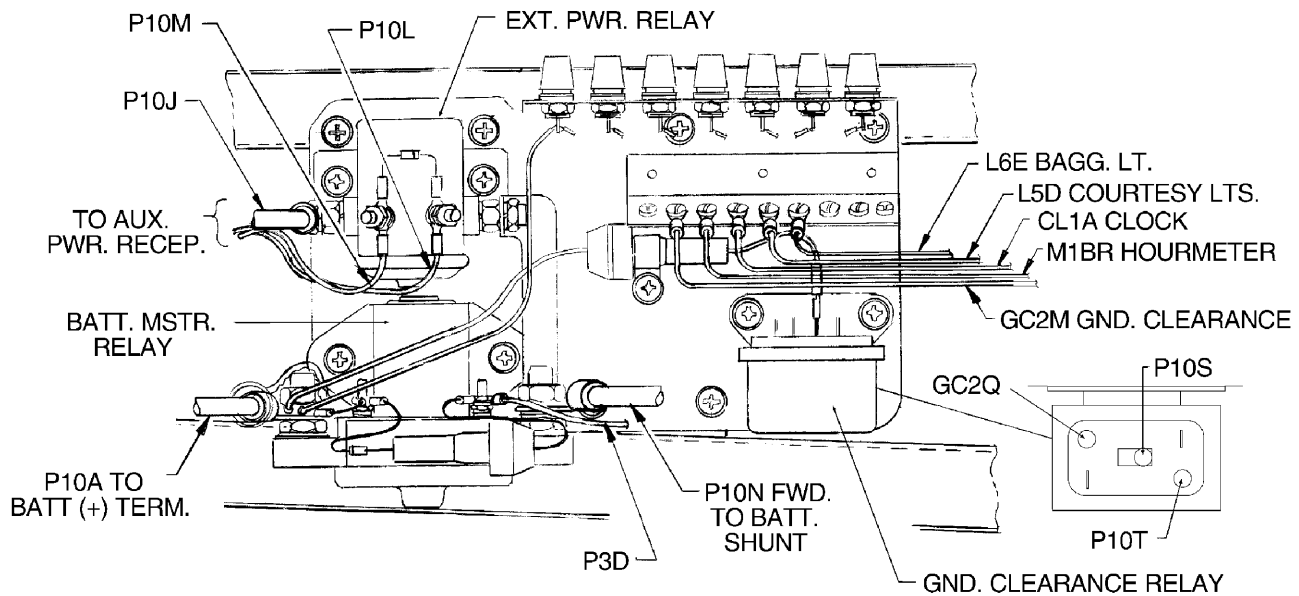


DETAIL F

Electrical / Electronic Equip. Component Locator
Figure 2 (Sheet 5 of 6)

[Effectivity](#)
[Seneca V](#)

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FS 178.00, VIEW LOOKING OUTBOARD, LEFT HAND SIDE

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CHAPTER

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STRUCTURES

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CHAPTER 51

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CHAPTER 51 - STRUCTURES

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GENERAL

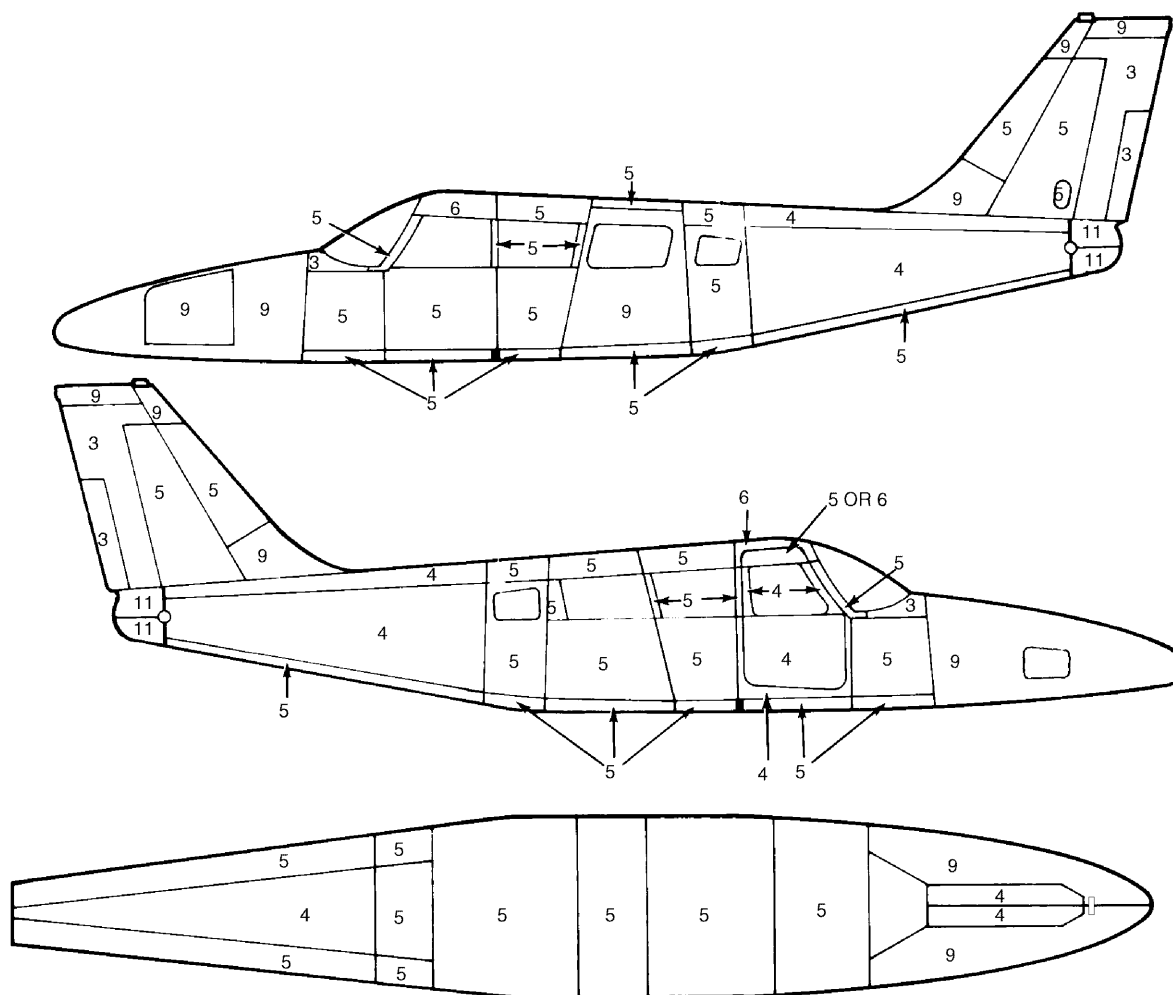
The PA-34-220T is an all metal semi-monocoque structure with a fuselage constructed of bulkheads, stringers and stiffeners, to which all of the outer skin is riveted. Windows include a single pane windshield and eight side windows; all windows are single pane. A storm window is located in the forward lower section of the left window and can be opened inward when the latch is released. There is a cabin entrance door located on the right side of the fuselage above the wing. Also, a door provided for entrance to the aft passenger compartment is located on the left side of the fuselage just aft of the wing trailing edge, with a baggage or cargo door adjacent and to the rear of the entrance door. Additionally, a forward baggage compartment door is located on the left side of the nose at F. S. 20.

Each wing is an all metal, full cantilever, semi-monocoque type construction, with a removable fiberglass or thermoplastic tip. Attached to each wing is an aileron, flap, main landing gear and power plant. The wings are attached to each side of the fuselage by inserting the butt ends of the main spars into a spar box carry-through. The spar box is an integral part of the fuselage structure which provides, in effect, a continuous main spar with splices at each side of the fuselage. There are also fore and aft attachments at the front and rear spars.

The all metal empennage group is a full cantilever design consisting of a vertical stabilizer (fin), rudder and stabilator, all with removable fiberglass or thermoplastic tips. The rudder and stabilator have trim tabs attached that are controllable from the cockpit. The stabilator also incorporates one channel main spar that runs the full length of the stabilator and hinges to the aft bulkhead assembly of the fuselage.

All exterior surfaces are coated with specially formulated primers and polyurethane overcoats. The standard airplane is completely primed with zinc chromate and/or other corrosion resistant paint processes.

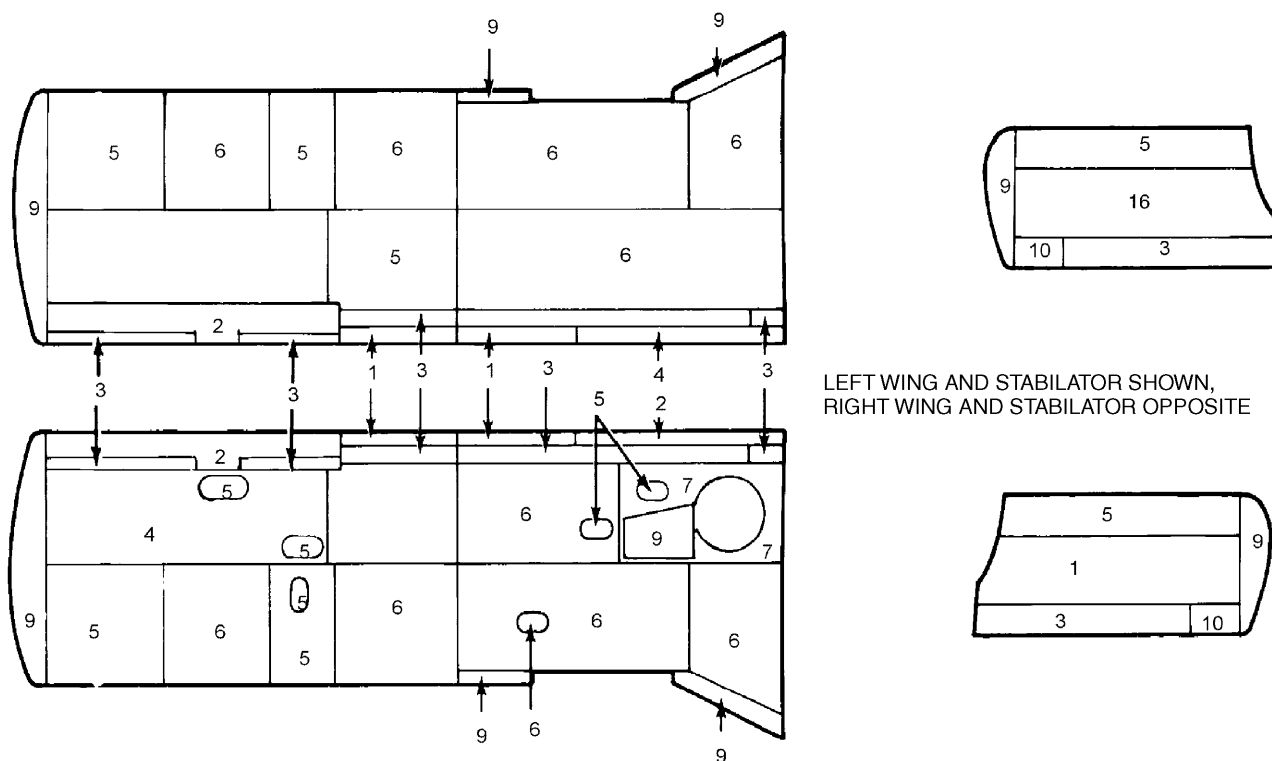
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NUMBER	MATERIAL	THICKNESS
1	2024-T3	.018
2	2024-O*	.020
3	2024-T3	.020
4	2024-T3	.025
5	2024-T3	.032
6	2024-T3	.040
7	2024-T3	.051
8	2024-T3	.025
9	FIBERGLASS	
10	2024-T3	.020
11	THERMOPLASTIC OR FIBERGLASS	
12	2024-O*	.025
13	5052-H34	.040
14	321A ST. STL.	.016

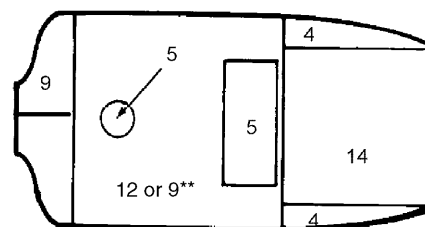
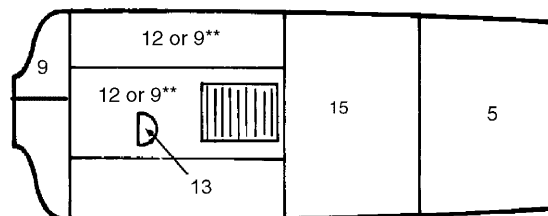
Skin Materials and Thickness
Figure 1 (Sheet 1 of 2)

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NUMBER	MATERIAL	THICKNESS
1	2024-T3	.018
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13	5052-H34	.040
14	321A ST. STL.	.016
15	2024-T3*	.025
16	2024-T3*	.018

* HEAT TREAT TO 2024-T42 AFTER FORMING
** FIBERGLAS ON SENECA V



Skin Materials and Thickness
Figure 1 (Sheet 2 of 2)

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INVESTIGATION, CLEANUP AND AERODYNAMIC SMOOTHNESS

Corrosion Control

Corrosion is the deterioration of metal by chemical or electrochemical attack. Water which is allowed to remain on the aircraft and industrial pollution are the major causes of corrosion in aircraft. The two general types of corrosion are:

- Direct chemical attack. (i.e. spilled battery acid)
- Electrochemical attack which requires a medium. (usually water)

The latter is the most common and is responsible for most forms of aircraft corrosion.

Since corrosion is a constant threat, the only effective method to control it is a routine of regular inspection, cleaning, and surface refinishing.

A. Forms of Corrosion

The following are the most common forms of corrosion:

- (1) Surface corrosion appears as a general roughening or pitting on the surface usually accompanied by a powdery deposit of corrosion products. It may spread under the surface and not be recognized until the paint or plating is lifted off the surface in small blisters.
- (2) Dissimilar metal corrosion may occur when two dissimilar metals are contacting each other. This type may be serious because it usually takes place out of sight. The only way to find it before structural failure is by disassembly and inspection. Insulating is necessary between two contacting dissimilar surfaces (2-3 coats of waterborne, chromated, fluid resistant, epoxy primer (i.e. - PRC Desoto) or a coat of epoxy polyamide on each surface; plus a .003 thick piece of vinyl tape if one of the surfaces is magnesium).
- (3) Intergranular corrosion is difficult to detect in its early stages. When severe, it causes the surface of the metal to exfoliate (flake or lift).
- (4) Stress Corrosion is the result of sustained tensile stresses and corrosive environment. It usually occurs in assemblies such as aluminum alloy bellcranks with pressed in bushings; landing gear shock struts with pipe thread grease fittings, clevis pin joints and shrink fit parts.
- (5) Fretting Corrosion takes place when two parts rub together, constantly exposing fresh active metal to the corrosive effects of the atmosphere
- (6) Filiform Corrosion is the appearance of numerous meandering thread-like filaments of corrosion on the surface of various types of metal.

B. Conditions Affecting Corrosion

Some conditions which affect the occurrence of corrosion are:

- (1) Heat and humidity increase corrosion.
- (2) Different metal and their relative sizes affect resistance or susceptibility to corrosion.
- (3) Frequent contributing factors to corrosion are:
 - (a) Soil and atmosphere dust.
 - (b) Oil, grease and exhaust residues.
 - (c) Salt water and salt moisture condensation.
 - (d) Spilled battery acids and caustic cleaning solutions.
 - (e) Welding, brazing and soldering flux residue

A clean aircraft will resist corrosion better than a dirty one. Cleaning frequency depends on several factors (such as geographical location, type of operation, etc). Soil should be removed as soon as possible, especially when it is on a high temperature area.

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**CHART 1
TYPES OF METAL CORROSION**

Type of Material	Type of Corrosion	Remedy (2)
Steel.	Rust ⁽¹⁾ .	Complete removal of corrosion by mechanical means.
Aluminum.	White to grey powdery material.	Mechanical polishing or brushing with material softer than aluminum.
Magnesium (highly susceptible to corrosion).	White powdery snow-like mounds and white spots.	Mechanical polishing or brushing for a smooth finish.
Cadmium (plating).	White to brown to black mottling of surface (plating is still protecting until iron appears).	Mechanical removal of corrosion is limited to metal surfaces from which cadmium has been depleted.
Chromium (plating).	May pit in chloride environment.	Polishing and buffing.
— NOTES —		
<p>(1) Red rust generally shows on bolts, nuts, and other aircraft hardware. Rust in these areas is generally not dangerous, however, it shows a need for maintenance and the possibility of corrosive attack in more critical areas. Any surface corrosion on highly stressed steel parts is potentially dangerous. A careful removal of corrosion using mild abrasives (rouge or fine grit aluminum oxide paper) is necessary. Do not overheat metal when removing corrosion.</p> <p>(2) For abrasion, do not use dissimilar material (for example steel wool on aluminum). Remove only material required to clean affected area.</p>		

After cleaning, ensure that no cleaning solution remains in any holes, crevices or joints, as it may lead to increased corrosion. Also, all exposed areas (landing gear, flap tracks, control surface, hinge parts, etc) should be lubricated after cleaning.

C. Corrosion Inspections

NOTE: Some areas of the airplane have been treated with a corrosion inhibiting compound which requires re-treatment at seven (7) year intervals. See Fuel Tank/Wing Spar Corrosion Inspection, 28-10-00.

Corrosion should be inspected for at every inspection. In trouble areas, the inspection frequency should be increased.

In addition to routine inspections:

- (1) Aircraft operating around a marine environment should be given special checks on a weekly basis.
- (2) Aircraft operating in a semi-acid condition should be inspected monthly. A semi-acid condition is likely to occur in industrialized areas where sulfur bearing particles in dust, smoke and smog attack painted surfaces.

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- (3) Inspections for corrosion should be performed by personnel familiar with corrosive problems and their remedies.
 - (a) Daily and preflight inspections should include the engine frontal areas, all intake vents, engine compartments, gaps, seams, and faying surfaces in the exterior skins, wheel and wheel well areas, battery compartment, fuel cell and all other drains, and any bilge areas not requiring extensive removal of inspection access covers.
 - (b) Detailed inspection should include the above referenced areas along with areas requiring removal of screw attached inspection plates and panels to thoroughly inspect the internal cavities of the aircraft.
 - (4) During inspection remember that paint tends to hide corrosion in its initial stages. However, the results of corrosion can sometimes be seen as blisters, flakes, chips and other irregularities in the paint.
- D. Corrosion Removal and Control

CAUTION: REMOVAL OF "SEVERE CORROSION" MAY BE CONSIDERED A MAJOR REPAIR. ANY REPAIR OF THIS TYPE MUST BE APPROVED BY THE FAA BEFORE RETURNING THE AIRPLANE TO SERVICE.

Corrosion cannot be prevented or eliminated on aircraft; it can only be reduced to an acceptable level by proper control methods.

All corrosion products must be removed prior to refinishing. If they are not removed, corrosion will begin again, even though the affected area is refinished.

- (1) Before beginning any rework:
 - (a) Position the airplane in a wash rack or provide some type of washing apparatus for rapid rinsing of all surfaces.
 - (b) Connect a static ground line to the airplane.
 - (c) Remove the airplane battery if required.
 - (d) Protect the pitot-static ports, engine openings, airscoops, louvers, wheels, tires and other portions of the airplane from moisture and chemical brightening agents.
 - (e) Protect the surfaces next to the rework areas from chemical paint strippers, corrosion removal agents and surface treatment materials.
- (2) An evaluation of the corrosion damage is necessary to determine the type and extent of repairs required.

The following are general guidelines:

- (a) Light Corrosion: Discoloration or pitting; normally removed by light hand sanding or a small amount of chemical treatment.
- (b) Moderate Corrosion: Similar to light corrosion except there could be some blistering or evidence of scaling and flaking. Removed by extensive hand sanding or mechanical sanding.
- (c) Severe Corrosion: Similar to moderate corrosion with severe blistering, exfoliation, scaling and / or flaking, normally removed by extensive mechanical sanding or grinding.

NOTE: The depth of material removed should not exceed safe limits.

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E. Corrosion Prone Areas

Certain areas are more prone to corrosion than others. The following list is intended to be a general guide to areas where corrosion is frequently found.

- (1) Areas around steel fasteners are susceptible to corrosion. The paint on these areas cracks which allows moisture to seep in and corrode the underlying metal. Each time the fastener is removed, it should be coated with zinc chromate before reinstallation. The paint should be wet when the fastener is installed.
- (2) Fluids tend to seep into faying surfaces, seams and joints due to capillary action. The effect of this type of intrusion is usually detectable by irregularities in the skin's surface.
- (3) Spot welded assemblies are particularly prone to corrosion. The only means to prevent this type of corrosion is by keeping potential moisture entry points in the spot weld filled with a sealant or preservative compound. On an aluminum spot welded assembly, a chromate conversion coating before paint is applied will help prevent corrosion.
- (4) Areas which are exposed to exhaust gases may have their finish damaged by deposits. These deposits may result in an aggressive attack on the metal by corrosion. Heat from the exhaust may also blister or otherwise damage the paint. Gaps, seams, hinges and fairings are some places where exhaust gas deposits may be trapped and not reached by normal cleaning methods.
- (5) The wheels and landing gear are the most exposed parts of the aircraft. Due to the complexity of its shape, assemblies and fittings, maintaining a protective coverage is difficult. The especially troublesome areas are:
 - (a) Magnesium wheels: around bolt heads, lugs and wheel well areas:
 - (b) Exposed rigid tubing, B-nuts, ferrules, under clamps and tubing identification tape:
 - (c) Exposed electrical equipment:
 - (d) Crevices between stiffeners, ribs and lower skin surfaces.
- (6) Flaps, flight control slots and equipment installed in these areas may corrode unnoticed unless a careful surveillance is maintained.
- (7) Engine frontal areas, air inlet ducts and the leading edge of wings, because they are constantly exposed to abrasion by dirt, dust, gravel and rain, should be checked frequently for the beginning of corrosion.
- (8) Hinges (piano hinges especially) are extremely vulnerable to corrosion due to the wearing away of their protective coating and their being a natural trap for dirt, salt and moisture.
- (9) Control cables may have bare spots in their preservative coating which could lead to corrosion. Cables having external corrosion should be checked for internal corrosion. If internal corrosion is present, replace the cable. If only external corrosion is present, remove corrosion with a wire brush and recoat cable with preservative.
- (10) Any area where water may be trapped is a trouble spot for corrosion. Drain holes should be checked and cleaned regularly.
- (11) Battery compartment and vent openings are particularly prone to corrosion due to spilled electrolyte. Fumes from overheated battery electrolyte will spread to adjacent areas and cause rapid corrosion of unprotected surfaces. Frequent cleaning and neutralization of deposits will minimize corrosion from this cause.
- (12) Due to magnesium parts being prone to corrosion, special attention should be given to their surface treatment, proper insulation (due to dissimilar metal corrosion) and paint coatings.
- (13) Electrical components and connectors should be checked. Their inspection frequency should be based on their operational environment and past trouble with them.

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- (14) Skin joints and lap-overs are two areas which may contain moisture. Corrosion in these areas may go unnoticed unless particular attention is paid to them during inspection.
- (15) Hoses having an internal wire braid which are located in a position where they are frequently water soaked need a protective treatment.
- (16) Drilled holes and the trimmed end of sandwich panels should be protected. An inhibitor solution and/ or sealant application is recommended. Any gaps or cavities which allow dirt or moisture to enter should be filled with a sealant.

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REPAIRS

Structural repair methods used must be in accordance with regulations set forth in FAA Advisory Circular 43.13-1, latest revision. To assist in making repairs and/or replacements, Figure 1, 51-00-00, identifies type and thickness of various skin material used.

WARNING: NO ACCESS HOLES ARE PERMITTED IN ANY CONTROL SURFACE. USE OF PATCH PLATES FOR REPAIRS OF ALL MOVABLE TAIL SURFACES IS PROHIBITED. USE OF ANY FILLER MATERIAL NORMALLY USED FOR REPAIR OF MINOR DENTS AND/OR MATERIALS USED FOR FILLING INSIDE OF SURFACES IS ALSO PROHIBITED ON ALL MOVABLE TAIL SURFACES.

Never make a skin replacement or patch plate from material other than type of original skin, or of a different thickness than original skin. Repair must be as strong as original skin. However, flexibility must be retained so surrounding areas will not receive extra stress.

1. Fiberglass Repairs

The following procedures describe methods for repair of Fiberglass Reinforced Structures; Fiberglass Touch-Up, and Surface Repairs such as blisters, open seams, delamination, cavities, small holes and minor damages that have not harmed fiberglass cloth material; and, Fiberglass Fracture and Patch Repairs such as puncture, breaks and holes that have penetrated through structure and damaged fiberglass cloth. A repair kit, part number 766-222, furnishes necessary material for such repairs, and is available through Piper Dealers.

NOTE: Very carefully follow resin and catalyst mixing instructions furnished with repair kit.

A. Fiberglass Touch-Up and Surface Repairs

- (1) Remove wax, oil and dirt from around damaged area with acetone, Methylethylketone or equivalent and remove paint to gel coat.
- (2) Damaged area may be scraped with a fine blade knife or a power drill with a burr attachment to roughen bottom and sides of damaged area. Feather edge surrounding scratch or cavity. Do not undercut edge. (If scratch or cavity is shallow and penetrates only surface coat, continue to para h, below.)
- (3) Pour a small amount of resin into a jar lid or on a piece of cardboard, just enough to fill area being worked on. Mix an equal amount of milled fiberglass with resin, using a putty knife or stick. Add catalyst, according to kit instruction, to resin and mix thoroughly. A hypodermic needle may be used to inject gel into small cavities not requiring fiberglass millings mixed with gel.
- (4) Work mixture of resin, fibers and catalyst into damaged area, using sharp point of a putty knife or stick to press it into bottom of hold and to puncture any air bubbles which may be present. Fill scratch or hole above surrounding undamaged area about 1/16 inch.
- (5) Lay piece of cellophane or waxed paper over repair to cut off air and start cure of gel mixture.
- (6) Allow gel to cure 10 to 15 minutes until it feels rubbery to touch. Remove cellophane and trim flush with surface, using a sharp razor blade or knife. Replace cellophane and allow to cure completely for 30 minutes to an hour. Patch will shrink slightly below structure surface as it cures. (If wax paper is used, ascertain wax is removed from surface.)
- (7) Rough up bottom and edges of hole with electric burr attachment or rough sandpaper. Feather hole into surrounding gel coat, do not undercut.
- (8) Pour out a small amount of resin, add catalyst and mix thoroughly, using a cutting motion rather than stirring. Use no fibers.

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- (9) Using tip of putty knife or fingertips, fill hole to about 1/16 inch above surrounding surface with gel coat mixture.
- (10) Lay piece of cellophane over patch to start curing process. Repeat paragraph (6), above, trimming patch when partially cured.
- (11) After trimming patch, immediately place another small amount of gel coat on cut edge of patch and cover with cellophane. Then, using a squeegee or back of a razor blade, squeegee level with area surrounding patch, leave cellophane on patch for one or two hours or overnight, for complete cure.
- (12) After repair has cured for 24 hours, sand patched area using sanding block with fine wet sandpaper. Finish by priming, again sanding and applying color coat.

B. Fiberglass Fracture and Patch Repairs

- (1) Remove wax, oil and dirt from around damaged area with acetone, methylethylketone or equivalent.
- (2) Using a key hole saw, electric saber saw, or sharp knife cut away ragged edges. Cut back to sound material.
- (3) Remove paint three inches back from around damaged area.
- (4) Working inside structure, bevel edges to approximately a 30 degree angle and rough-sand hole and area around it, using 80-grit dry paper. Feather back for about two inches all around hole. This roughens surface for strong bond with patch.
- (5) Cover a piece of cardboard or metal with cellophane. Tape it to outside of structure covering hole completely. Cellophane should face toward inside of structure. If repair is on a sharp contour or shaped area, a sheet of aluminum formed to a similar contour may be placed over area. Aluminum should also be covered with cellophane.
- (6) Prepare a patch of fiberglass mat and cloth to cover an area two inches larger than hole.
- (7) Mix small amount of resin and catalyst, enough to be used for one step at a time, according to kit instructions.
- (8) Thoroughly wet mat and cloth with catalyzed resin. Daub resin on mat first, and then on cloth. Mat should be applied against structure surface with cloth on top. Both pieces may be wet out on cellophane and applied as a sandwich. Enough fiberglass cloth and mat reinforcements should be used to at least replace amount of reinforcements removed in order to maintain original strength. If damage occurred as a stress crack, an extra layer or two of cloth may be used to strengthen area.
- (9) Lay patch over hole on inside of structure, cover with cellophane, and squeegee from center to edges to remove all air bubbles and assure adhesion around edge of hole. Air bubbles will show white in patch and they should all be worked out to edge. Remove excess resin before it gels on part. Allow patch to cure completely.
- (10) Remove cardboard or aluminum sheet from outside of hole and rough-sand patch and edge of hole. Feather edge of hole about two inches into undamaged area.
- (11) Mask area around hole with tape and paper to protect surface. Cut a piece of fiberglass mat about one inch larger than hole and one or more pieces of fiberglass cloth two inches larger than hole. Brush catalyst resin over hole, lay mat over hole and wet out with catalyzed resin. Use a daubing action with brush. Then apply additional layer or layers of fiberglass cloth to build up patch to surface of structure. Wet out each layer thoroughly with resin.
- (12) With a squeegee or broad knife, work out all air bubbles in patch. Work from center to edge, pressing patch firmly against structure. Allow patch to cure for 15 to 20 minutes.

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- (13) As soon as patch begins to set up, but while still rubbery, take a sharp knife and cut away extra cloth and mat. Cut an outside edge of feathering. Strip cut edges of structure. Do this before cure is complete, to save extra sanding. Allow patch to cure overnight.
- (14) Using dry 80-grit sandpaper on a power sander or sanding block, smooth patch and blend with surrounding surface. Should air pockets appear while sanding, puncture and fill with catalyzed resin. A hypodermic needle may be used to fill cavities. Let cure and resand.
- (15) Mix catalyzed resin and work into patch with fingers. Smooth carefully and work into any crevices.
- (16) Cover with cellophane and squeegee smooth. Allow to cure completely before removing cellophane. Let cure and resand.
- (17) Brush or spray a coat of catalyzed resin to seal patch. Sand patch, finish by priming, again sanding and applying color coat.

NOTE: Brush and hands may be cleaned in solvents such as acetone or methylethylketone. If solvents are not available, a strong solution of detergent and water may be used.

2. Thermoplastic Repairs

The following procedures will assist in making field repairs to items made of thermoplastic which are used throughout the airplane. A list of material needed to perform these repairs is given in Chart 1, along with suggested suppliers of the material. Common safety precautions should be observed when handling some of the materials and tools used while making these repairs.

A. Surface Preparation:

- (1) Surface dirt and paint if applied must be removed from item being repaired. Household cleaners have proven most effective in removing surface dirt.
- (2) Preliminary cleaning of damaged area with perchlorethylene or VM&P Naptha will generally insure a good bond between epoxy compounds and thermoplastic.

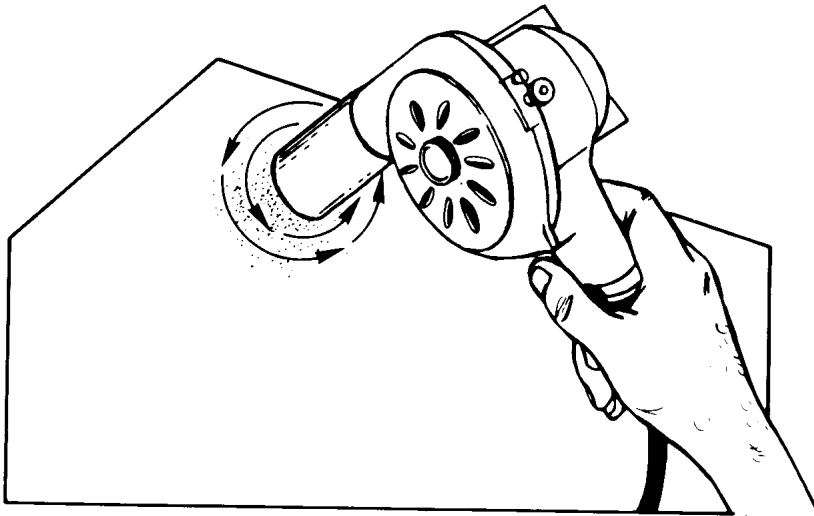
B. Surface Scratches, Abrasion or Ground-in-Dirt: (Refer to Figure 1.)

- (1) Shallow scratches and abraded surfaces are usually repaired by following directions on containers of conventional automotive buffing and rubbing compounds.
- (2) If large dirt particles are embedded in thermoplastic parts, they can be removed with a hot air gun capable of supplying heat in temperature range of 300°F to 400°F. Use care not to overheat material. Hold nozzle of gun about 1/4 of an inch away from surface and apply heat with a circular motion until area is sufficiently soft to remove dirt particles.
- (3) Thermoplastic will return to its original shape upon cooling.

C. Deep scratches, Shallow Nicks and Small Holes: (Less than 1 inch diameter.) (See Figure 2.)

- (1) Solvent cements will fit virtually any of these applications. If area to be repaired is very small, it may be quicker to make a satisfactory cement by dissolving thermoplastic material of the same type being repaired in solvent until desired paste-like consistency is achieved.
- (2) This mixture is then applied to damaged area. Upon solvent evaporation, hard durable solids remaining can easily be shaped to desired contour by filing or sanding.
- (3) Solvent adhesives are not recommended for highly stressed areas, on thin walled parts or for patching holes greater than 1/4 inch in diameter.
- (4) For larger damages an epoxy patching compound is recommended. This type material is a two part, fast curing, easy sanding commercially available compound.
- (5) Adhesion can be increased by roughing bonding surface with sandpaper and by utilizing as much surface area for bond as possible.

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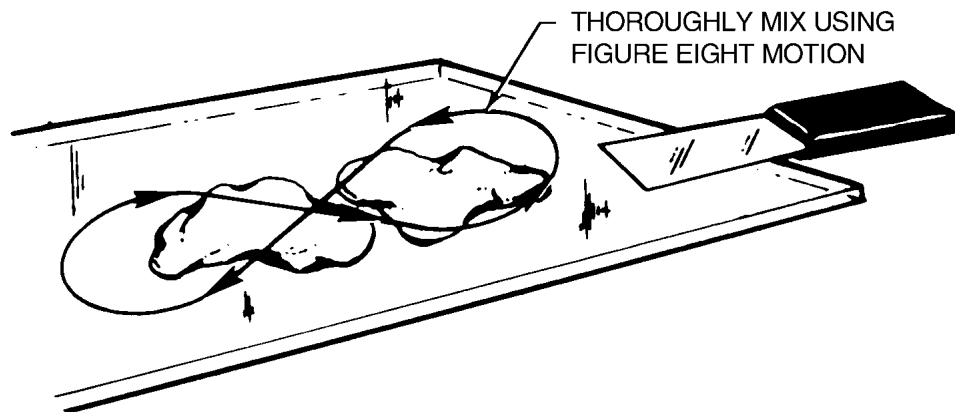


Surface Scratches - Abrasions or Ground in Dirt
Figure 1

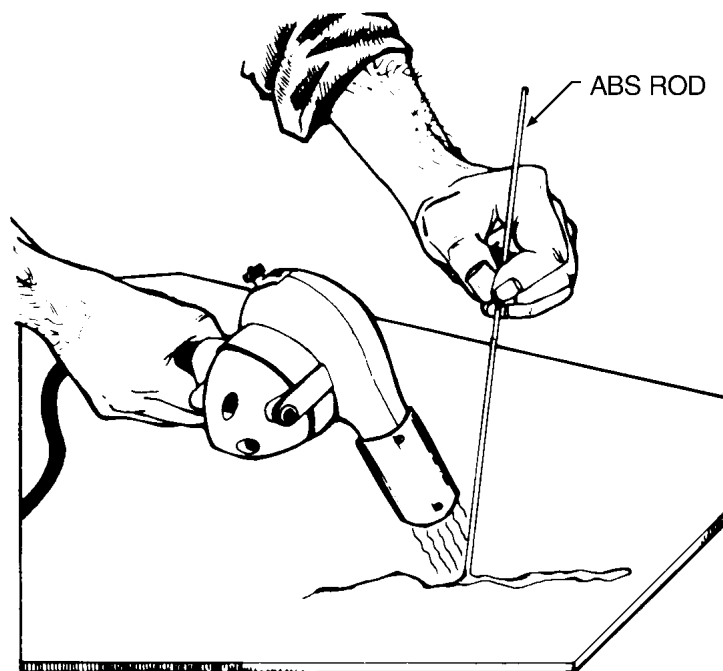


Deep Scratches, Shallow Nicks and Small Holes
Figure 2

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Mixing Epoxy Patching Compound
Figure 3



Welding Repair Method
Figure 4

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- (6) Patching compound is mixed in equal portions on a hard flat surface using a figure eight motion. Damaged area is cleaned with perchlorethylene or VM&P Naptha prior to applying compound. (Refer to Figure 3.)
- (7) A mechanical sander can be used after compound is cured, providing sander is kept in constant motion to prevent heat buildup.
- (8) For repairs in areas involving little or no shear stress, hot melt adhesives, polyamids which are supplied in stick form may be used. This type of repair has a low cohesive strength factor.
- (9) For repairs in areas involving small holes, indentations or cracks in material where high stress is apparent or thin walled sections are used, welding method is suggested.
- (10) Welding method requires a hot air gun and ABS rods. To weld, gun should be held to direct flow of hot air into fusion (repair) zone, heating damaged area and rod simultaneously. Gun should be moved continuously in a fanning motion to prevent discoloration of material. Pressure must be maintained on rod to insure good adhesion. (Refer to Figure 4.)
- (11) After repair is completed, sanding is allowed to obtain surface finish of acceptable appearance.

D. Cracks: (Refer to Figure 5.)

- (1) Before repairing a crack in thermoplastic part, first determine what caused crack and alleviate that condition to prevent it recurring after repair is made.
- (2) Drill small stop holes at each end of crack.
- (3) If possible, a double plate should be bonded to reverse side of crack to provide extra strength to part.
- (4) Crack should be V-grooved and filled with repair material, such as solvent cement, hot melt adhesive, epoxy patching compound or hot air welded, whichever is preferred.
- (5) After repair has cured, it may be sanded to match surrounding finish.

E. Repairing Major Damage: (Larger than 1 inch in diameter.) (Refer to Figure 6.)

- (1) If possible a patch should be made of same material and cut slightly larger than section being repaired.
- (2) When appearances are important, large holes, cracks, tears, etc, should be repaired by cutting out damaged area and replacing it with a piece of similar material.
- (3) When cutting away damaged area, under cut perimeter and maintain a smooth edge. Patch and/or plug should also have a smooth edge to insure a good fit.
- (4) Coat patch with solvent adhesive and firmly attach it over damaged area.
- (5) Let patch dry for approximately one hour before any additional work is performed.
- (6) Hole, etc, is then filled with repair material. A slight overfilling of repair material is suggested to allow for sanding and finishing after repair has cured. If patching compound is used, repair should be made in layers, not exceeding a 1/2 inch in thickness at a time, thus allowing compound to cure and insuring a good solid buildup of successive layers as required.

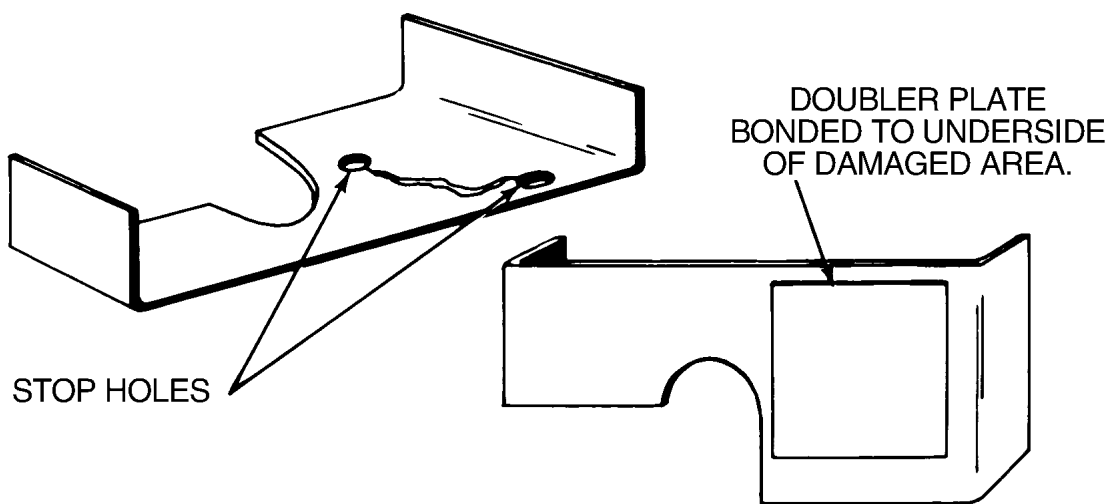
F. Stress Lines: (Refer to Figure 7.)

- (1) Stress lines produce a whitened appearance in a localized area and generally emanate from severe bending or impacting of material. (Refer to Figure 8.)
- (2) To restore material to its original condition and color, use a hot air gun or similar heating device and carefully apply heat to affected area. Do not overheat material.

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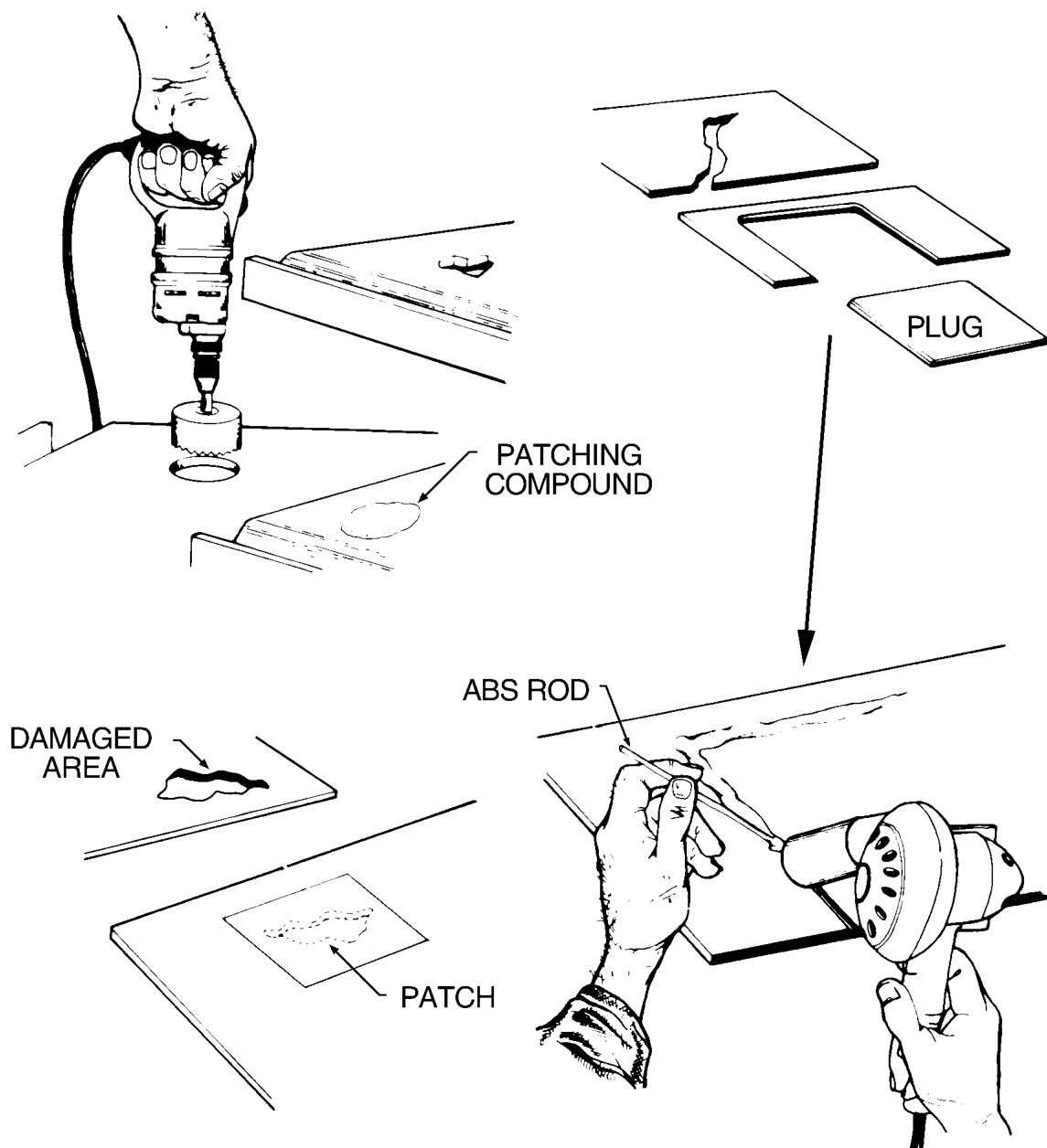
CHART 1
THERMOPLASTIC REPAIR LIST OF MATERIALS

Item	Description	Source
Buffing and Rubbing Compounds	Automotive Type - DuPone #7	DuPont Company Wilmington, DE 1998
	Ram Chemical #69 x 1	Ram Chemicals Gardena, CA 90248
	Mirror Glaze #1	Mirror Bright Polish Co., Inc. Irvin, CA 92713
Cleaners	Fantastic Spray	Local Suppliers
	Perchloroethylene	
	VM&P Naptha (Lighter Fluid)	
ABS-Solvent Cements	Solarite 11 Series	Solar Compounds Corp. Linden, NJ 07036
Solvents	Methylethyl Ketone	Local Suppliers
	Methylene Chloride	
	Acetone	
Epoxy Patching Compound	Solarite #400	Solar Compounds Corp. Linden, NJ 07
Hot Melt Adhesives Polyamids and Hot Melt Gun	Stick From 1/2 in. dia. 3 in. long	Sears Roebuck & Co., or most hardware stores
Hot Air Gun	Temp. Range 300° to 400°F	Local Suppliers



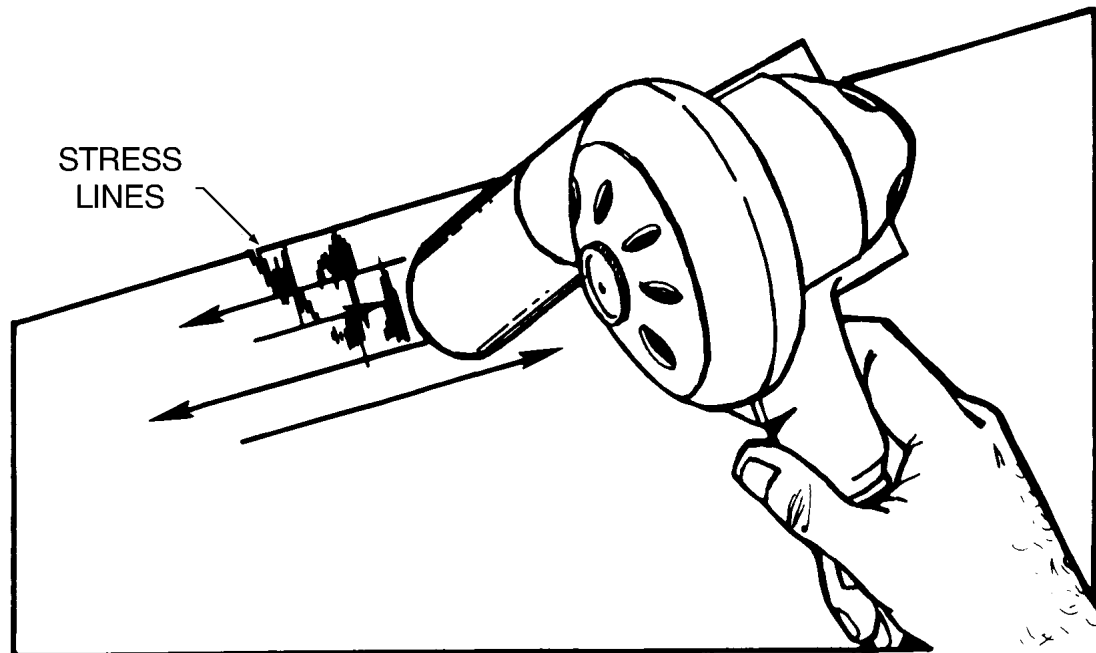
Repairing Cracks
Figure 5

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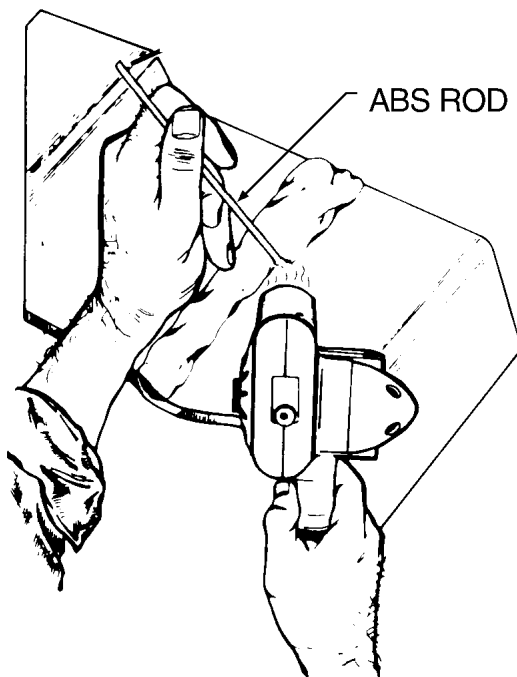


Various Repairs
Figure 6

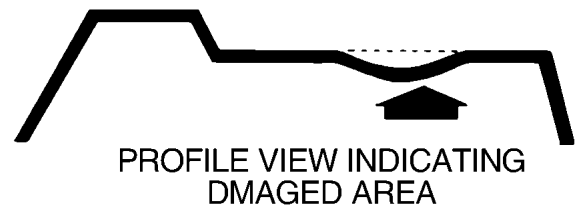
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Repairing Stress Lines
Figure 7



Repairing Impact Damage
Figure 8



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G. Painting the Repair:

- (1) An important factor in obtaining a quality paint finish is proper preparation of repair and surrounding area before applying any paint.
- (2) It is recommended that parts be cleaned prior to painting with a commercial cleaner or a solution made from one-fourth cup of detergent mixed with one gallon of water.
- (3) Paint used for coating thermoplastic can be either lacquers or enamels depending on which is preferred by repair facility or customer.

NOTE: It is extremely important that solvent formulations be considered when selecting a paint, because not all lacquers or enamels can be used satisfactorily on thermoplastics. Some solvents used in paints can significantly affect and degrade plastic properties.

- (4) Another important matter to consider is that hard, brittle coatings that are usually best for abrasion resistance should not be used in areas which incur high stress, flexing or impact. Such coating may crack, thus creating a weak area.

3. Safety Walk Repair

A. Pressure Sensitive Safety Walk

- (1) Surface Preparation For Pressure Sensitive Safety Walk

NOTE: Areas to which pressure sensitive safety walk is to be installed must be free from all contaminants and no moisture present.

If liquid safety walk is installed the area must be prepared as follows:

- (a) Area must be masked off to protect painted surfaces.
- (b) Apply suitable stripper MEK Federal Spec. TT-M-261, U.S. Rubber No. 3339 to windwalk compound. As compound softens remove by using putty knife or other suitable tool.
- (c) Area must be clean and dry prior to painting.
- (d) Prime and paint area.

- (2) Application of Pressure Sensitive Safety Walk

NOTE: Newly painted surfaces shall be allowed to dry for 2.5 hours minimum prior to application of safety walk.

NOTE: Wipe area with a clean dry cloth to insure that no moisture remains on surface. Do not apply when surface temperature is below 50F.

- (a) Peel back full width of protective liner approximately 2 inches from leading edge of safety walk.
- (b) Apply safety walk to wing area, begin at leading edge, insure proper alignment and position from wing lap.
- (c) Remove remaining protective liner as safety walk is being applied from front to back of wing area.
- (d) Roll firmly with a long handled cylindrical brush in both lengthwise directions. Make sure all edges adhere to wing skin.
- (e) Install and rivet leading edge retainer.

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B. Liquid Safety Walk

These airplanes were delivered from the factory with Pressure Sensitive Safety Walk installed. Use of existing shelf stocks of Liquid Safety Walk Compound is an authorized replacement option.

(1) Surface Preparation

- (a) Clean all surfaces with a suitable cleaning solvent to remove dirt, grease and oils. Solvents may be applied by dipping, spraying or mopping.
- (b) Insure that no moisture remains on surface by wiping with a clean, dry cloth.
- (c) Outline area to which liquid safety walk compound is to be applied, and mask adjacent surfaces.

(2) Product Listing For Liquid Safety Walk Compound

(a) Suggested Solvents:

Safety Solvent per MIL-S-18718
Sherwin Williams Lacquer Thinner R7KC120
Glidden Thinner No. 207

(b) Safety Walk Material:

Walkway Compound and Matting Nonslip (included in Piper Part No. 179872)

(3) Application Of Liquid Safety Walk Compound

NOTE: Newly painted surfaces shall be allowed to dry for 2.5 hours minimum prior to application of safety walk.

NOTE: Liquid safety walk compound shall be applied in an area free of moisture for a period of 24 hours minimum after application. Do not apply when surface to be coated is below 50°F. Apply liquid safety walk compound as follows:

- (a) Mix and thin liquid safety walk compound in accordance with manufacturer's instructions on container.
- (b) Coat specified surfaces with a smooth, unbroken film of liquid safety walk compound. A nap type roller or a stiff bristle brush is recommended, using fore and aft strokes.
- (c) Allow coating to dry for 15 minutes to one hour before recoating or touchup, if required after application of initial coating.
- (d) After recoating or touchup, if one, allow coating to dry for 15 minutes to one hour before removing masking.

NOTE: Coated surface shall not be walked on for six hours minimum after application of final coating.

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4. Metal / Wire Stitching Repair (See Figure 9.)

(Ref. PPS-20024, Rev. A.)

CAUTION: METAL/WIRE STITCHING (AND THE ALTERNATE METHOD OF JOINING DESCRIBED BELOW) SHALL ONLY BE USED FOR NON-STRUCTURAL, NON-LOAD CARRYING APPLICATIONS.

A metal/wire stitching process is used to staple fabric and rubber seal materials to engine baffles and some composite materials. The following alternate method of joining is approved for field use when replacing these fabric and rubber seal materials.

Alternate (Rivet) Method of Joining.

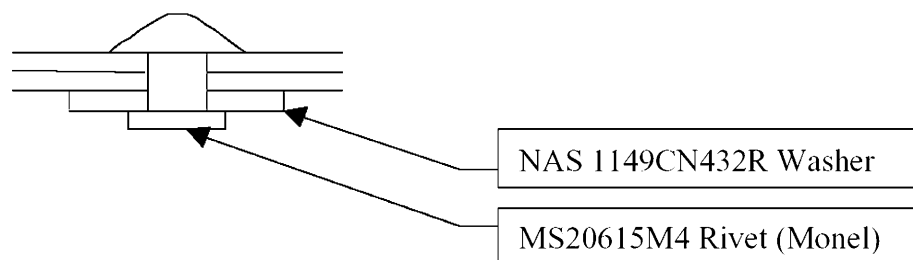
- (1) Substitute two rivets in lieu of each staple where stitching was previously used or is specified. Maintain a minimum of .75 inch spacing between rivets.
- (2) When materials being joined include Stainless Steel, Galvanized Steel or Steel, use:
 - (a) MS20615M4 Rivet (Monel) and NAS1149CN432R Washer (See Figure 9.)
 - (b) Install with manufactured (factory) head against hardest material. Install washer against opposite side of joint and upset rivet (bucktail) against washer.
- (3) When materials being joined include only aluminum and nonmetallic materials use:
 - (a) MS20470A4 Rivet and NAS1149DN432H Washer (See Figure 9.)
 - (b) Install with manufactured (factory) head against hardest material. Install washer against opposite side of joint and upset rivet (bucktail) against washer.

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When materials being joined include Stainless Steel, Galvanized Steel or Steel, use:

MS20615M4 Rivet (Monel)
NAS1149CN432R Washer

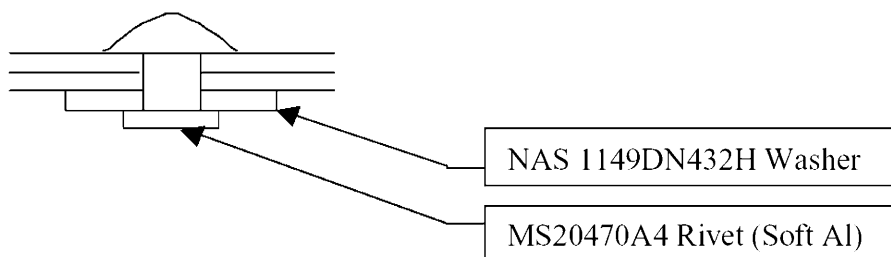
Install with manufactured (factory) head against hardest material. Install washer against opposite side of joint and upset rivet (bucktail) against washer.



When materials being joined include only aluminum and nonmetallic materials use:

MS20470A4 Rivet
NAS1149DN432H Washer

Install with manufactured (factory) head against hardest material. Install washer against opposite side of joint and upset rivet (bucktail) against washer.



Metal / Wire Stitching Repair
Figure 9

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ELECTRICAL BONDING

1. General

(PIR-PPS55006, Rev. S.)

All electrical and electronic equipment and specified components shall be installed in such a manner as to provide a continuous low resistance path (bonds) from the equipment enclosure/component to the airplane structure. Bonds must be installed to ensure that the structure and equipment are electrically stable and free from the hazards of lightning, static discharge, electrical shock, etc.

- A. All parts shall be bonded with as short a lead as possible.
- B. All bonding surfaces shall be cleaned prior to the installation of the bonded joint.
- C. All nuts used in bonding shall be of the self-locking type. (Do Not use fiber-locking type).
- D. All electrical bonding shall be accomplished without affecting the structural integrity of the airframe.

2. 100 Hour Inspection

(PIR-AC 43.13-1, Rev. B.)

Each 100 hours, visually inspect shield and shield terminations of each electrical harness for integrity, condition, and security. If electrical arcing is evident, check for intermittent contact between conducting surfaces. Arcing can be prevented by bonding or insulation, as appropriate.

Inspect the components listed in Chart 1 as follows:

- A. Bond connections shall be secure and free from corrosion.
- B. Bonding jumpers installed so as not to interfere in any way with the operation of moveable components of the aircraft.
- C. No self-tapping screws used for bonding purposes.
- D. Exposed conducting frames or parts of electrical or electronic equipment should have a low resistance bond of less than 2.5 milliohms to structure. If the equipment design includes a ground terminal or pin, which is internally connected to such exposed parts, a ground wire connection to such terminal will satisfy this requirement.
- E. Parts shall be bonded directly to the primary structure rather than to other bonded parts.
- F. Where aluminum or copper is bonded to dissimilar metallic structures, ensure installed hardware (typically washers) is as called out in the parts catalog to minimize electrolytic corrosion and ensure the hardware should corrode first.

3. On Condition Inspection

Whenever any electrically bonded component (see Chart 1) is removed and reinstalled, or visual inspection reveals the electrical bonding to be suspect, measure resistance between component and aircraft structure.

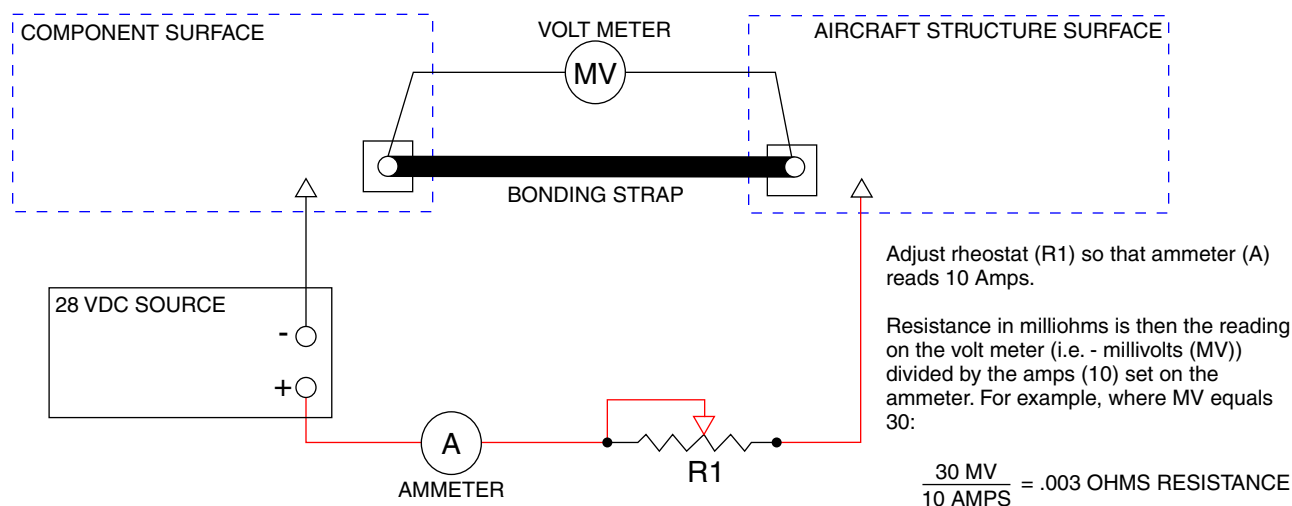
To ensure proper operation and suppression of radio interference from hazards, electrical bonding of equipment must not exceed the maximum allowable resistance values specified in Chart 1.

- A. Measurements should be performed after the grounding and bonding mechanical connections are complete to determine if the measured resistance values meet the basic requirements.
- B. A high quality test instrument (AN AN/USM-21A or equivalent) will accurately measure the very low resistance values specified.
- C. Another method of measurement is the millivolt drop test as shown in Figure 1.

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**CHART 1
ELECTRICAL BONDING RESISTANCE INDEX**

Component	Maximum Allowable Resistance Value in Ohms
Engine Mount(s)	.003
Generator(s)	.010
Ailerons	.003
Elevator / Stabliator	.003
Rudder	.003
Alternator(s)	.010
Trim Tab(s)	
Conventional Hinge	.003
Piano Hinge	.010
Instrument Panel Inserts	.010
Exterior Lights Mounted on Non-Conductive Material	.003
Avionics 'Black Boxes'	.003
NOTE: Harnesses should be installed and connected for this check, internal chassis wiring through the connector to ground is permissible for this grounding.	
Battery Ground Point	.010
Static wick mounting plates (TCO Model B-4) P/N 452-094	1.00
NOTE: Where jumper wires or cables are used to accomplish a proper bond, resistance between the jumper terminal and the component or structure shall not exceed .001 ohms. The controlling points for measuring resistance will be within the limits of the cleaned area to be bonded and within 1/4 inch of the exterior limits of the bonding jumper terminal or material called for in the bill of materials of the drawing. Resistance to ground will be measured from wire terminal to structure for electrical / electronic equipment not internally grounded and from mounting flange to structure for equipment that is internally grounded.	



Millivolt Drop Test
Figure 1

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CHAPTER

52

DOORS

**THE NEW PIPER AIRCRAFT, INC.
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CHAPTER 52

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CHAPTER 52 - DOORS

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GENERAL

1. Description

This airplane is provided with a crew entrance door located on the forward right side of the fuselage and a passenger compartment door on the left side of the fuselage aft of the wing trailing edge. A rear baggage compartment door adjoins the passenger compartment door. The forward baggage compartment door is located on the left side of the fuselage at station 20.

2. Door Snubber Seals (See Figure 1.)

Door snubber seals are incorporated in the door jambs to improve door sealing in all doors except the forward cabin door. The latching mechanism used in the forward cabin door has improved sealing characteristics sufficient to allow the removal of snubber seals from those doors.

NOTE: Seneca IV S/N's 3447001 thru 3447012 use an older forward cabin door latch design and, accordingly, do use snubber seals on the forward cabin door.

NOTE: Seneca V S/N's 3449089 and up use a new type door seal on the aft cabin door that make the snubber seal no longer necessary.

NOTE: If existing seal is torn or badly deteriorated, it should be replaced. If seal is loose or bond is "marginal", it should be rebonded. Adhesives listed below are recommended for rebonding:

3M EC 1300L (Preferred)

Proco Adhesive 6205-1

Scotch Grip 2210

A. Removal

- (1) Remove windlace retainers, "roll" back windlace (tape to secure) out of way, remove all scuff plates and disconnect door holder.
- (2) Remove all striker plates except where shown in Figure 1, Section A-A.
- (3) With a plastic scraper or other appropriate instrument, scrape off snubber while applying mineral spirits as necessary to loosen strip and wipe off excess adhesive with a clean cloth.

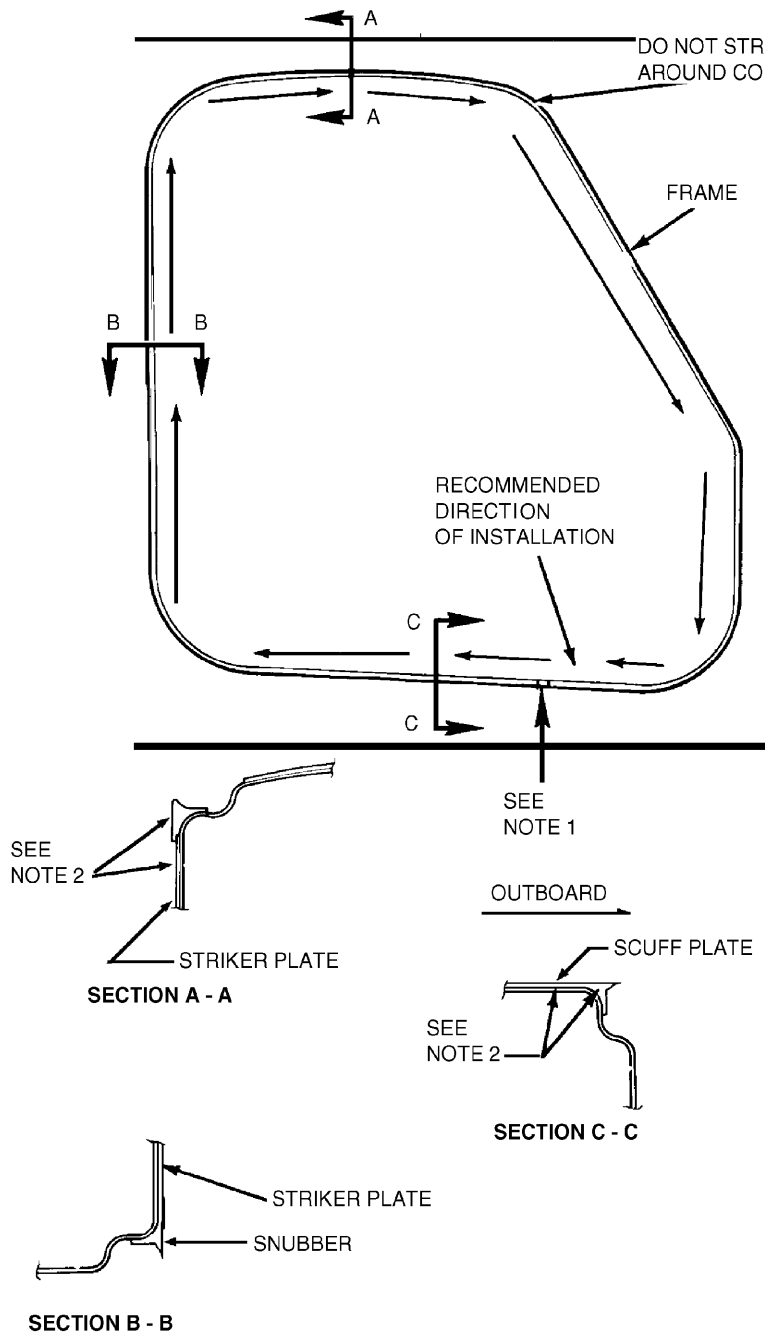
B. Installation

- (1) If door jamb is flaking or excessively scuffed, rub down with wet and dry emery cloth. Clean surface using Prep-Sol or equivalent cleaner which will not leave an oily residue.
- (2) Mask jamb as shown in view E of figure 1.
- (3) Apply adhesive to door jamb as shown in view E of figure 1.
- (4) Apply adhesive to inside surface of snubber.
- (5) Position snubber with protruding leg facing outboard beginning at lower center of door jamb and work progressively around jamb applying pressure to snubber to remove any trapped air and to ensure a proper bond. Do not prestretch snubber as this can induce cracks.

NOTE: Normal tack time for 3M EC 1300L is 30-45 minutes at 75°F. However, adhesive that has "set" may be reactivated by a clean rag moistened with Toluol or MEK.

- (6) It takes approximately 1 day for bond to cure. Do Not allow door to close during this period. It is recommended that door be left open as long as possible to effect curing.
- (7) Remove masking tape if used and clean off excessive adhesive smears using Mineral Spirits or Toluol and a clean cloth. Install striker plates and windlacing. Cut snubber for aft cabin door as shown in Figure 1.
- (8) Check that doors close properly and readjust as necessary to achieve a flush fit. Latching effort must not have increased.

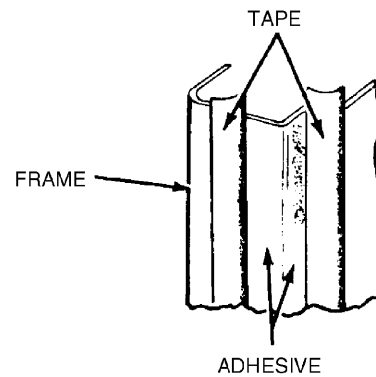
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**FORWARD CABIN
DOOR INSTALLATION
(Seneca IV -
S/N's 3447001
thru 3447012 only)**

NOTES

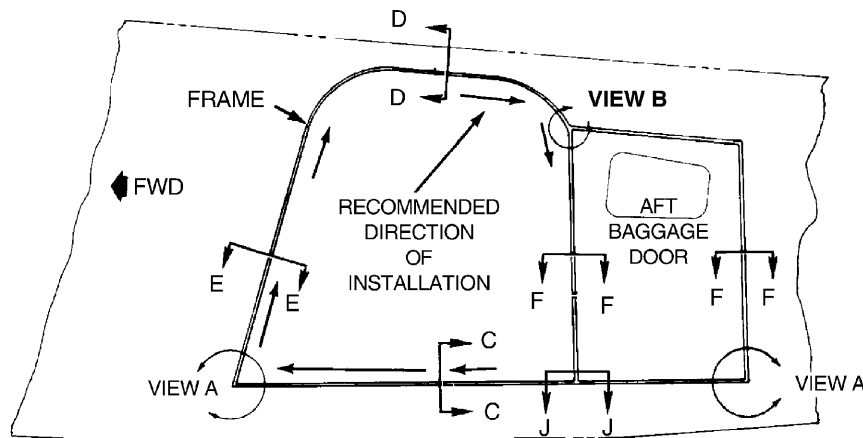
1. SNUBBER BUTT JOINT SHOULD OCCUR AT DOOR DRAIN AREA AS APPLICABLE.
2. ORIENT SNUBBER FLAT WITH SURFACE INDICATED BY NOTE DESIGNATION



APPLICATION OF ADHESIVE

Door Snubber Seal Installation
Figure 1 (Sheet 1 of 2)

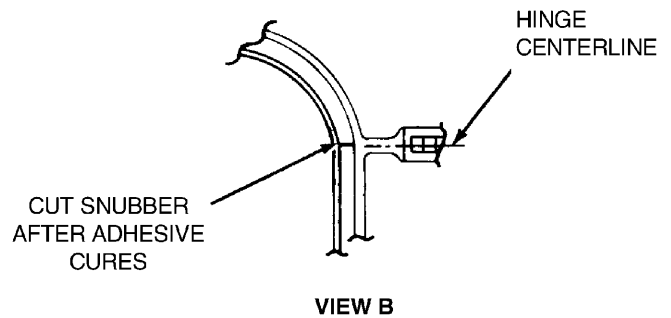
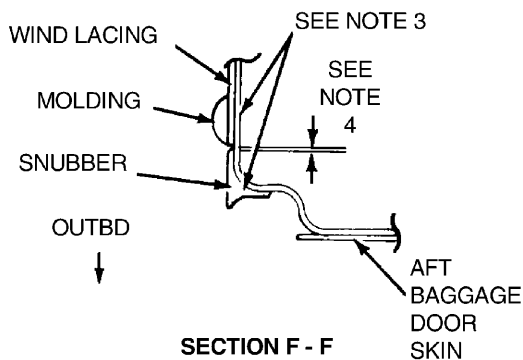
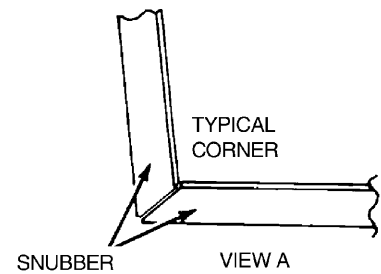
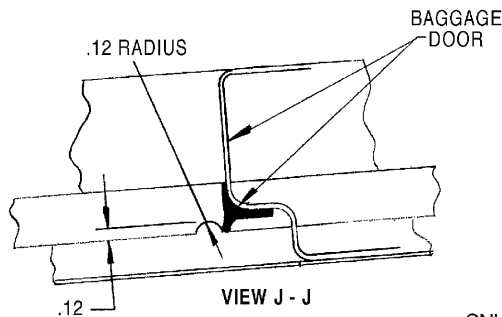
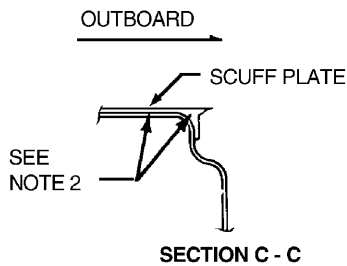
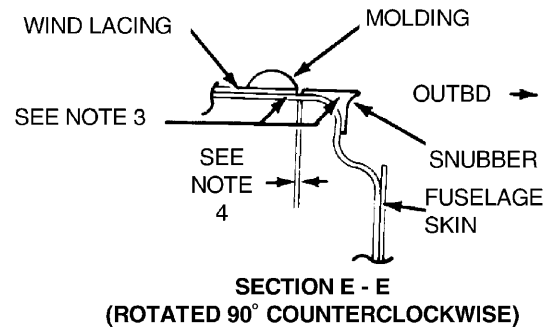
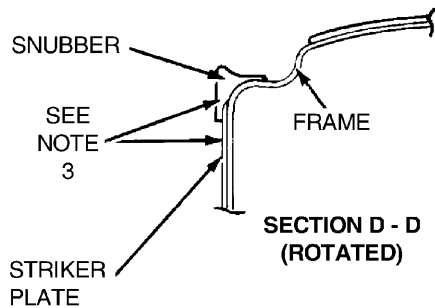
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**AFT CABIN DOOR
INSTALLATION**

NOTES

3. ORIENT SNUBBER FLAT WITH SURFACE INDICATED WITH NOTE DESIGNATION.
4. TRY TO KEEP WIND LACING AT LEAST 0.03 TO 0.06 IN. (0.762 TO 1.524 MM) FROM SNUBBER.



Door Snubber Seal Installation
Figure 1 (Sheet 2 of 2)

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- (9) With all hardware and plates installed, coat snubbers with silicone.
- (10) To check for proper cure, try peeling back a small local area of the snubber leg.
- (11) With adhesive properly cured, remove the masking tape. Replace scuff plates and windlacing. If the snubber for the aft cabin door has just been installed, cut snubber as shown in Figure 1.
- (12) With both the aft cabin and aft baggage door held open, install the door scuff plate and the baggage door vertical trim strip.
- (13) Check that the door closes properly and readjust as necessary to achieve a flush fit. Latching effort must not have increased.
- (14) With all hardware and plates reinstalled coat snubbers with silicone.

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PASSENGER / CREW

1. Cabin Doors

A. Removal

- (1) Remove the clevis bolt, washer and bushing from the door holder assembly.
- (2) Remove cotter pins, clevis pins and washers from door hinges.
- (3) Remove the door from the airplane.

B. Installation

- (1) Insert the door into position and install the washers, clevis bolts and cotter pins on the door hinges.
- (2) For adjustment of door, refer to Adjustment, below.
- (3) Hook up and install the clevis bolt, bushing and washer into the door holder assembly.

C. Adjustment

- (1) To acquire the proper vertical adjustment of the door, insert the necessary washer combination between the cabin door hinge and fuselage bracket assembly.
- (2) Additional adjustments may be made by tapping out the serrated door hinge bushings and rotating them to obtain the hinge centerline location that will provide proper door fit.
- (3) To ensure long life of door seals and improve sealing characteristics, lubricate with a dry lubricant in a spray can.

2. Door Locks

A. Removal

- (1) Remove the door trim upholstery by removing the attachment screws.
- (2) Loosen the nut on the lock assembly and remove the lock by turning it sideways.

B. Installation

- (1) Install the lock in the door by turning it sideways and placing it through the opening provided.
- (2) Replace the nut on the back of the lock assembly and tighten.
- (3) Replace the door trim upholstery and secure with the attachment screws.

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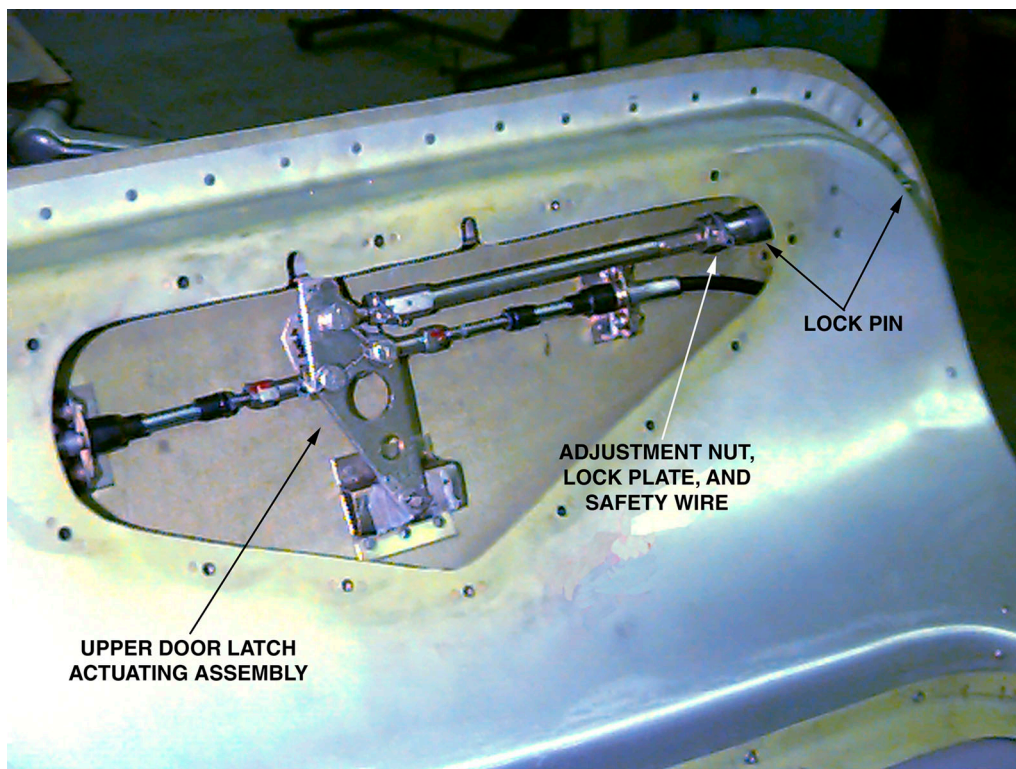
3. Door Latch Mechanisms

A. Forward Cabin Door - Upper - Adjustment (Refer to Figure 1.)

CAUTION: DO NOT LUBRICATE LOCK PIN / LOCK PIN TEFLON GUIDE BEARING.

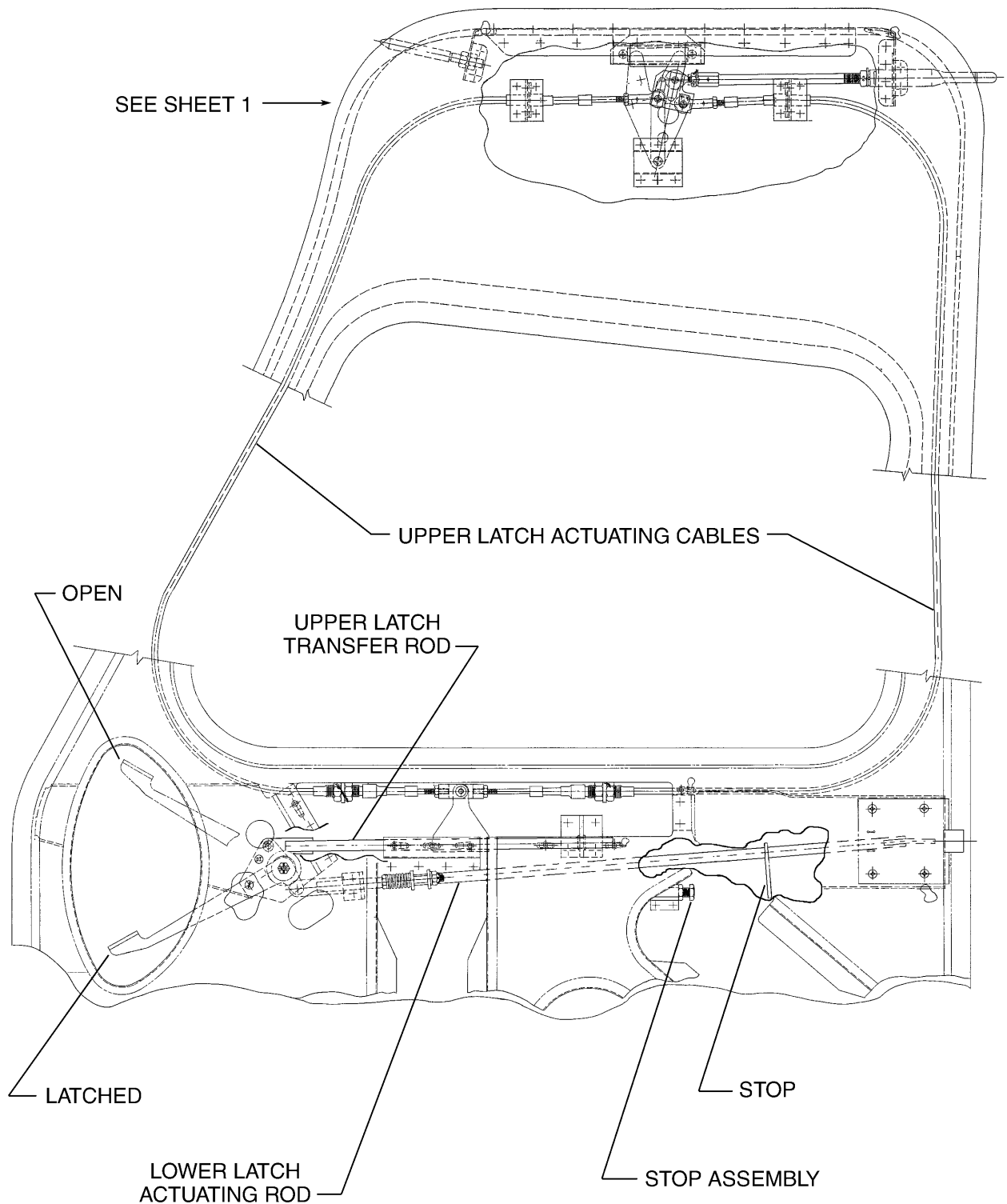
NOTE: Seneca IV S/N's 3447001 thru 3447012 are equipped with the same upper latch described under Aft Cabin Door, below.

- (1) Remove the door trim upholstery by removing the attachment screws.
- (2) Remove upper cabin door access cover on inside of door to gain access to the upper door latch assembly.
- (3) Remove lockwire from nut at aft end of pin assembly.
- (4) Back nut off from lock plate.
- (5) Move lock plate to disengage from aft pin.
- (6) Adjust pin so that, in extended position, rigging groove on pin aligns with forward face of pin receptacle on aft door frame.
- (7) Engage lock plate, making sure safety wire tab on lock plate is facing inboard.
- (8) Tighten nut.
- (9) Install safety wire.



Fwd Cabin Door Latch Installation
Figure 1 (Sheet 1 of 2)

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VIEW OUTBOARD, SHOWN LATCHED

Fwd Cabin Door Latch Installation
Figure 1 (Sheet 2 of 2)

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B. Aft Cabin Door

(1) Lower Latch

(a) Removal

- 1 Remove the door latch mechanism by removing the door trim upholstery and the screws that attach the latch plate and latch mechanism to the door.
- 2 Disconnect the latch pull rod from the inside door handle.
- 3 Remove the complete latch mechanism.

(b) Installation

- 1 Place the latch assembly into position on the door.
- 2 Connect the latch pull rod to the inside door handle.
- 3 Replace the screws that attach the latch plate and mechanism to the door. Install the door trim upholstery and secure with screws.

(c) Adjustment

To adjust the door latch, loosen the screws on the striker plate, make necessary adjustment, and retighten the screws.

(2) Upper Latch

(a) Removal

- 1 Remove the inside and outside handles and the screws holding the pan on the inside of the door.
- 2 Remove the pan and pull the latch assembly through the opening on the door. With the aft door only, pull the pan and latch forward to ensure the locking pin assembly comes free from its receptacle and exits the opening without bending.

(b) Installation

- 1 Place the latch assembly into position for installation. With the aft door only, insert the locking pin assembly first and guide it into its receptacle as the latch assembly reaches its final position.
- 2 Replace the pan and install the screws and handles.
- 3 Check the latch assembly for operation and be certain that it is free of rubbing on the trim panels.

(c) Adjustment

- 1 To adjust the door safety latch, remove the two screws from latch plate found at the top of the door opening.
- 2 Remove the plate and turn the loop assembly in or out to make necessary adjustments.
- 3 Replace the latch plate and secure with the two attachment screws.
- 4 In the aft door only, the locking pin may be adjusted through the opening near the locking pin receptacle.

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CARGO

1. Baggage Doors

A. Removal

With door open remove hinge pin from hinge and remove the door.

B. Installation

Place door in position so that hinge halves are properly matched and install hinge pin. It will not be necessary to replace hinge pin with a new pin if it is free of bends and wear.

C. Seal Installation

(1) Remove any traces of the old seal.

(2) Clean the surface to be bonded with methylethylketone (MEK) to remove any dirt, oil, and grease.

(3) Bond the door seal to the retainer with RTV-732 (P/N 279-195) or RTV-103 (P/N 179-759).

2. Forward Baggage Door Lock

A. Removal

(1) With door open remove nut from back of lock assembly by use of a special made wrench. (This tool may be fabricated from dimensions given in 95-00-00, Figure 3.)

(2) Remove lock assembly through front of door.

B. Installation

(1) Place lock into position for installation.

(2) Install nut on lock assembly and tighten with use of a special wrench.

3. Baggage Door Hinges

A. Removal

(1) Remove door from airplane as described in Baggage Doors, Removal, above.

(2) Remove hinge half from airplane or door by drilling out rivets and removing hinge.

B. Installation

(1) Place hinge halves together and install hinge pin.

(2) Install door into closed position and drill two end rivet holes and install rivets.

(3) Operate door and check for proper fit and installation. Drill remaining holes and install rivets.

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CHAPTER

55

STABILIZERS

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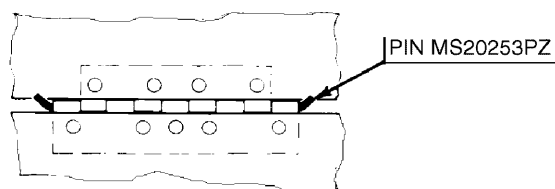
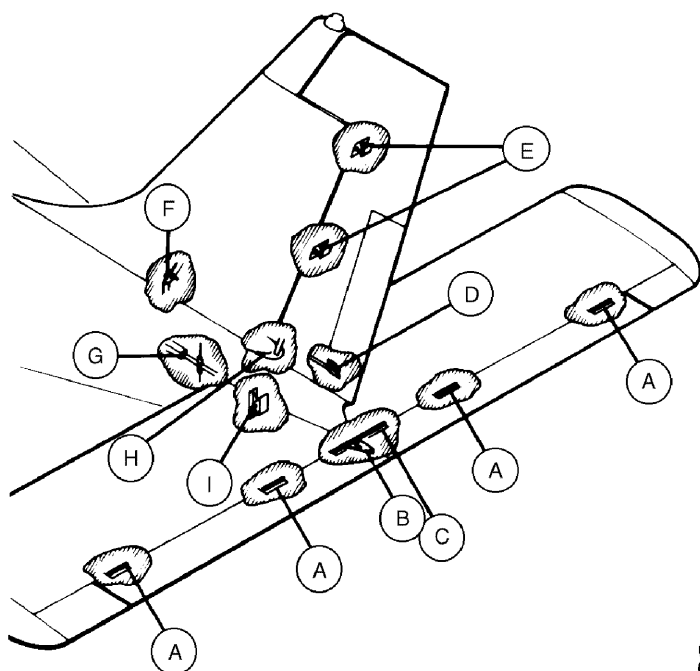
GENERAL

CAUTION: BEFORE ENTERING THE AFT PORTION OF THE FUSELAGE TO ACCOMPLISH ANY OF THE FOLLOWING PROCEDURES, ATTACH A STAND TO THE TAIL SKID FOR SUPPORT. USE A HEAVY PAD TO PROTECT THE BULKHEADS SO AS NOT TO DAMAGE THE FUSELAGE SKIN OR BULKHEAD.

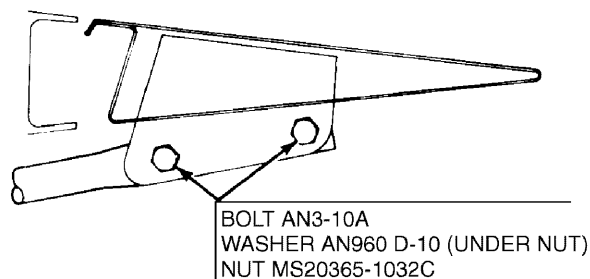
The all metal empennage group is a full cantilever design consisting of a vertical stabilizer (fin), rudder and stabilator, all with removable fiberglass or thermoplastic tips. The rudder and stabilator have trim tabs attached that are controllable from the cockpit. The stabilator also incorporates a one channel main spar that runs the full length of the stabilator and hinges to the aft bulkhead assembly of the fuselage.

Refer to Figure 1 for overview of empennage assemblies.

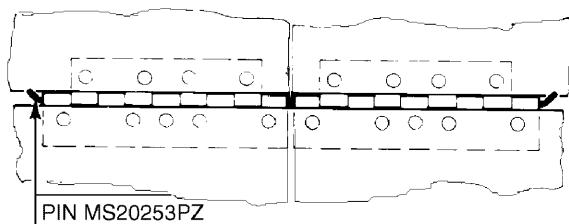
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SKETCH A

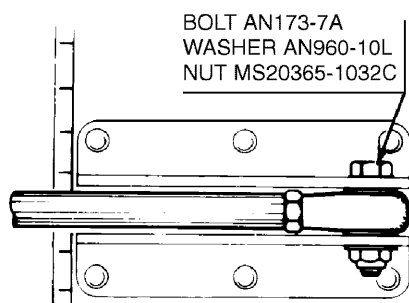


SKETCH B

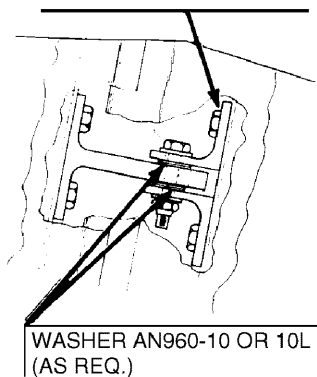


SKETCH C

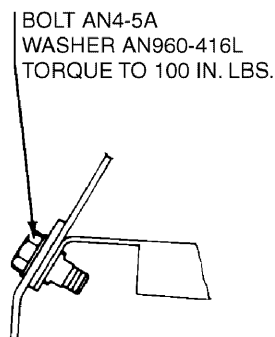
AN173-11A
WASHER AN960-10 (2 REQ.
1 UNDER H/D, 1 UNDER NUT)
NUT MS20365-1032C
35-40 IN. LB TORQUE
AN960-10L (UNDER NUT)
2 REQ.



SKETCH D



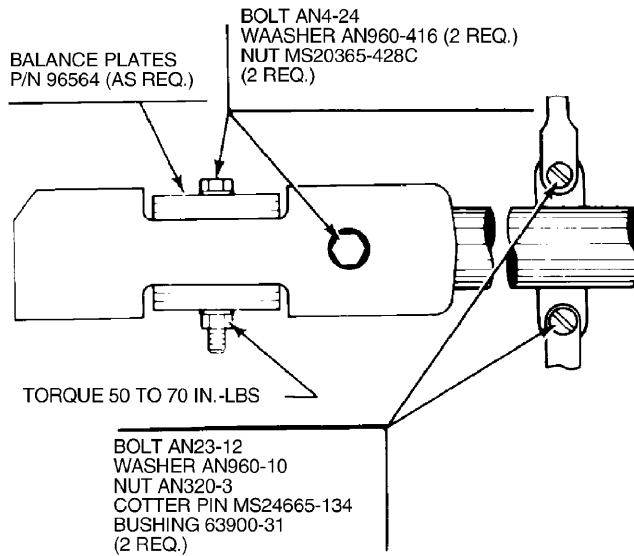
SKETCH E



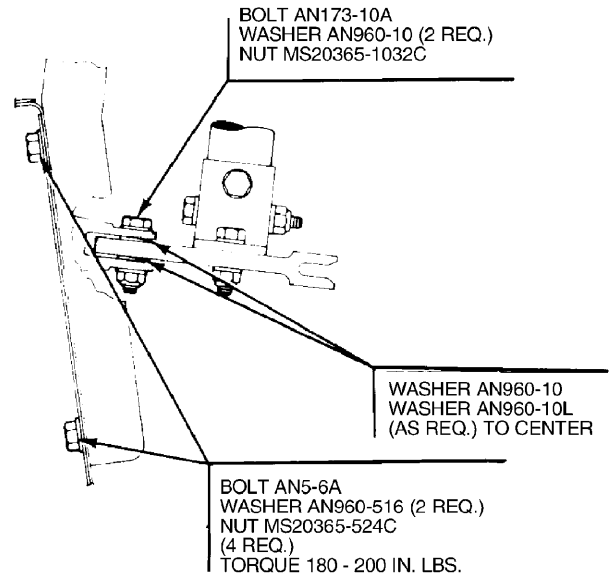
SKETCH F

Empennage Installation
Figure 1 (Sheet 1 of 2)

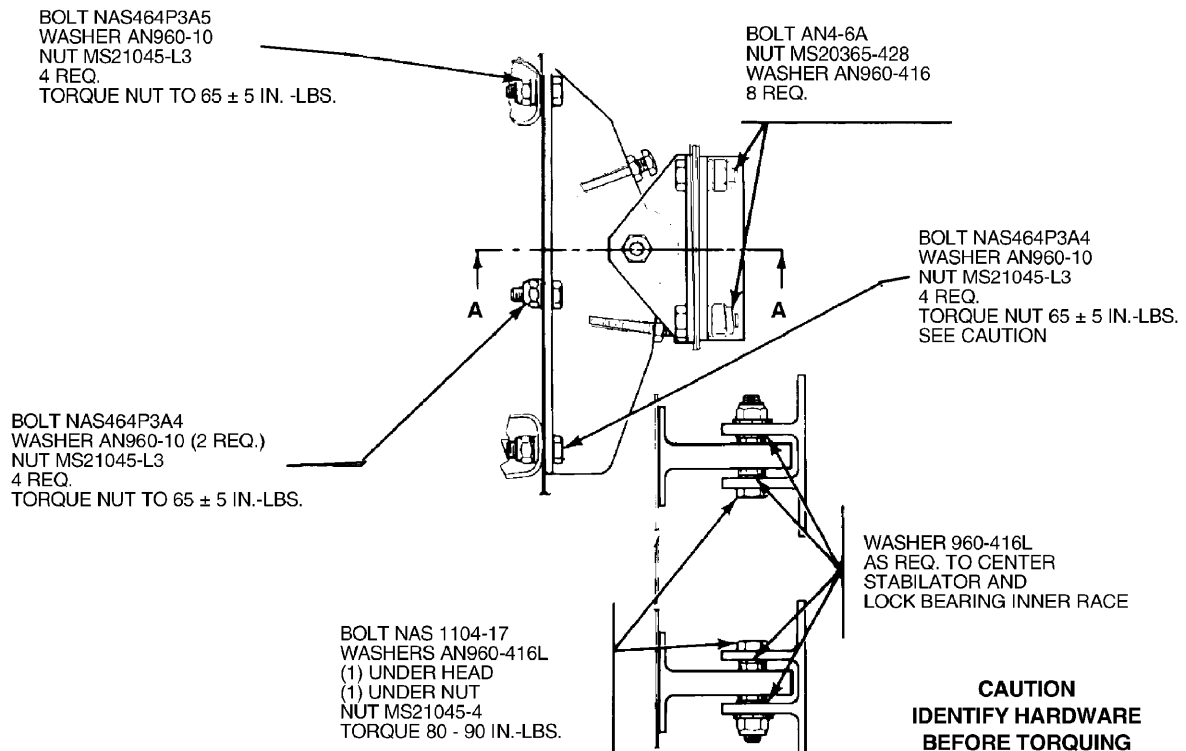
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SKETCH G



SKETCH H



SKETCH I

DETAIL A - A

**CAUTION
IDENTIFY HARDWARE
BEFORE TORQUING**

Empennage Installation
Figure 1 (Sheet 2 of 2)

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STABILATOR

CAUTION: CONTROL SURFACE SKINS MUST BE REPLACED IF THEY SUSTAIN DAMAGE OR EXHIBIT CRACKS.

1. Stabilator (See 55-00-00 Figure 1.)

A. Removal

CAUTION: AT EACH REMOVAL OF THE STABILATOR, CONDUCT ATTACH BRACKETS CORROSION CONTROL INSPECTION, BELOW.

- (1) Remove the screws from around the upper and lower tail cone fairings and remove the assemblies separately.
- (2) Block the trim cable at the barrel of the trim screw assembly to prevent the cable from unwrapping.
- (3) Remove the access panel to the aft section of the fuselage located at the back wall of the baggage compartment.
- (4) Install cable blocks (see 27-30-00, Figure 2) on the stabilator trim control cable at the first set of pulleys forward of the cable turnbuckles to prevent the forward cable from unwrapping.
- (5) Disconnect the trim cables at the turnbuckles within the aft section of the fuselage.
- (6) Relieve tension from the stabilator control cables by loosening one of the cable turnbuckles in the aft section of the fuselage.
- (7) Disconnect the stabilator control cables from the stabilator balance arm by removing the connecting hardware.
- (8) Disconnect the trim assembly from the aft bulkhead of the fuselage by removing the attaching hardware of the horizontal and diagonal support brackets.
- (9) Move the trim assembly up through the tail cone fairing cutout in the stabilator and remove, with cable, from the airplane.
- (10) Remove the two hinge bolts at the pivot points and remove the stabilator as a complete assembly.

B. Installation

WARNING: ALL CONTROL SURFACES THAT HAVE BEEN REPLACED, REPAINTED, OR HAVE HAD DEICE BOOTS ADDED OR REMOVED, MUST BE BALANCED BEFORE INSTALLATION PER INSTRUCTIONS IN BALANCING, BELOW.

NOTE: A clearance of $0.25 \pm .06$ of an inch (6.350 ± 1.524 mm) between the stabilator and the side of the fuselage and 0.18 of an inch (4.572 mm) minimum between all parts of the stabilator and the tail cone assembly must be maintained throughout the stabilator travel. Use a proper washer combination on the stabilator hinges to attain the necessary tolerances.

- (1) Insert the stabilator in position and install attaching hinge bolts, washers and nuts. Torque as specified in 55-00-00, Figure 1.
- (2) Move the trim assembly through the cutout in the stabilator and attach the brackets of the assembly to the aft bulkhead with bolts, washers and nuts. Insert the trim cable ends into the fuselage.
- (3) Attach the stabilator control cables to the stabilator balance arm with clevis bolts, bushings, washers, nuts and cotter pins.
- (4) Connect the ends of the fore and aft trim cables at the turnbuckles within the aft section of the fuselage.
- (5) Remove the cable block from the trim control cable within the fuselage.

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- (6) Set stabilator control cable tension and check rigging and adjustment according to Rigging and Adjustment, Stabilator Control Cables, 27-30-00.
- (7) Remove the cable blocks from the trim cable at the barrel of the trim screw assembly.
- (8) Set stabilator trim control cable tension and check rigging and adjustment according to Rigging and Adjustment, Stabilator Trim Controls (Aft), 27-30-00.
- (9) Remove the pad from the aft section of the fuselage and replace the access panel.
- (10) Install the tail cone fairing and remove tail stand.

2. Stabilator Trim Tab (See 55-00-00, Figure 1.)

A. Removal

- (1) Disconnect the stabilator trim control rod by removing the bolts that attach the control rod to the stabilator trim tab.
- (2) Remove the stabilator trim hinge pins by cutting one end of the wire pins and removing.
- (3) The stabilator trim tab can now be removed.

B. Installation

- (1) Place the trim tab in position on the aft end of the stabilator.
- (2) Replace the old hinge pins with new pins.
- (3) Insert the pins and secure by bending the end to a 45 degree angle.
- (4) Install the control rod and attach with the four bolts and washers.
- (5) The trim tab free play must not exceed 0.125 inches (3.175 mm) maximum.

3. Checking Free Play

A. Stabilator

Check the stabilator for any free play at its attachment points by grasping each half near the tip and gently trying to move it up and down, fore and aft, and in and out. No play is allowed.

B. Stabilator Trim Tab

Set the stabilator trim tab in neutral position. This neutral position is determined with the airplane properly rigged per instructions given in 27-30-00 and the trim indicator at its neutral position. Obtain a straightedge long enough to extend from the ground up to a few inches above the trim tab trailing edge. Place the straightedge next to the trim tab inboard (center) trailing edge, secure the stabilator in neutral and grasping the tab, gently move it up and down, mark the limit of tab free play on the straightedge. The overall travel (free play) must not exceed 0.125 of an inch (3.175 mm). The use of a dial indicator and fixed stand is recommended.

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4. Balancing

WARNING: ALL CONTROL SURFACES THAT HAVE BEEN REPLACED OR REPAINTED MUST BE BALANCED BEFORE INSTALLATION.

A. Balancing Equipment (Refer to Figure 1.)

Balancing must be done using a suitable tool capable of measuring unbalance in inch-pounds from centerline of control surface hinge pin. A suggested tool configuration is shown in 95-00-00, Figure 2. Other tool configurations may be used, provided accuracy is maintained and recalibration capability is provided.

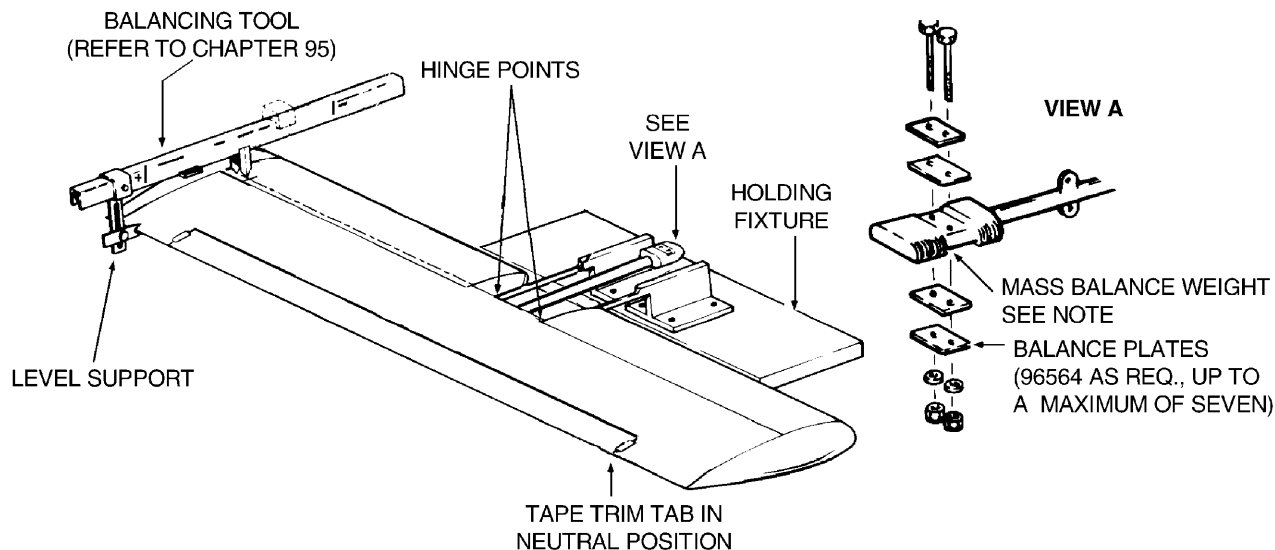
To use this tool:

- (1) Insure that the control surface is in its final Flight configuration, static wicks, trim tabs, trim tab push pull rod and control surface tip (as applicable) should be installed. The surface should be painted and trim/servo tabs should be in the neutral position.

NOTE: Because paint is a considerable balance factor, it is recommended that existing paint be removed prior to repainting a control surface.

- (2) Place hinge bolts through control surfaces and place control surface on a holding fixture.
- (3) Calibrate the tool.
 - (a) Avoiding rivets, place the balancing tool on the control surface with the tool's hinge centerline directly over the hinge line of the control surface.
 - (b) Adjust the movable trailing edge support to fit the width of the control surface. Tighten the set screw on the trailing edge support.
 - (c) Adjust the trailing edge support vertically until the beam is parallel with the control surface chord line.
 - (d) Remove the tool from the control surface and balance the tool itself by adding or removing nuts or washers from the beam balancing bolt. When balancing the tool, the movable weight must be at the bar's hinge centerline.
- (4) After balancing the tool, reattach it to the control surface. Keep the beam positioned 90° from the control surface hinge line.
- (5) Determine balance of control surface by sliding movable weight along the balance beam.
- (6) Read the scale when the bubble level has been centered. Multiply by three to determine in-lbs. (I.E. - Since the movable weight weighs three pounds, every inch it is moved from the center of the beam equals three inch-lbs of force.)

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BALANCE WEIGHT	
LEADING EDGE	TRAILING EDGE
HEAVY	HEAVY
0.00	-13.0

NOTE: WEIGHT OF MASS BALANCE WEIGHT
ON AIRCRAFT WITH DEICER BOOTS
6.00 LBS. \pm 5 OZ. ON AIRCRAFT WITHOUT
DEICER BOOTS 6.69 LBS. \pm 5 OZ.

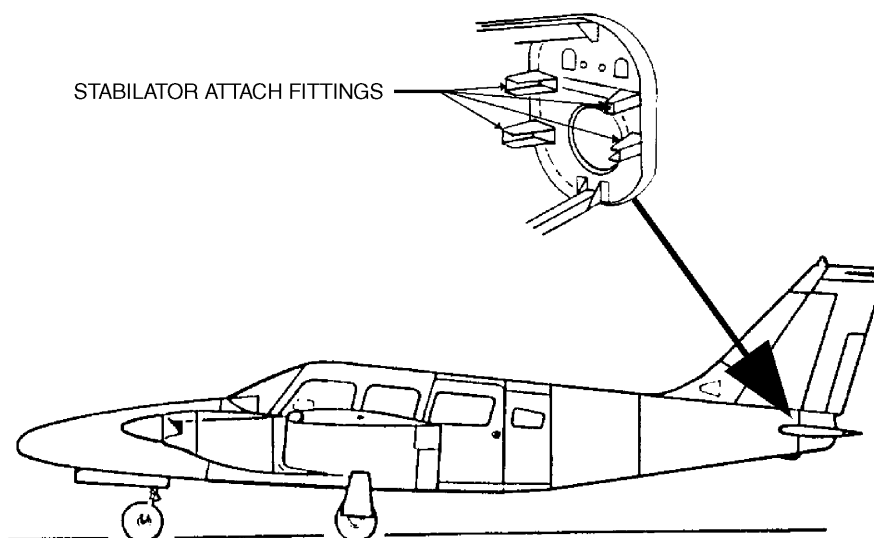
Balancing Stabilator
Figure 1

B. Balancing Stabilator (Refer to Figure 1.)

To balance stabilator, assembly must be complete including trim tab, tab pushrod and end bearing, stabilator tips and all attaching screws. Before balancing, tape trim tab in neutral position with a small piece of tape. Place complete assembly on knife edge supports in a draft-free beam perpendicular to hinge centerline. Do not place tool on trim tab. Calibrate tool as described in Balancing Equipment, above. Read scale when bubble level has been centered by adjustment of movable weight and determine static balance limit. If static balance is not within limits given in Figure 1, proceed as follows:

- (1) If the stabilator is out of limits on the leading edge heavy side, remove balance plates from the mass balance weight until the static balance is within limits.
- (2) If stabilator is out of limits on trailing edge heavy side, add balance plates (4 Maximum) to mass balance weight until static balance is within limits.

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Stabilator Attach Brackets (Typical)
Figure 2

5. Attach Brackets Corrosion Control Inspection (Refer to Figure 2.)

During each annual inspection, use the following method to inspect stabilator attach brackets for rust and corrosion between the steel attach fittings and the adjacent fuselage structure. Take corrective action as required.

- A. Remove upper and lower tail cone fairing assembly.
- B. Remove the aft fuselage closeout plate assembly on the applicable models.
- C. Inspect the steel stabilator attach fittings (4 places) and adjacent fuselage structure for the presence of rust and/or corrosion. (Refer to Figure 2.)

NOTE: Refer to F.A.A. Advisory Circular (AC) 43-4A, Corrosion Control for Aircraft.

- D. If rust and/or corrosion is present, repair or replace as required. Add corrosion protection per AC43-4A.
- E. Install aft fuselage closeout plate assembly. Verify integrity of rubber seals; replace if required
- F. Install upper and lower tail cone fairing assembly.

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VERTICAL STABILIZER

Vertical Fin (Refer to 55-00-00, Figure 1.)

A. Removal

- (1) Remove the screws from the upper and lower tail cone fairing; the fin tip cover and the fairing at the forward base of the fin.
- (2) Remove the rudder per 55-40-00, Rudder, Removal.
- (3) Disconnect the leads from the antenna terminals (optional) and attach a line to the leads to assist in reinstallation.
- (4) Disconnect the wire antenna (optional) that attaches to the leading edge of the fin.
- (5) Disconnect the positive lead to the rotating beacon (optional) and attach a line prior to removal. Disconnect the ground lead by removing the attachment screw.
- (6) Remove the rudder trim assembly and trim cable in accordance with 27-20-00, Rudder Trim Controls (Aft), Removal.
- (7) Remove the bolt and washer that attaches the leading edge of the fin to the fuselage.
- (8) Remove the nuts, washers, and bolts that secure the fin spar to the aft bulkhead and remove the vertical fin.

B. Installation

- (1) Insert the vertical fin into position and install the bolts, washers, and nuts that secure the fin spar to the aft bulkhead.
- (2) Install the bolt and washer that attaches the leading edge of the fin to the fuselage.
- (3) Torque fasteners installed in (1) and (2) as specified in 55-00-00, Figure 1.
- (4) Install the rudder trim assembly and trim cable per instructions given in 27-20-00, Rudder Trim Controls (Aft), Installation.
- (5) Install the rudder per 55-40-00, Rudder, Instructions.
- (6) Pull the electrical and antenna leads through the vertical fin with the line that was attached.
- (7) Connect the antenna leads to the proper terminals and secure with the washers and nuts.
- (8) Connect the electrical leads at the disconnects and insulate.
- (9) Rig and adjust the rudder and trim control cables as given in 27-20-00: Rigging and Adjustment; and, Rudder Trim Controls (Aft), Rigging and Adjustment.
- (10) Check the operation of the radios and electrical lights.
- (11) Replace all fairings and access plates and secure with attaching screws.

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RUDDER

CAUTION: CONTROL SURFACE SKINS MUST BE REPLACED IF THEY SUSTAIN DAMAGE OR EXHIBIT CRACKS.

1. Rudder (Refer to 55-00-00, Figure 1.)

A. Removal

- (1) Remove the screws from around the upper tail cone fairing assembly and remove the fairing.
- (2) Remove the rudder tip by removing the attaching screws and disconnect the tail position light wire at the quick disconnect located at the tip of the rudder. Open the access panel in the rear of the baggage compartment to gain access to the aft section of the fuselage.
- (3) Relieve the cable tension from the rudder control system by loosening one of the cable turnbuckles in the aft section of the fuselage.
- (4) Disconnect the two control cables from the rudder horn by removing the cotter pins, nuts, washers, bushings and bolts.
- (5) Disconnect the rudder trim tab push rod from the actuating link by removing cotter pin, nuts, washer and bolt.
- (6) Disconnect the jumper lead between the rudder and vertical fin.
- (7) Remove the cotter pins, nuts, washers, and bolts from the upper and lower rudder hinge pivot points.
- (8) Pull the rudder up and aft from the vertical fin.

B. Installation

WARNING: ALL CONTROL SURFACES THAT HAVE BEEN REPLACED OR REPAINTED MUST BE BALANCED BEFORE INSTALLATION PER INSTRUCTIONS IN BALANCING, BELOW.

- (1) Place the rudder in position and install the hinge bolts, washers, nuts, and cotter pins. Torque as specified in 55-00-00, Figure 1.

NOTE: Use any washer combination of the hinge assembly to suit best centering and operation of the rudder.

- (2) Connect the rudder trim tab push rod to the actuating link with bolt, washer, nut and cotter pin.
- (3) Connect the tail position light electrical lead at the quick disconnect and cover the connector with an insulating sleeve. Tie both ends of the sleeve with number six electrical lacing twine.
- (4) Connect the jumper lead between the rudder and vertical fin.
- (5) Connect the control cables to the rudder horn with bolts, washers, nuts and cotter pins.
- (6) Check the rudder in accordance with 27-20-00, Rigging and Adjustment.
- (7) Install the upper tail cone fairing and rudder tip and secure with the attachment screws. Secure the access panel to the aft section of fuselage.

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2. Rudder Trim Tab (Refer to 55-00-00, Figure 1.)

A. Removal

- (1) Remove the bolt assembly which connects the trim tab actuating arm to the tab assembly.
- (2) Remove the trim tab hinge pin and remove the tab assembly from the rudder.

B. Installation

WARNING: IF THE RUDDER TRIM TAB HAS BEEN REPLACED OR REPAINTED, BALANCE THE RUDDER BEFORE INSTALLATION PER INSTRUCTIONS IN BALANCING, BELOW.

- (1) Position the trim tab assembly into the rudder aligning the two hinge bolts.
- (2) Install a new hinge pin. Ensure that at least 0.50 of an inch (12.7 mm) of hinge pin extends out from each end of the hinge.
- (3) Bend both ends of the hinge pin to a 30° angle to secure it in place.
- (4) Connect the trim tab actuating arm to the bracket and the tab and secure with bolt assembly.

3. Balancing (See Figure 1.)

WARNING: ALL CONTROL SURFACES THAT HAVE BEEN REPLACED OR REPAINTED MUST BE BALANCED BEFORE INSTALLATION.

A. Balancing Equipment

Balancing must be done using a suitable tool capable of measuring unbalance in inch-pounds from centerline of control surface hinge pin. A suggested tool configuration is shown in 95-00-00, Figure 2. Other tool configurations may be used, provided accuracy is maintained and recalibration capability is provided.

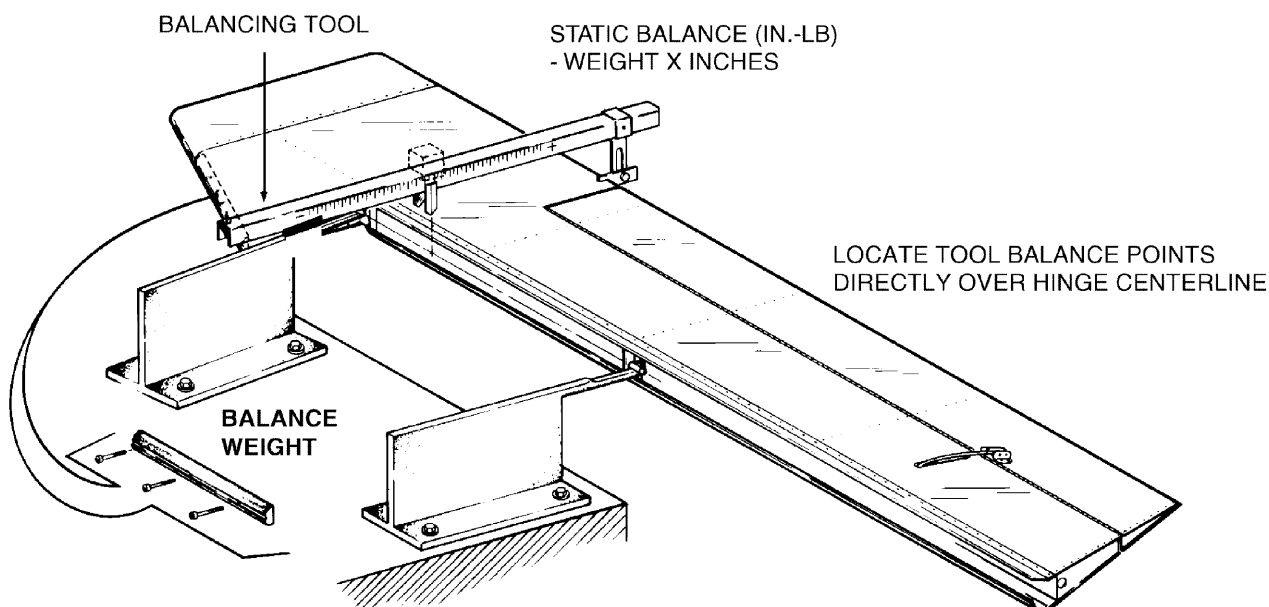
To use this tool:

- (1) Insure that the control surface is in its final Flight configuration, static wicks, trim tabs, trim tab push pull rod and control surface tip (as applicable) should be installed. The surface should be painted and trim/servo tabs should be in the neutral position.

NOTE: Because paint is a considerable balance factor, it is recommended that existing paint be removed prior to repainting a control surface.

- (2) Place hinge bolts through control surfaces and place control surface on a holding fixture.
- (3) Calibrate the tool.
 - (a) Avoiding rivets, place the balancing tool on the control surface with the tool's hinge centerline directly over the hinge line of the control surface.
 - (b) Adjust the movable trailing edge support to fit the width of the control surface. Tighten the set screw on the trailing edge support.
 - (c) Adjust the trailing edge support vertically until the beam is parallel with the control surface chord line.
 - (d) Remove the tool from the control surface and balance the tool itself by adding or removing nuts or washers from the beam balancing bolt. When balancing the tool, the movable weight must be at the bar's hinge centerline.
- (4) After balancing the tool, reattach it to the control surface. Keep the beam positioned 90° from the control surface hinge line.
- (5) Determine balance of control surface by sliding movable weight along the balance beam.
- (6) Read the scale when the bubble level has been centered. Multiply by three to determine in.-lbs. (I.E. - Since the movable weight weighs three pounds, every inch it is moved from the center of the beam equals three inch-lbs of force.)

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	LEADING EDGE HEAVY	TRAILING EDGE HEAVY
SENECA IV	-16.00	-35.00
SENECA V	-16.00	-32.00

Balancing Rudder
Figure 1

B. Balancing Rudder

To balance rudder, assembly must be complete including sector assembly. Place complete assembly horizontally on knife edge support in a draft-free area in a manner that allows unrestricted movement. Place tool on rudder with beam perpendicular to hinge centerline. Calibrate tool as described in Balancing Equipment, above. Read scale when bubble level has been centered by adjustment of moveable weight and determine static balance limit. If static balance is not within limits given in Figure 1, proceed as follows:

- (1) **Nose Heavy:** This condition is highly improbable; recheck calculations and measurements.
- (2) **Nose Light:** In this case, the mass balance weight is too light or the rudder is too heavy because of painting; it will be necessary to strip the paint and repaint. If the rudder is too heavy as a result of repairs, the repair must be removed and the damaged parts replaced.

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CHAPTER

56

WINDOWS

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CHAPTER 56

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CHAPTER 56 - WINDOWS

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FLIGHT COMPARTMENT

Windshield (Refer to Figure 1.)

These airplanes have a one-piece windshield. As shown in Figure 1, the windshield aft of Fuselage Station 69.8 is fitted in a channel and sealed with vinyl foam tape. Forward of F.S. 69.8, the windshield is held in place by inner and outer collars which are secured to the airplane by two different types of screws. If removing the windshield, mark the screws and collars to ensure the proper screws are replaced in their appropriate positions during installation.

A. Removal

- (1) Remove the screws around the forward part of the windshield. (On Seneca V models it may be necessary to also loosen screws on the sideposts.)

NOTE: To facilitate installation, the screws should be cross marked to the collars ensuring the proper screws are replaced in their appropriate positions.

- (2) Remove the outer collars. With the tape and sealant between the outer collars and windshield, it may be necessary to carefully pry the collars off the windshield.

NOTE: Save the old or damaged windshield for use as a pattern for trimming the new windshield.

- (3) Raise the forward portion of the windshield slightly and slide the assembly forward out of the fuselage channel.
- (4) Clean old tape and sealer from collars and channel.

B. Installation

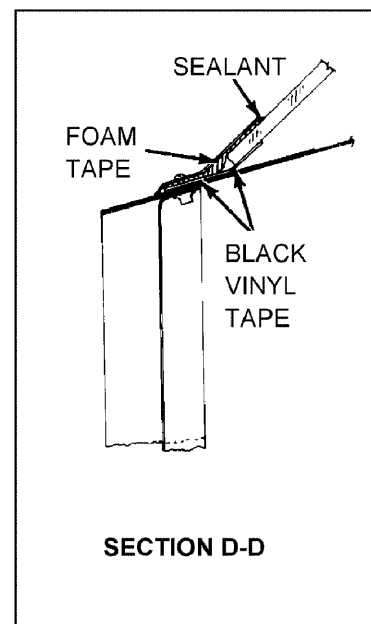
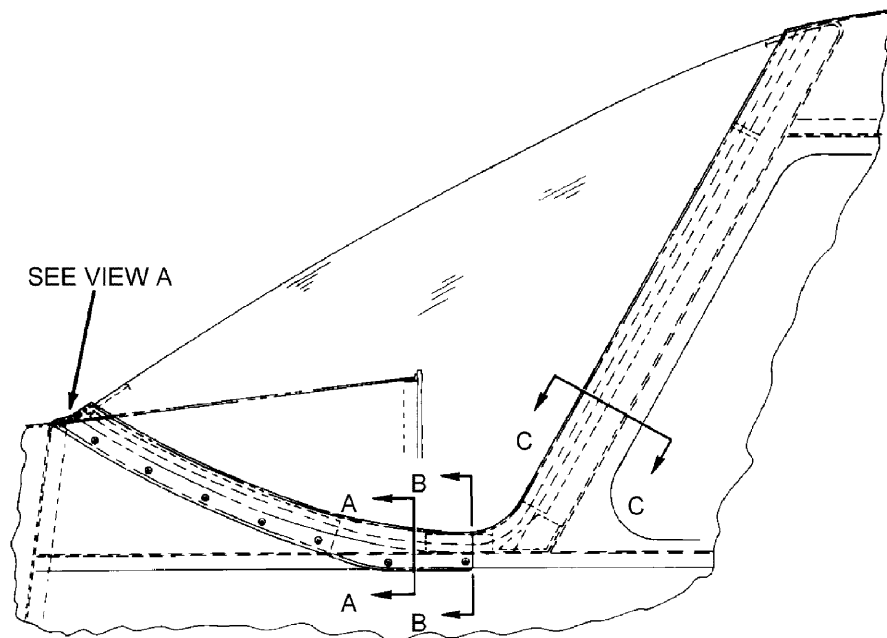
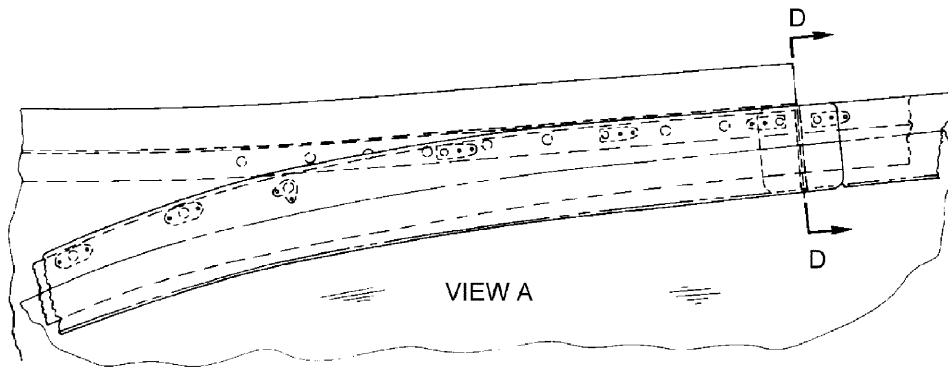
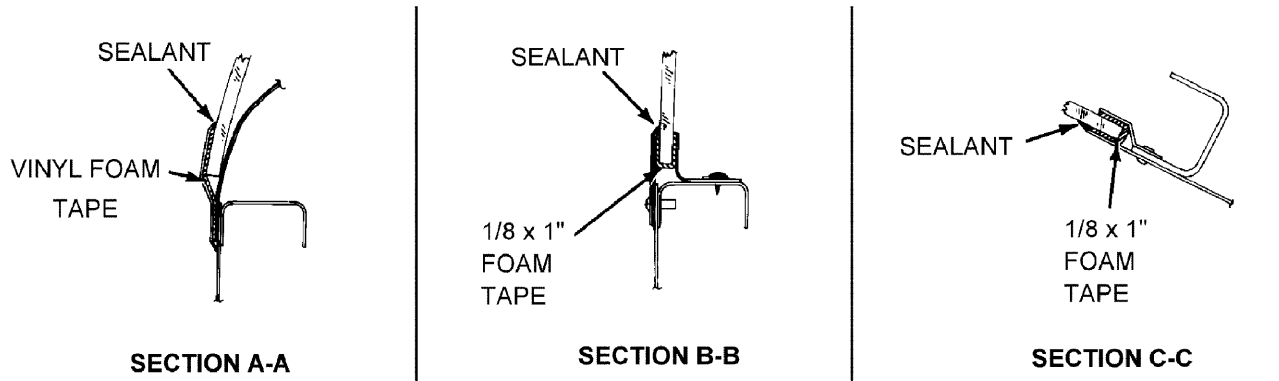
- (1) Ensure the outline or outside contour of the new windshield edge properly fits. Grind or cut the new windshield as necessary to acquire proper dimensions.

NOTE: If saved, the old windshield can be used as a pattern for trimming the new windshield.

- (2) Apply black vinyl tape to the inside collar surfaces that mate to the windshield and outside collars. Refer to Figure 1, Section A-A.
- (3) Apply vinyl foam tape around the edge of the windshield to be inserted in the fuselage channel. The affected edge of the windshield is that which extends behind F.S. 69.8.
- (4) Align the windshield in position and slide it aft into the fuselage channel.
- (5) Apply vinyl foam tape (see List of Consumable Materials, 91-10-00) to the inside of the outer collars and loosely connect them to the fuselage around the edge of the windshield.
- (6) Insert screws into place on collars but do not tighten.
- (6) Apply sealant ((PRC) PR 307, as specified in List of Consumable Materials) by forcing it under the flange edges specified in Figure 1. Mating parts can be separated slightly using a soft wooden wedge or tongue depressor. The sealant must be forced deep into the gap. Avoid bending or scratching aluminum or window surfaces.
- (7) Tighten the screws on the windshield collars.
- (8) Clean off excess sealant immediately, using clean rags, plastic scrapers, and solvent. Use only Tripolene or Apperson Solvent No. 12D around windows. Toluol may be used in areas away from windows.

NOTE: Joints may be completely filled. All sealed areas should be smoothly blended after clean up.

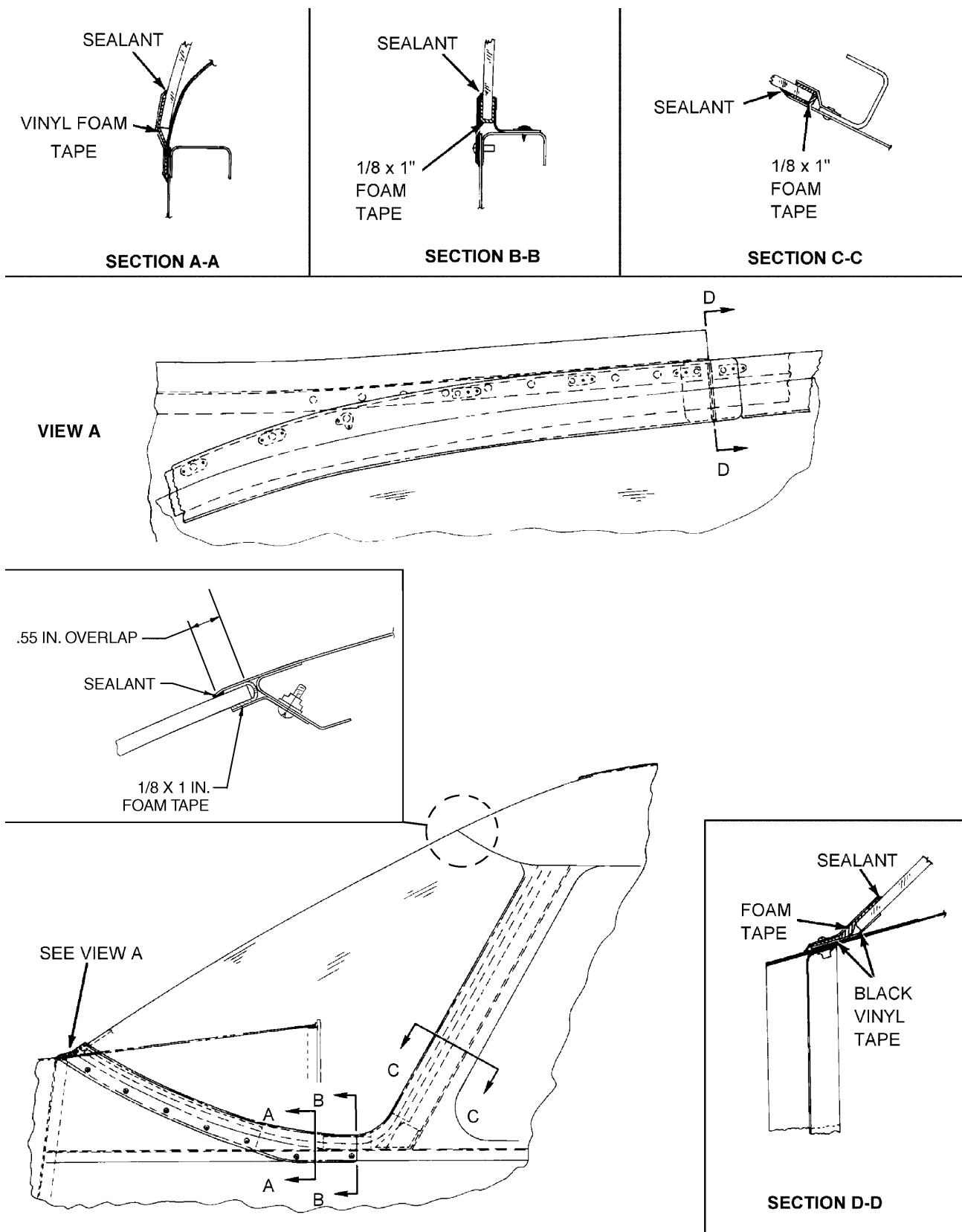
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Effectivity
Seneca IV

Windshield Installation
Figure 1 (Sheet 1 of 2)

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Windshield Installation
Figure 1 (Sheet 2 of 2)

[Effectivity](#)
[Seneca V](#)

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PASSENGER COMPARTMENT

1. Side Windows (Refer to Figure 1.)

These airplanes are equipped with single pane side windows.

A. Removal

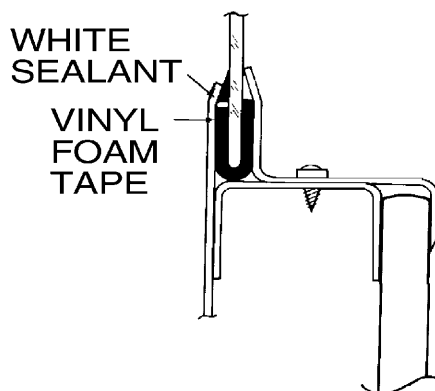
- (1) Remove the molding and retainer from around the window by removing attaching screws.
- (2) Carefully remove the damaged window from the frame.
- (3) Remove old tape and sealer from window frame and molding.

NOTE: A damaged window should be saved to provide a pattern for trimming the new window.

B. Installation

Install all side windows except the cabin door window as follows:

- (1) Match new window to old. If necessary, cut or grind the new window to the same dimensions.
- (2) Apply 1/8 in. by 1 in. vinyl foam tape, Norton V510 or equivalent (i.e. - Tape - Vinyl Foam, Type 2; 91-10-00, Consumable Materials), around entire edge of window.
- (3) Insert the window into the frame, install the retainer moldings and attachment screws, but do not tighten. Take care not to damage or dislocate the vinyl foam tape.
- (4) Apply polyurethane, urethane, acrylic, or polysulfide sealant (i.e. - Sealant - Window and Airframe; 91-10-00, Consumable Materials), completely around the outer surface of the window at all attachment flanges as indicated in Figure 1. Force the sealant between the mating parts, which may be separated slightly using a soft wooden wedge or a tongue depressor. Force sealant deep into the gap. Take care to avoid bending or scratching aluminum or window surfaces. Joints should be completely filled, and blended smoothly with adjacent surfaces after clean-up.
- (5) Tighten attachment screws until vinyl foam tape is compressed approximately 25 percent.
- (6) Remove excess sealant from window areas using rags, disposable wipers or plastic scrapers. A tool made of acrylic sheet with a wedged end (.25 inch thick and 1.5 inch wide) can be fabricated and used. Tirpolene solvent or Apperson solvent No. 120 may be used to clean polysulfide sealants.



Side Window Installation
Figure 1

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2. Cabin Door Windows (Refer to Figure 2.)

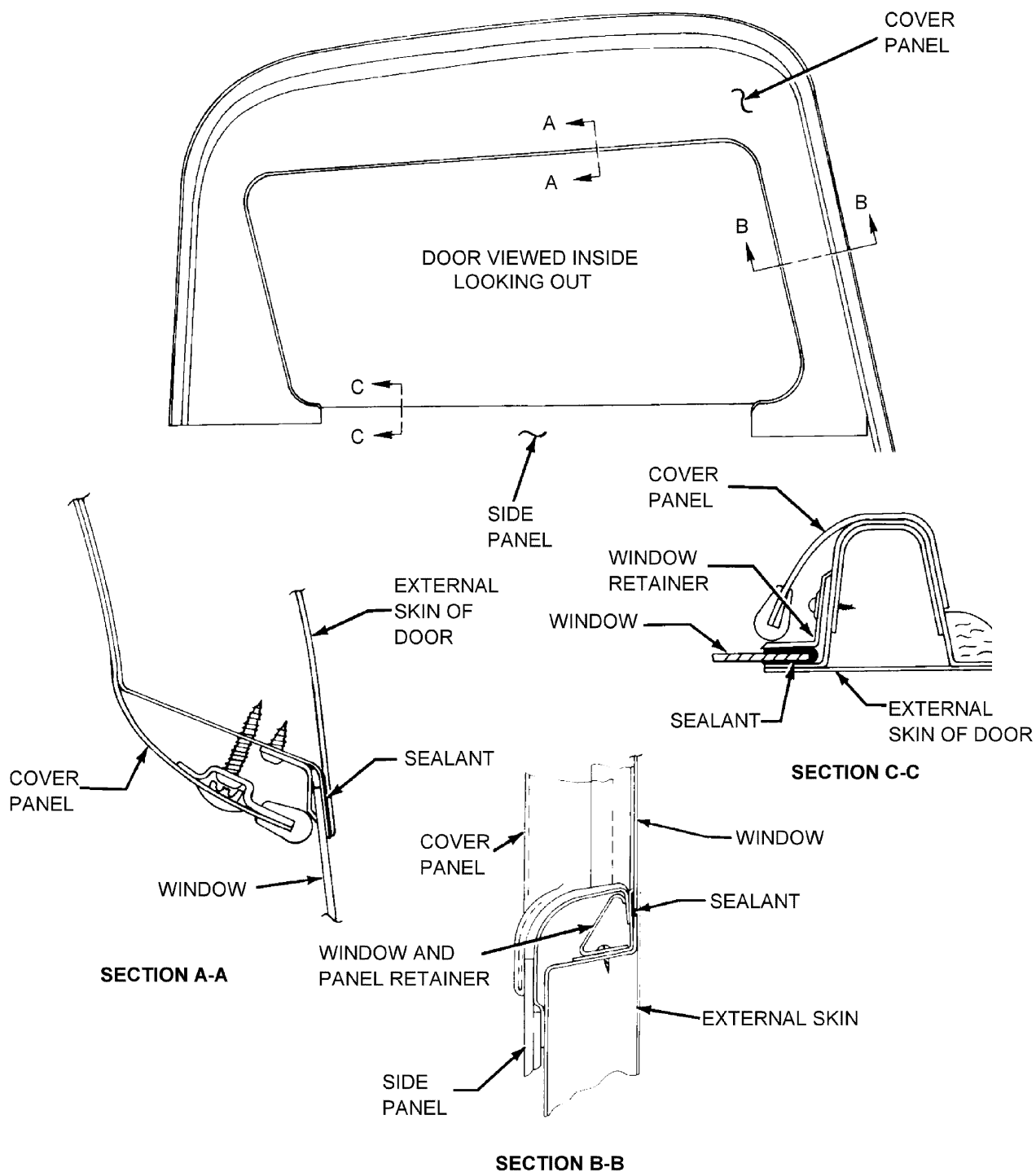
A. Removal

Remove cabin door windows per Side Windows, Removal, above.

B. Installation

- (1) Apply sealant, with protective paper in place, to edges of windows.
- (2) Remove protective paper just before installing window.
- (3) Insert window in frame and apply hand pressure to the perimeter of the window by using a narrow rubber roller.
- (4) Install window retention parts and hardware.

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Cabin Door Window Installation
Figure 2

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CHAPTER

57

WINGS

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CHAPTER 57

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CHAPTER 57 - WINGS

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GENERAL

Description

Each wing is an all metal, full cantilever, semi-monocoque type structure with removable tips and access panels. Attached to each wing is an aileron, flap, main landing gear and power plant. Installed in each wing ahead of the main spar are two metal fuel tanks with a capacity of 24.5 U.S. gallons each, or 49 U.S. gallons per wing. Also, a 15 U.S. gallon bladder cell is interconnected between the two tanks, providing each wing with a capacity of 64 U. S. gallons, giving a total capacity of 128 U. S. gallons.

The wings are attached to each side of the fuselage by inserting the butt ends of the main spars into a spar box carry through. The spar box is an integral part of the fuselage structure which provides, in effect, a continuous main spar with splices at each side of the fuselage. There are also fore and aft attachments at the front and rear spars.

NOTE: The major subassemblies of the wing may be removed individually or the wing may be removed as a unit. To remove a wing, a fuselage and wing supporting cradle is required.

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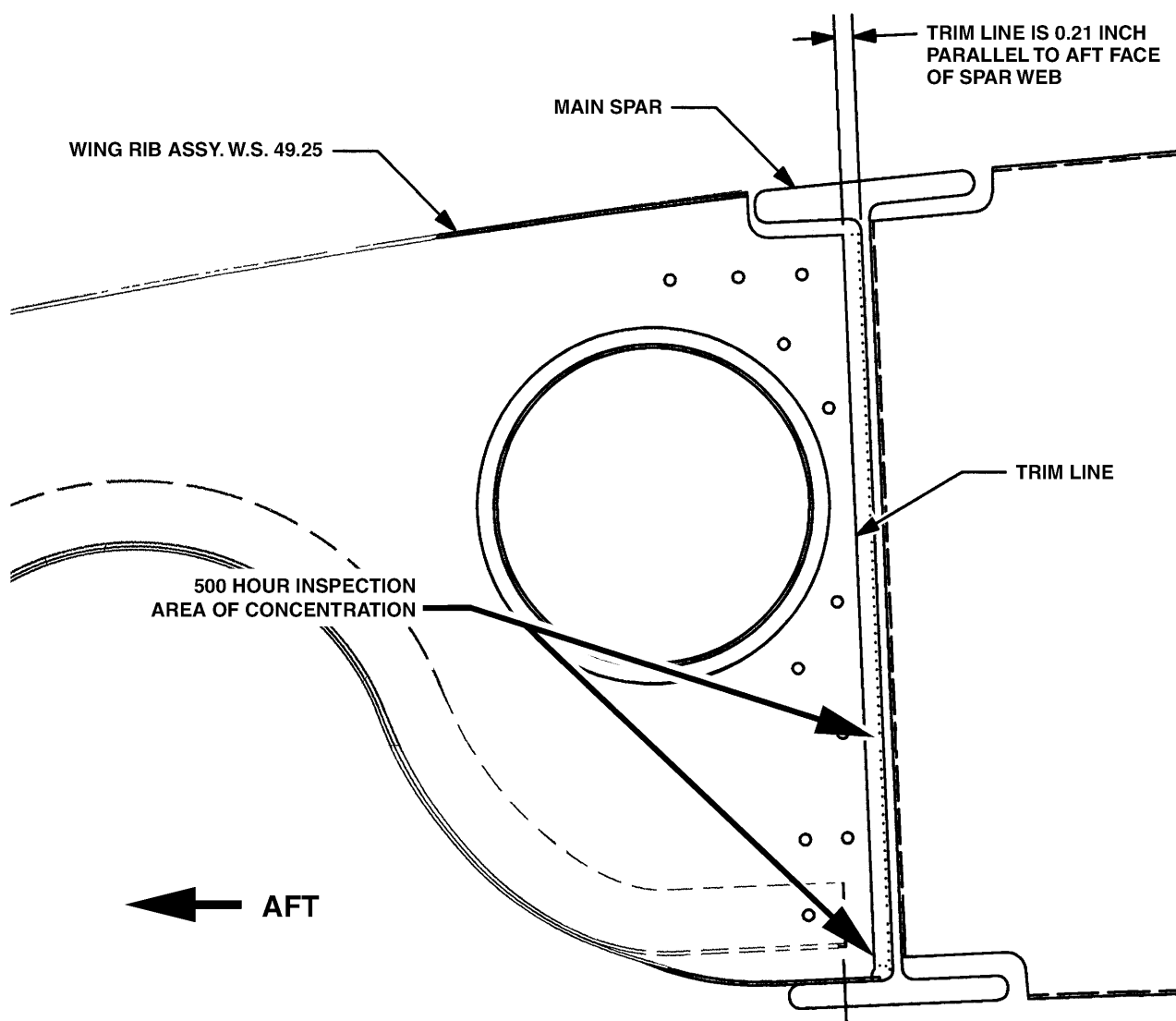
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MAIN FRAME

Wing Rib Assembly W.S. 49.25

The left and right rib assemblies, factory installed in S/N's 3447001 thru 3447029 and 3449001 thru 3449322 aft of the main spar at W.S. 49.25 can, under certain conditions, crack. The cracking is typically observed vertically along the bend radius of the flange common to the main spar and the main landing gear side brace attach fitting (see Figure 1). Accordingly, in S/N's 3447001 thru 3447029 and 3449001 thru 3449322 only, perform the following inspections at the intervals indicated:

NOTE: Installation of Kits No. 767-397 (LH) and 767-398 (RH), confirmation of existing rib assemblies stamped with Date Code 8313 (see Figure 2) or higher, installation of new rib assemblies with Date Code 8313 or higher, or any combination of the above will eliminate the following 100 hour and 500 hour repetitive inspection requirements.



Wing Rib Inspection (W.S. 49.25)
Figure 1

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A. 100 Hour Wing Rib Inspection

In S/N's 3447001 thru 3447029 and 3449001 thru 3449322 only, for airplanes which have not installed Kits No. 767-397 (LH) and 767-398 (RH), or do not have rib assemblies at W.S. 49.25 stamped with Date Code 8313 (see Figure 2) or higher, each 100 hours time-in-service:

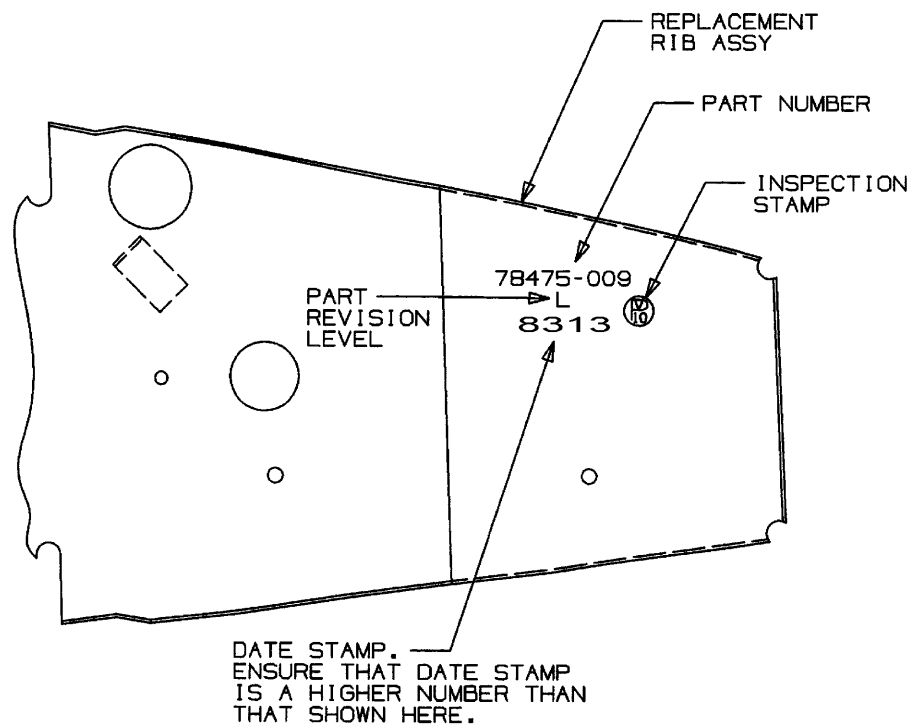
- (1) Place the airplane on jacks per 7-10-00.
- (2) In both the right and left wings:
 - (a) Inspect the Aft Rib Assembly at W.S. 49.25 for any evidence of cracks (see Figure 1.)
 - (b) Inspection shall be limited to a visual examination.
 - (c) Inspect the exposed (upper half) portion of the bend radius of the flange common to the Aft Rib Assembly and the Main Spar Web.
- (3) If any crack is detected visually, proceed to a more detailed examination.
 - (a) Remove the Main Landing Gear Side Brace, by removing the five (5) bolts that fasten it to the wing structure. Retain hardware for reassembly.
 - (b) Inspect the cracked Rib Assembly in the bend radius of the flange common to the Main Spar Web, using dye penetrant inspection techniques, to determine the full extent of crack propagation.
 - (c) Determine if trimming, as shown in Figure 1, will remove all the material affected by the crack.
 - 1 If so, install the appropriate kit (see above).
 - 2 If this cannot be accomplished, replace the cracked Rib Assembly.
- (4) If no cracks are detected, reassemble/reinstall any parts or components previously removed.
- (5) Verify proper functioning of landing gear.
- (6) Verify gear are down and locked and remove airplane from jacks.
- (7) Make an appropriate logbook entry.

B. 500 Hour Wing Rib Inspection

In S/N's 3447001 thru 3447029 and 3449001 thru 3449322 only, for airplanes which have not installed Kits No. 767-397 (LH) and 767-398 (RH), or do not have rib assemblies at W.S. 49.25 stamped with Date Code 8313 (see Figure 2) or higher, each 500 hours time-in-service:

- (1) Place the airplane on jacks per 7-10-00.
- (2) In both the right and left wings:
 - (a) Remove the Main Landing Gear Side Brace, by removing the five (5) bolts that fasten it to the wing structure. Retain hardware for reassembly.
 - (b) Inspect the Rib Assembly for evidence of cracks in the bend radius of the flange common to the Main Spar Web (as show in Figure 1), using dye penetrant inspection techniques.
- (3) If a crack is detected, identify the path of the propagation, and determine if trimming, as shown in Figure 2, will remove all the material affected by the crack.
 - (a) If so, install the appropriate kit.
 - (b) If this cannot be accomplished, replace the cracked Rib Assembly.
- (4) If no cracks are detected, reassemble/reinstall any parts or components previously removed.
- (5) Verify proper functioning of landing gear.
- (6) Verify gear are down and locked and remove airplane from jacks.
- (7) Make an appropriate logbook entry.

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Wing Rib Assembly Marking
Figure 2

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AUXILIARY STRUCTURE

Wing Tip

A. Removal

- (a) Remove the screws holding the wing tip to the wing, being careful not to damage the wing or wing tip.
- (b) Pull off the wing tip far enough to disconnect the landing light and navigation and strobe light wire assemblies. Be sure to unscrew the ground lead at the wing rib.
- (c) Inspect the wing tip to ascertain that it is free of cracks, severe nicks and minor damage. If repair is required, refer to Repair, below.

B. Installation

- (a) Place the wing tip in a position that the landing light and navigation and strobe light leads may be connected. Be sure to connect the navigation/strobe ground lead to the wing rib by use of a screw and nut. Ensure that the ground lead is free of dirt and film to insure a good connection.
- (b) Insert the wing tip into position and install the screws round the tip. Take care to refrain from damaging the wing tip or wing. Check operation of the lights.

C. Repair

See 51-70-00.

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ATTACH FITTINGS

1. Wing to Fuselage

A. Wing Removal (See Figure 1.)

- (1) Close the fuel valve and drain the fuel from the wing to be removed. (See 12-10-00, Fuel System, Fuel Tanks, Draining Entirely.)
- (2) Drain the brake lines and reservoir. (See 12-10-00, Brake System, Draining Brake System.)
- (3) Remove the engine from the wing to be removed. (See Engine, Removal, 71-00-00.)
- (4) Drain the hydraulic lines of the landing gear of the wing to be removed by separating the lines and elbows at the actuating cylinder.
- (5) Remove the access plate at the wing butt rib and wing inspection panels. (See Access Plates and Panels, 6-00-00.)
- (6) Remove the front and back seats from the airplane.
- (7) Expose the spar box and remove the side trim cockpit panel assembly that corresponds with the wing being removed.
- (8) Place the airplane on jacks. (See Jacking, 7-10-00.)

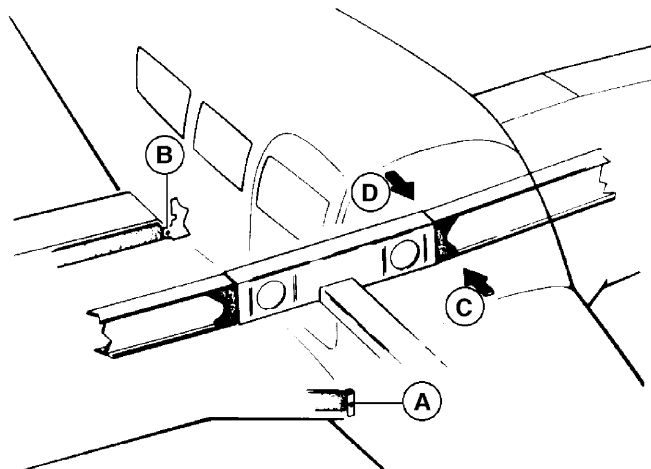
NOTE: To facilitate reinstallation of control cables, power plant controls, and fuel and hydraulic lines, mark cable and line ends in some identifying manner. Attach a line, where applicable, to cables before drawing them through the fuselage or wing.

- (9) Disconnect the aileron balance and control cables at the turnbuckles that are located within the fuselage aft of the spar.
- (10) If the left wing is being removed, remove the cotter pin from the pulley bracket assembly to allow the left aileron balance cable end to pass between the pulley and bracket.
- (11) Disconnect the flap from the torque tube by extending the flap to its fullest degree and removing the bolt and bushing from the bearing at the aft end of the control rod.

CAUTION: PLACE A PROTECTIVE COVER OVER FUEL, HYDRAULIC AND MISCELLANEOUS LINES ENDS TO PREVENT CONTAMINATION OR DAMAGE TO LINE FITTINGS AND ENDS .

- (12) Disconnect the fuel line at the fitting located inside of the wing by removing the access panel on the forward inboard portion of the wheel well and reaching through to the fuel line coupling.
- (13) Remove the clamps that are necessary to release the electrical harness assembly. Disconnect the leads from the terminal strip by removing the cover and appropriate nuts and washers.
- (14) With the appropriate trim panel removed, disconnect the hydraulic brake line at the fitting located within the cockpit at the leading edge of the wing.
- (15) Disconnect the landing gear hydraulic lines at the fittings aft of the spar and within the fuselage.
- (16) If the left wing is being removed, it will be necessary to disconnect pitot and static tubes at the elbows located within the cockpit at the wing butt line.
- (17) Arrange a suitable fuselage cradle and supports for both wings.
- (18) Remove the wing jacks.
- (19) Remove the front and rear spar bolts.
- (20) Remove the eighteen main spar bolts.
- (21) Slowly remove the wing being certain that all electrical leads, control cables, power plant controls, and fuel lines are disconnected.

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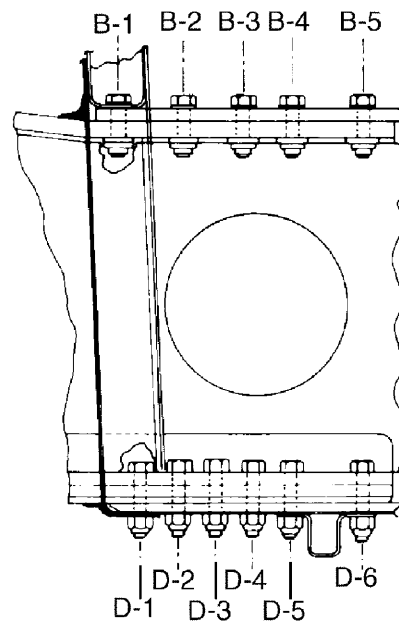
BOLT LEGEND

WASHER

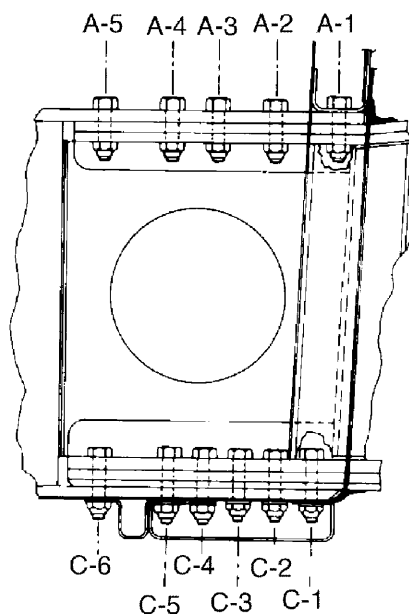
POSITION	BOLT	NUT	UNDER HEAD	UNDER NUT
A1	NAS464P6LA17	MS21042-6	AN960-616	AN960-616 (2 MAX)
A2	NAS464P6LA16	MS21042-6	AN960-616	AN960-616 (NOTE 3)
A3	NAS464P6LA16	MS21042-6	AN960-616	AN960-616 (NOTE 3)
A4	NAS464P6LA16	MS21042-6	AN960-616	AN960-616 (NOTE 3)
A5	NAS464P6LA16	MS21042-6	AN960-616	AN960-616 (NOTE 3)
B1	NAS464P6LA16	MS21042-6	AN960-616L	96352-3 (NOTE 1)
B2	NAS464P6LA15	MS21042-6	AN960-616	96352-3 (NOTE 1)
B3	NAS464P6LA15	MS21042-6	AN960-616	96352-3 (NOTE 1)
B4	NAS464P6LA15	MS21042-6	AN960-616	96352-3 (NOTE 1)
B5	NAS464P6LA15	MS21042-6	AN960-616	96352-3 (NOTE 1)
C1	NAS464P6LA20	MS21042-5	AN960-516L	AN960-516 (2 MAX)
C2	NAS464P6LA20	MS21042-6	AN960-616L	AN960-616 (2 MAX)
C3	NAS464P6LA20	MS21042-6	AN960-616L	AN960-616 (2 MAX)
C4	NAS464P6LA20	MS21042-6	AN960-616L	AN960-616 (2 MAX)
C5	NAS464P6LA21	MS21042-6	AN960-616L	96352-3 (NOTE 2)
C6	NAS464P6LA22	MS21042-6	AN960-616L	96352-3 (NOTE 2)
D1	NAS464P6LA20	MS21042-5	AN960-516L	AN960-516 (2 MAX)
D2	NAS464P6LA20	MS21042-6	AN960-616L	AN960-616 (2 MAX)
D3	NAS464P6LA20	MS21042-6	AN960-616L	AN960-616 (2 MAX)
D4	NAS464P6LA20	MS21042-6	AN960-616L	AN960-616 (2 MAX)
D5	NAS464P6LA21	MS21042-6	AN960-616L	96352-3 (NOTE 2)
D6	NAS464P6LA22	MS21042-6	AN960-616L	96352-3 (NOTE 2)

TORQUE BOLT HEADS ON UPPER SPAR CAP & NUT ON LOWER SPAR CAP AS FOLLOWS: 5/16 INCH BOLT = 205-225 IN.-LBS.
3/8 INCH BOLT = 360-390 IN.-LBS.

- NOTES: 1. WASHERS TO BE INSTALLED WITH RADIUS SIDE UP.
2. A MAXIMUM OF ONE AN960-616L WASHER OR ONE AN960-616 WASHER MAY ALSO BE USED BETWEEN THE SPECIAL WASHER AND NUT.
3. IN ADDITION TO THE AN960-616L WASHER SPECIFIED UNDER NUT, ONE ADDITIONAL AN960-616L WASHER, OR ONE ADDITIONAL AN960-616 WASHER MAY BE INSTALLED AS REQUIRED TO ACCOMMODATE MANUFACTURING TOLERANCES. IF THE AN960-616L IS USED, PLACE IT BETWEEN THE AN960-616 WASHER AND THE NUT.
TOTAL STACK UP UNDER NUT SHALL NOT EXCEED TWO (2) WASHERS.



SKETCH C



SKETCH D

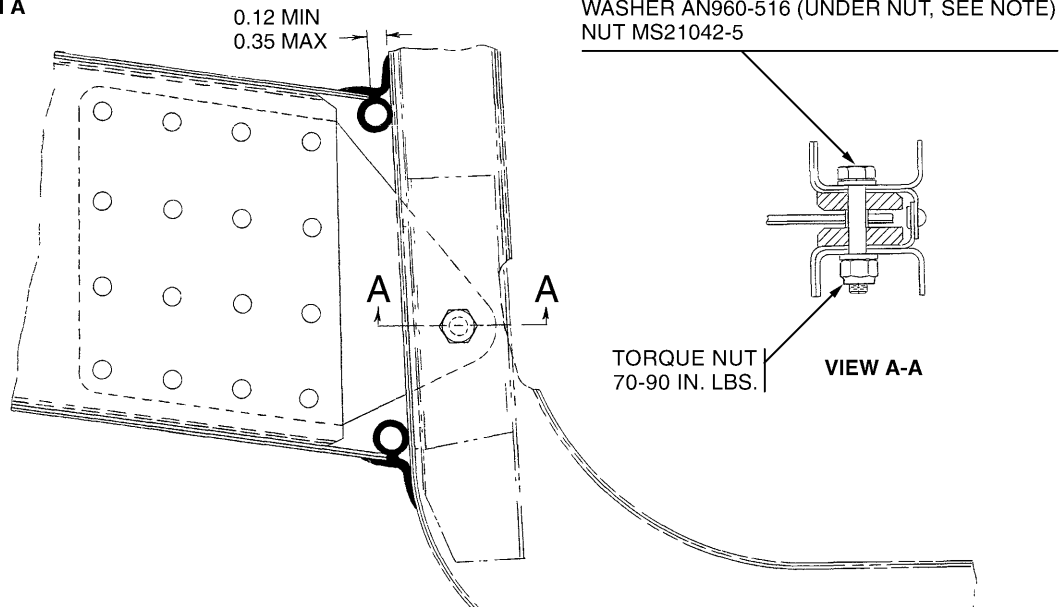
Wing Installation
Figure 1 (Sheet 1 of 2)

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FORWARD SPAR ATTACHMENT
(LOOKING AFT, RIGHT SIDE)

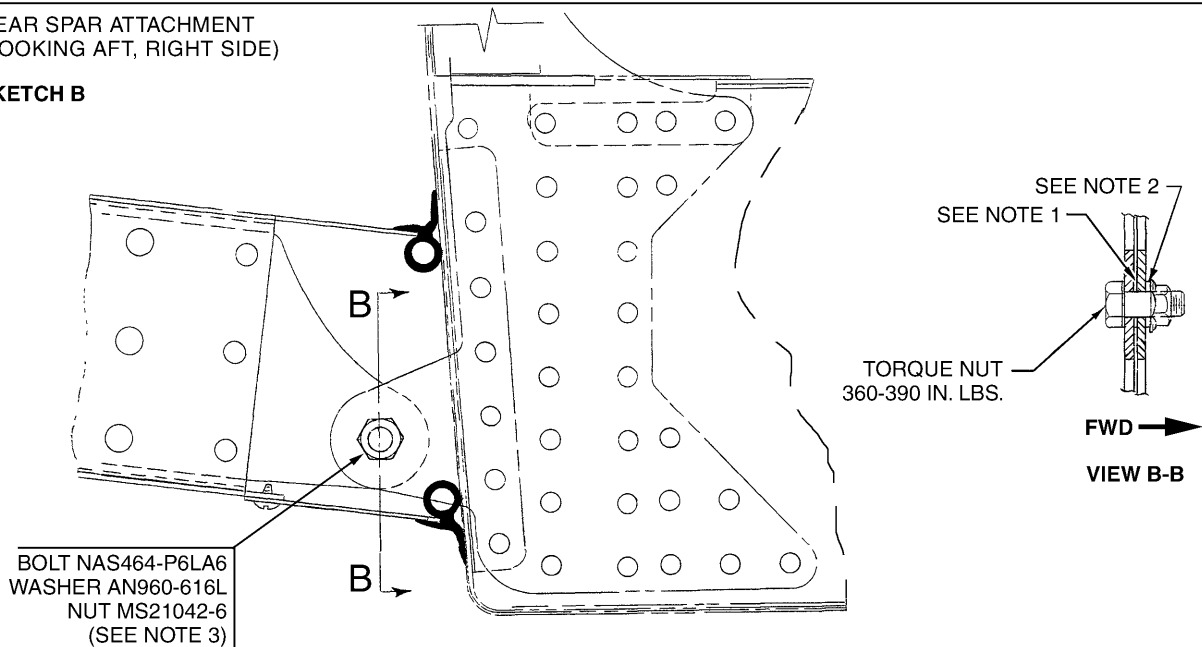
SKETCH A



NOTE: USE ONE AN960-516 OR ONE AN960-516L WASHER UNDER NUT AS REQUIRED TO LEAVE A MINIMUM OF 1 ½ USABLE THREADS EXPOSED ON BOLT.

REAR SPAR ATTACHMENT
(LOOKING AFT, RIGHT SIDE)

SKETCH B



- NOTES: (1) 0.15 INCH MAXIMUM GAP BETWEEN FORWARD FACE OF WING FITTING AND AFT FACE OF FUSELAGE FITTING. USE ANY COMBINATION OF AN960-616 AND AN960-616L WASHERS AS REQUIRED.
(2) USE AN960-616 AND/OR AN960-616L WASHER(S) UNDER NUT AS REQUIRED TO LEAVE A MINIMUM OF 1 ½ USABLE THREADS EXPOSED ON BOLT.
(3) NEW SERVICE REPLACEMENT WINGS ARE NOT DRILLED FOR THE REAR SPAR ATTACHMENT BOLT. ACCORDINGLY, USING SUITABLE TOOLING TO ENSURE PROPER HOLE ALIGNMENT, DRILL A .3745/.3765 INCH HOLE IN THE REAR ATTACH FITTING.

Wing Installation
Figure 1 (Sheet 2 of 2)

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B. Wing Installation (See Figure 1.)

NOTE: If a factory replacement wing is being installed, the wing aft spar fitting will need a .3745/.3765 dia hole drilled in it to match the existing hole in the fuselage fitting.

NOTE: If installing a "replacement" wing, perform the Flight Test Procedure provided in 27-30-00, Stall Warning System, upon completion of wing installation.

- (1) Ascertain that the fuselage is positioned solidly on a support cradle.
- (2) Place the wing in position for installation, with the spar end a few inches from the side of the fuselage and set on trestles.
- (3) Prepare the various electrical leads, fuel lines, control cables, and power plant controls for insertion into the wing or fuselage when the wing is eased into place.
- (4) Slide the wing into position on the fuselage.
- (5) Install the main spar bolts in accordance with the information given in Figure 1, Sketches C and D.
- (6) Install the bolt, washers, and nut that attaches the front spar and fuselage fitting. A minimum of one washer is required under the bolt head; then add washers as needed to leave a maximum of one and one-half threads visible or a minimum of bolt chamfer exposed. (See Sketch A, View A-A, Figure 1.)
- (7) Install the bolt, washers, and nut that attaches the rear spar and fuselage fitting. It is acceptable to have the faces of the fittings against each other in which case the AN960-616L washer should be used under the bolt head. The AN960-616 washer may be added under the nut when not used as a shim. (See Sketch B, View B-B, Figure 1.) Check to ensure that no threads are bearing on the forward plate prior to installing the nut.
- (8) Torque the main spar bolts in accordance with specifications given in the Bolt Legend, Figure 1. Torque the forward and rear spar to fuselage attach bolts as specified in Sketches A and B, Figure 1.
- (9) Install the wing jacks and tail support to the tail skid with approximately 250 pounds of ballast on the base of the tail support. Remove the fuselage cradle and wing supports.
- (10) If the left wing was removed, reconnect the pitot and static tubes at the elbows located within the cockpit at the wing butt line. Replace or install clamps where found necessary.
- (11) Connect the hydraulic brake line onto the fitting located within the cockpit at the landing edge of the wing and the landing gear hydraulic lines at the fittings within the fuselage aft of the spar.
- (12) Connect the leads to the appropriate posts on the terminal strip and install the washers and nuts. (Refer to the electrical schematics in Chapter 91.) Place the clamps along the electrical harness to secure it in position and install the terminal strip dust cover.
- (13) Connect the fuel line at the fitting located inside the wing by reaching through the access panel on the forward inboard portion of the wheel well.
- (14) Connect the aileron balance and control cables at the turnbuckles that are located within the fuselage aft of the spar. After the left balance cable has been inserted through the bracket assembly and connected, install a cotter pin cable guard into the hole that is provided in the bracket assembly.
- (15) Connect the flap by placing the flap handle in the full flap position; place the bushing on the outside of the rod end bearing and insert and tighten bolt.
- (16) Install the engine. (See Engine, Installation, in 71-00-00.)
- (17) Check the rigging and control cable tension of the ailerons and flaps. (See Rigging and Adjustment, 27-30-00; and also 27-50-00.)

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- (18) Service and refill the brake system with hydraulic fluid in accordance with Brake System, 12-10-00. Bleed the system as outlined in 32-40-00 and check for fluid leaks.
- (19) Check the fluid level of the landing gear hydraulic system and fill in accordance with Hydraulic System, Hydraulic Pump/Reservoir, 12-10-00. With the airplane sitting on jacks, operate the gear through several retraction and extension cycles to be certain that there are no hydraulic leaks. Test the hydraulic system in accordance with 29-10-00. Ascertain that the landing gear is down and locked.
- (20) Service and fill the fuel system in accordance with 12-10-00, Fuel System, Fuel Tanks, Filling. Open the fuel valve and check for leaks and fuel flow.
- (21) Check the operation of all electrical equipment, pitot and static systems.
- (22) Remove the airplane from jacks.
- (23) Install the cockpit trim panel assembly, spar box carpet, the front and back seats and wing root rubber. Replace all the access plates and panels.

2. Aft Wing Attach Fittings 100 Hour Inspection

A. Background

Should the seals for the windows and doors not be maintained, leaks may develop which, if not corrected, will allow an ingress of water. This water contamination will wet the insulation around the aft wing attach fittings creating a highly corrosive environment.

B. Procedure

Each 100 hours, inspect to determine condition of the aircraft window and door seals, the condition of the aft wing attach fittings, the insulation material around the affected area, and the drain holes in the bottom fuselage skin at the aft attach fittings area.

- (1) Gain access to the left and right aft wing attach fittings.
 - (a) Remove center seats and the center floorboard.
 - (b) Remove interior moldings and carpet as necessary.
- (2) Inspect thoroughly the left and right aft wing attach fittings for evidence of flaking paint and/or corrosion. (Flaking paint may be a symptom of hidden corrosion.) If no corrosion exists, continue with these instructions.
 - (a) If corrosion is superficial and there is no metal flaking and/or pitting, clean and paint fittings, using a good quality aircraft primer.
 - (b) If serious corrosion is found, consult the Piper Illustrated Parts Catalog (P/N 761-887) for replacement part numbers and obtain and install new parts before next flight.
- (3) Upon completion of the inspection and after replacement or refurbishment of fittings, treat the aft attach fittings area using DINOL AV 8 corrosion compound (P/N 89500-800). The treatment may be brushed or sprayed.

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- (4) Inspect insulation in and around the rear fittings.
 - (a) If insulation is wet or matted down where it has been wet, it will be necessary to replace this insulation and it will be necessary to inspect all windows, doors, and exterior panels leading to the cabin.
 - 1 Check door seals for deterioration, cracks, and voids in adhesive.
 - 2 Check window seals for voids, cracks, and deterioration.
 - 3 Perform a leak check with water to determine where the water is entering. Cure all leak paths before continuing these instructions.
 - 4 Consult the Piper Illustrated Parts Catalog (P/N 761-887) for replacement part numbers and obtain and install new parts before continued operation.
 - 5 If sealing windows, use P/N 279-058 Sealant (Bostik 1100 FS) or equivalent.
 - 6 If using insulation other than Piper original material, be sure that the insulation is flame resistant and conforms to FAR part 23.853.
 - (b) If the insulation material has not been wet, or if new material is being installed, ensure a six (6) inch clearance in the insulation has been cut out in all directions around each attach fitting.
- (5) Locate the two 0.191 inch drain holes, one beneath each rear attach fitting, in the bottom fuselage skin and ensure each is clean and free of obstruction.
- (6) Re-install floorboards, seats, interior panels, and other articles previously removed. Perform a functional test of any system or component that may have been interrupted or removed.

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FLIGHT SURFACES

1. Aileron (See Figure 1.)

CAUTION: CONTROL SURFACE SKINS MUST BE REPLACED IF THEY SUSTAIN DAMAGE OR EXHIBIT CRACKS.

A. Removal

- (1) Disconnect the aileron control rod at the aileron attachment point by removing the nut, washers and bolt from the rod end bearing. To simplify installation note location of washers removed.
- (2) Remove the attaching nuts, bolts and washers from the hinges at the leading edge of the aileron, and remove the aileron.

B. Installation

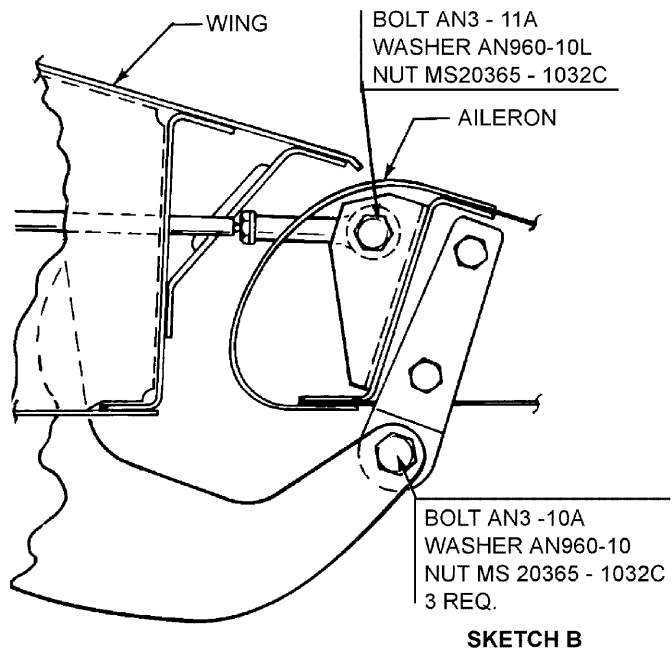
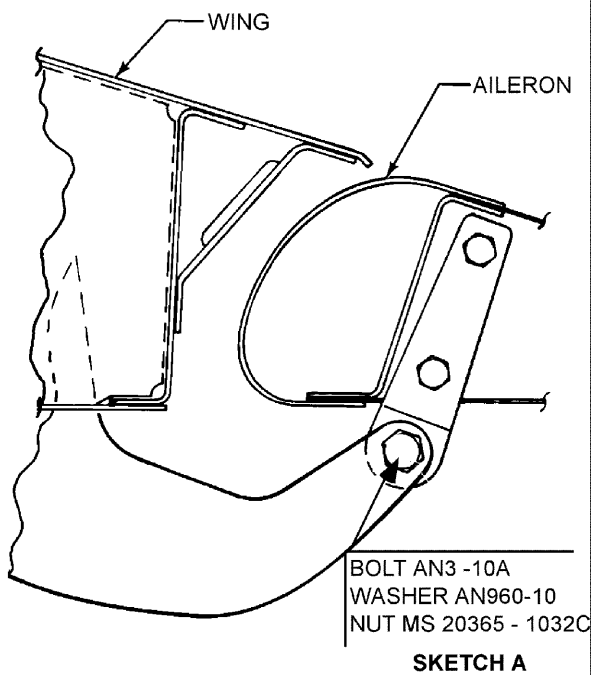
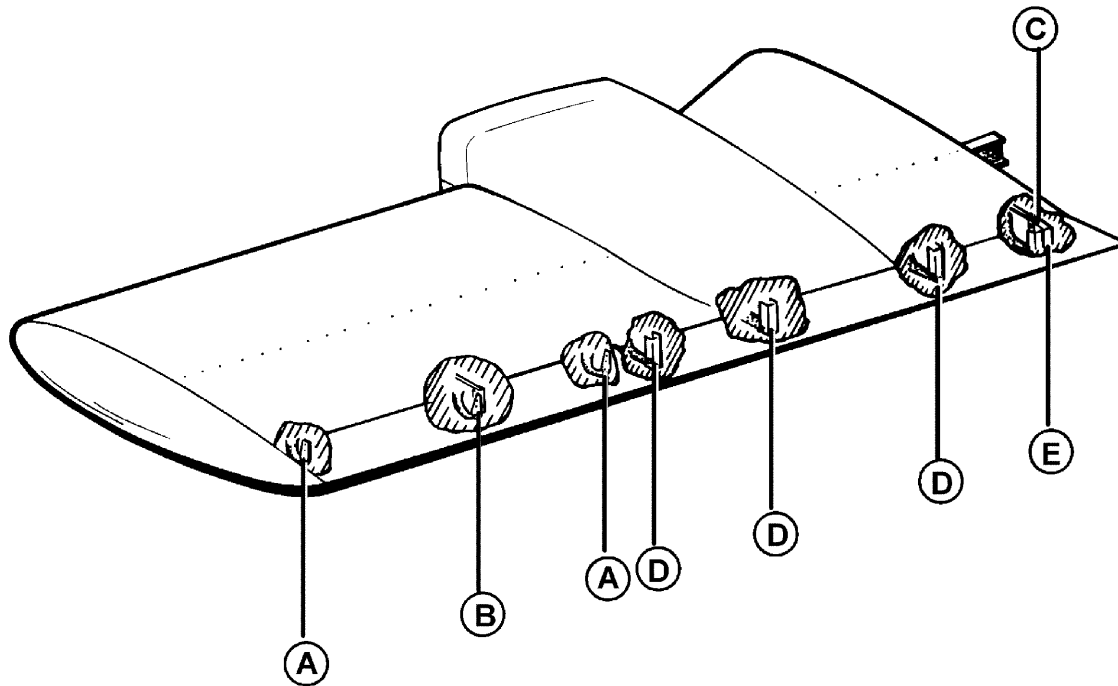
WARNING: ALL CONTROL SURFACES THAT HAVE BEEN REPLACED OR REPAINTED MUST BE BALANCED BEFORE INSTALLATION PER INSTRUCTIONS IN BALANCING, BELOW.

- (1) Move the aileron into place and install attaching bolts, washers and nuts. Ascertain that the aileron is free to move with no interference.
- (2) Attach the aileron control rod with bolts, washers and nut, dividing the washers so that the aileron is free to rotate from stop to stop without the control rod binding or rubbing on the opening in the aft spar. Be certain that the rod end bearing has no side play when tightening the bolt and that the rod does not contact the side of the bracket.
- (3) Actuate the aileron controls to insure freedom of movement.

C. Checking Free Play

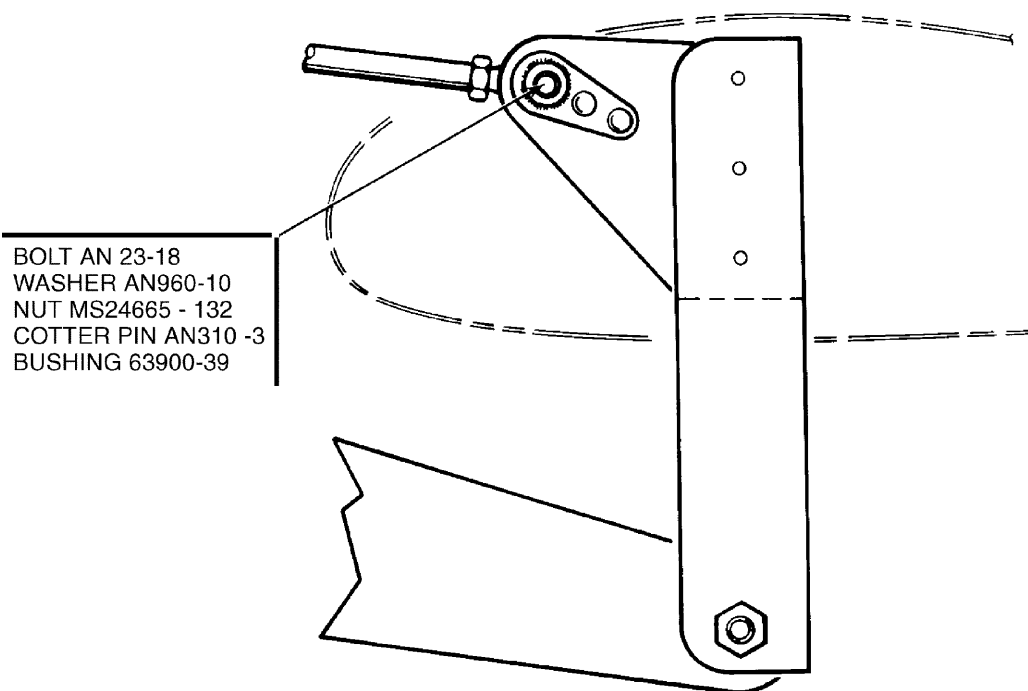
- (1) Set the aileron in its neutral position and secure.
- (2) Obtain a straightedge long enough to extend from the ground up to a few inches above the aileron trailing edge. Place the straightedge next to the aileron trailing edge and gently move the aileron up and down, mark the limit of travel (free play) on the straightedge.
- (3) The overall travel (free play) must not exceed 0.24 of an inch (6.096 mm). Should free play exceed the limit stated, make necessary repairs as required to eliminate free play.
- (4) Grasp the aileron and move it spanwise (inboard/outboard) to insure maximum end play of 0.035 of an inch (0.889 mm) is not exceeded.

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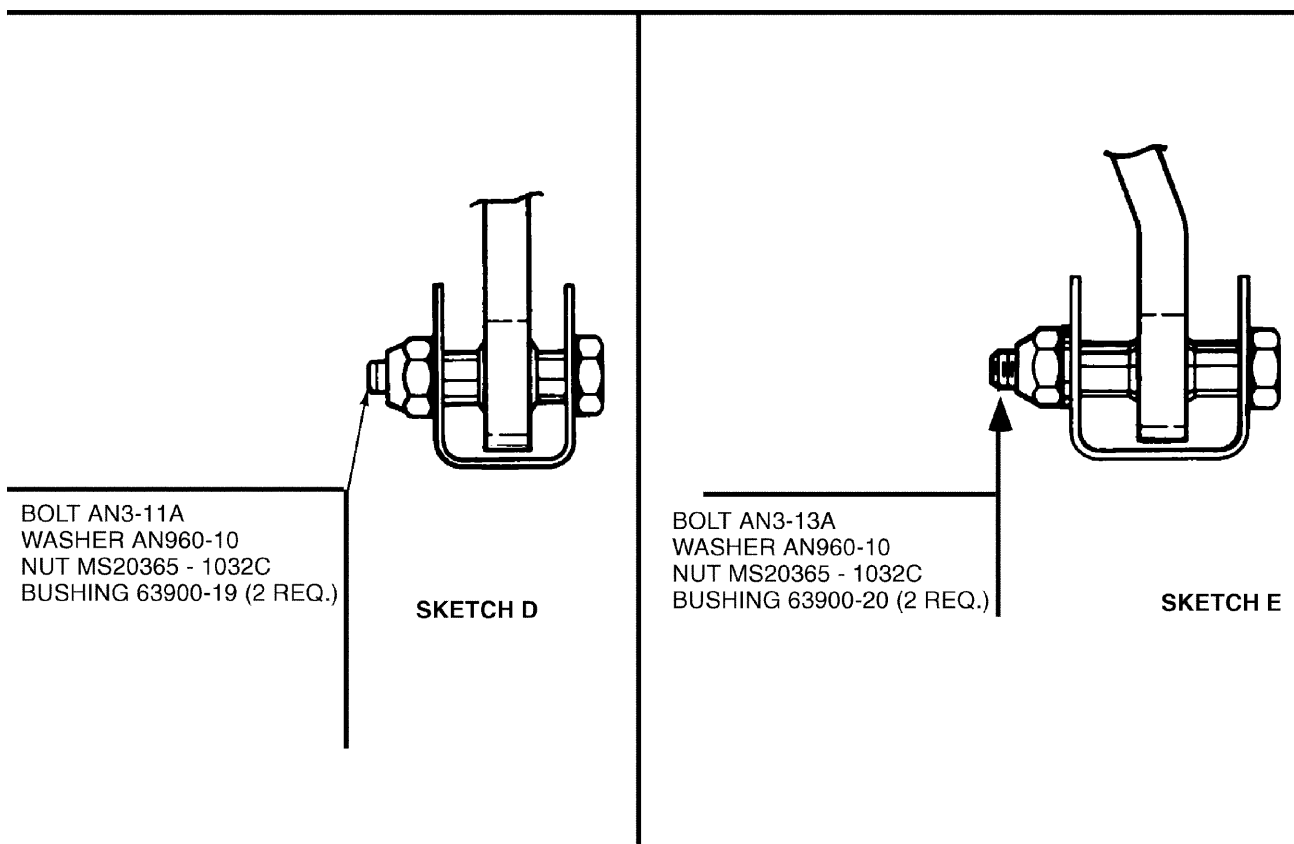


Aileron and Flap Installation
Figure 1 (Sheet 1 of 2)

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SKETCH C



Aileron and Flap Installation
Figure 1 (Sheet 2 of 2)

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2. Balancing

WARNING: ALL CONTROL SURFACES THAT HAVE BEEN REPLACED OR REPAINTED MUST BE BALANCED BEFORE INSTALLATION.

A. Balancing Equipment (Refer to Figure 1.)

Balancing must be done using a suitable tool capable of measuring unbalance in inch-pounds from centerline of control surface hinge pin. A suggested tool configuration is shown in 95-00-00, Figure 2. Other tool configurations may be used, provided accuracy is maintained and recalibration capability is provided.

To use this tool:

- (1) Insure that the control surface is in its final Flight configuration, static wicks, trim tabs, trim tab push pull rod and control surface tip (as applicable) should be installed. The surface should be painted and trim/servo tabs should be in the neutral position.

NOTE: Because paint is a considerable balance factor, it is recommended that existing paint be removed prior to repainting a control surface.

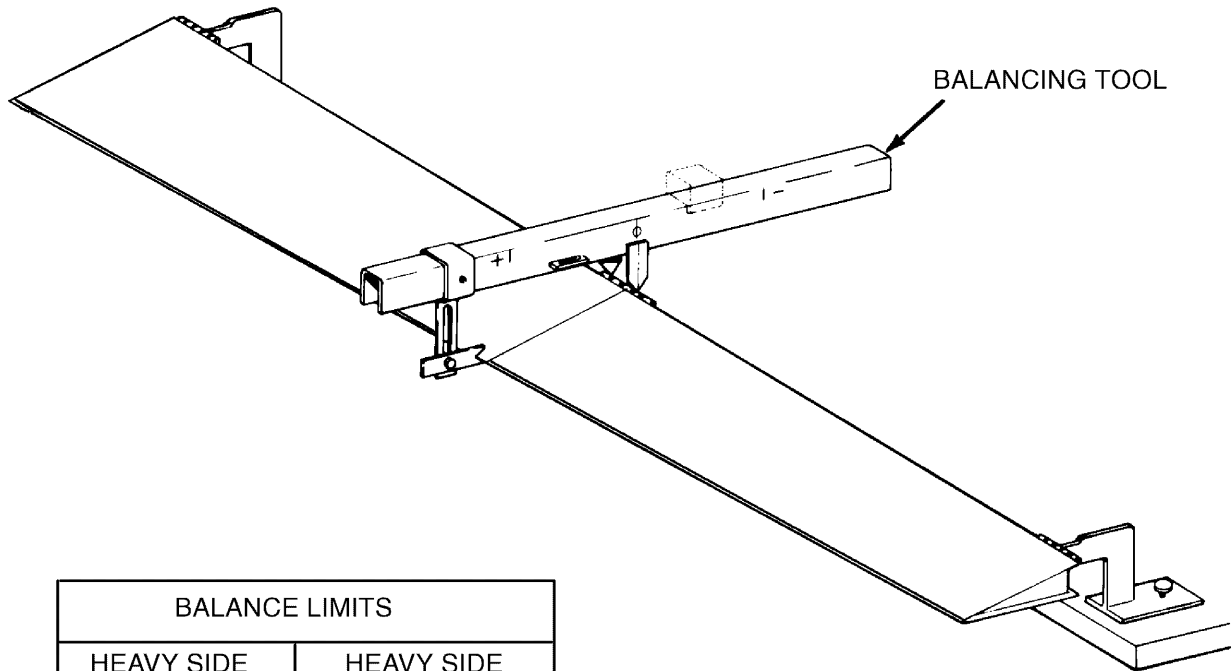
- (2) Place hinge bolts through control surfaces and place control surface on a holding fixture.
- (3) Calibrate the tool.
 - (a) Avoiding rivets, place the balancing tool on the control surface with the tool's hinge centerline directly over the hinge line of the control surface.
 - (b) Adjust the movable trailing edge support to fit the width of the control surface. Tighten the set screw on the trailing edge support.
 - (c) Adjust the trailing edge support vertically until the beam is parallel with the control surface chord line.
 - (d) Remove the tool from the control surface and balance the tool itself by adding or removing nuts or washers from the beam balancing bolt. When balancing the tool, the movable weight must be at the bar's hinge centerline.
- (4) After balancing the tool, reattach it to the control surface. Keep the beam positioned 90° from the control surface hinge line.
- (5) Determine balance of control surface by sliding movable weight along the balance beam.
- (6) Read the scale when the bubble level has been centered. Multiply by three to determine in-lbs. (I.E. - Since the movable weight weighs three pounds, every inch it is moved from the center of the beam equals three inch-lbs of force.)

B. Balancing Aileron

Position the aileron on the balancing fixture in a draft free area and in a manner which allows unrestricted movement of the aileron. Place the tool on the aileron, avoiding rivets, and keep the beam perpendicular to the hinge centerline. Read the scale when the bubble level has been centered by adjustment of the movable weight and determine the static balance. If the static balance is not within the limits specified in Figure 2, proceed as follows:

- (1) Leading edge heavy: This condition is highly improbable; recheck measurements and calculations.
- (2) Trailing edge heavy: There are no provisions for adding weight to balance weight to counteract a trailing edge heavy condition. Therefore, it will be necessary to determine the exact cause of the unbalance. If the aileron is too heavy because of painting over old paint, it will be necessary to strip all paint from the aileron and repaint. If the aileron is too heavy resulting from repair to the skin or ribs, it will be necessary to replace all damaged parts and recheck the balance.

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BALANCE LIMITS	
HEAVY SIDE LEADING EDGE	HEAVY SIDE TRAILING EDGE
+5 LBS.	-2.75 LBS.

Balancing Aileron
Figure 2

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3. Wing Flap (See Figure 1.)

CAUTION: CONTROL SURFACE SKINS MUST BE REPLACED IF THEY SUSTAIN DAMAGE OR EXHIBIT CRACKS.

A. Removal

- (1) Extend the flaps to their fullest degree and remove the bolt and bushing from the rod end bearing.
- (2) Remove the nuts, washers, bushing and hinge bolts that hold the flap to the wing assembly.
- (3) Pull the flap straight back off the wing.

B. Installation

- (1) Replace the wing flap by placing the flap onto its proper position and inserting the hinge bolts, bushings, washers and nuts.
- (2) With the flap control in the full flap position, place the bushing on the outboard side of the rod end bearing and insert and tighten the bolt.
- (3) Operate the flap several times to be certain it is operating freely. (See 27-50-00 for rigging information.)

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GRIDS 5K18 THRU 5L24
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AIRPLANE MAINTENANCE MANUAL

CARD 6 OF 7

PA-34-220T

Seneca IV

(SN's 3447001 THRU 3447029)

SENECA

(SN's 3449001 AND UP)

THE NEW PIPER AIRCRAFT, INC.

Published by
Technical Publications

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AEROFICHE REVISION STATUS

Revisions to Maintenance Manual (P/N 761-888) issued July 12, 1995, are as follows:

<u>Revision</u>	<u>Publication Date</u>	<u>Aerofiche Card Effectivity</u>
ORG950712	November 7, 1996	1, 2, 3, 4 and 5
PR980415	April 15, 1998	1, 2, 3, 4 and 5
PR981115	November 15, 1998	1, 2, 3, 4 and 5
PR020531	May 31, 2002	1
CR050819	August 19, 2005	1, 2, 3, 4, 5, 6 and 7
PR051107	November 7, 2005	1, 2, 4 and 5
PR060428*	April 28, 2006	1, 2, 3, 4, 5, 6 and 7

*** PARTIAL REVISION OF MAINTENANCE MANUAL 761-888**

Revisions appear in Aerofiche Cards 1, 2, 3, 4, 5, 6, and 7. Accordingly, discard your existing Aerofiche Cards and replace them with the cards dated April 28, 2006.

Consult the Customer Service Information Aerofiche (P/N 1753-755) for current revision dates for this manual.

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INTRODUCTION

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	2	Aug 19/05			
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INTRODUCTION

1. Instructions for Continued Airworthiness

WARNING: INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA) FOR ALL NON-PIPER APPROVED STC INSTALLATIONS ARE NOT INCLUDED IN THIS MANUAL. 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 ICA 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, THE PIPER PROVIDED ICA MAY NOT BE VALID FOR AIRPLANES SO MODIFIED.

The PIPER PA-34-220T Seneca IV / V Maintenance Manual constitutes the Instructions for Continued Airworthiness (ICA) as required by Federal Aviation Regulations (FAR) Part 23, Appendix G. Chapter 4 contains the Airworthiness Limitations section (4-00-00) and the Inspection Program is in Chapter 5 (5-20-00).

2. General

This publication is prepared in accordance with the General Aviation Manufacturers Association (GAMA) Specification No. 2, with respect to the arrangement and content of the System/Chapters within the designated Chapter/Section-numbering system.

WARNING: USE ONLY GENUINE PIPER AIRCRAFT PARTS OR PIPER AIRCRAFT APPROVED PARTS OBTAINED FROM PIPER APPROVED SOURCES, IN CONNECTION WITH THE MAINTENANCE AND REPAIR OF PIPER AIRPLANES.

This manual generally does not contain hardware callouts for installation. Hardware callouts are only indicated where a special application is required. To confirm the correct hardware used, refer to the PA-34-220T Parts Catalog, P/N 761-887, and FAR 43 for proper use.

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.

THE NEW PIPER AIRCRAFT, INC. expressly disclaims any responsibility for malfunctions, failures, damage or injury caused by use of non-PIPER approved parts.

NOTE: THE NEW PIPER AIRCRAFT, INC. expressly reserves the right to supersede, cancel and/or declare obsolete any part, part numbers, kits or publication that may be referenced in this manual without prior notice.

In any question concerning the care of your airplane, be sure to include the airplane serial number in any correspondence.

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3. Effectivity

This maintenance manual is effective for PA-34-220T Seneca IV airplanes, serial numbers 3447001 thru 3447029, and Seneca V airplanes, serial numbers 3449001 and up.

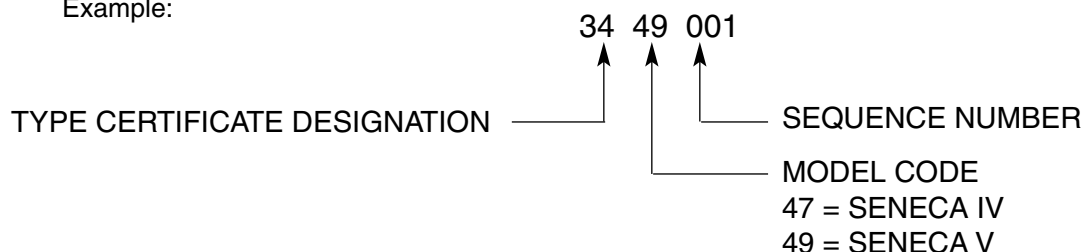
This encompasses the following model years:

NOTE: The following is provided as a general reference only.

<u>Model</u>	<u>Serial Numbers</u>	<u>Model Year</u>
Seneca IV	3447001 thru 3447012	1995
	3447013 thru 3447029	1996
Seneca V	3449001	Prototype
	3449002 thru 3449041	1997
	3449042 thru 3449096	1998
	3449097 thru 3449151	1999
	3449152 thru 3449195	2000
	3449196 thru 3449231	2001
	3449232,	2002
	3449237 thru 3449239, and	
	3449241 thru 3449268	
	3449269, 3449273, and	2003
	3449275 thru 3449300	
	3449301 thru 3449310	2004
	3449311 thru 3449322	2005
	3449323 and Up	2006

4. Serial Number Explanation

Example:



5. Assignment of Subject Material

This publication is divided into industry standard, three element, numeric subject groupings as follows:

- A. System/Chapter - The various groups are broken down into major systems such as Environmental Systems, Electrical Power, Landing Gear, etc. They are assigned a number, which becomes the first element of the standardized numbering system. Thus, the element "28" of the number 28-40-01 refers to the chapter "Fuel". Everything concerning the fuel system will be covered in this chapter.
- B. Sub-System/Section - The major systems/chapters of an airplane are broken down into subsystems. These sub-systems are identified by the second element of the standard numbering system. The element "40" of the number 28-40-01 concerns itself with the indicating section of the fuel system.

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- C. Unit/Subject - The individual units within a sub-system/section may be identified by the third element of the standard numbering system. The element "01" of the number 28-40-01 is a subject designator. This element is assigned at the option of the manufacturer and is normally zeroed out by PIPER.

Refer to paragraph 14, Chapter/Section Index Guide, for a complete breakdown and list. The material is arranged in ascending numerical sequence.

6. Pagination

The Chapter - Section (i.e. - 28-40-00) numbering system (explained above) forms the primary page numbering system for this manual. Within each Section, pages are numbered consecutively beginning with Page 1 (i.e. - 28-40-00, Page 1). Additionally, the aerofiche grid numbering system (explained below) is also used to indicate location within the manual.

7. Aerofiche Effectivity

- A. The General Aviation Manufacturers Association (GAMA) has developed specifications for microfiche reproduction of aircraft publications. The information compiled in this Aerofiche Maintenance Manual will be kept current by revisions distributed periodically. These revisions will supersede all previous revisions and will be complete Aerofiche card replacements and shall supersede Aerofiche cards of the same number in the set. The "Aerofiche Effectivity" page at the front of this manual lists the current revision for each card in this set.

- B. Conversion of Aerofiche alpha/numeric grid code numbers:

First number is the Aerofiche card number.

Letter is the horizontal row reference per card.

Second number is the vertical column reference per card.

Example: 2J16 = Aerofiche card number two, row J, column 16.

- C. To aid in locating information, the following is provided at the beginning of each aerofiche card:

- (1) A complete Introduction containing the Chapter/Section Index Guide for all fiche in this set.
- (2) A complete subject Index for all fiche in this set.

8. Identifying Revised Material

A revision to a page is defined as any change to the printed matter that existed previously. Revisions, additions and deletions are identified by a vertical line (i.e. - change bar) along the left-hand margin of the page opposite only that portion of the printed matter that was changed.

A change bar in the left-hand margin opposite the footer (i.e. - chapter/section/subject, page number and date), indicates that the text was unchanged but the material was relocated to a different page.

Example.

NOTE: Change bars are not used in the title pages, list of effective pages, or index.

9. Indexing

An alphabetically arranged subject Index follows this introduction to assist the user in locating desired information. In addition, each System/Chapter begins with an individual Table of Contents.

10. List of Effective Pages

Each System/Chapter has a List of Effective Pages preceding the Table of Contents to identify the effective revision date for each page in that chapter.

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11. Warnings, Cautions and Notes

These adjuncts to the text are used to highlight or emphasize important points when necessary. **Warnings** call attention to use of materials, processes, methods, procedures or limits which must be followed precisely to avoid injury or death to persons. **Cautions** call attention to methods and procedures which must be followed to avoid damage to equipment. **Notes** call attention to methods which make the job easier. Warnings and Cautions shall be located directly above and Notes directly beneath the text and be in line with the paragraphs to which they apply.

12. Accident/Incident Reporting

To improve our Service and Reliability system and aid in our compliance with FAR 21.3, knowledge of all incidents and/or accidents must be reported to Piper immediately. To expedite and assist in reporting all incidents and accidents, Piper Form 420-01 has been created. See Service Letter 1041 for latest revision. This procedure is to be used by all Dealers, Service Centers and Repair Facilities.

13. Supplementary Publications

The following publications/sources provide servicing, overhaul and parts information for the PA-34-220T Seneca IV / V airplanes and their various components. Use them to supplement this manual.

A. Piper Publications: (by Part Number)	Seneca IV	Seneca V
(1) Parts Catalog:	761-887	761-887
(2) Periodic Inspection Report:	230-1061	767-012
(3) Progressive Inspection Manual (50 Hour):	761-753	767-006

B. Vendor Publications:

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY.

(1) AIR CONDITIONING COMPRESSOR:

Vendor:	Sanden International (USA), Inc. 601 South Sanden Blvd. Wylie, TX 75098-4999 http://www.sanden.com	PH: - (972) 442-8400
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(2) AUTOFLIGHT:

Vendor(s):	Honeywell One Technology Center 23500 W. 105th St., M/D #45 Olathe, Kansas 66061-1950 http://www.bendixking.com/	(or)	S-TEC Corporation One S-TEC Way Mineral Wells, Tx 76067 PH: - (940) 325-9406 www.s-tec.com
Flight Control:	Bendix/King		
System Flight Line Installation Manual:	KFC 150 P/N 006-0287-00		

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(3) BATTERY:

Vendor:	GILL Batteries	PH: - (800) 456-0070
	A Division of Teledyne Continental Motors	
	http://www.gillbatteries.com	

(4) BRAKES AND WHEELS:

Vendor:	Parker Hannifin Corp.	PH: - (800) 272-5464
	Aircraft Wheel and Brake Division	
	1160 Center Road	
	Avon, Ohio 44011	
	http://www.parker.com/cleveland/Universe/book.pdf	

(5) ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS):

Vendor:	Meggitt Avionics, Inc.	PH: - (603) 669-0940
	10 Ammon Drive	FAX: - (603) 669-0931
	Manchester, NH 03103-7406	
	http://www.meggittavi.com/	

Vendor:	Avidyne Corporation	PH - (800) 284-3963
	55 Old Bedford Road	
	Lincoln, MA 01773	
	http://www.avidyne.com/index.htm	

Instructions for Continued Airworthiness

Primary Flight Display and Magnetometer/OAT:	Document No. AVPFD-174
Multifunction Display:	Document No. AVMFD-167
Data Acquisition Unit:	Document No. AVSIU-011

(6) EMERGENCY LOCATOR TRANSMITTER:

Vendor:	Artex Aircraft Supplies	PH: - (800) 547-8901
	14405 Keil Road NE	
	Aurora, Oregon 97002	
	http://www.artex.net/	

(7) ENGINE:

Vendor:	Teledyne Continental Motors	PH: - (800) 718-3411
	Attn: Aircraft Products Division	FAX: - (251) 432-7352
	Mobile, Alabama 36601	

[SENECA IV](#)

Overhaul Manual =	CONTINENTAL - Form No. X-30030A
Parts Catalog =	CONTINENTAL - Form No. X-30031A
Operators Handbook =	CONTINENTAL - Form No. X-30553

[SENECA V](#)

Maintenance Manual =	CONTINENTAL - Form No. X-30645A
Overhaul Manual =	CONTINENTAL - Form No. X-30596A

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(8) FIRE EXTINGUISHER (PORTABLE):

Vendor:	H3R Inc. 43 Magnolia Ave # 4 San Francisco, California 94123-2911 http://www.h3r.com/index.htm	PH: - (800) 249-4289
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(9) FUEL CELLS:

Vendor:	Engineered Fabrics Corporation 669 Goodyear Street Rockmart, Georgia 30153-0548 http://www.kfefc.com/index.htm	PH: - (770) 684-7855 FAX: - (770) 684-7438
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(10) FUEL PUMP:

Vendor:	Weldon Pumps P.O. Box 46579 640 Golden Oak Parkway Oakwood Village, Ohio 44146 http://www.weldonpumps.com/index.html	PH: - (440) 232-2282 FAX: - (440) 232-0606
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(11) GEAR LOCKING ACTUATORS, HYDRAULIC PUMP, AND ALL HYDRAULIC COMPONENTS:

Vendor:	Parker Hannifin Corporation 6035 Parkland Boulevard Cleveland, OH 44124-4141 USA email: c-parker@parker.com	PH: - (800) C-PARKER (800) 272-7537 FAX: - (440) 266-7400
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(12) KEVLAR:

Vendor:	KEVLAR Special Products E.I. DuPont De Nemours & Co. Inc. Textile Fibers Department Centre Road Building Wilmington, Delaware 19898
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A Guide to Cutting and Machining Kevlar Aramid

(13) LIGHTS - NAVIGATION, STROBE, AND MAP LIGHTS:

Vendor:	Whelen Engineering Co. Inc. Route 145, Winthrop Rd. Chester, Connecticut 06412 http://www.whelen.com/	PH: - (860) 526-9504 FAX: - (860) 526-2009
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(14) MAGNETOS:

Vendor:	TCM Aircraft Products P. O. Box 90 Mobile, AL 36601 http://www.tcmlink.com/	PH: - (800) 718-3411 FAX: - (251) 432-7352
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Installation, Operation and Maintenance	Teledyne Continental Motors (TCM) Service Support Manual, P/N x42002
Instructions =	S-20 / S-200 Series High Tension Magnets

or,

Vendor:	Slick Aircraft Products Unison Industries Attn: Subscription Service 7575 Baymeadows Way Jacksonville, FL 32256 http://www.unisonindustries.com/news/service_documents.html	PH: - (904) 739-4000 FAX: - (904) 739-4006
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Installation, Operation and Maintenance Instructions:	F1100 MASTER SERVICE MANUAL, 4300/6300 SERIES MAGNETO MAINTENANCE AND OVERHAUL MANUAL - L-1363
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(15) NAVIGATION, COMMUNICATIONS, AND GPS (NAV/COM/GPS):

Vendor:	Garmin International 1200 East 151ST Street Olathe, KS 66062 http://www.garmin.com	PH: - (913) 397-8200
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(16) OXYGEN SYSTEM:

Vendor:	Scott Aviation 2225 Erie Street Lancaster, New York 14086 http://www.scottaviation.com/	PH: - (716) 683-5100
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(17) PROPELLER:

Vendor:	Hartzell Propeller Inc. One Propeller Place Piqua, OH 45356-2634 http://www.hartzellprop.com/index2.htm	PH: - (937) 778-4379 FAX: - (937) 778-4321
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Overhaul Instructions:	Manual No. 117
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or,

Vendor:	McCauley Accessory Division 3535 McCauley Drive P.O. Drawer 5053 Vandalia, Ohio 45377-5053
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McCAULEY C500 SERIES SERVICE MANUAL - P/N 810915

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(18) STANDBY ATTITUDE INDICATOR:

Vendor Address: Mid-Continent Instruments Co., Inc. PH - (316) 630-0101
9400 E. 34 TH Street N. FAX - (316) 630-0723
Wichita, KS 67226
<http://www.mcico.com/index.html>

Installation Manual and
Operating Instructions: Manual No. 9015762

(19) STARTER:

Electro Systems, Inc.
(see "Voltage Regulator," below)

(20) VACUUM PUMP:

Vendor: Aero Accessories, Inc. PH: - (800) 822-3200
1240 Springwood Avenue
Gibsonville, NC 27249
<http://www.aeroaccessories.com/index.html>

(21) VACUUM REGULATOR:

Vendor: Parker Hannifin Corp. PH: - (800) 382-8422
Airborne Division
711 Taylor Street
Elyria, Ohio 44035
<http://www.parker.com/cleveland/Universe/book.pdf>

(22) VOLTAGE REGULATOR:

Vendor: Electro Systems, Inc. PH: - (888) 461-6077
Airport Complex
P. O. Box 273
Fort Deposit, Alabama 36032
<http://www.kellyaerospace.com/index.htm/>

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14. Chapter/Section Index Guide

NOTE: The following GAMA Specification No. 2 standard chapters are not included in this Maintenance Manual: 23, 36, 38, 49, 53, 54, 60, 72, 75, and 83. These chapters are omitted because the subject system is either: not installed in these airplanes; adequately covered in vendor or other manuals; or, for ease of use, has been combined with another chapter.

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GENERAL

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

Description

On **Seneca IV** models, the McCauley three bladed propeller is the standard installation, and the Hartzell two bladed propeller is available as an option. On **Seneca V** models, the Hartzell two bladed propeller is the standard installation, and the McCauley three bladed propeller is available as an option.

Both the Hartzell two bladed or the McCauley three bladed installations are constant speed, controllable pitch, feathering propellers.

Pitch is controlled by oil and nitrogen pressure. Oil pressure sends the propeller toward high rpm or unfeather position; nitrogen pressure sends the propeller toward low rpm or feather position, which also prevents propeller overspeed. Feathering is accomplished by releasing the governor oil pressure, allowing the counterweights, nitrogen pressure and internal feathering spring to feather the blades.

Each engine is equipped with a governor that supplies engine oil at varying pressure through the propeller shaft to maintain constant rpm, which controls engine speed by varying propeller blade angle (pitch) to match load torque to engine torque in response to changing flight conditions.

Feathering is accomplished by moving the desired propeller control lever fully aft through the low rpm detent into the FEATHER position. Unfeathering in flight is accomplished by moving the propeller control forward past the low rpm detent and engaging the starter until the engine begins to windmill.

Unfeathering on the ground can be accomplished by moving the mixture to full rich position, engaging the starter until the engine fires, and then moving the propeller control full forward to the high rpm position. Unfeathering on the ground may also be accomplished by moving the propeller control forward past the low rpm detent and using blade paddles to mechanically pull the propeller out of feather.

An unfeathering accumulator system is available as an option. It uses stored air/oil pressure to aid unfeathering in flight.

DO NOT unfeather a propeller if the engine was stopped due to mechanical failure.

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PROPELLER ASSEMBLY

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

Propeller

A. Removal

WARNING: ENSURE THE MAGNETO AND MASTER SWITCHES ARE OFF AND THE MIXTURE CONTROL IS IN THE IDLE CUT-OFF POSITION.

CAUTION: WHEN REMOVING A PROPELLER EQUIPPED WITH ENGINE SYNCHROPHASER MAGNETIC PICKUPS, REMOVE PICKUP PRIOR TO REMOVING PROPELLER TO PREVENT DAMAGE TO THE PICKUP.

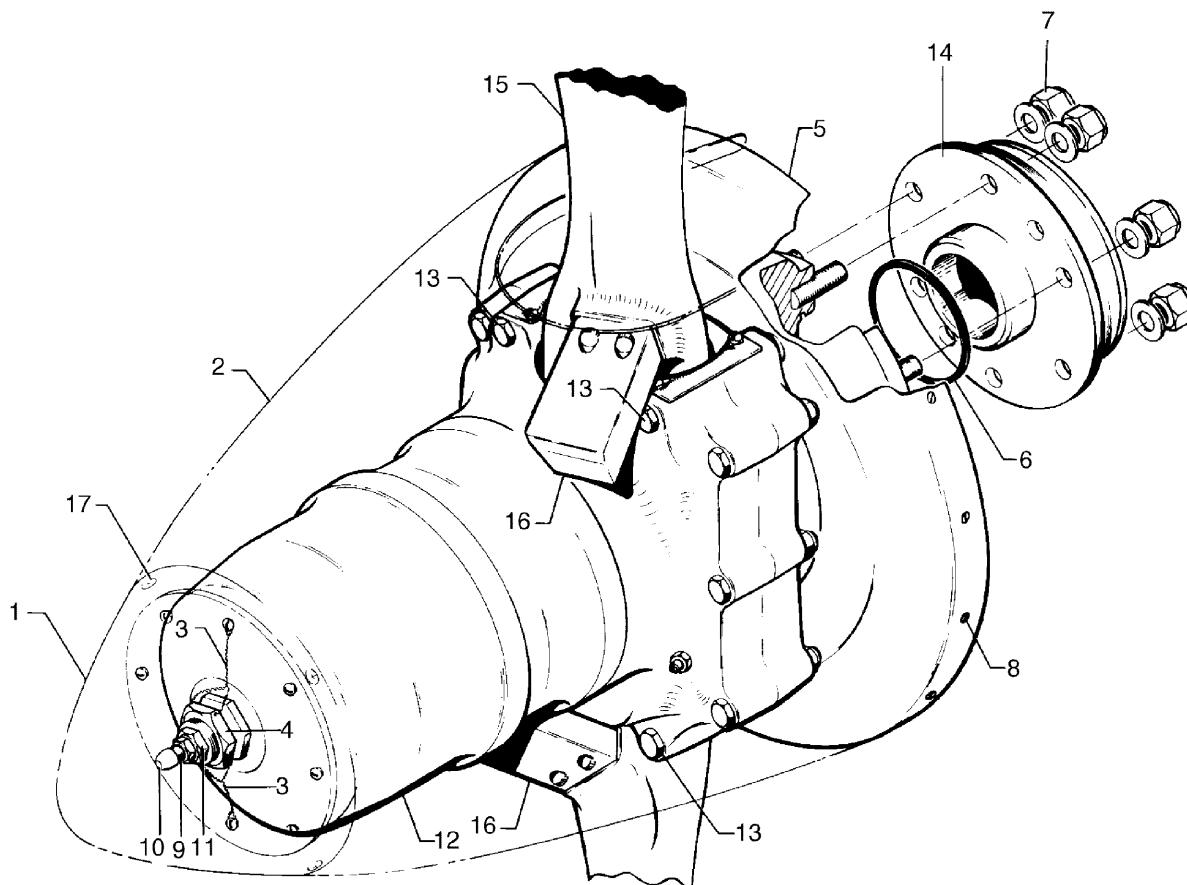
- (1) Remove the cowling.
- (2) Place a drip pan under the propeller and engine to catch oil spillage.
- (3) If desired, the spinner on the McCauley installation can now be removed by removing the screws at the spinner bulkhead and withdrawing spinner.
- (4) Remove safety wire and nuts from the propeller mounting studs and withdraw propeller.
- (5) The spinners are installed differently on the Hartzell and McCauley propellers. They are removed as follows:
 - (a) Hartzell Spinner Removal
Disassemble the spinner nose cap from the spinner, remove the check nut on the valve boss, and the screws securing the spinner to its aft bulkhead. If it is necessary to remove the spinner bulkhead, remove the bolts securing the bulkhead to the propeller hub. Do not lose the spacers, if any, between the valve boss locknut and front spinner bulkhead.
 - (b) McCauley Spinner Removal
The propeller is held in position by a support on the hub dome inside the spinner and is not attached to the spinner. Remove the spinner by unscrewing the screws attaching the spinner to its bulkhead at the rear of the propeller and slide off the assemblies. The support can be removed from the dome by pulling it off the assembly. Do not lose the spacers inside the support assembly.
- (6) Make sure to cover or plug the crankshaft port as well as the propeller hub port.

B. Installation (See Figures 1 and 2.)

WARNING: ENSURE MASTER AND MAGNETO SWITCHES ARE OFF, AND MIXTURE CONTROL IS AT IDLE CUT-OFF.

- (1) Hartzell propellers (Refer to Figure 1.)
 - (a) Remove any coverings from the propeller and engine crankshaft and clean the mounting flanges. Make sure that dirt, lint, or other foreign material does not enter any of the propeller or crankshaft passages.
 - (b) Remove the appropriate bolts and install the spinner aft bulkhead. Torque the nuts as specified in Chart 1.
 - (c) Lubricate and install O-ring in the propeller hub.
 - (d) Position the propeller on the shaft mounting flange.
 - (e) Install the retaining nuts and torque as specified in Chart 1.

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CAUTION: THE FOLLOWING PROPELLER ASSEMBLIES
MUST BE MOUNTED IN PAIRS AND NOT MIXED.

SENECA IV

LEFT

BHC-C2YF-2CKUF/FC8459-8R

RIGHT

BHC-C2YF-2CLKUF/FJC8459-8R

SENECA V

LEFT

BHC-J2YF-2CUF/FC8459(B)-8R

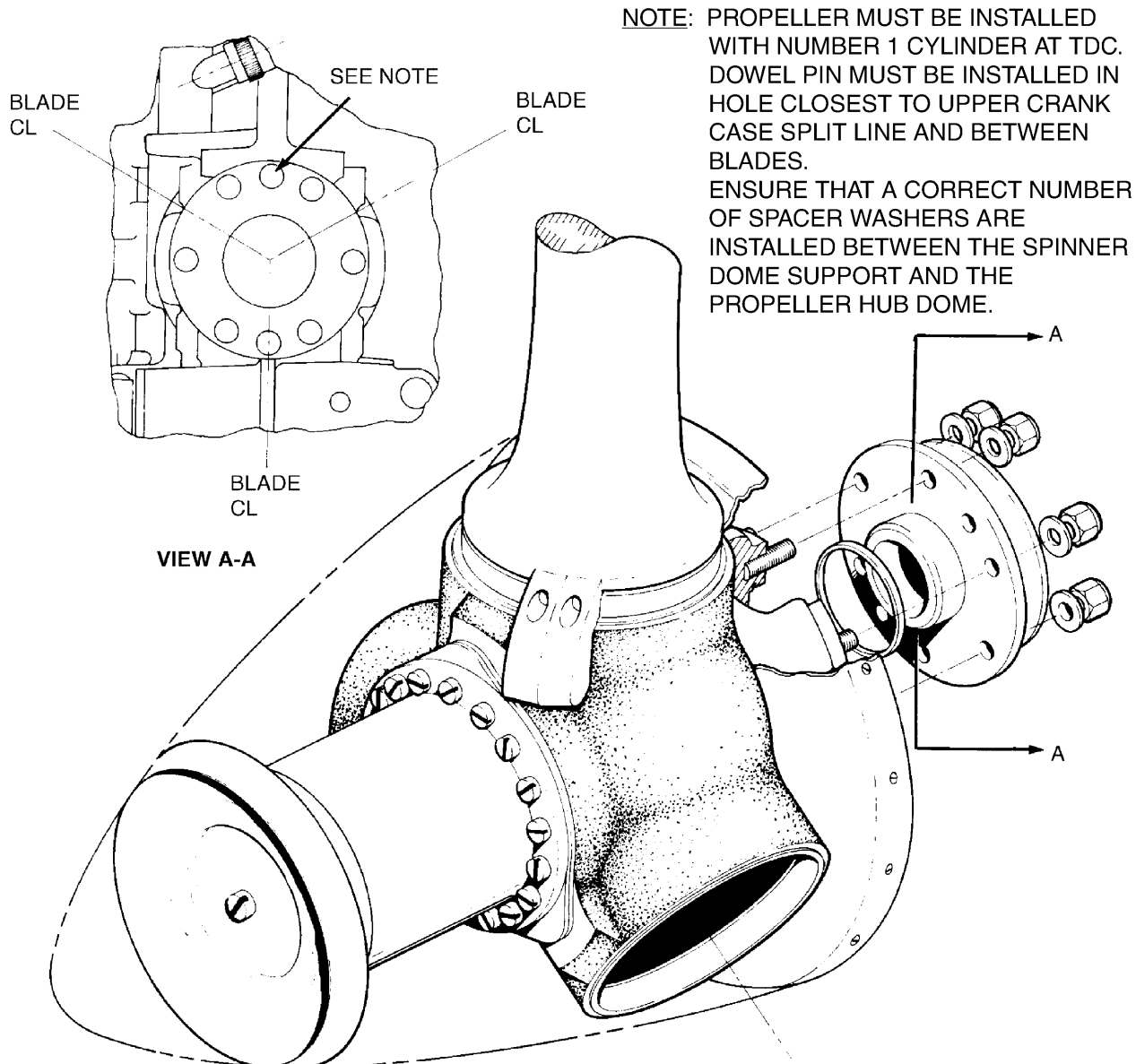
RIGHT

BHC-J2YF-2CLUF/FJC8459(B)-8R

1. SPINNER CAP
2. SPINNER
3. SAFETY WIRE
4. SPINNER CHECK NUT
5. AFT BULKHEAD
6. O-RING
7. PROPELLER MOUNTING NUT
8. SPINNER ATTACHMENT SCREW
9. AIR VALVE
10. AIR VALVE CAP
11. LOW PITCH ADJUSTMENT
12. PROPELLER - R DOME
13. BULKHEAD BOLT
14. ENGINE FLANGE
15. PROPELLER BLADE
16. COUNTERWEIGHT
17. CAP ATTACHMENT SCREW

Hartzell Two Bladed Propeller Installation
Figure 1

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SENECA IV
LEFT
3AF32C508/82NFA-6

RIGHT
3AF32C509/L82NFA-6

SENECA V
LEFT
3AF32C522/82NJA-6

RIGHT
3AF32C523/L82NJA-6

McCauley Three Bladed Propeller Installation
Figure 2

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- (f) Install the spacer(s) (A169-7) over the valve boss. The spacer(s) provide proper alignment of the spinner.
- (g) Slide the spinner onto the propeller. Align the holes in the spinner dome with those in the aft bulkhead and push the dome onto the bulkhead until the holes line up. Install attaching screws.
- (h) Install check nut on the valve boss and torque as specified in Chart 1.
- (i) Safety wire the locknut and screws on the forward spinner bulkhead.
- (j) Check air pressure per Chart 2.
- (j) Install spinner nose cap.
- (2) McCauley propellers (Refer to Figure 2.)
 - (a) Remove any coverings from the propeller and engine crankshaft and clean the mounting flanges. Make sure that dirt, lint, or other foreign material does not enter any of the propeller or crankshaft passages.
 - (b) Lubricate and install O-ring in the propeller hub.
 - (c) On [Seneca IV](#) models, position the spinner back plate over the studs on the propeller hub. On [Seneca V](#) models, attach spinner bulkhead to back of aft end of propeller hub. Tighten mounting screws to a torque as specified in Chart 1. Safety wire screws in pairs.
 - (d) Rotate the engine until the number one cylinder is at its top dead center position.
 - (e) Mount the propeller on the crankshaft mounting flange such that the hub dowel pin, located between two of the blades, is inserted in the flange hole closest to the split line of the upper crankcase. Install mounting nuts.
 - (f) Torque the mounting nuts as specified in Chart 1.
 - (g) With the same amount of spacers in the spinner dome support as when removed, install the spinner support on the propeller hub dome.
 - (h) Align the spinner and slide it over the propeller. The spinner holes must be misaligned forward of those in the bulkhead by half a hole, so that the spinner need be pressed rearward to install the hardware. If the holes align perfectly, or misalign to the rear of the holes in the bulkhead, remove spinner and support and add more spacers inside the spinner support.

C. Cleaning, Inspection, and Repair

CAUTION: DO NOT ATTEMPT TO DISASSEMBLE THE PROPELLER ANY FURTHER THAN STATED IN THIS MANUAL. PROPELLER SHOULD BE REFERRED TO THE HARTZELL OR MCCAULEY FACTORY, OR A CERTIFIED REPAIR STATION, FOR INTERNAL REPAIRS AND REPLACEMENT OF PARTS.

- (1) Check for oil and grease leaks.
- (2) Clean the spinner, propeller hub, and blades with a non-corrosive solvent.
- (3) Inspect the hub parts for cracks.
- (4) Steel hub parts should not be permitted to rust. Use aluminum paint to touch up, if necessary, or replat them during overhaul.
- (5) Check all visible parts for wear and safety.
- (6) Check blades to determine whether they turn freely on the hub pilot tube. This can be done by rocking the counterweights or blades back and forth through the slight freedom allowed by the pitch change mechanism. If they appear tight and are properly lubricated, the propeller should be disassembled by an authorized Service Center.

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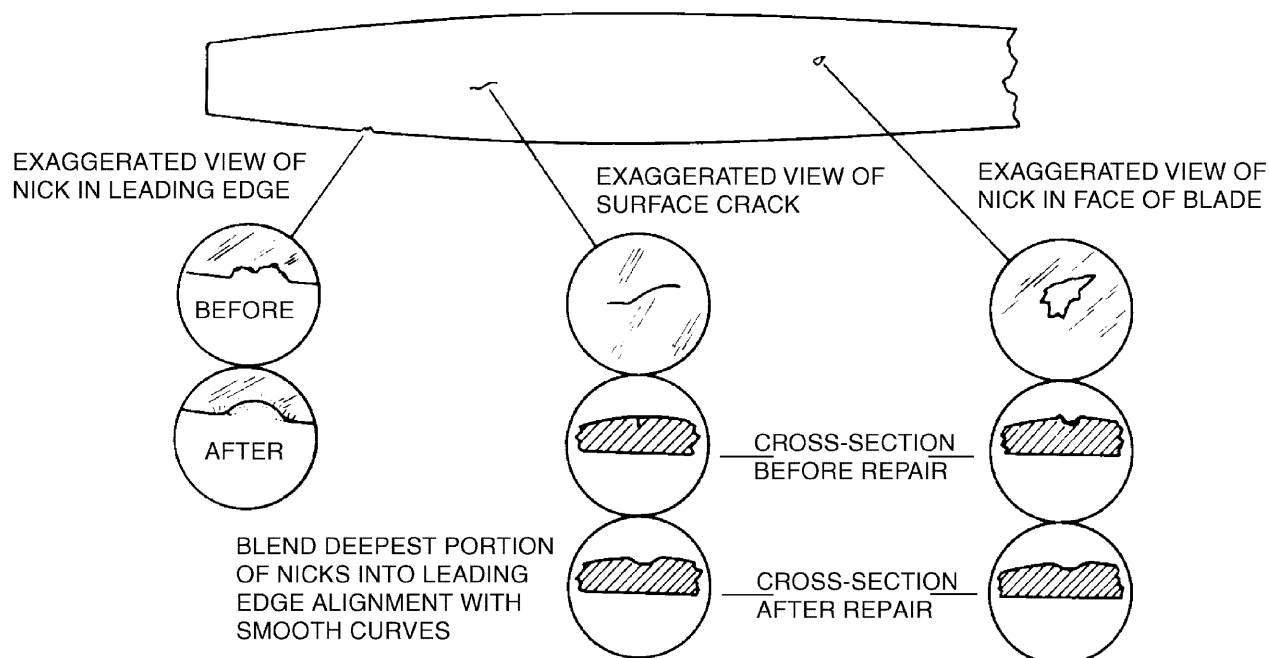
CHART 1
PROPELLER SPECIFICATIONS

	Hartzell (2-Blade)	McCauley (3-Blade)
Blade Angle		
Low Pitch (High RPM) ¹		
(Seneca IV)	12.6° ± 0.2°	11.0° ± 0.2°
(Seneca V)	14.6° ± 0.2°	12.6° ± 0.2°
High Pitch (Low RPM) ¹		
(Seneca IV)	80° to 81.5°	81° to 83.5°
(Seneca V)	80° to 81.5°	81.6° to 82.6°
Propeller RPM Setting		
Engine Static High RPM		
(Seneca IV)	2800 rpm max.	2800 rpm max.
(Seneca V)	2600 rpm max.	2600 rpm max.
Propeller Torque Limits (Dry²)		
Spinner Bulkhead (Aft)		
(Seneca IV)	20-22 foot-pounds	N/A
(Seneca V)	20-22 foot-pounds	72-84 in. lb.
Propeller Mounting		
(Seneca IV)	60-70 foot-pounds	Per Placard on Hub
(Seneca V)	60-70 foot-pounds	45-50 foot-pounds
		(Lubricated with McCauley
		P/N A-1637-16
		(MIL-T-83483) only.)
Locknut (Low Stop)		
(Seneca IV)	50-75 foot-pounds	N/A
(Seneca V)	15-20 foot-pounds	N/A
Spinner Bulkhead Check Nut	15-20 foot-pounds	N/A
Spinner Attachment Screws	35-40 inch-pounds	35-40 inch-pounds
NOTES: 1. Measured at 30 inch station. 2. Unless otherwise noted.		

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**CHART 2
HARTZELL PROPELLER CHAMBER PRESSURE vs. TEMPERATURE**

	Temp °F (C)	Pressure (psi)
Seneca IV		
Propeller Hubs BHC-C2YF-2CKUF and BHC-C2YF-2CLKUF		
	70 to 100 (21.11 to 37.78)	22 ± 2
	40 to 70 (4.44 to 21.11)	17 ± 2
	0 to 40 (-17.8 to 4.44)	14 ± 2
	-30 to 0 (-34 to to -17.8)	9 ± 2
Seneca V		
Propeller Hubs BHC-J2YF-2CUF and BHC-J2YF-2CLUF		
	70 to 100 (21.11 to 37.78)	41 ± 1
	40 to 70 (4.44 to 21.11)	38 ± 1
	0 to 40 (-17.8 to 4.44)	36 ± 1
	-30 to 0 (-34 to to -17.8)	33 ± 1
NOTE: Do not check pressure or charge with propeller in feather position.		



Typical Nicks and Removal Methods
Figure 3

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- (7) Inspect the blades for damage or cracks. Nicks in the leading edges of blades should be filed out and all edges rounded, as cracks sometimes start from such places. Use fine emery cloth for finishing. (Refer to Figure 3 for propeller blade care.)
 - (8) Check the condition of the propeller mounting nuts and studs.
 - (9) Each blade face should be sanded lightly with fine sandpaper and painted, when necessary, with a flat black paint to retard glare. A light application of oil or wax may be applied to the surfaces to prevent corrosion.
 - (10) Grease the blade hub through the zerk fittings. Remove one of the two fittings for each propeller blade; alternate the next time. Apply grease through the zerk fitting until fresh grease appears at the fitting hole of the removed fitting. Care should be taken to avoid blowing out the hub gaskets.
 - (11) On Hartzell propellers, check for air leaks by applying a soap solution around the air valve and stop adjustment nut. Internal leakage will show up as air flows through the piston rod.
- D. Checking Propeller Blade Track

Blade track is the ability of one blade tip to follow the other, while rotating, in almost the same plane. Excessive difference in blade track - more than 0.0625 inch (1.5867 mm) - may be an indication of bent blades or improper propeller installation. Check blade track as follows:

- (1) With the engine shut down and blades vertical, secure to the aircraft a smooth board just under the tip of the lower blade. Move the tip fore and aft through its full "blade-shake" travel, making small marks with a pencil at each position. Then center the tip between these marks and scribe a line on the board for the full width of the tip.
- (2) Carefully rotate propeller by hand to bring the opposite blade down. Center the tip and scribe a pencil line as before and check that lines are not separated more than 0.125 inch (3.175 mm).
- (3) Propellers having excess blade track should be removed and inspected for bent blades, or for parts of sheared O-ring, or foreign particles, which have lodged between hub and crankshaft mounting faces. Bent blades will require repair and overhaul of assembly.

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CONTROLLING

1. Propeller Governor

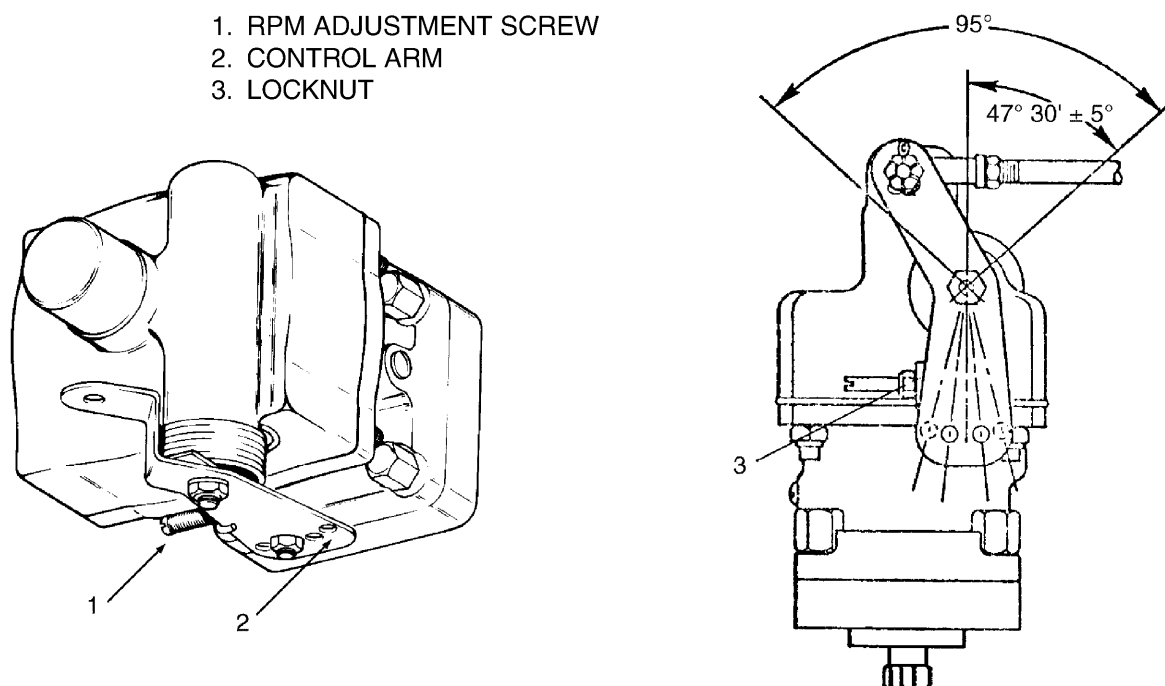
A. Removal

The propeller governor is mounted on the lower left forward portion of the engine crankcase. Remove the governor as follows:

- (1) Remove the left side of the nose cowl to gain access to the governor.
- (2) Disconnect the governor control cable end from the governor control arm.
- (3) Remove the governor mounting nuts and withdraw the governor from the mounting pad. Cover the mounting pad to prevent foreign material from entering the engine.

B. Installation

- (1) Clean the mounting pad and the governor drive shaft thoroughly.
- (2) Coat the mounting gasket with Dow Corning release agent or equivalent.
- (3) Lubricate governor drive shaft with engine oil and install governor on the mounting pad.
- (4) Tighten the mounting nuts evenly and tighten to a final torque of 140 to 160 inch-pounds.
- (5) Connect the control cable to the control arm. Check to be sure the attachment bolt does not contact the governor body while moving the control arm through its full travel. Clearance should be 0.03 inch (0.762 mm) minimum.



Propeller Governor
Figure 1

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C. Rigging and Adjustment (Refer to Figure 1.)

(PIR-FTP2001-12, Rev. F.)

- (1) Start engine; park 90° to wind direction and warm in normal manner.
- (2) (**Seneca IV** models) To check high rpm, low pitch setting, move the propeller control all the way forward. At this position the governor speed control arm should be against the high rpm fine adjusting screw. With the throttle full forward, observe engine rpm, which should stabilize between 2700 and 2800 rpm. A takeoff must be conducted during which the engine maintains 2800 rpm.

(**Seneca V** models) To check high rpm, low pitch setting, move the propeller control all the way forward. At this position the governor speed control arm should be against the high rpm fine adjusting screw. With the throttle full forward, observe engine rpm, which should stabilize at 2575-2600 rpm. A takeoff must be conducted during which the engine maintains 2575-2600 rpm.

- (3) (**Seneca IV** models) If the engine rpm does not read 2800 rpm in flight, the high rpm setting must be adjusted as follows.

(**Seneca V** models) If the engine rpm does not read 2575-2600 rpm in flight, the high rpm setting must be adjusted as follows:

- (a) Land, shut down the engine and open the cowl door(s).
- (b) (**Seneca IV** models) Adjust the governor by means of the fine adjustment screw to 2800 rpm. To do this, loosen the high rpm fine adjustment screw locknut and turn the screw in a clockwise direction to decrease engine or speed or in a counterclockwise direction to increase engine speed.
- (c) (**Seneca V** models) Adjust the governor by means of the fine adjustment screw to 2575-2600 rpm. To do this, loosen the high rpm fine adjustment screw locknut and turn the screw in a clockwise direction to decrease engine or speed or in a counterclockwise direction to increase engine speed.

NOTE: One revolution of the fine adjustment screw will increase or decrease the engine speed approximately 20 rpm.

- (d) Secure the cowl door(s) and repeat step (2) to ascertain proper rpm setting.
- (e) After setting the proper high rpm adjustment, run the self-locking nut on the fine adjustment screws against the base projection to lock.
- (4) With the high rpm adjustment complete, the control system should be adjusted so that the governor control arm will contact the high rpm stop when the cockpit control knob is .032 to .047 of an inch from its full forward stop. To adjust the control knob travel, disconnect the control cable end from the control arm; loosen the cable end jam nut and rotate the end to obtain the desired level clearance. Reconnect the cable end and tighten jam nut.
- (5) It is usually only necessary to adjust the high rpm (low pitch) setting of the governor control system, as the action automatically takes care of the positive low rpm (high pitch) setting.

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2. Propeller Unfeathering Accumulator System (See Figure 2.)

The propeller unfeathering system provides a means for storing air and oil pressure in an accumulator so that the propeller may be moved out of the feathered position when so desired. Refer to the Pilot's Operating Handbook for proper operating procedure.

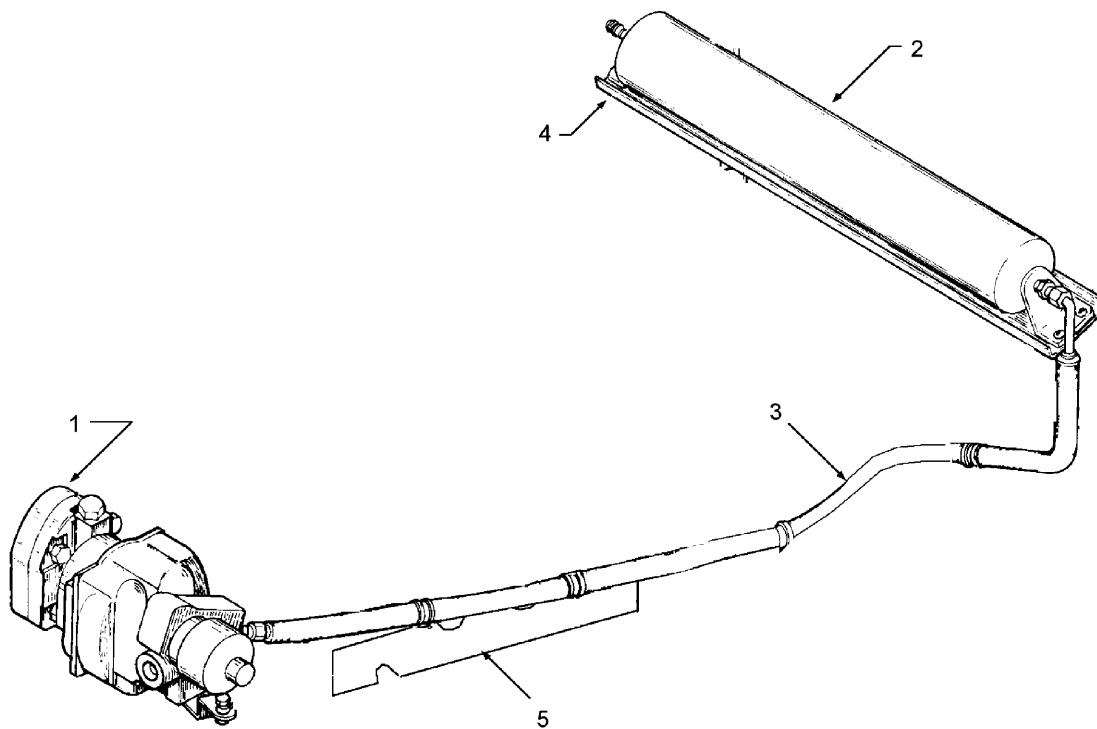
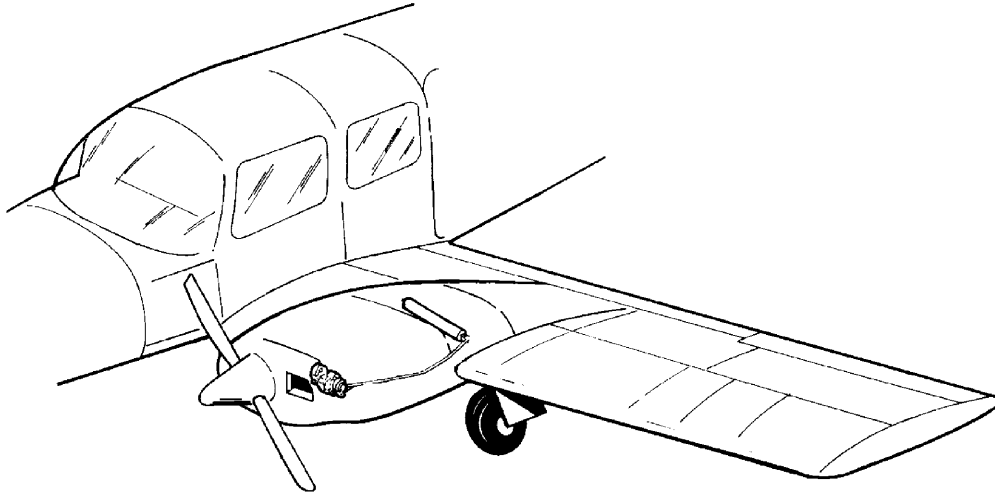
Accumulator

WARNING: COMPLETELY DISCHARGE ALL NITROGEN PRESSURE BEFORE DISCONNECTING THE OIL LINE, PRIOR TO REMOVAL OF THE UNIT FROM THE AIRPLANE.

This is a free piston type accumulator which is charged with nitrogen to a working pressure of 90 to 100 psig at normal room temperature. Accumulator overhaul should coincide with governor overhaul. Refer to McCauley Service Manual No. 780401 for detailed instructions.

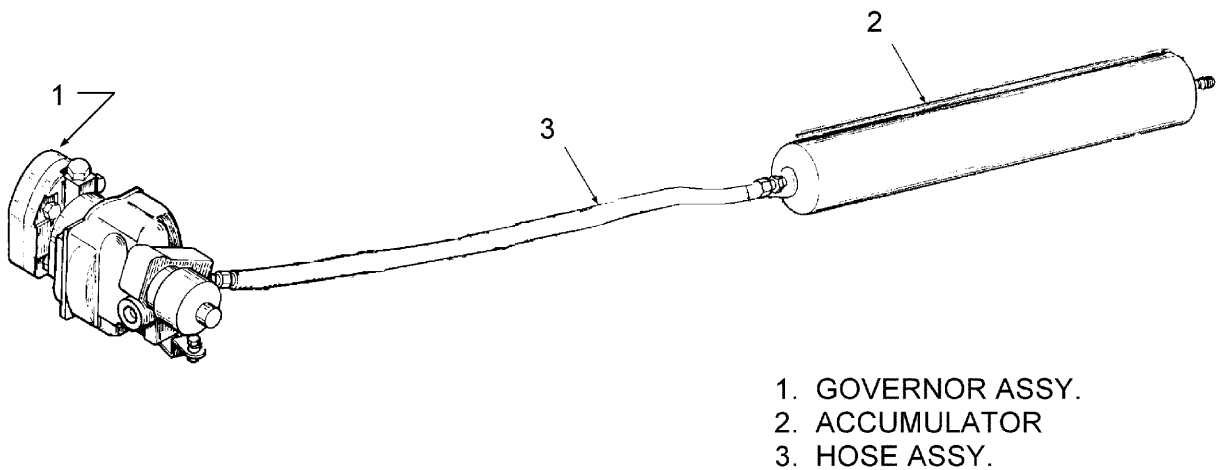
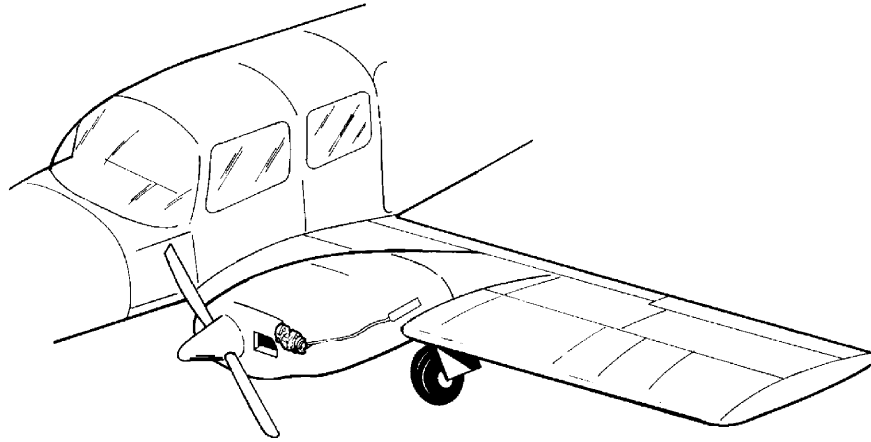
General servicing of the accumulator during its use between overhauls consists of periodically checking the nitrogen charge and visually inspecting the unit for any oil leaks. To perform an operational check, refer to the Pilot's Operating Handbook for proper operating procedure.

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- 1. GOVERNOR ASSY.
- 2. ACCUMULATOR
- 3. HOSE ASSY.
- 4. BRACKET
- 5. HEAT SHIELD

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Propeller Unfeathering Accumulator Installation
Figure 2 (Sheet 2 of 2)

[Effectivity](#)
[Seneca V](#)

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3. Engine Synchrophaser (See Figure 3.)

The synchrophaser installation is a Hartzell system which utilizes a computer, and an electrically slaved and mechanically operated propeller governor.

The function of the synchrophaser is to maintain both propellers at the same rpm and at a selected phase angle. This eliminates propeller "beat" effect and minimizes vibration. The left engine is utilized as the master engine. The right engine is equipped with a slave governor, which automatically maintains, or synchronizes, its rpm with the left engine rpm. The synchrophaser is turned ON with a three position switch located on the throttle quadrant below the propeller controls. It is labeled OFF for manual control and 1 or 2 for propeller synchrophaser. A blue press-to-test light, which illuminates when the propellers are out of synchronization, is located below the switch.

NOTE: Be certain Magneto Switches are OFF.

A. System Operation

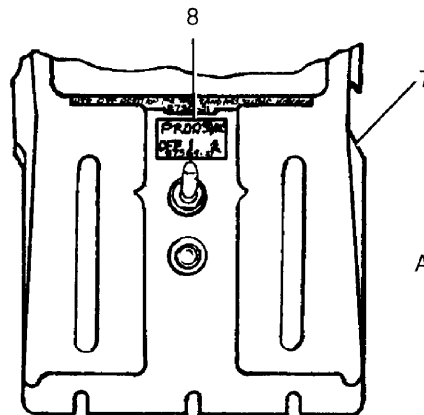
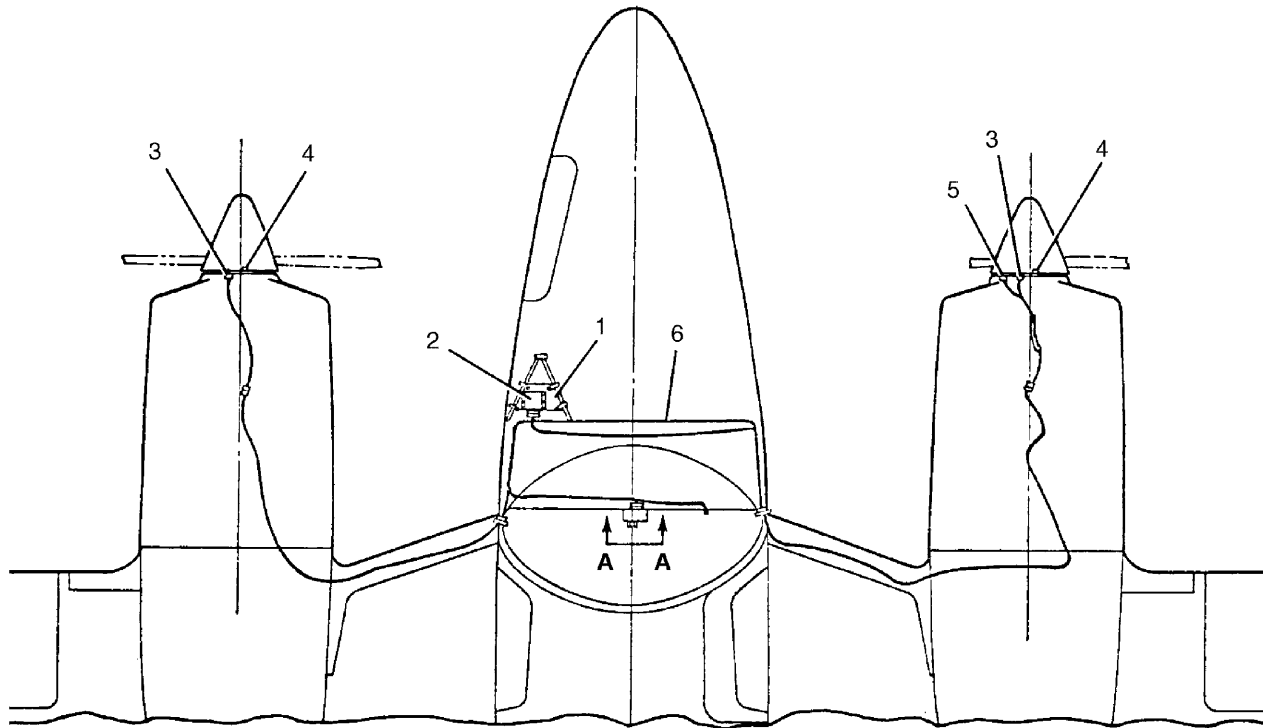
During taxi, takeoff, landing or single engine operations, the propeller synchrophaser switch should be in the OFF position. The blue press-to-test light below the switch will illuminate while the propellers are out of synchronization, whether or not the switch is in the OFF, 1, or 2 position. When the switch is in the OFF position, the propellers can be synchronized manually. The light will go out when propeller synchronization is complete. To utilize automatic synchronization, the propellers should first be synchronized manually to within approximately 10 rpm of each other; then the switch placed in position 1. The blue light will go out when synchronization is complete. For a given rpm and power setting, switch position 2 may provide smoother operation by means of providing a different phase angle. Set the switch to position 1 or 2, whichever provides the smoothest operation. Normally, propeller synchrophasing will take place within a few seconds, but occasionally it may take up to a full minute. Position the synchrophaser switch OFF for 30 seconds before making power setting adjustments. The synchrophaser switch may then be returned to position 1 or 2, whichever provides the smoothest operation. Should propeller rpm differential exceed 50 rpm, the switch should be selected OFF for 30 to 40 seconds; then the propellers can be synchronized again and the synchrophaser switch returned to position 1 or 2. Pulling the circuit breakers completely deactivates the propeller synchrophaser system. If the master switch is turned OFF, or if there is an electrical system failure, the slaved engine will return to the controlled selected rpm plus approximately 25 rpm "out of synchronization" regardless of the position of the synchrophaser switch.

B. Test Procedure

The purpose of the following procedure is to make sure all circuits and the propeller governor solenoid coil are functioning properly. Use the Hartzell B-4657 Test Set to perform the following tests.

- (1) Visually check installation for inadequate connections, incorrect connections, shorts, etc. All parts of the installation are to be connected with the exception of the computer.
- (2) With the aircraft master switch OFF and the test box function switch in position 1 (OFF position), remove forward baggage compartment trim panels to gain access to the computer. Connect the test box into the synchrophaser system in place of the computer.
- (3) Turn the master switch ON. Turn the function switch to position 2 (power position) and observe indicator light. If ON, the battery voltage and polarity to the check-out box is correct.
- (4) Turn the function switch to position 3 (right engine). Rotate right engine until light goes out. Repeat the same procedure in position 4 (left engine).

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SECTION A - A
SWITCH INSTALLATION
AND SYSTEM IDENTIFICATION

"AUTO-SYNC"
(FIXED PHASE)
INSTALLATION

1. MOUNTING BRACKET
2. COMPUTER
3. PICKUP ASSEMBLY
4. MAGNET ASSEMBLY
5. SLAVE GOVERNOR ASSEMBLY
6. WIRING HARNESS
7. CONTROL PEDESTAL
8. SYNCHROPHASER CONTROL SWITCH

Propeller Synchrophaser Installation
Figure 3

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- (5) Turn the function switch to position 5 (manual). Turn the synchrophaser's phase/manual switch to manual. The indicator light should be ON in position 5 (manual), OFF in position 6 (Phase I) and OFF in position 7 (Phase II). Turn the synchrophaser's phase /manual switch to Phase I, the indicator light should be OFF in position 5 (manual) and 7 (Phase II), ON in position 6 (Phase I). Turn the synchrophaser's phase/manual switch to Phase II. The light should be OFF in position 5 (manual), ON in position 6 (Phase I) and 7 (Phase II).
 - (6) Turn the function switch to position 8 (phase light). The indicator light on the test box should be ON. Unscrew top of lamp from synchrophaser phase indicator light. The indicator light on the test box should go OFF.
 - (7) Turn the function switch to position 9 (coil). The indicator light should be ON which indicates the leads to the coil appear to be correct. Turn the function switch to position 10 (coil short) and push coil short test switch. The indicator light should be OFF; if ON, the coil is shorted.
 - (8) If the indicator light does not come ON in any position, a check for proper battery voltage and polarity at system plug must be accomplished (positive at pin 14, negative at pin 1, 2 or 3). If voltage is correct, check indicator bulb. If bulb is burned out, replace with Sylvania #330 or equivalent. If the bulb is good, check the internal fuse. If fuse is damaged, replace with Buss AGC1/2 or equivalent. The 1/2 amp fast-blow fuse may not be replaced with anything heavier. After replacing the fuse, recheck the wiring harness for improper connections and/or shorts. Do this prior to reconnecting the test box.
 - (9) Remove test box and install computer.
- C. Prop Sync Switch

Removal and Installation

- (1) Remove the knobs from the control levers and remove the upper control quadrant cover.
- (2) Remove the retaining nut from the toggle side of the switch and remove the switch from the cover.
- (3) Slide the shaded wire protective covering back off the soldered connections.
- (4) Make note of where each specific wire is soldered and remove the wires from their terminals.
- (5) Install the wires on the new switch as noted and reinstall the switch in the opposite manner of removal.

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D. Magnetic Pickup (Refer to Figures 4 and 5.)

The magnetic pickup consists of a permanent magnet with a coil placed near the counterweight assembly. Low output may be the result of a defective or incorrectly adjusted magnetic pickup and will result in improper synchrophaser system operation.

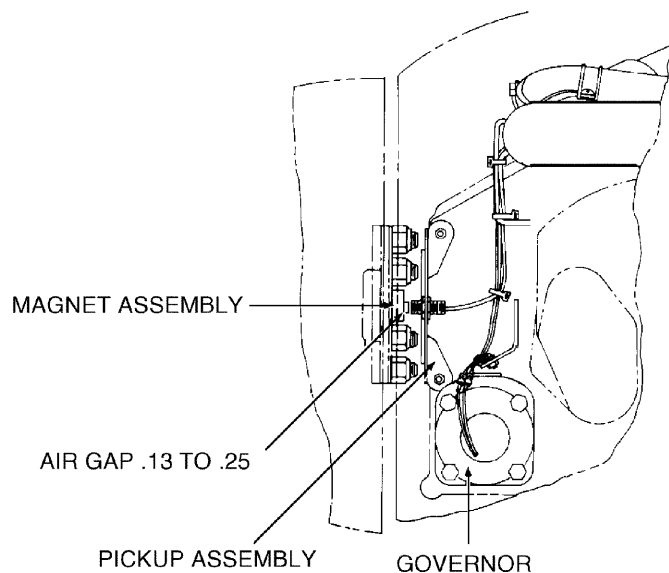
CAUTION: MAGNETIC PICKUPS SHOULD NOT BE HAMMERED OR JARRED AS THIS MAY DECREASE THE STRENGTH OF THE MAGNET.

(1) Removal

- (a) Remove the top cowl of the desired engine.
- (b) Remove the nut attaching the pickup to the bracket.
- (c) The unit can now be removed by cutting the tie wraps and disconnecting the wires.

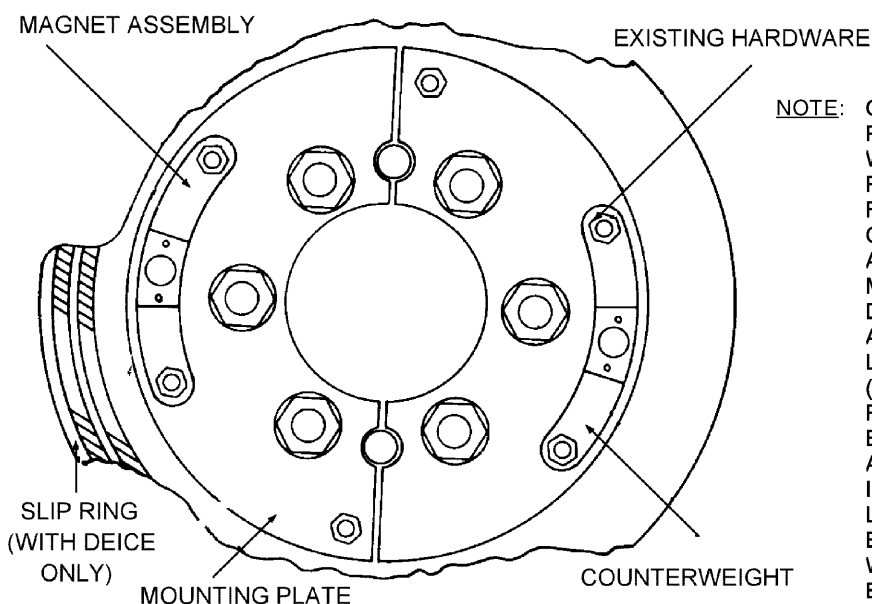
(2) Installation

- (a) The clearance between the dowel pin and pickup should be .13 to .25 inch with the crankshaft pushed aft. Using a feeler gauge, adjust the nuts securing the pickup to the bracket to give the proper gap.
- (b) Rotate propeller, making sure the crankshaft is pushed aft and ensure the proper clearance is maintained.



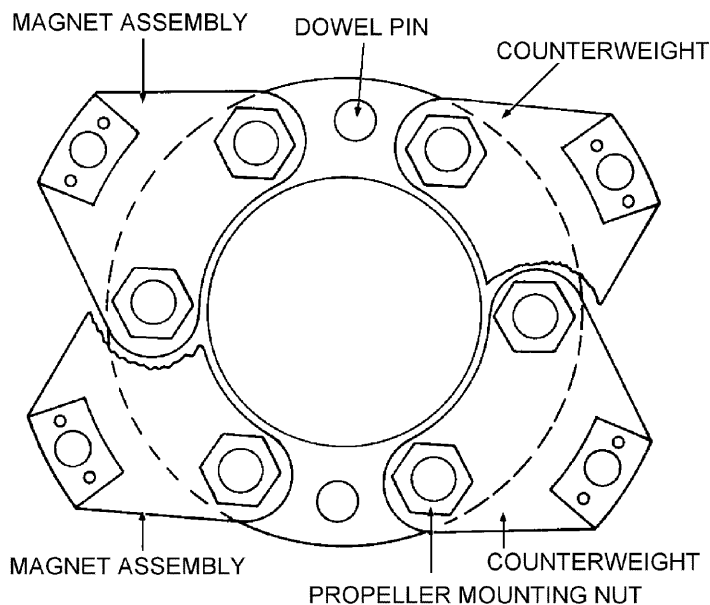
Magnetic Pickup and Governor Installation
Figure 4

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NOTE: ORIENT THE RIGHT ENGINE TO PLACE DOWEL PIN AT TOP ALIGNED WITH THE CRANKCASE SPLIT LINE. REMOVE NO. 5 SPARK PLUG (RIGHT FRONT) AND ROTATE TO TDC ON COMPRESSION STROKE FOR APPROXIMATE LOCATION. ROTATE MINIMUM NO. DEGREES TO PLACE DOWEL AT CRANKCASE SPLIT LINE. ACCOMPLISH THE SAME ON THE LEFT ENGINE USING NO. 6 CYLINDER (LEFT FRONT). REMOVE THE SLIP RING MOUNTING NUTS WHICH WILL BE USED TO MOUNT THE MAGNET AND COUNTERWEIGHT ASSEMBLIES. INSTALL AS SHOWN, IN THE SAME LOCATION ON RIGHT AND LEFT ENGINES. MAGNET ASSEMBLIES WILL BE ON THE LEFT SIDE OF EACH ENGINE WITH COUNTERWEIGHTS OPPOSITE.

SENECA IV WITH DEICE AND SENECA V WITH AND WITHOUT DEICE



NOTE: ORIENT THE RIGHT ENGINE TO PLACE DOWEL PIN AT TOP ALIGNED WITH THE CRANKCASE SPLIT LINE. REMOVE NO. 5 CYLINDER SPARK PLUG AND ROTATE AS NECESSARY TO FIND TDC ON COMPRESSION STROKE. ROTATE THE MINIMUM NO. DEGREES TO PLACE DOWEL AT CRANKCASE SPLIT LINE. ACCOMPLISH THE SAME ON THE LEFT ENGINE USING NO. 6 CYLINDER (LEFT FRONT). REMOVE PROPELLER MOUNTING NUTS AND WASHERS FROM THE 4 LUGS TO BE USED FOR MOUNTING. INSTALL MAGNET ASSEMBLY, COUNTER BALANCE AND NUTS AS SHOWN. DO NOT USE WASHERS UNDER NUTS SECURING MAGNET AND COUNTER BALANCE ASSEMBLIES. (NOTE: DIFFERENT LUGS ARE USED ON LEFT AND RIGHT ENGINES.)

SENECA IV WITHOUT DEICE

Magnet Assemblies
Figure 5

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CHAPTER

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STANDARD PRACTICES - ENGINE

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GENERAL

WARNING: ENSURE MAGNETOS AND MASTER SWITCH ARE OFF AND MIXTURE IS IN IDLE CUT-OFF PRIOR TO WORKING AROUND ENGINE.

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

Review the following suggestions before working on the power plant.

1. To insure proper reinstallation and/or assembly, tag and mark all parts, clips, and brackets as to their location prior to their removal and/or disassembly.

NOTE: Use tags or temporary marking methods which are durable enough to ensure identification during ordinary handling, storage and final assembly of parts.

2. During removal of various tubes or engine parts, inspect them for indications of scoring, burning or other undesirable conditions. To facilitate reinstallation, observe the location of each part during removal. Tag any unserviceable part and/or units for investigation and possible repair.

CAUTION: DUST CAPS USED TO PROTECT OPEN LINES MUST ALWAYS BE INSTALLED OVER THE TUBE ENDS AND NOT IN THE TUBE ENDS. FLOW THROUGH THE LINES MAY BE BLOCKED OFF IF LINES ARE INADVERTENTLY INSTALLED WITH DUST CAPS IN THE TUBE ENDS.

3. Extreme care must be taken to prevent foreign matter from entering the engine, such as lockwire, washers, nuts, dirt, dust, etc. This precaution applies whenever work is done on the engine, either on or off the aircraft. Suitable protective caps, plugs, and covers must be used to protect all openings as they are exposed.
4. Should any items be dropped into the engine, the assembly process must stop and the item removed, even though this may require considerable time and labor.
5. Insure that all parts are thoroughly clean before assembling.
6. Never reuse any lockwire, lockwashers, tablocks, tabwashers or cotter pins. All lockwire and cotter pins must fit snugly in holes drilled in studs and bolts for locking purposes. Cotter pins should be installed so the head fits into the castellation of the nut, and unless otherwise specified, bend one end of the pin back over the stud or bolt and the other end down flat against the nut. Use only corrosion resistant steel lockwire and/or cotter pins. Bushing plugs shall be lockwired to the assembly base or case. Do not lockwire the plug to the bushing.
7. All gaskets, packings and rubber parts must be replaced with new items of the same type at reassembly. Insure the new nonmetallic parts being installed show no sign of having deteriorated in storage.
8. When installing engine parts which require the use of a hammer to facilitate assembly or installation, use only a plastic or rawhide hammer.

CAUTION: ENSURE THAT ANTI-SEIZE COMPOUNDS ARE APPLIED IN THIN EVEN COATS, AND THAT EXCESS COMPOUND IS COMPLETELY REMOVED TO AVOID CONTAMINATION OF ADJACENT PARTS.

9. Anti-seize lubrication should be applied to all loose-fit spline drives which are external to the engine and have no other means of lubrication. For certain assembly procedures, molybdenum disulfide in either paste or powdered form mixed with engine oil or grease may be used.

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CHAPTER

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POWER PLANT

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GENERAL

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The purpose of this chapter is to provide instructions for the removal, minor repair, service and installation of the engine and components. For instructions on major repairs and overhauls, consult the appropriate publication of the component manufacturer.

1. Description (Refer to Chart 1.)

A. **Seneca IV** models

Seneca IV models are powered by two Continental engines; a TSIO-360-KB (left) and LTSIO-360-KB (right). Each engine is turbocharged with a Rayjay turbocharger and controlled through a ground adjustable exhaust bypass valve. An overboost relief valve is also used in each of the intake systems to protect the engine from an overboost condition. The engines are rated at 200 hp at 2600 rpm and 40 in. Hg manifold pressure with a five minute takeoff power rating of 220 hp at 2800 rpm and 40 in. Hg manifold pressure.

Each engine cowl is made up of two nose sections and side panels, an upper support section and a lower cowl assembly. The nose and side panels are interconnected to the upper support, lower cowl and nacelle by camlock fasteners. Each lower cowl assembly also houses a cowl flap assembly which is operated manually through a cable from a lever in the cockpit.

B. **Seneca V** models

Seneca V models are powered by two Continental engines: a TSIO-360-RB (left) and LTSIO-360-RB (right). Each engine is turbocharged with a Garrett turbocharger and controlled with a variable absolute controller and automatic exhaust bypass valve (wastegate). An overboost relief valve is also used in each of the intake systems to protect the engine from an overboost condition. The engines are rated at 220 hp at 2600 rpm and 38 in. Hg manifold pressure and are approved for maximum continuous operation at this setting.

Each engine cowl is made up of two nose sections, an upper cowl assembly and a lower cowl assembly. The nose section, lower cowl and upper cowl are connected by camlock fasteners. Each lower cowl assembly also houses a cowl flap assembly which is operated manually through a cable from a lever in the cockpit.

2. Troubleshooting

Troubles peculiar to the powerplant are listed in Chart 2, along with the probable causes and suggested remedies. When troubleshooting engine, propeller or fuel system, always ground the magneto primary circuit before performing any checks.

NOTE: Seneca V models incorporate the RSA-5 Fuel Injection System. Please see Chart 1, 73-10-00, for troubleshooting this system.

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**CHART 1
ENGINE DATA**

Model (Teledyne Continental)	TSIO & LTSIO-360-KB	TSIO & LTSIO-360-RB
Number of Cylinders	6 Horizontally Opposed	6 Horizontally Opposed
Bore (Inches)	4.44	4.44
Stroke (Inches)	3.88	3.88
Displacement (Cubic Inches)	360	360
Compression Ratio	7.5:1	7.5:1
Type of Propeller Drive, Flanged	Direct	Direct
Fuel, Minimum Octane	100 or 100 LL	100 or 100 LL
Oil Sump Capacity	8 quarts	8 quarts
Oil Pressure (PSI):		
Minimum	10 (Idle)	10 (Idle)
Normal	30-80	30-80
Maximum	100 (Cold - Ground)	100 (Cold - Ground)
Oil Temperature (°F):		
Minimum	100	100
Normal	100-200	100-200
Maximum	240	240
Probe Location	Above Oil Cooler	Above Oil Cooler
Cylinder Head Temperature (°F)		
No. 2 cyl.:		
Minimum	240°F	240°F
Normal	240-420°F	240-420°F
Maximum	460°F	460°F
Magnetos	Bendix 25 Series	Slick 6324 (left) 6320 (right)
Left Bank	Fires 20° BTC Lower Right, Upper Left	Fires 22° BTC Lower Right, Upper Left
Right Bank	Fires 20° BTC Lower Left, Upper Right	Fires 22° BTC Lower Left, Upper Right
Firing Order:		
LTSIO-360-KB	1-4-5-2-3-6	1-4-5-2-3-6
TSIO-360-KB	1-6-3-2-5-4	1-6-3-2-5-4
Spark Plugs (Shielded):	AC, SR86, S86R, HSR86 Auto Lt. PH24, PH260 Champ. REM38W, RHM38W, RHM38E Red Seal. SE270, SE270P, SS270, SU270P	AC, SR86, S86R, HSR86 Auto Lt. PH24, PH260 Champ. REM38W, RHM38W, RHM38E Red Seal. SE270, SE270P, SS270, SU270P
Spark Plug Torque	360 to 420 inch-pounds	360 to 420 inch-pounds
Alternator	12-volt, 60 ampere	24-volt, 85 ampere
Starter	12-volt, Prestolite	24-volt, Prestolite
Engine Dry Weight With Accessories	392 pounds	420

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**CHART 2 (Sheet 1 of 5)
TROUBLESHOOTING ENGINE**

Trouble	Cause	Remedy
Engine will not start.	No fuel gauge pressure - fuel to engine.	Check fuel control for proper position, auxiliary pump "ON" and operating, feed valves open. Fuel filters open and tank fuel level.
	Have gauge pressure - engine flooded.	Turn off auxiliary pump and ignition switch; set throttle to "FULL OPEN" and fuel control to "IDLE CUT-OFF", and crank engine to clear cylinder of excess fuel. Repeat starting procedure.
	Have gauge pressure - no fuel to engine.	Check for vent or loose fuel lines. Loosen line at fuel nozzle. If no fuel shows, replace fuel manifold valve.
Engine starts but fails to keep running.	Inadequate fuel to fuel manifold valve.	Set fuel control in "FULL RICH" position; turn auxiliary pump "ON," check to be sure feed lines and filters are not restricted. Clean or replace defective components.
	Defective ignition system.	Check accessible ignition cables and connections. Tighten loose connections. Replace defective spark plugs.
Engine runs rough at idle.	Improper idle mixture adjustment.	(Seneca IV) Readjust idle setting. Turn adjustment screw clockwise to lean mixture and counter-clockwise to richen mixture.
	Fouled spark plugs. idle.	Remove and clean plugs, adjust gaps. Replace defective plugs.
	Discharge nozzle (injector) air vent manifold restricted or defective.	Check for bent or loose connections. Tighten loose connections. Check for restrictions and replace defective components.

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**CHART 2 (Sheet 2 of 5)
TROUBLESHOOTING ENGINE**

Trouble	Cause	Remedy
Engine has poor acceleration.	Idle mixture too lean.	Readjust idle mixture.
	Incorrect fuel-air mixture, work control linkage or restricted air cleaner.	Tighten loose connections. Service air cleaner.
	Defective ignition system.	Check accessible cables and connections. Replace defective spark plugs.
	Malfunctioning turbocharger.	(Seneca IV) Check operation; listen for unusual noise. Check exhaust bypass screw and for exhaust system defects. Tighten loose connections.
Engine runs rough at speeds above idle.	Improper fuel-air mixture.	(Seneca IV) Check manifold connections for leaks. Tighten loose connections. Check fuel control for setting and adjustment. Check fuel filters and screens for dirt. Check for proper pump pressure and readjust as necessary.
	Restricted fuel nozzle.	Remove and clean all nozzles.
	Ignition system and spark plugs defective.	Clean and re-gap spark plugs. Check ignition cables for defects. Replace defective components.
Engine lacks power, reduction in maximum manifold pressure or critical altitude.	Incorrectly adjusted throttle control, "sticky" linkage or dirty air cleaner.	Check movement of linkage by moving control from idle to full throttle. Make proper adjustments and replace worn components. Service air cleaner.
	(Seneca IV) Improperly adjusted waste gate valve.	Check exhaust bypass screw adjustment.

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**CHART 2 (Sheet 3 of 5)
TROUBLESHOOTING ENGINE**

Trouble	Cause	Remedy
Engine lacks power, reduction in maximum manifold pressure or critical altitude. (cont.)	Defective ignition system.	Inspect spark plugs for fouled electrodes, heavy carbon deposits, erosion or electrodes, improperly adjusted electrode gaps and cracked porcelains. Test plugs for regular firing under pressure. Replace damaged or misfiring plugs. Spark plug gap to be 0.015 to 0.019 inches (0.381 to . 0.482 mm).
	Loose or damaged exhaust system.	Inspect entire exhaust system to turbocharger for cracks and leaking connections. Tighten connections and replace damaged parts.
	Loose or damaged intake manifold.	Inspect entire manifold system for possible leakage at connections. Replace damaged components; tighten all connections and clamps.
	Fuel nozzles defective.	Inspect fuel nozzle vent manifold for leaking connection. Tighten and repair as required. Check for restricted nozzles and lines and clean or replace as necessary.
	Malfunctioning turbocharger.	Check for unusual noise in turbocharger. If malfunction is suspected, remove exhaust and/or air inlet connections and check rotor assembly for possible rubbing in housing, damaged rotor or defective bearings. Replace turbocharger if damage is noted.
	Exhaust system gas leakage.	Inspect exhaust system for gas leakage, gaskets at turbine inlet flanges, etc, and correct.

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**CHART 2 (Sheet 4 of 5)
TROUBLESHOOTING ENGINE**

Trouble	Cause	Remedy
Low fuel flow.	Restricted flow to fuel metering valve.	Check mixture control for full travel. Check for restrictions in fuel filters and lines; adjust control and clean filters. Replace damaged parts.
	Fuel nozzle vent system defective causing improper pressure regulation.	Check venting system for leaks at connections and other defects. Tighten connections and replace defective parts.
	Fuel control lever interference.	Check operation of throttle control and for possible contact with cooling shroud. Adjust as required to obtain correct operation.
	Incorrect fuel injector pump adjustment and operation.	Check and adjust using appropriate equipment. Replace defective pump.
	Air leakage in fuel pump pressurization line.	Locate cause of leakage and correct.
High fuel flow.	Restricted flow beyond fuel control assembly.	Check for restricted fuel nozzles or fuel manifold valve. Clean or replace nozzles. Replace defective fuel manifold valve.
	(Seneca IV) Defective relief valve operation in fuel injector.	Check fuel injector pump control line from turbocharger for loose connections and defects. Tighten connections, replace damaged line.
	Restricted recirculation passage in fuel injector.	Replace pump.
	(Seneca IV) Air leakage in fuel gauge vent pressurization line.	Locate cause of leakage and eliminate.
Fluctuating fuel flow.	Vapor in fuel system.	Normally operating the auxiliary pump will clear system. Operate auxiliary pump and purge system.
	(Seneca IV) Fuel gauge line leak or improperly purged lines.	Purge gauge line and tighten connections.

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**CHART 2 (Sheet 5 of 5)
TROUBLESHOOTING ENGINE**

Trouble	Cause	Remedy
Low oil pressure on engine gauge.	Insufficient oil in oil sump, oil dilution or using improper grade of oil for prevailing ambient temperature.	Add oil or change oil to proper viscosity.
	High oil temperature.	Defective vernatherm valve in oil cooler; oil cooler restriction. Replace valve or clean oil cooler.
	Leaking, damaged or loose oil line connections - restricted screens and filter.	Check for restricted lines and loose connections, and for partial plugged oil filter and screens. Clean parts, tighten connections, and replace defective parts.
	Leaking oil seal in turbocharger.	Check for oil in turbocharger exhaust outlet. Replace turbocharger.
	Defective check valve in turbocharger oil supply line.	Disassemble and clean valve or replace.
Poor engine idle cutoff.	Engine getting fuel.	Check fuel control for being in full "IDLE CUTOFF" position. Check auxiliary pump for being "OFF." Check for leaking fuel manifold valve. Replace defective components.
White smoke exhaust.	Turbo choking oil forced through seal in turbine housing.	Clean or change turbocharger. Refer to Chapter 81.

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3. Engine (See Figure 1.)

A. Removal

- (1) Turn off all electrical switches in the cockpit and disconnect the battery ground wire at the battery.
- (2) Move the fuel selector valve in the cockpit to the OFF position.
- (3) Remove the engine cowl.
- (4) Remove the propeller. (See 61-10-00.)
- (5) Disconnect the starter positive lead and ground lead at the starter.
- (6) ([Seneca IV](#) models) Disconnect the tachometer cable to the engine.
- (7) Disconnect the governor control cable at the governor and cable attachment clamps.
- (8) Disconnect the throttle and mixture cables from the fuel-air control unit ([Seneca IV](#)), or from the fuel servo ([Seneca V](#)).
- (9) On the left engine, disconnect the air conditioning compressor lines, if compressor is installed.
- (10) Disconnect the cylinder temperature sender wire at No. 2 cylinder.
- (11) Disconnect the fuel pump supply line and, on [Seneca IV](#) models, disconnect vent line from the engine.

NOTE: In some manner, identify all hoses, wires and lines to facilitate installation. Open fuel, oil, vacuum lines and fittings should be covered to prevent contamination.

- (12) Disconnect the magneto "P" leads at the magnetos.
- (13) Disconnect the engine vent tube at the engine.
- (14) Disconnect the engine oil temperature lead at the aft end of the engine.
- (15) Untie the ignition harness, hoses and lines at the aft end of the engine.
- (16) Disconnect the pneumatic pump lines at pump and remove fittings from pump.
- (17) Disconnect the oil pressure line at the engine.
- (18) Disconnect the fuel flow line at the left rear engine baffle.
- (19) Disconnect the manifold pressure line at the left rear side of the engine.
- (20) Disconnect the alternator leads and the cable attachment clamps.

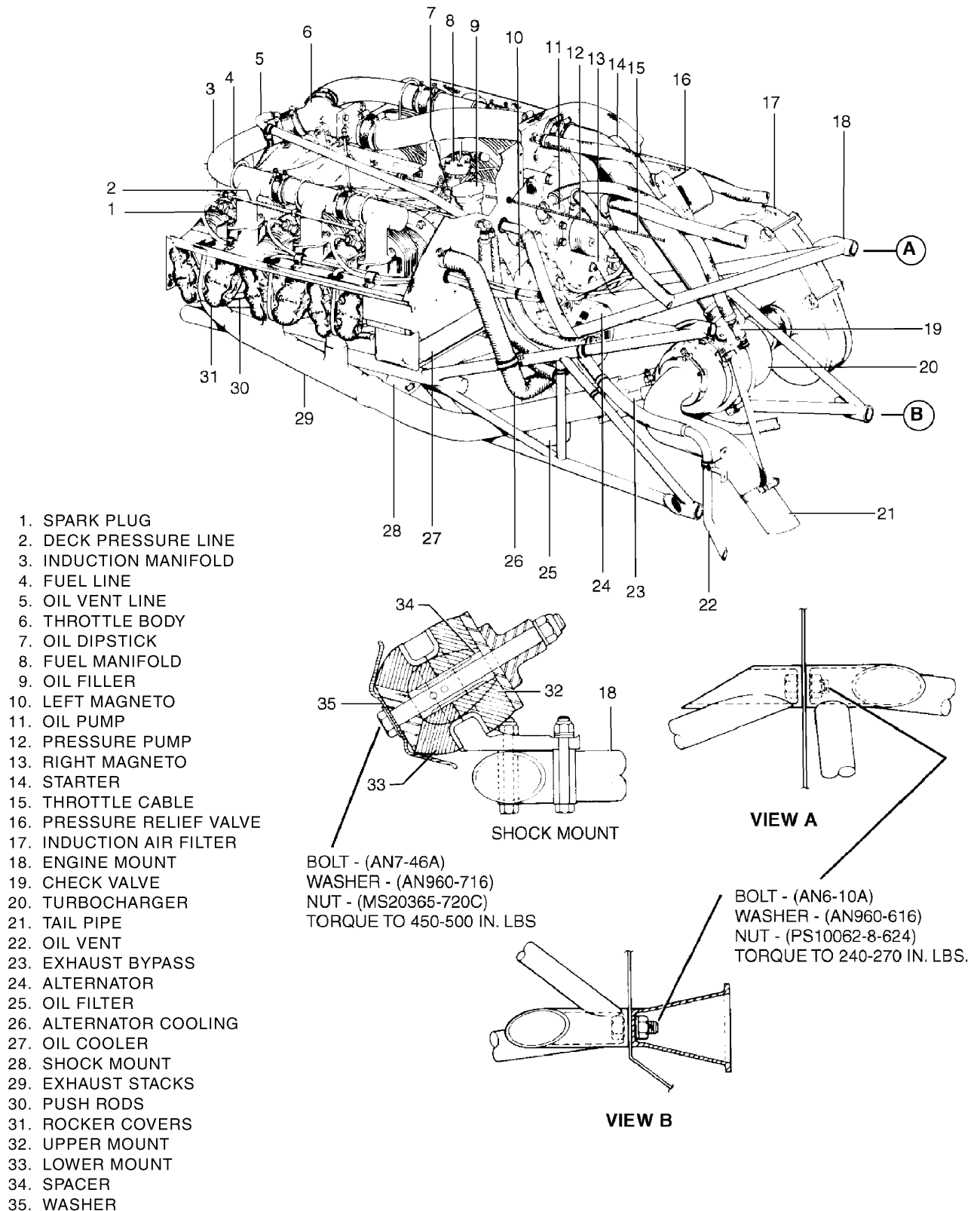
CAUTION: PLACE A TAIL STAND UNDER THE TAIL OF THE AIRPLANE BEFORE REMOVING AN ENGINE.

- (21) Attach a one-half ton (minimum) hoist to the hoisting straps and relieve the tension from the engine mounts.
- (22) Check the engine for any attachments remaining to obstruct its removal.

NOTE: Remove exhaust system components where they pass through engine mount.

- (23) Drain the engine oil.
- (24) Remove the engine mounting bolts and lower mount assembly.
- (25) Carefully raise the engine and pull forward to clear the mount. Ensure there are no connections remaining to obstruct removal of the engine. Remove engine from airplane and place on a suitable stand.

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Power Plant Installation
Figure 1 (Sheet 1 of 2)

[Effectivity](#)
[Seneca IV](#)

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B. Installation

CAUTION: PRIOR TO INSTALLING THE ENGINE, BE SURE TO INSTALL ALL ITEMS THAT WERE REMOVED AFTER THE ENGINE WAS REMOVED FROM THE AIRCRAFT.

CAUTION: REMOVE ALL PROTECTIVE CAPS AND IDENTIFICATION TAGS AS EACH ITEM IS INSTALLED.

- (1) Install the shock mount in the engine mount and hoist the engine into position on the mount.
- (2) Install the lower shock mount assemblies and mounting bolts. Torque the bolts as specified in Figure 1, Sheet 1, for both models.
- (3) Route and connect the throttle and mixture control cables and adjust.
- (4) Route and connect the propeller governor control cable and adjust.
- (5) Connect the alternate air cable and adjust.

CAUTION: APPLY LOCTITE NO. 567 PST SEALANT TO ALL MALE PIPE THREAD FITTINGS. DO NOT ALLOW TO ENTER SYSTEM.

CAUTION: SECURE ALL CABLES, HOSES AND WIRES WITH CLAMPS AND TY-STRAP IN THE SAME LOCATION AS BEFORE REMOVAL.

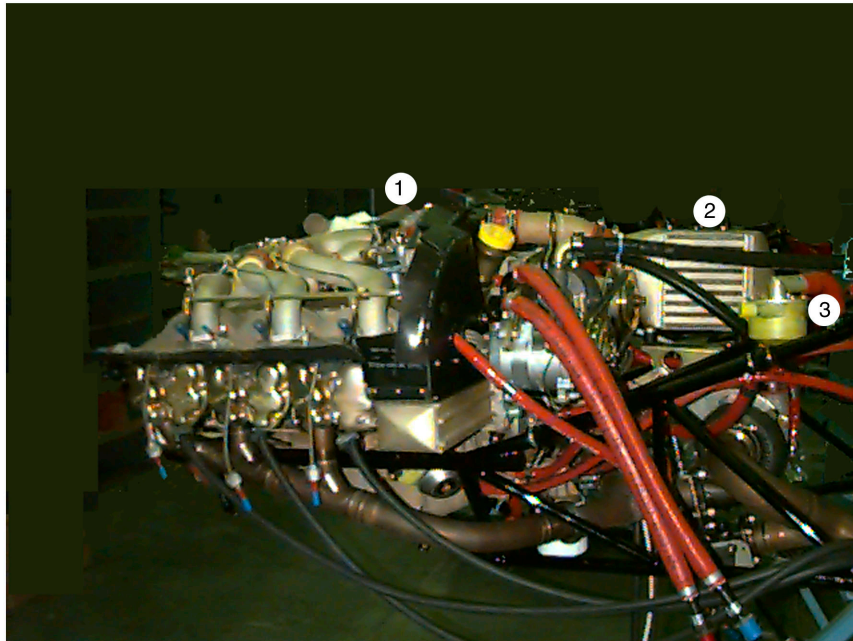
- (6) Reconnect all lines and hoses previously disconnected from the engine.
- (7) Route and connect the electrical leads to the appropriate connections on the engine.
- (8) Connect the tachometer drive cable ([Seneca IV](#)) or electrical connections ([Seneca V](#)).
- (9) Connect the air conditioning compressor lines, if compressor is installed.

CAUTION: ON [SENECA V](#) MODELS, CHECK AND ADJUST ALTERNATOR AND COMPRESSOR BELT TENSIONS. ALTERNATOR BELT TENSION SHOULD BE BETWEEN 80 AND 90 LB. FOR COMPRESSOR BELT TENSION, SEE 21-50-00.

- (10) Install the propeller and spinner per 61-10-00.
- (11) Service the engine with the proper grade and quantity of oil. (See 12-20-00).
- (12) Be certain all switches are in the OFF position and connect the battery cables.
- (13) Install the engine cowl.
- (14) Make a final check of the security, location and installation of all lines, wires and cables.
- (15) Perform an operational check of the engine; inspect for leaks and make final adjustments to engine controls as required.

CAUTION: CHECK EXHAUST PIPE CLEARANCE. MINIMUM CLEARANCE TO STRUCTURE AND COWL FLAP DOOR OPENING SHOULD BE 0.62 OF AN INCH.

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1. RSA FUEL INJECTOR
2. INTERCOOLER
3. AIR/OIL SEPARATOR

Power Plant Installation
Figure 1 (Sheet 2 of 2)

[Effectivity](#)
[Seneca V](#)

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COWLING

1. Engine Cowling (See Figure 1.)

A. Removal

(1) **Seneca IV**

- (a) Release the fasteners securing the two side access panels.
- (b) Remove the fasteners securing the top cowl and then remove the top cowl.
- (c) Disconnect the cowl flap control.
- (d) Support the bottom cowl and remove the screws that attach the bottom cowl to the nose cowl, engine mount and nacelle.
- (e) Remove the nose cowl by removing the attaching screws and separating the two cowl halves.

(2) **Seneca V**

- (a) Remove the fasteners securing the top cowl and then remove the top cowl.
- (b) Disconnect the cowl flap control, alternate air control linkage, induction air hose, and cylinder drain valve.
- (c) Support the bottom cowl and remove the screws that attach the bottom cowl to the nose cowl, engine mount and nacelle.
- (d) Remove the nose cowl by removing the attaching screws and separating the two cowl halves.

B. Installation

(1) **Seneca IV**

- (a) Position the two nose cowl halves on the front of the engine and secure with screw fasteners.
- (b) Position the bottom cowl and secure with screw fasteners to the nose cowl, engine mount and nacelle.
- (c) Connect the cowl flap control.
- (d) Position the top cowl and secure with attaching screw fasteners.
- (e) Secure the side cowls to the upper and lower cowling.

(2) **Seneca V**

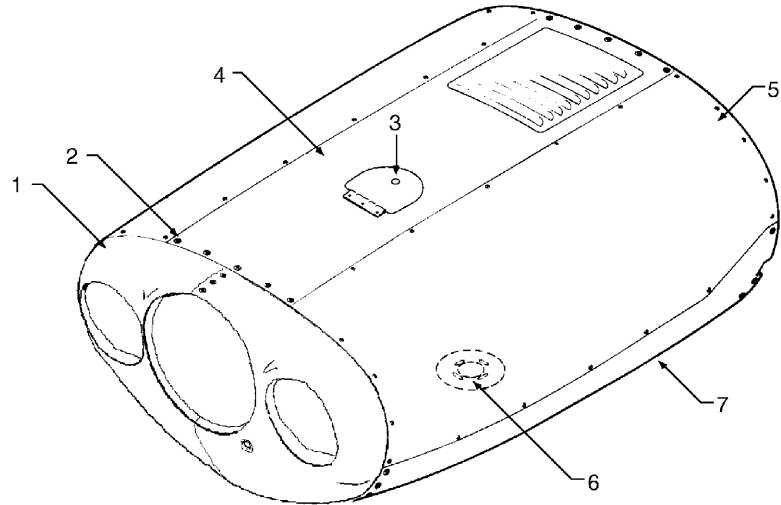
- (a) Position the two nose cowl halves on the front of the engine and secure with screw fasteners.
- (b) Position the bottom cowl and secure with screw fasteners to the nose cowl, engine mount and nacelle.
- (c) Connect the cowl flap control, alternate air control linkage, induction air hose, and cylinder drain valve.
- (d) Position the top cowl and secure with attaching screw fasteners.

C. Cleaning, Inspection, and Repair

- (1) The cowl should be cleaned with a suitable solvent and then wiped with a clean cloth.
- (2) Inspect the cowling for dents, cracks, loose rivets, damaged or missing fasteners and damaged fiberglass areas.
- (3) Repair all defects to prevent further damage. Fiberglass repair procedures may be accomplished according to Fiberglass Repairs, 51-70-00.

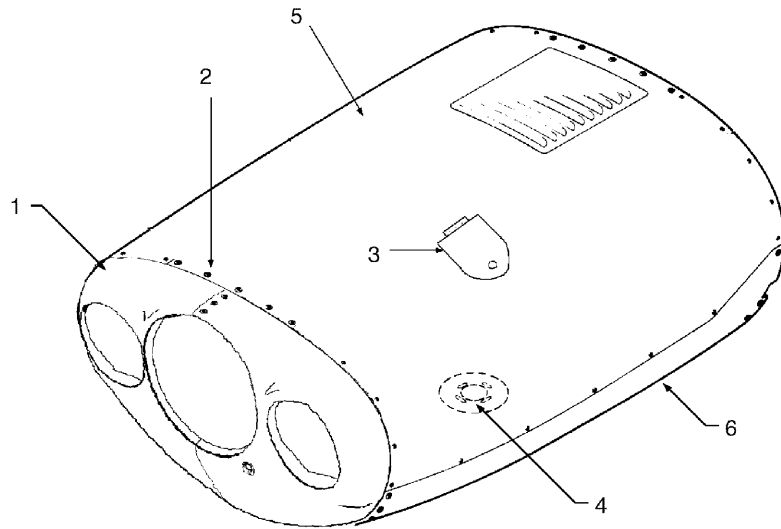
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SENECA IV



1. NOSE COWL ASSEMBLY
2. SCREW FASTENER
3. OIL FILLER DOOR
4. TOP PANEL
5. SIDE PANEL
6. ACCESS HOLE, ENGINE OIL DRAIN
7. BOTTOM COWL

SENECA V



1. NOSE COWL ASSEMBLY
2. SCREW FASTENER
3. OIL FILLER DOOR
4. ACCESS HOLE, ENGINE OIL DRAIN
5. TOP COWL
6. BOTTOM COWL

Engine Cowling Installation
Figure 1

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2. Engine Cowl Flaps (See Figure 2.)

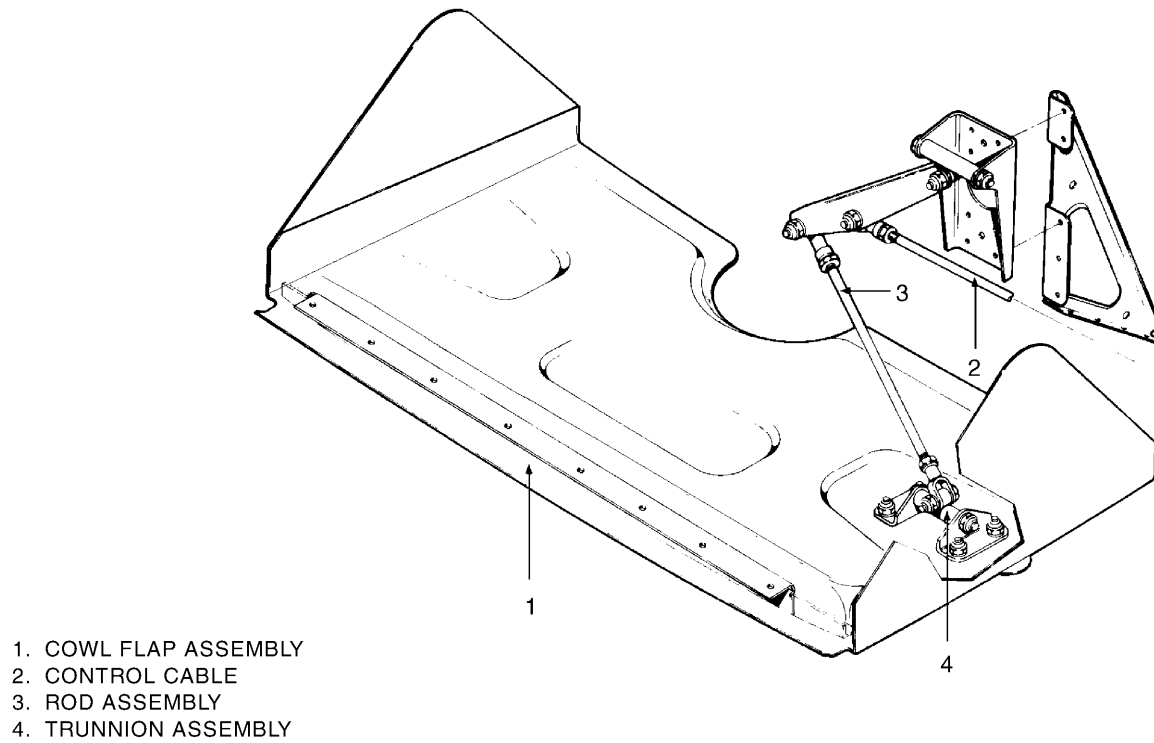
The cowl flaps are all metal flaps located on the rear of the bottom cowl. The flaps are manually operated through a push-pull control from the cockpit. The cowl flaps are connected to the engine cowl with full length piano type hinges.

Operation and Adjustment

The cowl flaps operate through three positions; closed, intermediate and open by control levers located on the console. When the control levers are in the up position, the flaps are closed. To operate the cowl flaps, depress the lock and move the lever down, releasing the lock after the initial down movement will allow the lock to stop the flap travel at the intermediate position. For full open position, depress the lock and move the control down; release the lock after the initial movement and continue to move the control down until the lock stops the travel of the control. To raise the cowl flaps reverse the procedure. The cowl flaps should be adjusted as follows:

- A. Place the control in the up position.
- B. Ascertain that the control lock is engaged.
- C. Check the cowl flap to visually determine that the flap is flush with the bottom of the engine cowl.
- D. If the flap is not flush, disconnect the push-pull control from the arm on the inboard side of the flap.
- E. Loosen the jam nut on the clevis end and adjust the clevis to get a flush fit between the cowl flap and engine cowl.
- F. Reconnect the control to the flap and operate the cowl flap through its full range a few times; then place the control in the closed position and visually check the flap to determine if it is flush with the engine cowl.
- G. If the cowl flap is not flush, repeat steps (D) through (F).
- H. When the adjustment is completed, tighten the clevis jam nut and secure the push-pull control to the cowl flap.

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Cowl Flap Installation
Figure 2

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MOUNTS

1. Engine Shock Mounts

Replacement of Engine Shock Mounts (See 71-00-00, Figure 1.)

- (1) Remove the engine cowling.
- (2) Relieve the engine weight on the mounts using a one-half ton hoist attached to the engine lifting points.
- (3) Remove the four engine mounting bolts and the lower half of the mount assemblies.
- (4) Carefully raise the engine just enough to remove the shock mounts. Check all lines, wires and cables for interference. Disconnect any lines and cables if necessary.
- (5) Check all components for wear, damage or cracks and install new mounting kit.
- (6) Lower the engine slowly and use mounting bolts to keep the components aligned.
- (7) When the engine is supported by the mount, check the mounts for proper seating.
- (8) Install the mounting bolt, nut, washer and torque 450 to 500 inch-pounds and safety.
- (9) Reconnect any lines, wires or cable that were disconnected and install engine cowling.

2. Engine Mount Corrosion Inspection, Immersion in Water

The following guidance is general in nature and should be applied or varied to fit the individual situation based on water level during immersion, length of time immersed, length of time since exposure, etc. Proceed as follows:

A. Inspection

- (1) Level the aircraft in accordance with 8-20-00 in this maintenance manual.
- (2) In two of the larger, lower, engine mount tubes, drill a 3/16 inch hole in each tube, at the approximate mid-point.
- (3) Visually inspect the interior surface of each tube through the 3/16 inch hole for evidence of internal corrosion. Pay particular attention to the lower end of each tube as this is where corrosion is most likely to appear first.
- (4) Should evidence of corrosion be detected in step (3), above, replace the engine mount. If no corrosion is detected, proceed with corrosion prevention, paragraph B, below.

B. Corrosion Prevention

If no evidence of corrosion is detected in step (3), above, proceed as follows:

- (1) Place a drip pan below the inspection holes in each engine mount tube.
- (2) Insert a plastic tube thru each inspection hole and feed it up to the high point of the engine mount tube.
- (3) Using a syringe inserted into the end of the plastic tube, pump linseed oil into the upper end of the engine mount tube while rotating the syringe / plastic tube assembly to assure maximum coverage. Continue pumping until the lower end of the engine mount tube is filled with linseed oil to the level of the inspection hole.
- (4) Now, draw the plastic tube out of the upper end of the engine mount tube and reinsert it in the opposite direction, feeding it to the lower end of the engine mount tube.
- (5) Suck excess linseed oil out of the engine mount tube with the syringe / plastic tube assembly.
- (6) When linseed oil can no longer be picked up by the syringe / plastic tube assembly, remove it and allow the engine mount tube to drain into drip pans for approximately two hours.
- (7) Purge excess oil from tubes by applying air pressure to each 3/16 inch inspection hole, one at a time.

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- (8) Insure that roughly the same amount of linseed oil that was pumped in is retrieved in the drip pans.
- (9) Apply a liberal coating of an approved fuel tank sealant (see Consumable Materials, 91-10-00) to each inspection hole and seal the hole with an appropriate blind rivet. After installing the rivet, apply a liberal coating of the approved fuel tank sealant over the head of the rivet.

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AIR INTAKES

1. Induction System Air Filter (See Figures 1 and 2.)

A. Removal

(1) **Seneca IV**

- (a) Remove the side panel cowl on the right side of the engine.
- (b) Release the stud fasteners; remove the filter cover and withdraw the filter element.

(2) **Seneca V**

- (a) Remove the upper cowling.
- (b) Disconnect alternate air linkage/cable.
- (c) Remove induction air hose.
- (d) Remove lower cowl.
- (e) Remove six screws securing cover.
- (f) Remove filter.

B. Cleaning

CAUTION: NEVER WASH THE FILTER ELEMENT IN ANY LIQUID OR SOAK IT IN OIL. NEVER ATTEMPT TO BLOW OFF DIRT WITH COMPRESSED AIR.

The air filter element should be cleaned as often as it becomes dirty, everyday under severe dust conditions. The filter element should be replaced if any holes or tears exist. When cleaning the filter, it is good practice to remove the filter box assembly and clean with a solvent. Blow the assembly dry and wipe with a clean cloth to remove embedded debris. Be careful not to damage the sealing ends.

C. Installation

CAUTION: CHECK THE INDUCTION SYSTEM TO BE SURE THAT NO AIR LEAKS EXIST AT ANY POINT THAT WOULD ALLOW UNFILTERED AIR TO ENTER THE ENGINE.

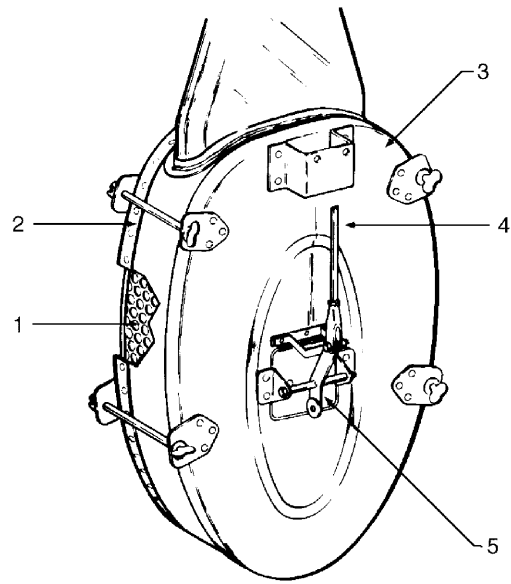
(1) **Seneca IV**

- (a) Install the filter box assembly if removed.
- (b) Position the filter element in the box assembly and secure the cover assembly with the stud fasteners.

(2) **Seneca V**

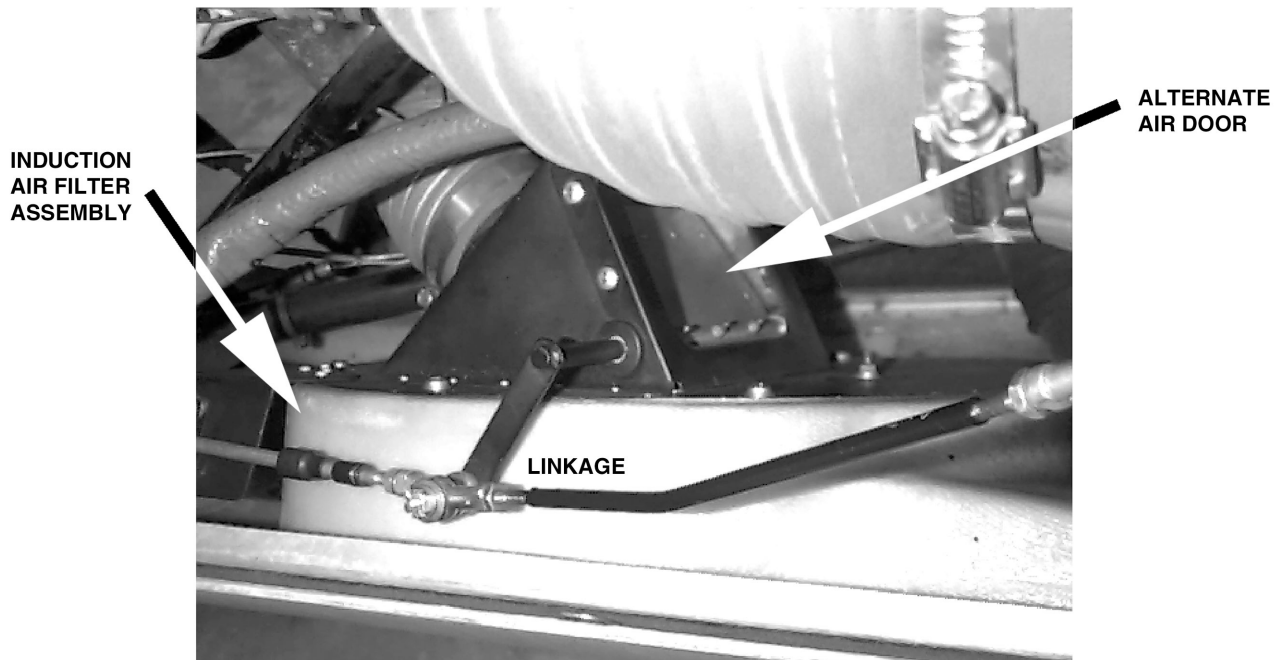
- (a) Install the filter box assembly if removed.
- (b) Position the filter element in the box assembly and secure the cover assembly with the six screws.
- (c) Install lower cowl.
- (d) Connect alternate air linkage/cable and induction air hose.
- (e) Install upper cowl.

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1. FILTER ELEMENT CA-161-PL
2. BOX ASSEMBLY
3. COVER ASSEMBLY
4. ALTERNATE AIR CONTROL CABLE
5. ALTERNATE AIR DOOR

Seneca IV - Induction System Installation
Figure 1



Seneca V - Induction System Installation
Figure 2

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2. Alternate Air Door (See Figures 1 and 2.)

The alternate air door is located in the alternate air box to provide a source of air to the engine should there be an air stoppage through the filter system. The following should be checked during inspection:

A. **Seneca IV**

- (1) Check that air door seals are tight and the hinge and torsion spring are secure.
- (2) Adjust the control cable to position the roller on the arm assembly clear of the door in the closed position. Check that when the cockpit control is in the closed position the door is properly seated in the closed position.
- (3) Actuate the door by operating the control lever in the cockpit to determine that it is not sticking or binding.
- (4) Check the cockpit control cable for free travel.

B. **Seneca V**

- (1) Check that air door seals are tight and the hinge is secure.
- (2) Adjust the control cable to position the alternate air door fully shut (against stops) when alternate air control is positioned in the off position.
- (3) Adjust linkage to intercooler shutoff valve to position valve against stops (fully open) when alternate air cockpit control is positioned in the off position.
- (4) Actuate the door by operating the control lever in the cockpit to determine that it is not sticking or binding.
- (5) Check the cockpit control cable for free travel.

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CHAPTER

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ENGINE FUEL AND CONTROL

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CHAPTER 73 - ENGINE FUEL SYSTEMS

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DISTRIBUTION

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1. Description (See Figure 1.)

A. **Seneca IV**

The Continental Fuel Injection System is used on each of the engines of the **Seneca IV**. This system uses individual injectors for each cylinder and, while compensating for altitude and engine operating conditions, provides continuous flow to the cylinders.

Each system makes use of a combination fuel pump/mixture control unit to supply fuel pressure to the fuel metering unit on the air throttle body. The metering unit determines and controls fuel flow to the manifold valve and injectors by interconnection with the throttle valve.

The engine driven fuel pump is mounted to the right crankcase and located ahead of the engine mount. Both pumps are of a positive displacement, rotary vane type, each having an integral vapor separator and altitude compensating android valve.

The throttle/metering unit is on the top forward part of the engine connected to the entrance of the intake manifold. A rotary valve makes up the metering unit and is attached to the throttle valve. As the throttle is moved, the cam shaped edge of the rotary valve moves across the fuel delivery port controlling the flow of fuel to the manifold valve and nozzles.

The fuel manifold valve is the central point for dividing fuel to the individual cylinders. A diaphragm and plunger valve within the manifold valve raises or lowers by fuel pressure to open or close the individual fuel supply ports simultaneously.

The fuel discharge nozzles are an air bleed type nozzle with a calibrated orifice. A nozzle is installed in the cylinder head outside each intake valve for each cylinder.

B. **Seneca V**

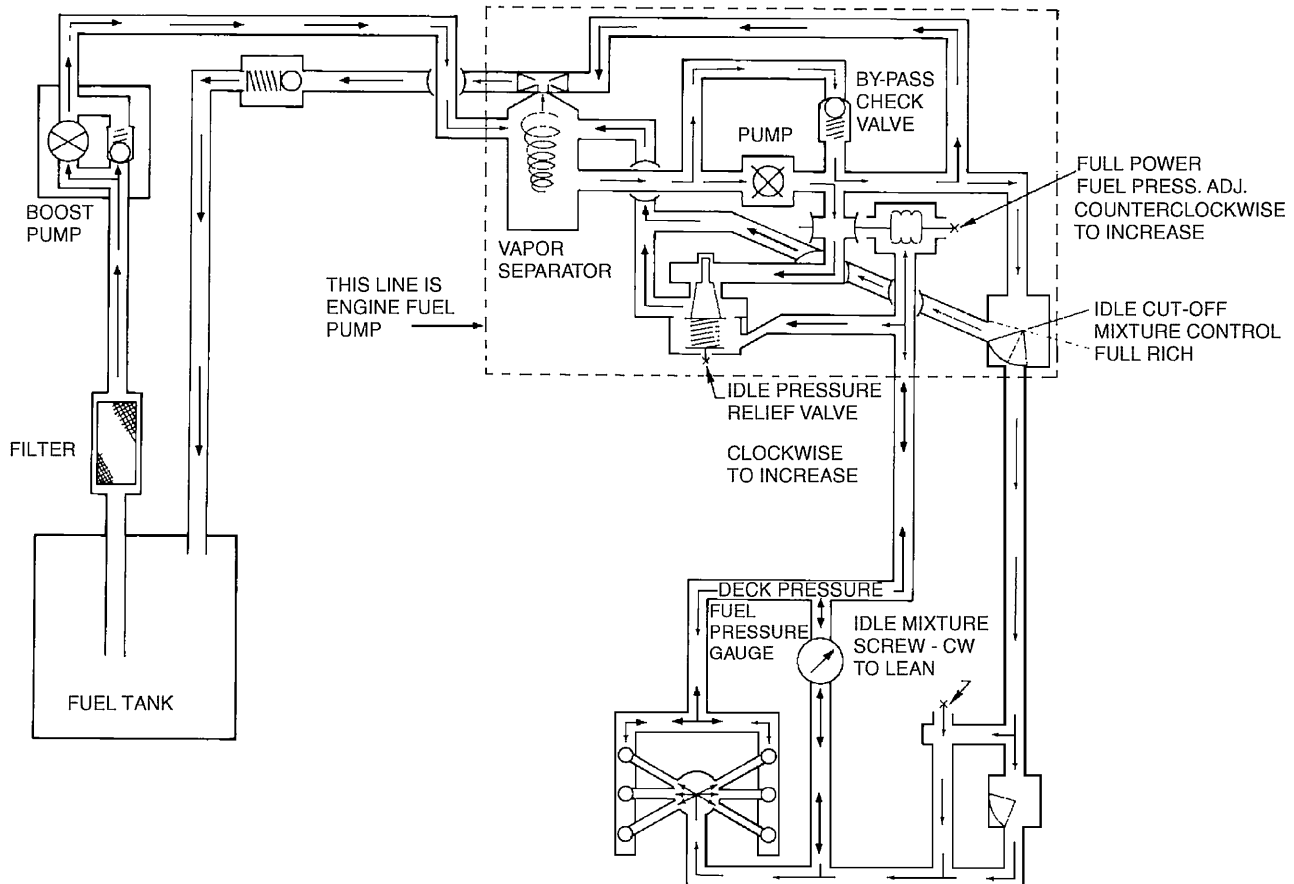
The Precision Airmotive Fuel Injection System is used on each of the engines of the **Seneca V**. The injector is mounted on top of the engine. This system uses individual injectors for each cylinder and, while compensating for engine operating conditions, provides continuous flow to the cylinders.

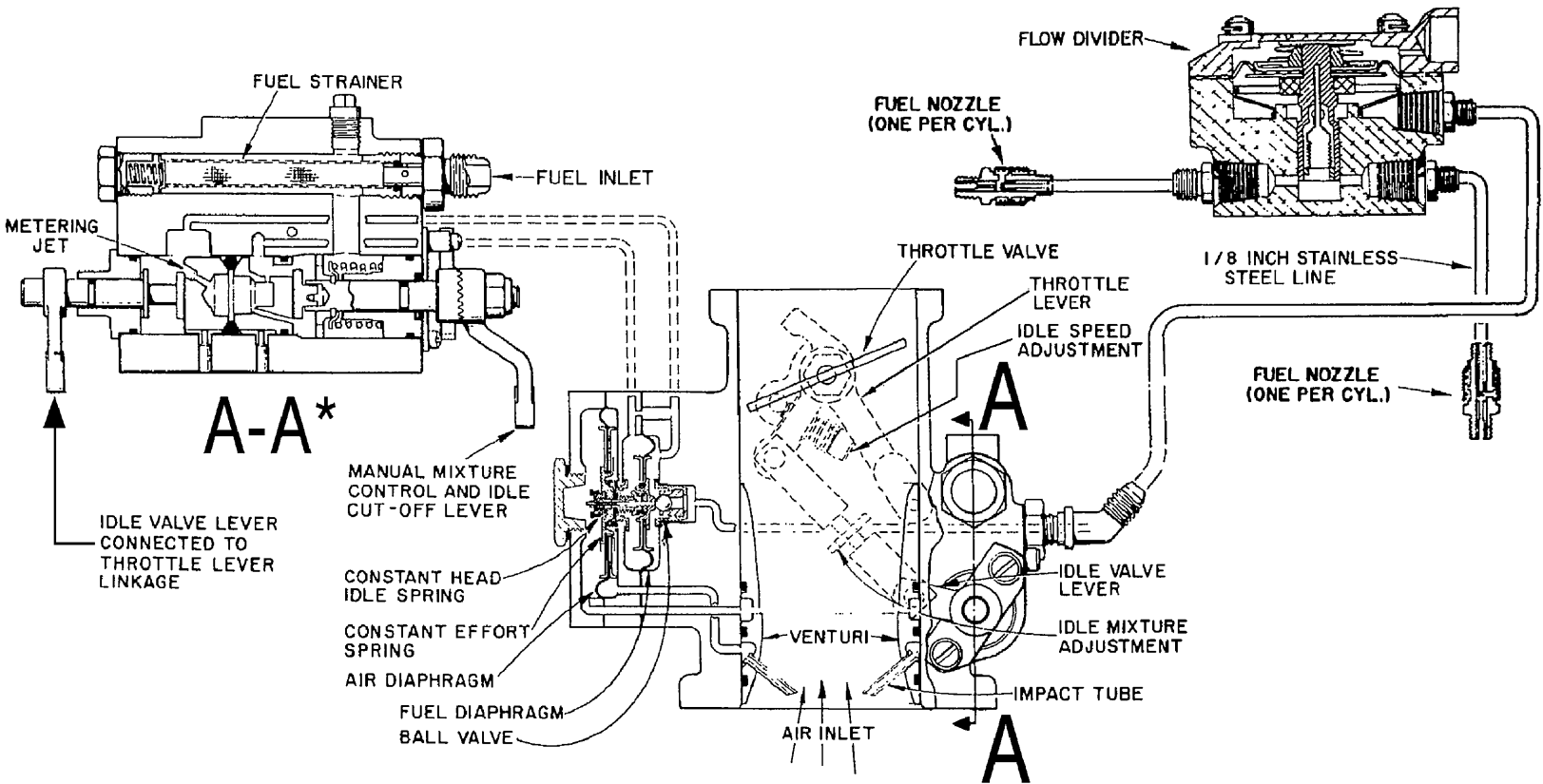
Precision Airmotive Fuel Injection Systems are designed to meter fuel in direct ratio to the volume of air being consumed by the engine at any given time. This is accomplished by sensing venturi suction and impact air pressures in the throttle body. Opening or closing the throttle valve results in a change in the volume of air being drawn into the engine. This results in a change in the velocity of air passing across the impact tubes and through the venturi. When air velocity increases, the pressure at the impact tubes remains relatively constant depending upon the inlet duct configuration, air filter location, etc. The pressure at the venturi throat decreases, creating a differential (impact minus suction) which is used over the entire range of operation of the fuel injection system as a measurement of the volume of air consumption.

2. Troubleshooting

See Chart 1.

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* HIGH END TRIM VALVE NOT SHOWN

Fuel Injection System Functional Schematic
Figure 1 (Sheet 2 of 2)

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**CHART 1 (Sheet 1 of 3)
TROUBLESHOOTING RSA-5 FUEL INJECTION SYSTEM (SENECA V)**

Trouble	Cause	Remedy
Hard starting.	Technique.	Refer to aircraft manufacturer's recommended starting procedure.
	Flooded.	Clear engine by cranking with throttle open and mixture control in ICO.
	Throttle valve opened too far.	Open throttle to position approximating 800 rpm.
	Insufficient prime (Usually accompanied by a backfire).	Increase amount of priming.
Rough idle.	Mixture too rich or too lean.	Confirm with mixture control. A too rich mixture will be corrected and roughness decreased during lean-out while a too lean mixture will be aggravated and roughness increased. Adjust idle to give a 25-50 rpm rise @ 700 rpm.
	Plugged nozzle(s). (Usually accompanied by high take-off fuel flow readings.)	Clean nozzles in Methyl-Ethyl-Ketone, acetone, hydrocarbon cleaning solvent or a chlorinated solvent equivalent to chlorothene. Check system for source of contamination.
	Slight air leak into induction system through manifold drain check valve. (Usually able to adjust initial idle but rough in 1,000 - 1,500 rpm range.)	Confirm by temporarily plugging drain line. Replace check valves as necessary.
	Air leak in fuel line from tank to servo unit.	Confirm by connecting clear tubing between servo and flow divider and watch for air bubbles. Locate and correct source of leakage. May include boost pump or main pump seal leakage.

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**CHART 1 (Sheet 2 of 3)
TROUBLESHOOTING RSA-5 FUEL INJECTION SYSTEM (SENECA V)**

Trouble	Cause	Remedy
Rough idle. (continued)	Slight air leak into induction system through loose intake pipes or damaged "O" rings. (Usually able to adjust initial idle but rough in 1,000-1,500 rpm range.)	Repair as necessary.
	Large air leaks into induction system, such as missing pipe plugs, etc. (Usually unable to throttle engine down below 800-900 rpm.)	Repair as necessary.
	Internal leak in injector. (Usually unable to lean-out idle range.)	Replace injector.
	Unable to set and maintain idle.	Replace injector.
	Fuel vaporizing in fuel lines or distributor. (Encountered only under high ambient temperature conditions or following prolonged operation at low idle rpm's.)	Refer to the suggestions in Section Four.
Low take off fuel flow.	Strainer plugged.	Remove strainer and clean a suitable solvent. Acetone, MEK, hydrocarbon cleaning solvent, or a chlorinated solvent equal to chlorothene is recommended.
	Injector out of adjustment.	Replace injector.
	Faulty gage.	In a twin engine installation, criss-cross gages. Replace as necessary. Single engine, change gage.
	Sticky flow divider valve.	Clean flow divider valves.
High fuel flow reading.	Plugged nozzle if high fuel flow is accompanied by loss of power and roughness.	Remove and clean nozzles in Acetone, MEK, hydrocarbon cleaning solvent, or a chlorinated solvent equivalent to chlorothene is recommended. Check system for source of contamination.
	Faulty gage.	Criss-cross gages and replace if necessary.
	Injector out of adjustment.	Replace injector.

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**CHART 1 (Sheet 3 of 3)
TROUBLESHOOTING RSA-5 FUEL INJECTION SYSTEM (SENECA V)**

Trouble	Cause	Remedy
Staggered mixture control levers.	If take-off is satisfactory, do not be too concerned about staggered mixture control levers because some misalignment is normal with twin engine installation.	Check rigging.
Poor cut-off.	Improper rigging of aircraft linkage to mixture control. Mixture control valve scored or not seating properly. Vapor in lines.	Adjust. Eliminate cause of scoring (usually burr or dirt) and lap mixture control valve and plug on surface plate. See Section Four.
Rough engine (turbo charged) and poor cutoff.	Air bleed hole(s) clogged.	Clean or replace nozzles.
Engine will not accelerate past a given rpm.	Plugged nozzles if accompanied by high fuel flow. Improper internal engine timing or magneto problem. Plugged or restricted exhaust manifold.	Clean or replace nozzles. Check system for source of contamination. Correct timing problem. Refer to engine manual for corrective action.

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3. Fuel Injection System Maintenance

CAUTION: DO NOT USE ANY FORM OF THREAD COMPOUND ON FUEL LINE FITTINGS. USE ONLY A FUEL SOLUBLE LUBRICANT SUCH AS ENGINE OIL.

- A. Check tightness and lockwiring of all nuts and screws which fasten the injector to the engine.
- B. Check all fuel lines for tightness, leaks, evidence of damage, or chafing by metal to metal contact.
- C. Check control connections, levers, and linkages for tightness, travel, and lockwiring.
- D. Inspect nozzles for cleanliness with particular attention to orifices. Use a standard 1/2 inch spark plug type deep socket to remove nozzles. Do not use wire or other object to clean orifices. To clean nozzles, remove from engine and immerse in fresh cleaning solvent. Use compressed air to dry. O-rings must be removed from nozzles prior to cleaning in certain solvents.
- E. (Seneca V only) Remove and clean the injector fuel inlet strainer at the first 25 hour inspection and each 50 hour inspection thereafter. Damaged strainer o-rings should be replaced.

4. Fuel Injector Nozzle Assembly (See Figure 2.)

A. Removal

- (1) Remove the cowling side access panels (Seneca IV) or top cowl (Seneca V).
- (2) Disconnect the fuel line and remove the reference air line from the nozzle.
- (3) Used a standard 1/2 inch spark plug type deep socket to remove the nozzle.

B. Cleaning and Inspection

WARNING: COMPRESSED AIR USED FOR CLEANING PURPOSES MUST NOT EXCEED 30 PSI. USE ONLY WITH EFFECTIVE CHIP- GUARDING AND PERSONAL PROTECTIVE EQUIPMENT (GOGGLES, SHIELDS, GLOVES, ETC.).

WARNING: METHYL ETHYL KETONE (MEK) AND ACETONE ARE FLAMMABLE AND HARMFUL TO EYES, SKIN, AND BREATHING PASSAGES. KEEP IGNITION SOURCES AWAY. PROVIDE ADEQUATE VENTILATION AND PROTECTIVE CLOTHING.

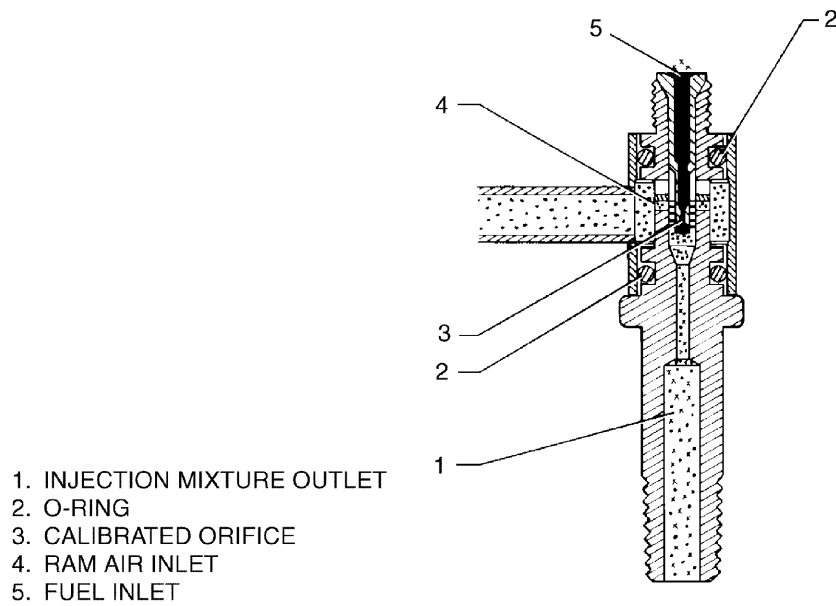
CAUTION: DO NOT USE WIRE OR OTHER OBJECT TO CLEAN ORIFICES. O-RINGS MUST BE REMOVED PRIOR TO CLEANING IN CERTAIN SOLVENTS.

- (1) Clean nozzles by immersing in methyl ethyl ketone or acetone. Use compressed air to dry.
- (2) Use compressed air to clean nozzle body in cylinder.
- (3) Inspect the nozzles for cleanliness; pay particular attention to the orifices. Check the condition of the nozzle and cylinder threads.

C. Installation

- (1) Carefully start the nozzles by hand to prevent cross-threading.
- (2) Using a clean, deep well, 1/2 inch socket, tighten and torque nozzle to 60 inch-pounds.
- (2) Install reference air lines on nozzles.
- (3) Connect the fuel line to the nozzle.
- (4) Install cowling side panels (Seneca IV) or top cowl (Seneca V).

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Fuel Injector Nozzle Assembly
Figure 2

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INDICATING

NOTE: For information on the fuel flow gauge installed in Seneca V models, see 77-40-00.

Dual Fuel Flow Gauge (Seneca IV)

The dual fuel flow gauge is a non-electric differential pressure gauge mounted in the bottom of the instrument panel in the column of engine instruments.

This instrument measures flow by reading the pressure drop across a fixed orifice. With fuel pressure being supplied by the engine driven pump and a fixed orifice in the fuel divider head, then measuring the pressure drop upstream of the orifice against deck pressure at nozzles, the resultant pressure can be equated to fuel flow in gallons per hour flow.

For troubleshooting see Chart 1.

**CHART 1
TROUBLESHOOTING FUEL FLOW GAUGE**

Trouble	Cause	Remedy
Pointer oscillates.	Air in fuel line.	Purge line.
Gauge read low at altitude.	Vent line restricted.	Check line and fittings.
Pointer does not return to zero.	Fuel in diaphragm of gauge.	Replace gauge.

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IGNITION

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ELECTRICAL POWER SUPPLY

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CAUTION: ENSURE THAT THE PRIMARY CIRCUITS OF BOTH MAGNETOS ARE GROUNDED BEFORE WORKING ON THE ENGINE.

1. Ignition System

A. Description

Ignition of the fuel charge in each cylinder is accomplished by two spark plugs independently excited by one of two magnetos, one mounted on each engine. Each magneto separately generates, times and distributes high tension (voltage) through leads to each cylinder. Both magnetos are pressurized to improve magneto efficiency at altitude.

The magnetos are controlled by two switches on the pilot's instrument panel. With the switch OFF, the magneto is grounded and will not produce spark.

B. Replacement Magnetos

NOTE: Check the magneto dataplate to verify the specific model number and series of the magneto being worked on.

C. Overhaul

Overhaul is required as conditions indicate, but in no case may Slick 6300 series magnetos time-in-service exceed the TBO for the engine. Magnetos must also be overhauled after a lightning strike or following a sudden engine stoppage.

NOTE: An alternative to overhaul is complete magneto replacement with a new magneto. New magnetos incorporate all the latest design features and may be a cost effective alternative to overhaul.

This chapter deals with general maintenance and timing of the magnetos to the engine. Refer to the appropriate vendor magneto overhaul manual for detailed procedures:

- (1) TCM/Bendix magnetos: Teledyne Continental Motors (TCM)
Service Support Manual, P/N x42002
S-20 / S-200 Series High Tension Magnetos

TCM Aircraft Products
P. O. Box 90
Mobile, AL 36601

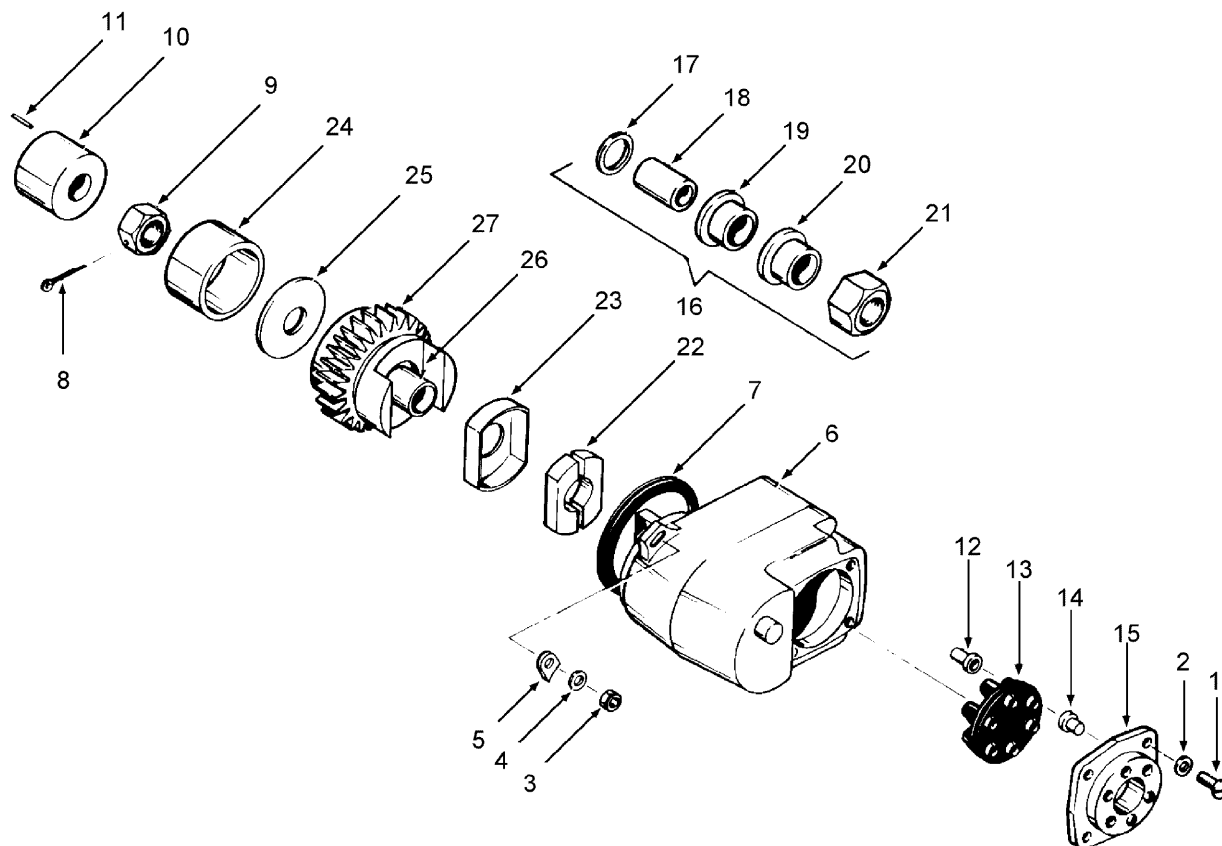
- (2) Slick magnetos: F1100 MASTER SERVICE MANUAL,
4300/6300 SERIES MAGNETO
MAINTENANCE AND OVERHAUL
MANUAL - L-1363

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- | | |
|-------------------------------|-----------------------------|
| 1. SCREW | 14. IGNITION CABLE FERRULE |
| 2. LOCK WASHER | 15. DISTRIBUTOR CABLE PLATE |
| 3. NUT | 16. GROUND TERMINAL KIT |
| 4. LOCK WASHER | 17. WASHER |
| 5. HOLD DOWN WASHER | 18. INSULATING SLEEVE |
| 6. MAGNETO | 19. INNER FERRULE |
| 7. GASKET | 20. OUTER FERRULE |
| 8. COTTER PIN | 21. COUPLING NUT |
| 9. NUT | 22. COUPLING BUSHINGS |
| 10. GEAR SUPPORT SHAFT | 23. RETAINER |
| 11. PIN | 24. NEEDLE BEARING |
| 12. IGNITION CABLE EYELET | 25. WASHER |
| 13. DISTRIBUTOR CABLE GROMMET | 26. PILOT SLEEVE BUSHING |
| | 27. MAGNETO DRIVE GEAR |

CAUTION

WHEN MAINTAINING OR INSPECTING MAGNETOS, BE SURE TO OBTAIN THE MANUFACTURER'S MAINTENANCE DATA FOR THE PARTICULAR MAGNETO INSTALLED IN YOUR AIRPLANE.

Magneto Assembly (Typical)
Figure 1

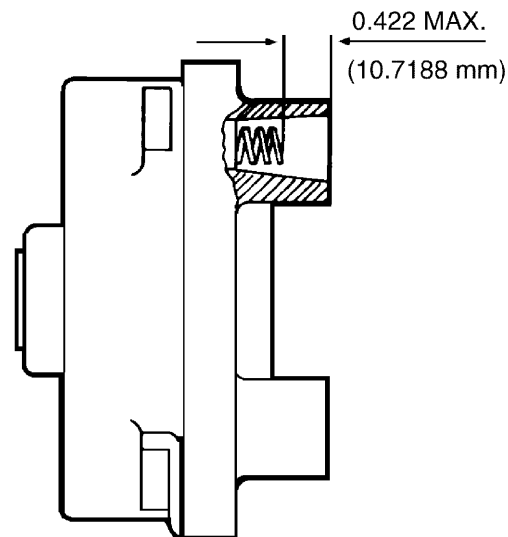
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2. Magnetos

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A. Inspection

- (1) After the first 25 hour and 50 hour periods, and periodically thereafter, the contact assemblies should be checked. Examine the points for excessive wear or burning. Points which have deep pits or excessively burned areas should be discarded. Examine the cam follower felt for proper lubrication. If necessary, points can be cleaned by using any hard finished paper. Clean breaker compartment with dry cloth.
- (2) If engine operating troubles develop which appear to be caused by the ignition system, it is advisable to check the spark plugs and wiring first before working on the magnetos.
- (3) Should the trouble appear to be definitely associated with the magneto, the most effective measure is to install a replacement magneto which is known to be in satisfactory condition. Send the suspected unit to the overhaul shop for test and repair.
- (4) Should this not be possible, a visual inspection may disclose the source of trouble. Remove the harness outlet plate from the magneto. Inspect for the presence of moisture and foreign matter on the rubber grommet and high tension outlet side of the distributor block. Check height of block contact springs. The top of the spring must not be more than 0.422 of an inch (10.718 mm) below the top of the tower as shown in Figure 2. If the springs are broken or corroded, replace them.
- (5) Inspect the distributor block for cracks or burned areas. The wax coating on the block should not be removed. Do not use solvents.
- (6) Check for excess oil in the breaker compartment. If present, it may mean a bad oil seal or oil seal bushing at the drive end. Check the magneto manufacturer's overhaul procedure.
- (7) Remove the breaker cover and harness securing screws and nuts and separate cover from magneto housing. Check contact assemblies to see that the cam follower is securely riveted to its spring. Examine the contact points for excessive wear or burning. Figure 3 shows how the average contact point will look when surfaces are separated for inspection. Desired contact surfaces have a dull gray, sandblasted (almost rough) or frosted appearance over the area where electrical contact is made. This means that points are worn in and mated to each other, thereby providing the best possible electrical contact and highest efficiency of performance.



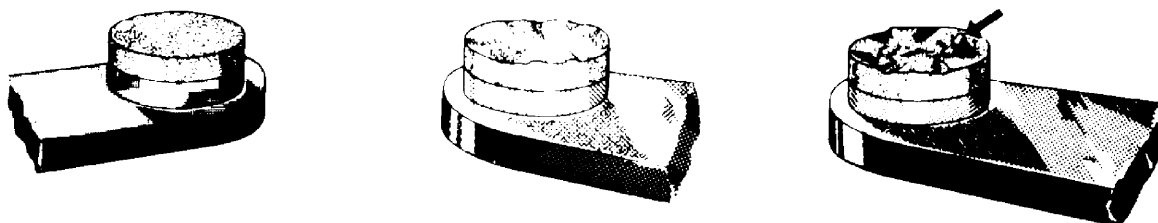
Contact Spring inspection
Figure 2

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NORMAL POINT IS SMOOTH AND FLAT. SURFACE HAS DULL GRAY "SANDBLASTED" APPEARANCE.

MINOR IRREGULARITIES - SMOOTH ROLLING HILLS AND DALES WITHOUT ANY DEEP PITS OR HIGH PEAKS. THIS IS A NORMAL CONDITION OF POINT WEAR.

WELL DEFINED MOUND EXTENDING NOTICEABLY ABOVE SURROUNDING SURFACE. REJECT POINTS.

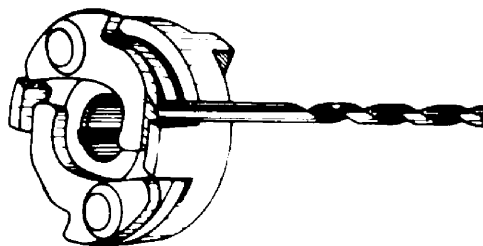


Contact Points
Figure 3

- (8) Minor irregularities or roughness of point surfaces are not harmful (refer to Figure 3, center), neither are small pits or mounds, if not too pronounced. If there is a possibility of pit becoming deep enough to penetrate pad, Figure 3, right, reject contact assembly.

NOTE: No attempt should be made to stone or dress contact points. Should contact assembly have bad points, or show excessive wear, replace complete assembly.

- (9) Check the condition of the cam follower felt. Squeeze felt tightly between thumb and forefinger. If fingers are not moistened with oil, re-oil using 2 or 3 drops of Bendix 10-86527 lubricant. Allow approximately 30 minutes for felt to absorb the oil. Blot off the excess with a clean cloth. Too much oil may foul contact points and cause excessive burning.
- (10) Inspect the felt washer in the distributor block for oil content. If the felt is dry, inspect the bronze bushing for wear. (Refer to manufacturer's overhaul instruction.) Oil felt washer with Bendix Distributor Block Lubricant Part No. 10-391200. Blot excess oil from washer until flat surfaces take on a "frosted" appearance and seat washer in its recess in block.
- (11) Check the capacitor mounting bracket for cracks or looseness. Using the Bendix 11-1767-1, -2 or -3 Condenser Tester or equivalent, check capacitor for capacitance, series resistance and leakage. Capacitance shall be at least 0.30 microfarads. Series resistance should not be over 1 ohm at 500 kHz.
- (12) Inspect coil leads for damaged insulation and terminals for tightness and soldered connection.
- (13) Inspect impulse coupling parts for excessive wear. Particularly check clearance between cam and flyweight of the cam assembly. Measure the clearance between the cam flyweight using the shank of a new No. 18 drill (0.1695 inch [4.3053 mm] diameter). If the drill will fit between cam and flyweight as shown in Figure 4, the cam assembly must be replaced. Check clearance between both flyweight and the cam of each cam assembly.



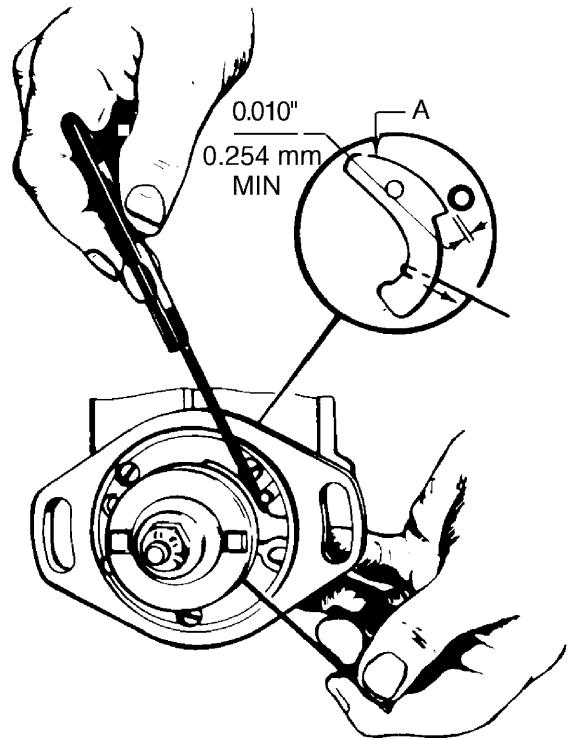
Impulse Coupling
Figure 4

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- (14) Check the clearance between each flyweight and each stop in as follows:

- (a) Bend the end of a stiff piece of wire into a right angle 0.125 inch (3.175 mm) long (maximum).
- (b) Hold magneto as shown in Figure 5. Pull heel of flyweight outward with the hooked wire and make certain that feeler gauge of 0.010 inch (0.254 mm) minimum thickness will pass between stop in and the highest point of the flyweight.

NOTE: A true and accurate check of the clearance between flyweight and stop pin can be obtained only by pulling the flyweight outward as described above. Do not attempt the check by pushing in on flyweight as point "A".



- (15) Check internal timing and reinstall and time magneto to engine.

B. Removal

- (1) Remove the side access panel from the engine nacelle.
- (2) Disconnect the "P" lead from the magneto.
- (3) Remove the harness outlet plate from the magneto by removing the four attaching screws.
- (4) Remove the two nuts and washers securing the magneto to the engine accessory housing.
- (5) Pull the magneto from the engine. Caution must be used to ensure that magneto drive rubbers do not fall into accessory sections.

Flyweight Clearance of Impulse Coupling
Figure 5

C. Installation and Timing Procedure (Magneto to Engine) (LTSIO is Counter Rotating) (See Figure 6.)

NOTE: On engines with deicer equipment installed, the deicer timing marks are hidden under the slip rings. To make allowance of this, install a timing disc or crossmark the slip ring.

- (1) TSIO timing marks are on the outer edge of the crankshaft counterweight blade between No. 2 and No. 4 cylinders. The inspection plug between No. 2 and No. 4 cylinders on the left top side of the crankcase must be removed to view the marks on the crankshaft. (Refer to Sketch A, Figure 6.)
 - (a) Plug one spark plug hole of the No. 1 cylinder and place a thumb over the other plug hole. Have a second person stand in front of the engine and turn the crankshaft in a counterclockwise direction until air pressure is felt on the thumb. No. 1 piston is coming up on the compression stroke.
 - (b) Remove the inspection hole plug and turn the crankshaft until the 20 degree (Seneca IV) or 22 degree (Seneca V) BTC mark appears in the center of the inspection hole. A timing device as described in the latest Continental Service Bulletin M68-2 may also be used.

NOTE: Verify correct engine timing for the airplane being worked on by checking the engine dataplate.

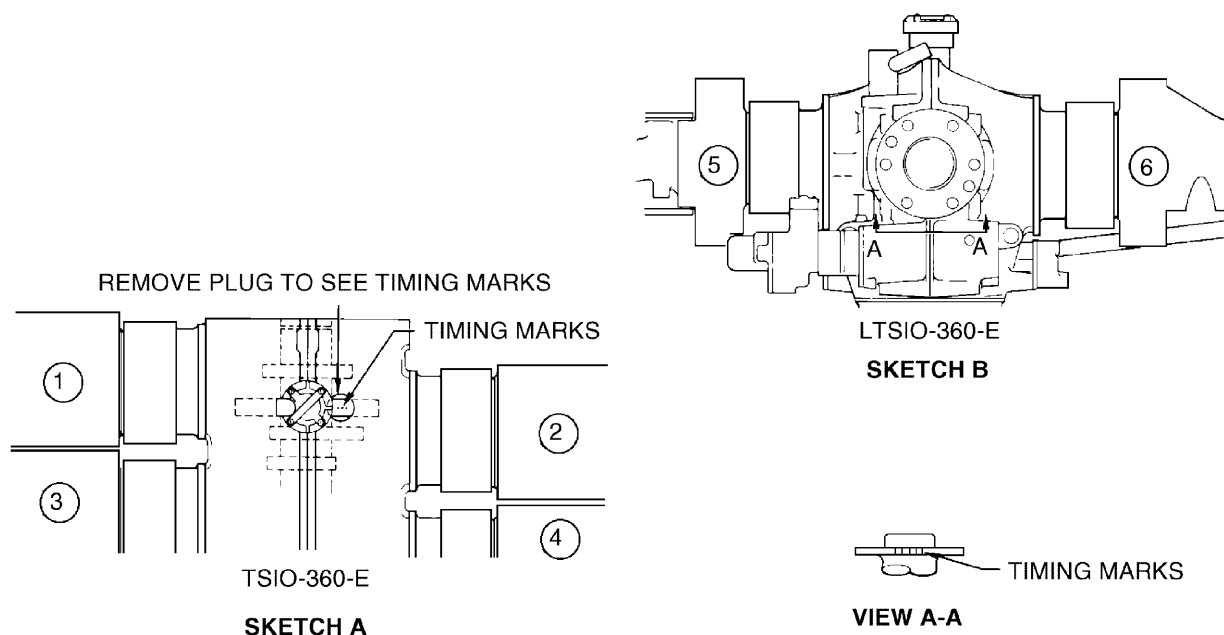
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- (c) Remove the inspection hole plug from the magneto. Turn the magneto coupling until the painted chamfered tooth on the distributor gear is approximately centered in the inspection hole. Hold the magneto in its approximate installed position. Note carefully the position of the coupling drive lugs.
- (d) Lubricate the gear support shaft with clean lubricating oil and install the drive gear assembly so the slots of the coupling bushings will be in the approximate position for aligning with the drive coupling lugs on the magneto.
- (e) Insert the retainer into the gear hub slot. Apply a film of Lubriplate grease to each of the new rubber bushings and insert the bushings into the retainers, rounded long edges first.
- (f) Place a new gasket on the magneto flange. Install the magneto carefully so the drive coupling lugs mate with the slots of the drive bushings. Install and snug down the two sets of attaching. Do not tighten at this time.
- (g) Breaker point opening may be checked by use of a suitable timing light. Tap the magneto case with a non-marring hammer, counterclockwise (from the rear) to make certain the points are closed. After the timing light indicates that the points are closed, tap the magneto lightly clockwise until the points are open. Tighten the magneto attaching nuts.

CAUTION: WHEN BACKING UP THE CRANKSHAFT, ENSURE THE MAGNETO IMPULSE COUPLINGS DO NOT ENGAGE.

- (h) Check timing by backing up crankshaft approximately 5 degrees and tapping gently forward until the timing light indicates opening of breaker points. If timing is correct, the 20 degree (Seneca IV) or 22 degree (Seneca V) mark will appear in the center of the inspection hole. The crankshaft has punch marks in 2 degree increments. Tighten the magneto attachment nuts and replace the plug in the inspection hole on top of the engine.

NOTE: Verify correct engine timing for the airplane being worked on by checking the engine dataplate.



Engine Timing Marks
Figure 6

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- (2) LTSl0 timing marks are on the outer edge of the crankshaft propeller flange. (See Sketch B, Figure 6.)
- (a) Plug one spark plug hole of the No. 1 cylinder and place a thumb over the other plug hole. Have a second person stand in front of the engine and turn the crankshaft in its direction of normal rotation until pressure is felt on the thumb. No. 1 piston is coming up on the compression stroke.
 - (b) Hold a machinist square so its base is along the crankcase vertical parting line above the crankshaft and the arm of the square is pointing outward past the crankshaft propeller flange.
 - (c) Turn the crankshaft until the 20 degree ([Seneca IV](#)) or 22 degree ([Seneca V](#)) Before Top Center mark on the engine is now in the advanced ignition firing position.

NOTE: Verify correct engine timing for the airplane being worked on by checking the engine dataplate.

- (d) Remove the inspection hole plug from the magneto. Turn the magneto coupling unit. The painted chamfered tooth on the distributor gear is approximately centered in the inspection hole. Hold the magneto in its approximate installed position. Note carefully the position of the coupling drive lugs.
- (e) Lubricate the gear support shaft with clean lubricating oil and install the drive gear assembly so the slots of the coupling bushings will be in the approximate position for aligning with the drive coupling lugs on the magneto.
- (f) Insert the retainer into the gear hub slot. Apply a film of Lubriplate grease to each of the new rubber bushings and insert the bushings into the retainers, rounded long edges first.
- (g) Place a new gasket on the magneto flange. Install and snug down the two sets of attaching paws. Do not tighten at this time.
- (h) Breaker point opening may be checked by the use of a suitable timing light. Tap the magneto case with a non-marring hammer clockwise from the rear to make certain the points are closed. After the timing light indicates that the points are closed, tap the magneto lightly counterclockwise until the points are open. Tighten the magneto attachment nuts.

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DISTRIBUTION

1. Harness Assembly

A. Inspection

- (1) Check the lead assemblies for nicks, cuts, mutilated braiding, badly worn section or any other evidence of physical damage. Inspect the spark plug sleeves for chafing or tears and damaged or stripped threads on coupling nuts. Check the compression spring to see if it is broken or distorted. Inspect the grommet for tears. Check all the mounting brackets and clamps to see that they are secure and not cracked.
- (2) Should a harness problem be suspected, integrity of the harness wiring may be checked using an ohmmeter, buzzer, or other suitable device such as the Bendix/ECD High Tension Lead Tester Kits, P/N 11-8950 or 11-8950-1; check each lead for continuity. If continuity does not exist, harness wire is broken and must be replaced.
- (3) If an insulation failure is suspected, the condition of the insulation may be determined using the Bendix 11-8950 and the 11-8950-1 High Tension Lead Tester Kits manufactured by the Electrical Components Division, The Bendix Corporation, Sidney, New York.
- (4) Test Unit Preparation:
 - (a) Install two "C" cells in the battery holder in accordance with correct position.
 - (b) Check that red and black leads are open-circuited.
 - (c) Depress PRESS-TO-TEST push-button switch.
 - (d) Ensure INDICATOR lamp flashes and GAP fires intermittently as long as PRESS-TO-TEST switch is depressed.
 - (e) Interconnect both red and black high voltage leads and again depress PRESS-TO-TEST switch. INDICATOR lamp only should flash. GAP does not fire.
 - (f) Disconnect black and red leads.
- (5) Insulation Test:
 - (a) Attach clip of red high voltage test lead to ignition harness lead terminal.
 - (b) Attach black test lead clip to lead ferrule.
 - (c) Depress PRESS-TO-TEST push-button switch.
 - (d) Observe that INDICATOR lamp flashes and GAP fires intermittently as long as PRESS-TO-TEST switch is held depressed.
 - (e) Whenever INDICATOR lamp flashes and gap fails to fire, lead under test is defective.
 - (f) When testing leads which are installed on an engine, it may be found that distributed capacitance causes the tester to reject good leads if the tester and red test lead are allowed to lay in close physical contact with the engine parts. For best results, keep the tester and the red high voltage lead well clear of the grounded metal parts of the engine.
 - (g) On some engines, leakage through the magneto distributor to the magneto coil may occur if the distributor finger electrode is lined up with the lead under test. If this occurs, the tester will indicate a rejection. Before final rejection of a lead which has one end connected to the magneto, turn the engine slightly and repeat test to confirm the reading.
- (6) A second acceptable method for performing an insulation check is with a high voltage, direct current tester such as the TAKK Model 86 or 86A or an equivalent direct current tester capable of delivering a test potential of 10,000 volts. Connect ground lead of high voltage tester to outer shielding braid of a single lead. Connect plug terminal. Turn tester ON and apply 10,000 volts. The insulation resistance should be 100 megohms minimum. Proceed to check other leads of harness in the same manner.

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B. Removal

- (1) Disconnect the clamps that secure the wires to the engine and accessories.
- (2) Loosen the coupling nuts at the spark plugs and remove the insulators from the spark plug barrel well. Use caution when withdrawing the insulator so that the insulator spring will not be damaged.
- (3) Place a guard over the harness insulators.
- (4) Remove the harness assembly terminal plate from the magneto.
- (5) Remove the harness from the airplane.

C. Installation

Before installing the harness plate on the magneto, check the mating surfaces for cleanliness. Spray the entire face of the grommet with a light coat of Plastic Mold Spray, SMOOTH Silicone Spray or equivalent. This will prevent the harness grommet from sticking to the magneto distributor block.

- (1) Place the harness terminal plate on the magneto and tighten the nuts around the plate alternately to seat the cover squarely on the magneto. Torque the nuts to 18 to 22 inch-pounds.
- (2) Route the ignition wires to their respective cylinders as shown in Figure 1.
- (3) Clamp the harness assembly in position.
- (4) Connect the leads to the spark plugs.

D. Maintenance

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

2. Spark Plugs

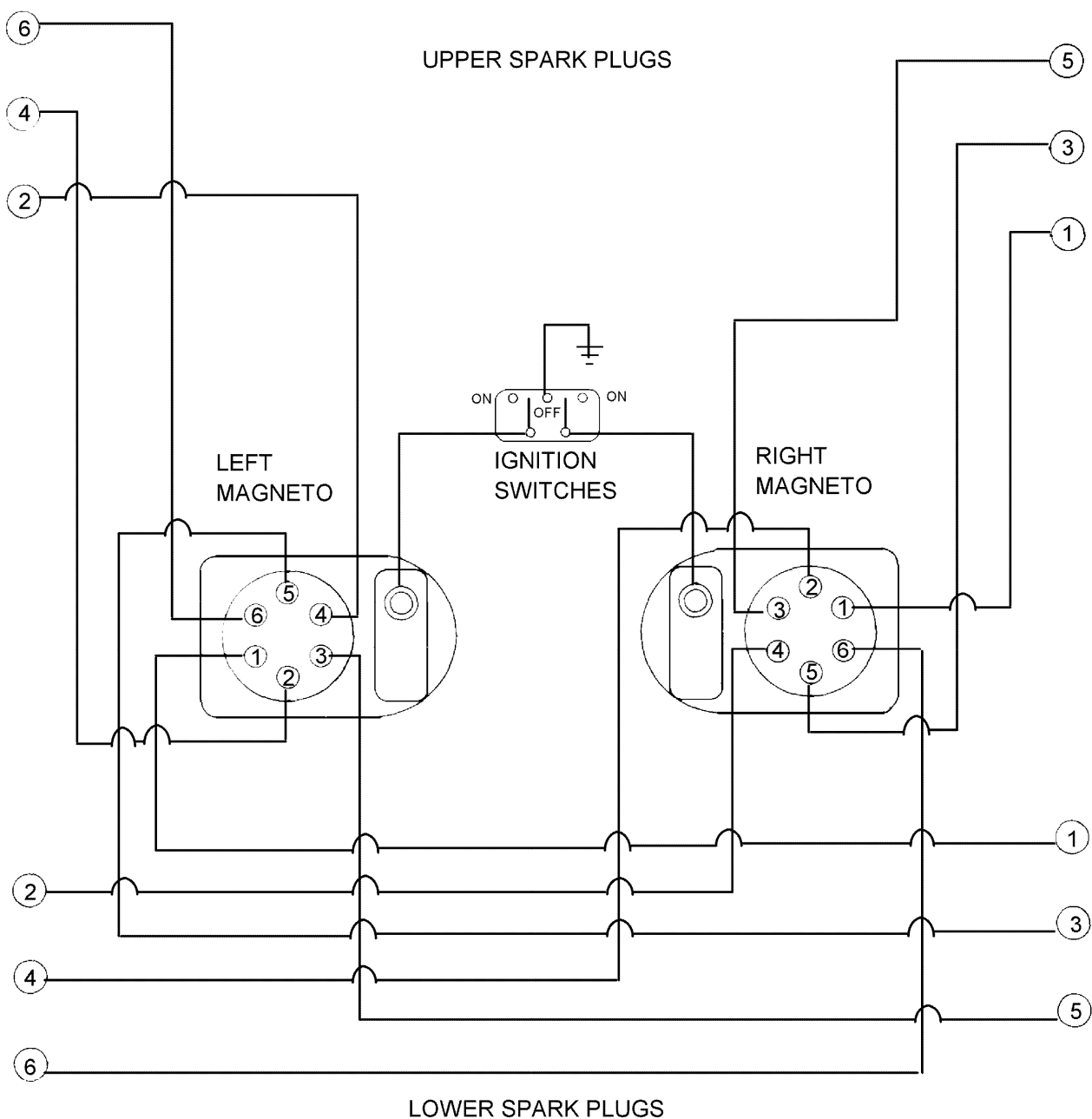
A. Removal

- (1) Loosen the coupling nut on the harness lead and remove the terminal insulator from the spark plug barrel well. (A crows foot adapter is needed to remove the lower spark plugs.)

NOTE: When withdrawing the ignition cable lead connection from the plug, care must be taken to pull the lead straight out and in line with the centerline of the plug barrel; otherwise, a side load will be applied which frequently results in damage to the barrel insulator and connector. If the lead cannot be removed easily in this manner, the resisting contact between the neoprene collar and the barrel insulator will be broken by a rotary twisting of the collar. Avoid undue distortion of the collar and possible side loading of the barrel insulator.

- (2) Remove the spark plug from the engine. In the course of engine operation, carbon and other combustion products will be deposited on the end of the spark plug and will penetrate the lower threads to some degree. As a result, greater torque is frequently required for removing a plug than for its installation. Accordingly, the torque limitations given do not apply to plug removal, and sufficient torque must be used to unscrew the plug. The higher torque in removal is not as detrimental as in installation, since it cannot stretch the threaded section. It does, however, impose a shearing load on this section and may, if sufficiently severe, produce a failure in this location.

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ENGINE FIRING ORDER:
LTSIO - 360 - KB - 1-4-5-2-3-6
TSIO - 360 - KB - 1-6-3-2-5-4
LTSIO - 360 - RB - 1-4-5-2-3-6
TSIO - 360 - RB - 1-6-3-2-5-4

MAGNETO FIRING ORDER
1-2-3-4-5-6

Ignition Schematic
Figure 1

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- (3) Place spark plugs in a tray that will identify their position in the engine as soon as they are removed.
- (4) Removal of seized spark plugs in the cylinder may be accomplished by application of liquid carbon dioxide by a conical metal funnel adapter with a hole at the apex just large enough to accommodate the funnel of a CO₂ bottle. (See Figure 2.) When a seized spark plug cannot be removed by normal means, the funnel adapter is placed over and around the spark plug. Place the funnel of the CO₂ bottle inside the funnel adapter and release the carbon dioxide to chill and contract the spark plug. Break the spark plug loose with a wrench. A warm cylinder head at the time the carbon dioxide is applied will aid in the removal of an excessively seized plug.
- (5) Do not allow foreign objects to enter the spark plug hole.

B. Installation

CAUTION: DO NOT INSTALL A SPARK PLUG THAT HAS BEEN DROPPED.

Before installing spark plugs, ascertain that the threads within the cylinder are clean and not damaged.

- (1) Apply anti-seize compound sparingly on the threads and install gasket and spark plugs. Torque 300 to 360 inch-pounds.

CAUTION: MAKE CERTAIN THE DEEP SOCKET IS PROPERLY SEATED ON THE SPARK PLUG HEXAGON. THE PLUG COULD BE DAMAGED IF THE WRENCH IS OFF CENTER WHEN PRESSURE IS APPLIED.

- (2) Carefully insert the terminal insulator in the spark plug and tighten the coupling unit.

C. Inspection and Cleaning

Good spark plug maintenance is necessary for engines to operate efficiently. Plugs should be as clean as possible; mechanically sound; exhibit enough electrode for additional use; exhibit properly gapped and contoured electrodes; and, pass necessary tests for electrical soundness. For further information not included herein, contact the spark plug manufacturer for further information.

- (1) Visually inspect each spark plug for the following non-repairable defects:
 - (a) Terminal barrel sleeve cracked.
 - (b) Badly battered or rounded shell hexagons.
 - (c) Threads at top of shielding badly nicked or corroded.
 - (d) Connector seat badly nicked or corroded.
 - (e) Chipped, cracked, or broken ceramic insulators in the firing end or shielding barrel.
 - (f) Badly eroded or disfigured electrodes.

- (2) Clean the spark plug as follows:

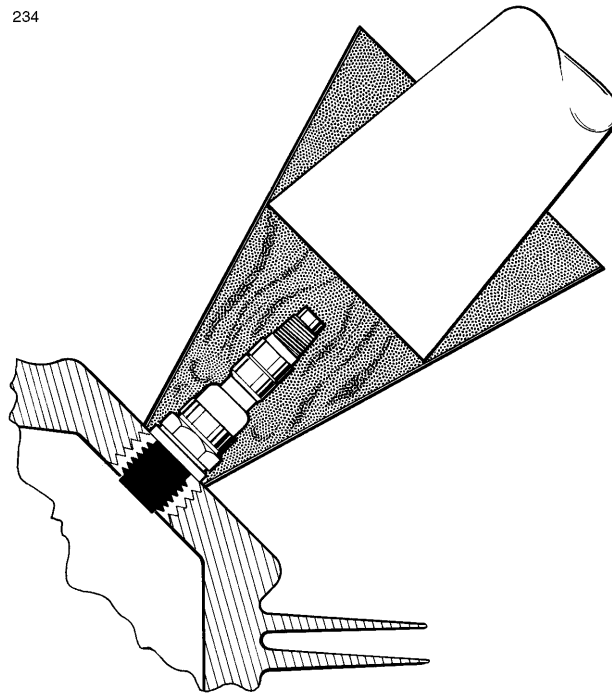
NOTE: Do not use carbon tetrachloride to degrease spark plugs except if using vapor degrease method. Do not soak plugs in solvent and ensure solvent does not enter shielding barrel.

- (a) Degrease the spark plugs as required. Refer to manufacturer's information for specific requirements.
- (b) Dry plugs using clean, dry air. Heating in a small oven is often recommended to thoroughly remove all traces of solvent.

NOTE: If any solvent or oil remains in the firing end, or connector well of the spark plug, abrasive will pack between the shell and insulator, if abrasive blasting is used.

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Removing Frozen Spark Plug
Figure 2

- (c) Clean the firing end and terminal well. There are different machines (vibrators, abrasive blasters, etc) and methods capable of accomplishing this task. Contact the manufacturer if necessary to determine the appropriate procedures and materials. To prevent flashover, all foreign matter, moisture, and stains should be removed from the terminal well insulator.
- (d) Set electrode gaps as specified by the spark plug manufacturer's specification.

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CHAPTER

76

ENGINE CONTROLS

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POWER CONTROL

This chapter contains information on rigging the power plant controls; throttle, propeller, and mixture.

CAUTION: ALIGNMENT OF THE CORRESPONDING ENGINE CONTROLS MUST BE WITHIN 0.25 IN. (6.350 MM) WHEN THEY ARE IN THEIR AFT POSITIONS AND HALF A KNOB WIDTH IN THEIR FULL FORWARD POSITIONS.

CAUTION: ENSURE ALL COTTER PINS AND/OR SAFETY WIRE ARE REPLACED.

1. Seneca IV

A. Rigging (Refer to Figure 1.)

(1) Throttle Controls

- (a) Move the affected throttle lever to its full throttle position (full forward).
- (b) At the appropriate engine, remove the upper left cowl panel and disconnect the cable from the throttle valve arm.
- (c) Move the throttle valve arm to its full open (throttle) position. Adjust the rod ends of the cable to provide the throttle lever with a 0.03 to 0.06 inch (0.762 to 1.524 mm) clearance or cushion between the quadrant stop and throttle lever, while leaving a clearance of at least 0.03 inch (0.762 mm) at the idle or aft throttle position stop. Check alignment of the corresponding control.
- (d) Refer to Chapter 32 and check the rigging of the "Gear Warning Throttle Switch."
- (e) Install cowl panel.

(2) Propeller Controls

- (a) If not already done so, move the particular propeller control to full increase (full forward).
- (b) At the affected engine, remove the upper left cowl panel and disconnect the control cable from the governor control arm.
- (c) Refer to Figure 1 and check the travel of the control arm. The Hartzell governor must meet the 95° travel requirement.
- (d) Move the governor control arm to max speed or full increase rpm and rig cable to provide 0.03 to 0.06 inch (0.762 to 1.524 mm) clearance or cushion between the appropriate prop lever and quadrant stop.
- (e) Install cowl panel and ensure alignment of the corresponding control for the other engine.

(3) Mixture Controls

- (a) Move the affected mixture control to its full rich (full forward) position.
- (b) Remove the upper right cowl panel on the appropriate engine and disconnect the control cable from the mixture control arm on the engine fuel pump.
- (c) Move or ensure the arm is to its full rich (full travel) position. Refer to Figure 1 for arm travel specifications.
- (d) Adjust the cable ends to provide the mixture lever with a clearance or cushion of 0.03 to 0.06 inch (0.762 to 1.524 mm) between the lever and quadrant stop when at the full rich position. When the lever is at idle cutoff, there must be a clearance of at least 0.03 (0.762 mm) inch between the lever and aft stop.
- (e) Check the alignment of the corresponding mixture lever and install removed panels and cowl panel.

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B. Engine Setup Procedures

The following procedures should be used to check and adjust the power plants to maintain the required operating limits and ensure obtaining good setup results. It is important that the following checks be made to both engines before proceeding with any actual system adjustments:

(1) Preparations

- (a) Remove the cowl to make access to the fuel injection pump, manifold valve, metering unit, injection nozzles, turbocharger unit, exhaust bypass (waste gate) valve, and overboost relief valve.
- (b) Ensure all lines are tight and that there are no indications of leaks. Fuel dye stains around a fuel fitting indicates a leak.
- (c) Ensure the overboost relief valve is seated.
- (d) Check exhaust and induction systems for tightness and no damage.
- (e) Ensure the intake inlets are clear and that the intake filter is clean.
- (f) Check the turbocharger for evidence of damage or overheating. If overheat damage is suspect, check that the compressor/turbine are free to turn.
- (g) Inspect the ignition harness, cooling baffles, oil lines and fittings (for loss of oil), and other items that could affect engine performance.
- (h) Ensure the auxiliary fuel pump system operates properly, refer to Chapter 28.

(2) Leak Check - Gauge Lines

- (a) Disconnect the manifold pressure line at the forward part of the throttle assembly; fuel flow vent line from the air throttle adapter fitting; and, the fuel flow pressure line at the manifold valve.
- (b) Connect surgical tubing to the fuel flow vent line and evacuate the line until a 10 gallon per hour (maximum) positive indication on the fuel flow gauge is obtained. Clamp off the tubing and observe the gauge for a steady reading. Any change of this reading would indicate a leak in the system, which must be repaired prior to continuing with the setup procedures.

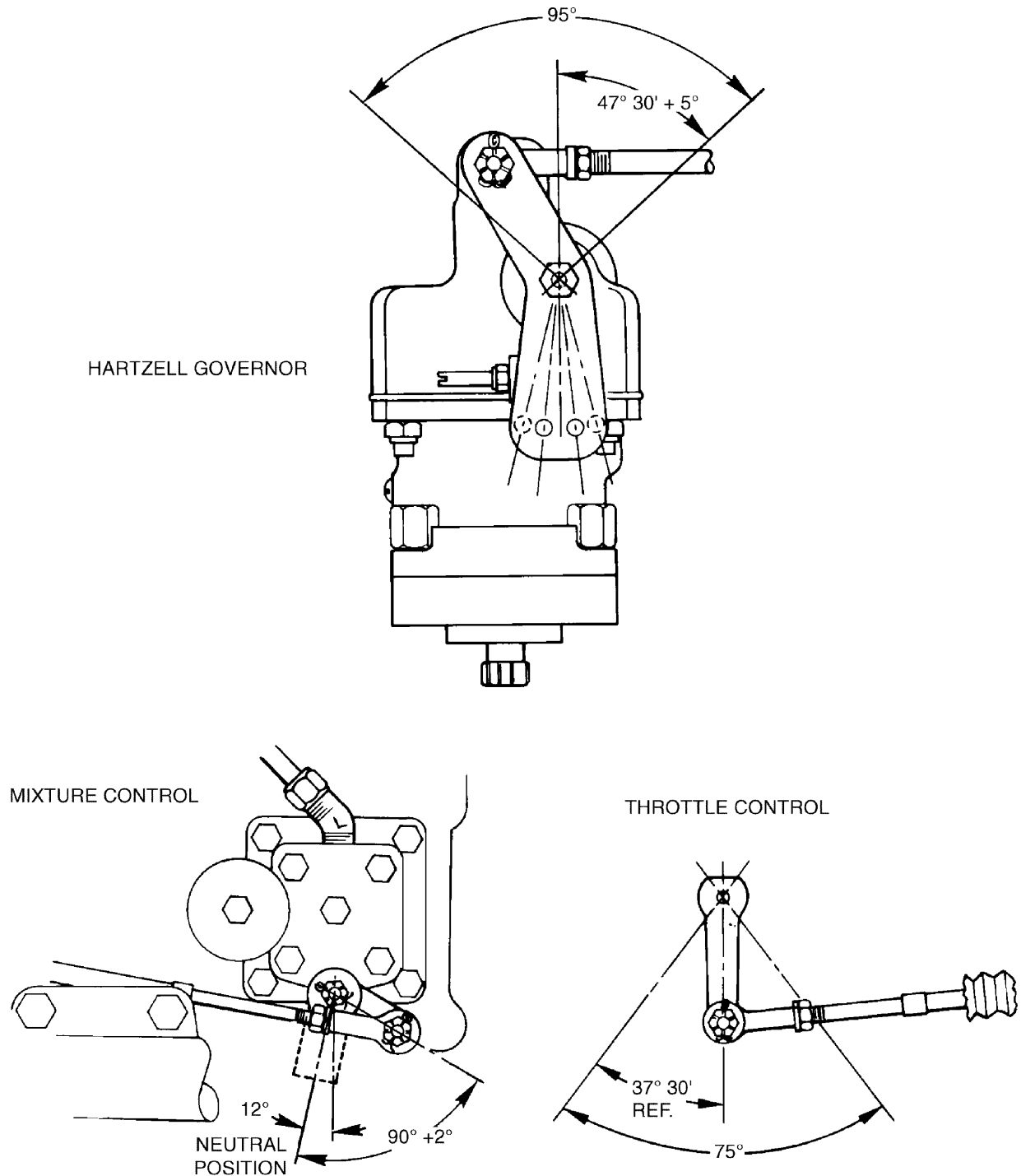
NOTE: A static system test unit can be used to leak check these lines.

- (c) Check the fuel flow pressure and manifold pressure lines in the same manner as given in Step (2) except apply positive pressure to the lines. Do not exceed 4 pounds per square inch (psi) on the fuel pressure gauge or 4 inches of mercury (in. Hg) increase on the manifold pressure gauge.
- (d) Reconnect and tighten the manifold pressure, compressor discharge pressure and fuel pressure lines.
- (e) The difference in the static reading on the manifold pressure gauges should not exceed 1/2 in. Hg.

CAUTION: DO NOT RUN PUMPS EXCESSIVELY AS FUEL BEING PUMPED INTO THE CYLINDER WILL WASH THE CYLINDER WALLS.

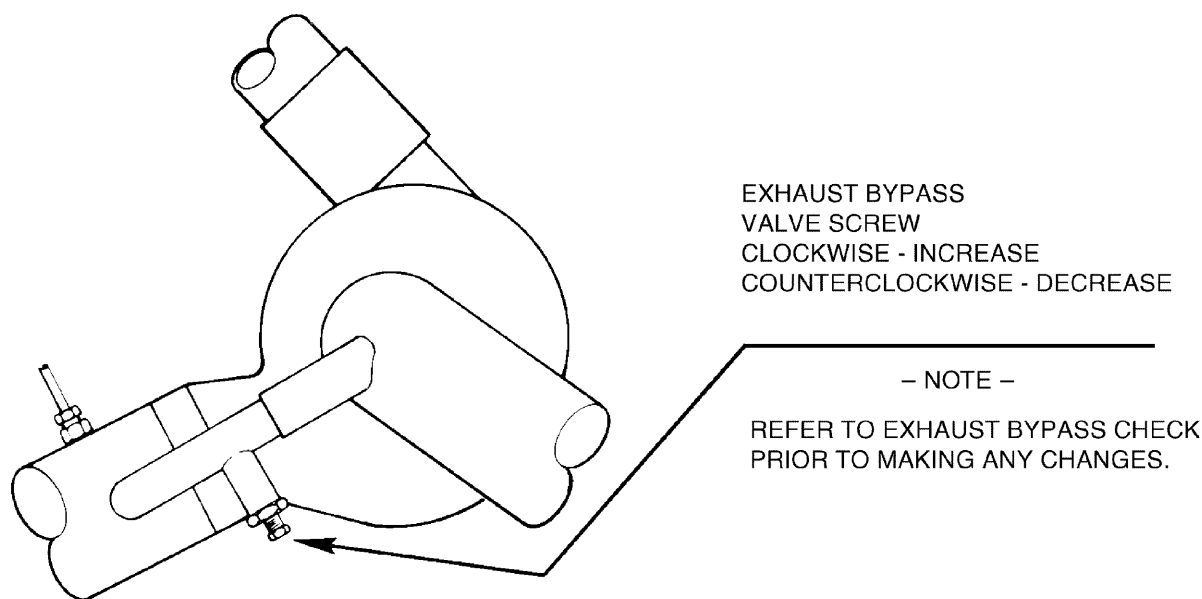
- (f) To reduce the possibility of trapped air in the fuel pressure lines following the test, disconnect the fuel pressure line at the rear of the fuel flow gauge and activate the auxiliary fuel pump long enough to purge the lines; then reconnect the lines.

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Engine Controls ([Seneca IV](#))
Figure 1

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Exhaust Bypass Valve Screw (Seneca IV)
Figure 2

(3) Exhaust Bypass Check (Refer to Figure 2.)

CAUTION: DURING ALL ENGINE OPERATIONS OUTLINED IN THESE INSTRUCTIONS, EXERCISE CAUTION TO AVOID HARM OR DAMAGE TO PERSONNEL AND EQUIPMENT BY PROPELLER BLAST AND ROTATING PROPELLER BLADES. WHEN REQUIRED TO MAKE ADJUSTMENTS TO THE ENGINE IN CLOSE PROXIMITY TO THE PROPELLER ARC, SHUT THE ENGINE DOWN BEFORE MAKING ADJUSTMENTS.

The adjusting screw on turbochargers installed on [Seneca IV](#) models has course threads. Check that the exhaust bypass adjusting screw consisting of fine threads has from eight to nine threads showing below the jam nut. Bypass adjustment screws having course threads should have three to four threads showing below the jam nut. This screw is preset at the factory and should not require any adjustment, unless it is known that critical altitude is not correct. If adjustment is necessary, use procedure given in Flight Testing.

NOTE: It is extremely important that both engines are thoroughly warmed up, operated and adjusted together to keep them matched. However, excessive engine temperatures must be avoided since setup temperature must closely parallel temperatures in flight.

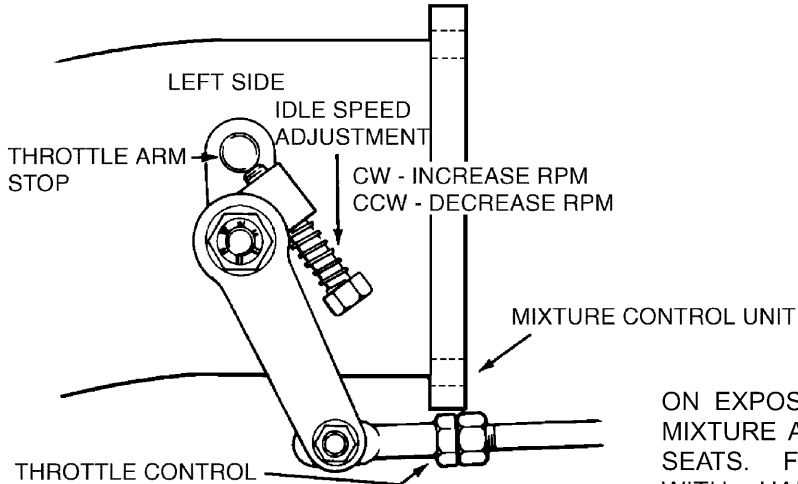
(4) Idle Performance Check (Refer to Figure 3.)

NOTE: Before performing any of these procedures, make sure the auxiliary fuel pump system is operating properly. Refer to Chapter 28.

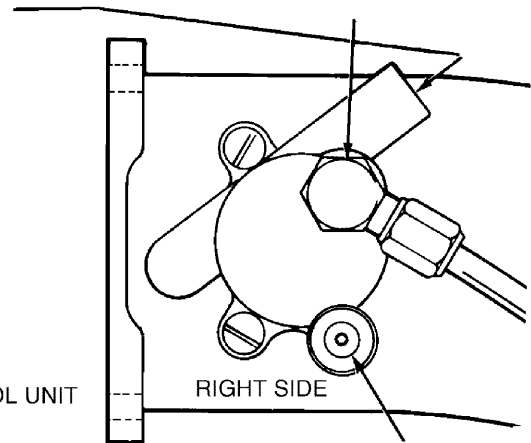
- (a) Remove the cap from the tee fitting on the right side of the throttle body.
- (b) Install a 0-60 psig calibrated pressure gauge (vented to the atmosphere) to the tee, using a suitable length of flexible tube. The gauge should always be at the same level as the fuel manifold valve when checking fuel pressure.

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ON UNEXPOSED ADJUSTING SCREW, REMOVE PUTTY FROM BOSS WHICH INCORPORATES THE ADJUSTING SCREW. USE THIS LOCATION FOR ALL FUTURE IDLE MIXTURE ADJUSTMENTS. REFER TO TCM SERVICE BULLETIN M76-17. IDLE MIXTURE ADJUSTMENT CW - LEAN AND CCW - RICH.



REMOVE PLUG AND CONNECT GAUGE FOR SETTING UP UNMETERED FUEL.



ON EXPOSED ADJUSTING SCREW, TURN IDLE MIXTURE ADJUSTING SCREW FULL IN UNTIL IT SEATS. FILL THE ADJUSTING SCREW BOSS WITH HARDENING PUTTY. USE ABOVE LOCATION FOR FUTURE ADJUSTMENTS. REFER TO TCM SERVICE BULLETIN M76-17.

Idle Speed and Mixture Adjustment Points (Seneca IV)

Figure 3

- (c) Purge the air from the tube.
- (d) Perform the following checks and adjustments:

1 Idle Fuel Pressure

NOTE: The following setup procedure is accomplished with the boost pumps OFF. Both engines should be thoroughly warmed up and adjusted together to keep them matched

- a Back off the idle speed adjusting screw two turns. (Refer to Figure 3.)
 - b Start both engines and warm them up at 1500 to 1800 rpm until the oil pressures are in the green arc, cylinder head temperatures are in the lower one-quarter of the green arc, and the oil temperatures are 160° to 180°F.
 - c While maintaining 700 ± 25 rpm, set the idle fuel pressure at 6.5 ± 0.5 psi by adjusting the idle pump adjustment screw (refer to Figure 4, item 6); clockwise adjustment increases pressure; counterclockwise adjustment decreases pressure.
- 2 Idle Mixture Check and Adjustment (Refer to Figure 3.)
- a Operate the engine at 1500 to 1800 rpm until cylinder head temperatures are in the lower one-quarter of the green arc, and the oil temperatures are 160° to 180°F (71° to 82.22°C).
 - b Reduce the engine speed and stabilize it at 700 ± 25 rpm.

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- c Slowly, but positively, move the mixture control from the full rich position to idle cut-off. The engine speed should increase 75 to 100 rpm before beginning to drop toward zero. Move the mixture control back to full rich before the engine stops.
- d If the engine speed increase is less than 75 rpm, adjust the idle mixture adjustment to enrich the mixture (counterclockwise). If the engine speed increase is more than 100 rpm, adjust the idle mixture to lean the mixture (clockwise).
- e After each adjustment, increase rpm to 1500-1700 for 10 seconds to "clean out" the engine.
- f Double check idle fuel pressure after adjusting idle mixture.

NOTE: Any adjustment of the idle fuel pressure or idle mixture will probably change the reading of each other. Continue to adjust and crosscheck until both are correct.

3 Idle Speed Check and Adjustment (Refer to Figure 3.)

- a With the idle fuel pressure and idle mixture set in accordance with instructions given previously, cylinder head temperatures in the lower one-quarter of the green arc, and oil temperatures at 160° to 180°F (71° to 82.22°C), set engine speed at 700 ± 25 rpm.
- b Adjust the idle speed adjusting screw until contact is made with the throttle arm stop.

NOTE: After final adjustment, recheck the idle fuel pressure, idle mixture and idle speed to ascertain that all are within specifications given in previous steps.

(5) Full Power Performance Check and Adjustment (Refer to Figure 4)

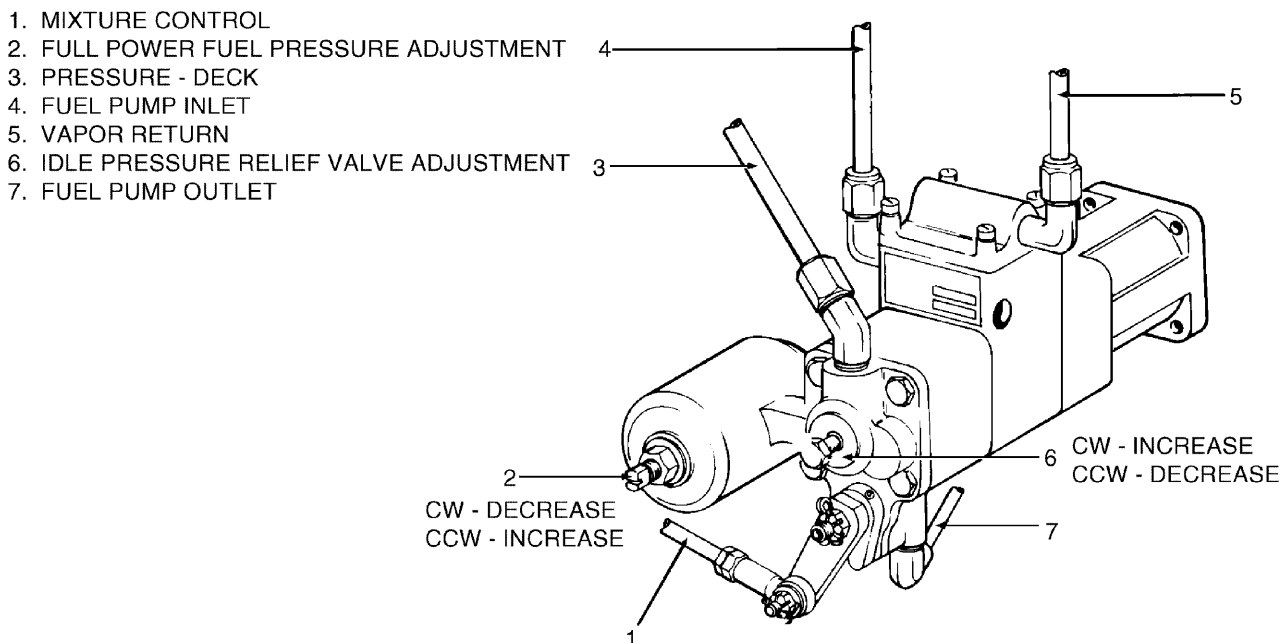
CAUTION: BEFORE ATTEMPTING FULL POWER CHECKS, BE SURE THAT THE BRAKES ARE PROPERLY MAINTAINED AND SET, AND THAT GROUND CONDITIONS WILL NOT PERMIT WHEELS TO SLIP DURING FULL POWER CHECK.

NOTE: Fuel flows are given for sea level density altitude. Use Chart 1 to interpolate correct fuel flow for the actual engine rpm. Refer to engine operating manual for further information. Charts 2 and 3 are included for reference only.

- (a) Run both engines at 39.8 to 40.0 in. Hg manifold pressure (overboost lights activated), and beat synchronize the engines at 2600 rpm using the propeller governor controls. Readjust the throttle controls as required to maintain 39.8 to 40.0 in. Hg manifold pressure on both engines.
- (b) Fuel flow should be 22.8 to 23.5 gallons per hour (gph), for each engine with the mixture controls in the full rich position.
- (c) Observe the 0-60 calibrated gauge to cross check performance. High unmetered pressure should be 36 to 40 psi.
- (d) If adjustment is required, shut the engine down, loosen the jam nut on the adjusting screw located on the aneroid housing of the fuel pump. (Refer to Figure 4, item 2.) Clockwise adjustment decreases fuel flow reading; counterclockwise adjustment increases fuel flow reading. Keep in mind that one full turn will cause a 1.0 to 1.5 gph change. Use CAUTION when loosening and tightening the jam nut so as not to change settings.

NOTE: A complete investigation of interface systems is required if other than minor adjustments are required to the fuel flow.

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Sectional View of Altitude Compensating Fuel Pump Assembly (Seneca IV)
Figure 4

- (e) Restart the engines and recheck the high end fuel flow.
- (f) Recheck the idle settings as directed in the four previous subject paragraphs.
- (g) Recheck Full Power Fuel Flow settings.
- (h) With engines operating at 2600 rpm (39.8 to 40 in. Hg manifold pressure), lean the mixture to obtain 21 gph fuel flow readings. The unmetered fuel pressure on the calibrated pressure gauge should be 32 to 36 psi.

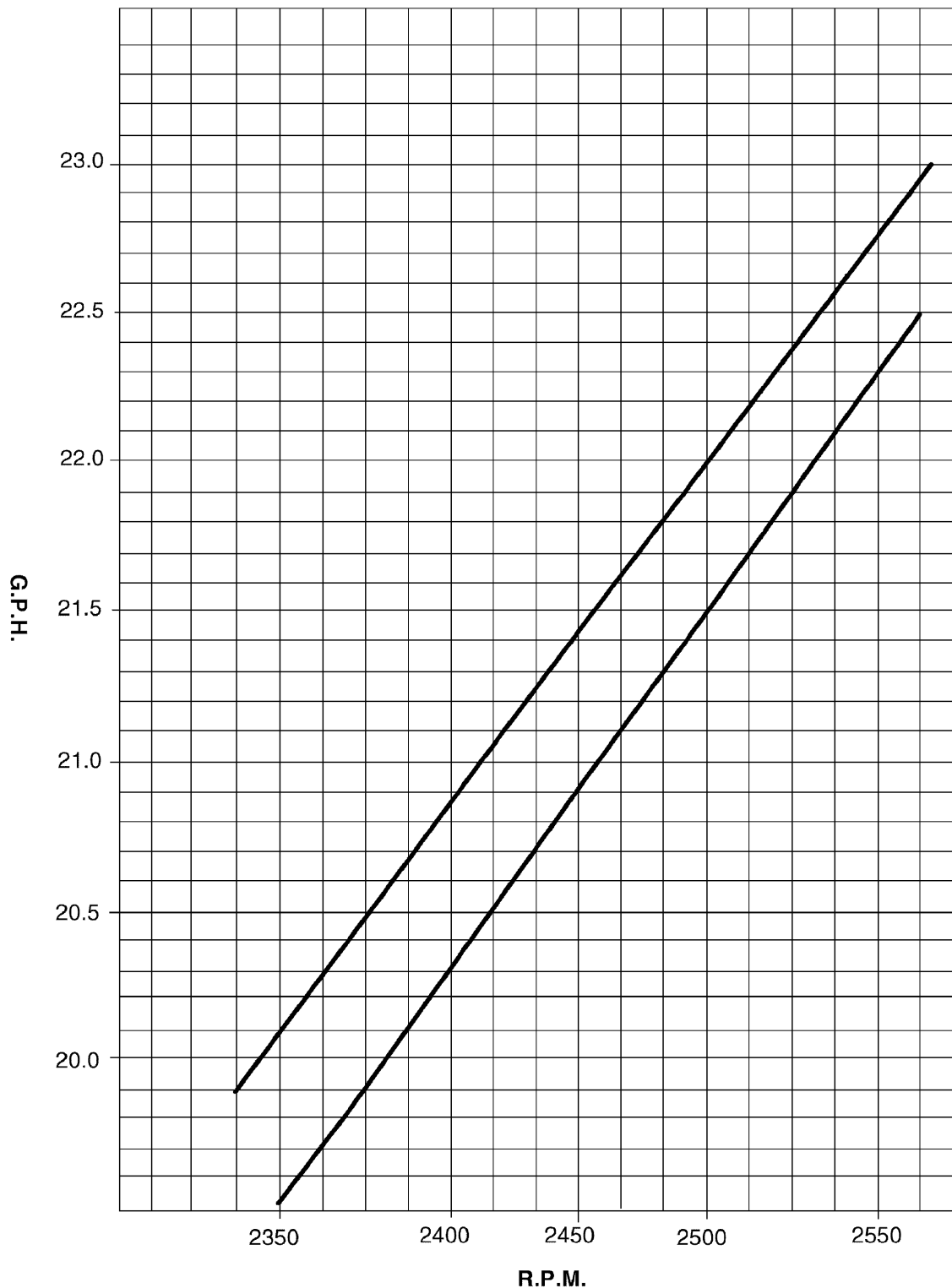
NOTE: The key to keeping engines and fuel systems matched is beat synchronizing of both engines and operating them together to keep temperatures equal. Adjusting engines singly seldom produces a good match.

- (6) Fuel System Match Check
 - (a) Set propeller governors to maintain 1900 to 2000 rpm and open throttles slowly, increasing engine speed until reaching 40 in. Hg manifold pressure. Keep engine speeds beat synchronized.
 - (b) Slowly reduce manifold pressures, keeping needles matched and observe fuel flows. A properly adjusted system will track fuel flows within a needle's width of each other.

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CHART 1
FUEL FLOW VS. ENGINE SPEED (SENECA IV)

40 IN. HG. MANIFOLD PRESSURE
FULL RICH MIXTURE



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CHART 2 (Reference Only)
FUEL FLOW VS. FUEL PRESSURE (SENECA IV)

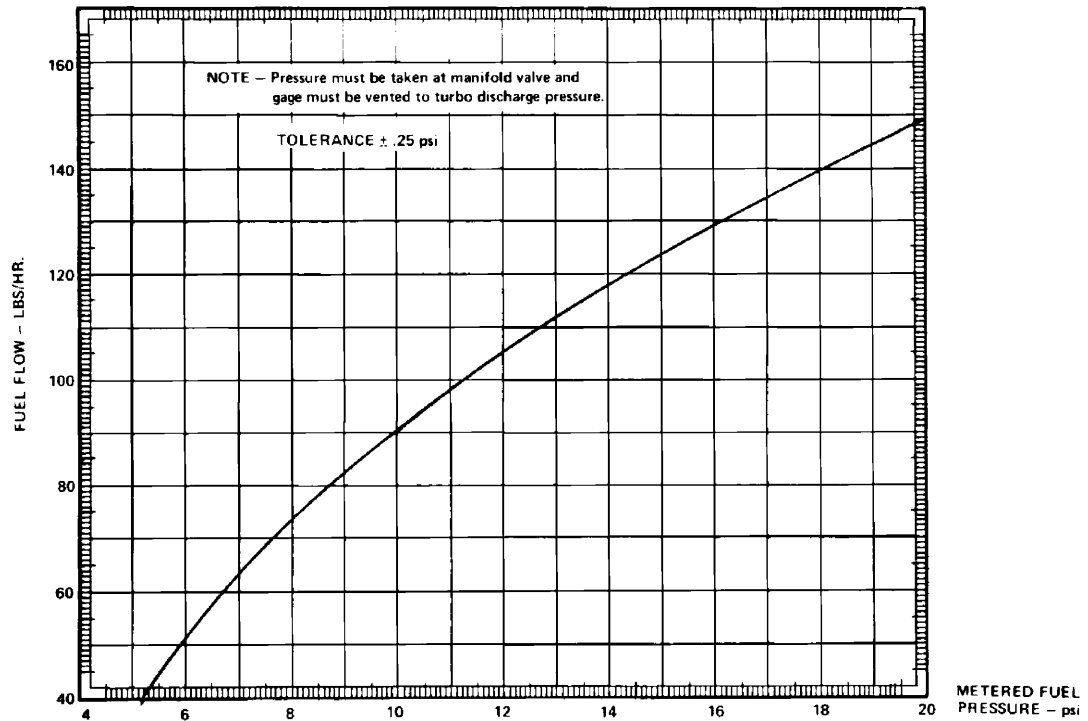
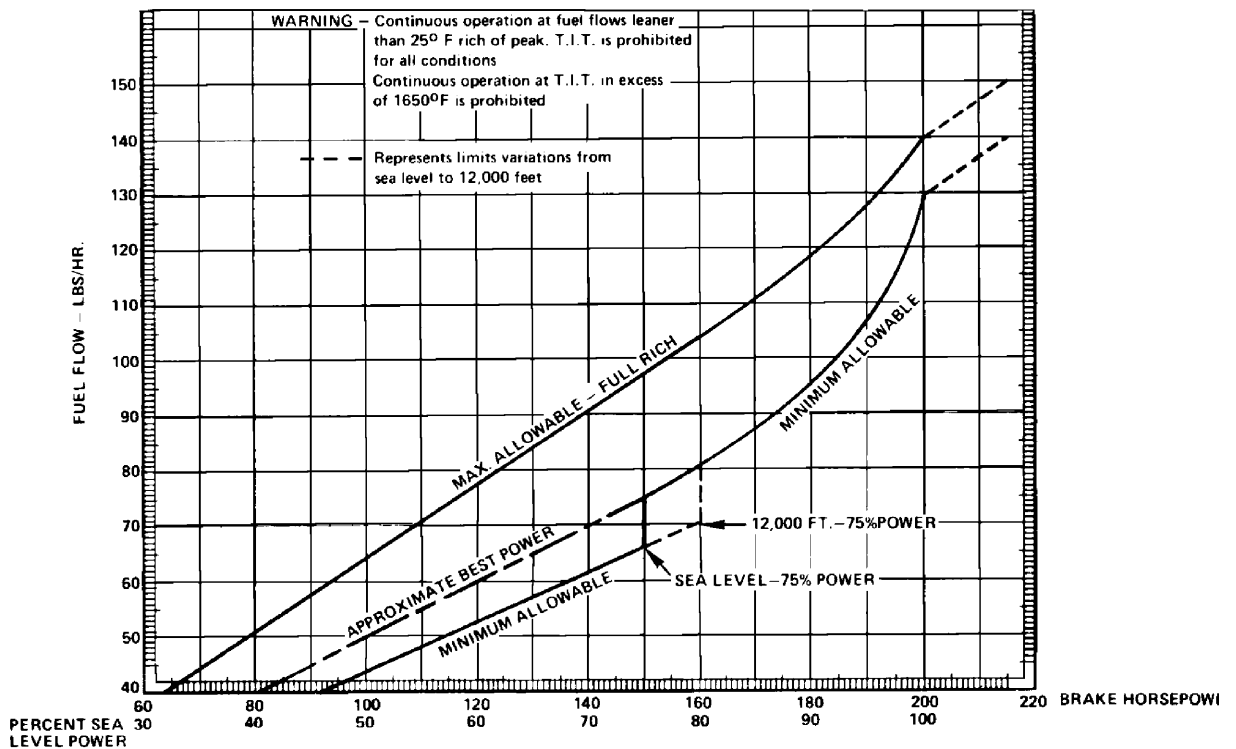


CHART 3 (Reference Only)
LIMITS - FUEL FLOW VS. BRAKE HP (SENECA IV)



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(7) Post Setup Procedures

- (a) Remove test equipment; safety wire the exhaust bypass screw and check nut to the bypass screw housing; reinstall the cap on the tee of the throttle body housing.
- (b) The accuracy of the cockpit fuel flow gauge at maximum power can be checked against a calibrated gauge by connecting the calibrated gauge at the manifold valve and maintaining the gauge on the same level as the valve while checking pressure and using Chart 1.

NOTE: The calibrated gauge fuel line must be purged of air and the reference side of the calibrated gauge vented to turbo discharge pressure.

C. Flight Test Procedures

- (1) At 8,000 feet density altitude, set the engines to operate at 2450 ± 25 rpm and 31.0 to 32.0 in. Hg manifold pressure.
- (2) Lean each engine to 25°F rich of peak exhaust gas temperature (EGT). (Peak EGT may not be the same for both engines; however, the difference should not exceed 50°F.)
- (3) Fuel flow at these conditions should be 11.0 to 12.0 gph.
- (4) Place the aircraft in a climb attitude at 92 KIAS with the mixture at full rich, cowl flaps half open, full throttle (2600 ± 25 rpm) and a manifold pressure 39.0-40.0 in. Hg (overboost annunciator lights illuminated).
- (5) Continue to climb until overboost annunciator lights go out (indicating critical altitude). As the lights go out note fuel flow, indicated altitude and OAT.
- (6) Fuel flow at critical altitude should be 23.0-25.0 gph and density altitude 11,500 minimum to 12,500 maximum.
- (7) If a discrepancy in critical altitude was noted, adjust the exhaust bypass valve. (Turning the exhaust bypass valve screw one full turn will alter the critical altitude in excess of 1,000 feet.)
 - (a) On turbochargers equipped with fine thread adjustment screws:
 - 1 One flat turn in will increase critical altitude approximately 200 feet.
 - 2 One flat turn out will decrease critical altitude approximately 200 feet.
 - (b) On turbochargers equipped with course thread adjustment screws:
 - 1 One flat turn in will increase critical altitude approximately 300 feet.
 - 2 One flat turn out will decrease critical altitude approximately 300 feet.

Adjustments of critical altitude in excess of 500 feet may require retrimming of the fuel flows at 100% power. Critical altitude should not differ more than 500 feet between engines.

- (8) With full rich mixture, cowl flaps open, 2600 ± 25 rpm, 92 KIAS airspeed, and 1,000 to 3,000 feet density altitude, check the operation of the manifold pressure relief valve. Slowly advance one throttle to the wide open position. The manifold pressure shall stabilize between 42.0 and 44.0 in. Hg; there shall be no loss of power, and fuel flow indication shall be well over the red line. Do not exceed 40.0 in. Hg manifold pressure for more than ten seconds. Repeat this check on the other engine.

NOTE: Idle speed and idle mixture indication is a function of engine temperatures. Therefore, at normal ground idle temperatures (cylinder and oil temperature indications may or may not be "in the green") idle speed will be approximately 700 ± 25 rpm, and the idle mixture check will result in a 25 to 50 rpm increase in engine speed.

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2. [Seneca V](#)

A. Rigging (Refer to Figure 5.)

(1) Throttle Controls

- (a) Move the affected throttle lever to idle position.
- (b) At the appropriate engine, remove the upper cowl and disconnect the cable from the throttle valve arm.
- (c) Move the throttle valve arm to idle position. Adjust the rod ends of the cable to provide a minimum clearance of 0.03 inch between the quadrant throttle lever and idle stop. With the engine control at full throttle, there must be a minimum clearance of 0.03 inch between the quadrant throttle lever and forward stop. Check alignment of the corresponding control.
- (d) Refer to 32-60-00 and check the rigging of the "Gear Warning Throttle Switch," if so equipped.
- (e) Install cowling.

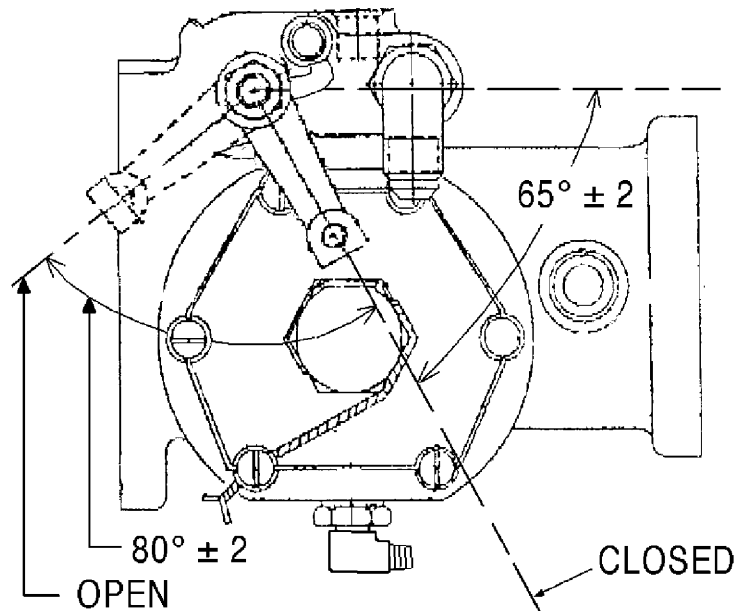
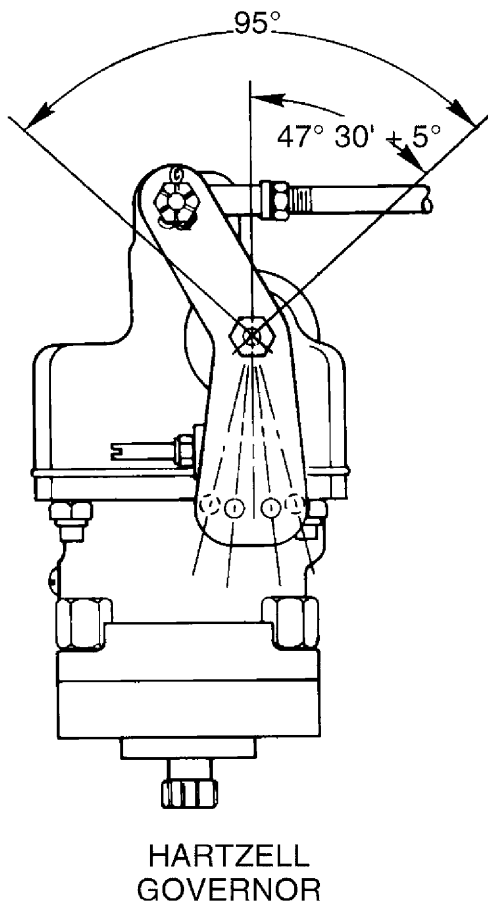
(2) Propeller Controls

- (a) If not already done so, move the particular propeller control to full increase (full forward).
- (b) At the affected engine, remove the upper left cowl panel and disconnect the control cable from the governor control arm.
- (c) Refer to Figure 5 and check the travel of the control arm. The Hartzell governor must meet the 95° travel requirement.
- (d) Move the governor control arm to max speed or full increase rpm and rig cable to provide 0.03 to 0.06 inch (0.762 to 1.524 mm) clearance or cushion between the appropriate prop lever and quadrant stop.
- (e) Install cowl panel and ensure alignment of the corresponding control for the other engine.

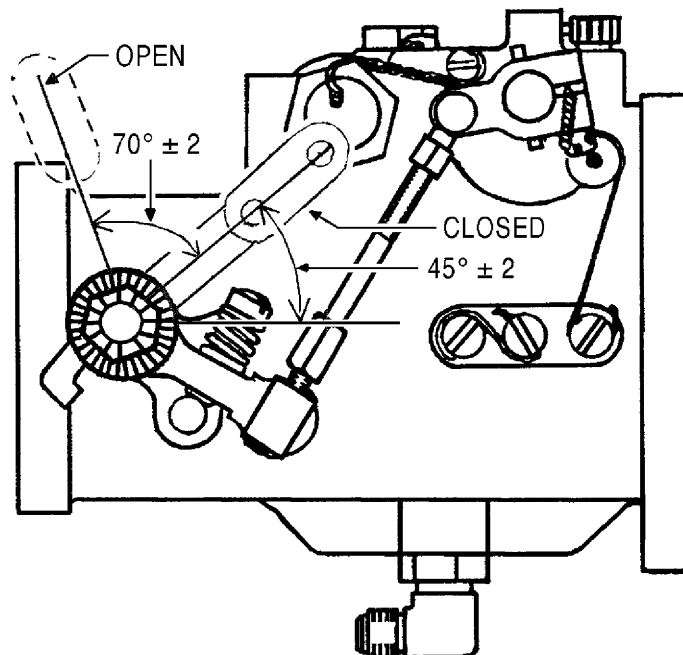
(3) Mixture Controls

- (a) Move the affected mixture control to its full rich (full forward) position.
- (b) Remove the upper cowl panel on the appropriate engine and disconnect the control cable from the mixture control arm on the fuel injection servo.
- (c) Move or ensure the arm is to its full rich (full travel) position. Refer to Figure 5 for arm travel specifications.
- (d) Adjust the cable ends to provide the mixture lever with a clearance or cushion of 0.03 to 0.06 inch (0.762 to 1.524 mm) between the lever and quadrant stop when at the full rich position. When the lever is at idle cutoff, there must be a clearance of at least 0.03 (0.762 mm) inch between the lever and aft stop.
- (e) Check the alignment of the corresponding mixture lever and install removed panels and cowl panel.

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MIXTURE CONTROL



THROTTLE CONTROL

Engine Controls ([Seneca V](#))
Figure 5

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B. Engine Setup Procedures

The following procedures should be used to check and adjust the power plants to maintain the required operating limits and ensure obtaining good setup results. It is important that the following checks be made to both engines before proceeding with any actual system adjustments:

(1) Preparations

Check all fuel lines, instrument lines, and electrical connections for proper routing and security of fittings.

(a) Manifold Pressure Gauge Check

Perform the following check:

- 1 Disconnect the manifold pressure hose at the bulkhead fitting on the firewall for both the LH and RH engines.
- 2 Connect two lines from a "tee" fitting on a pressurized air source to the LH & RH bulkhead fittings on the firewall. **DO NOT EXCEED 40 INCHES OF MERCURY (ABSOLUTE).**
- 3 The maximum difference in the static readings on the LH and RH manifold pressure gauges shall not exceed 0.50 In. Hg.

(b) Fuel line purge

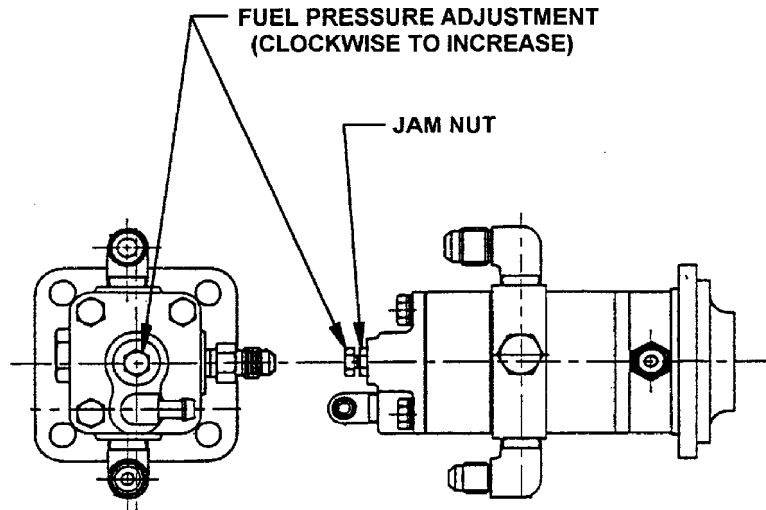
Disconnect the calibrated pressure gauge which was connected to the fuel line upstream of the servo on the previous test. Pump out approximately one quart of aviation fuel. Reconnect the fuel line to the fuel servo.

(2) Fuel pressure

(a) Emergency fuel pump operation check. Check the electric fuel pump as follows:

- 1 Install a calibrated fuel pressure gauge (range 0 to 75 psig) in the fuel line at the fuel flow transducer located just upstream of the inlet to fuel servo.
- 2 Using auxiliary power supplied to the aircraft such that the aircraft voltmeter shows 28.0 +.5, - .0 volts, engage the electric emergency fuel pump and verify that the "zero-flow" fuel pressure is between 44 and 60 psig. If the fuel pressure does not fall between these values, the pump must be replaced. There is no method of adjusting the fuel pump discharge pressure.
- 3 Disconnect external power from the aircraft.

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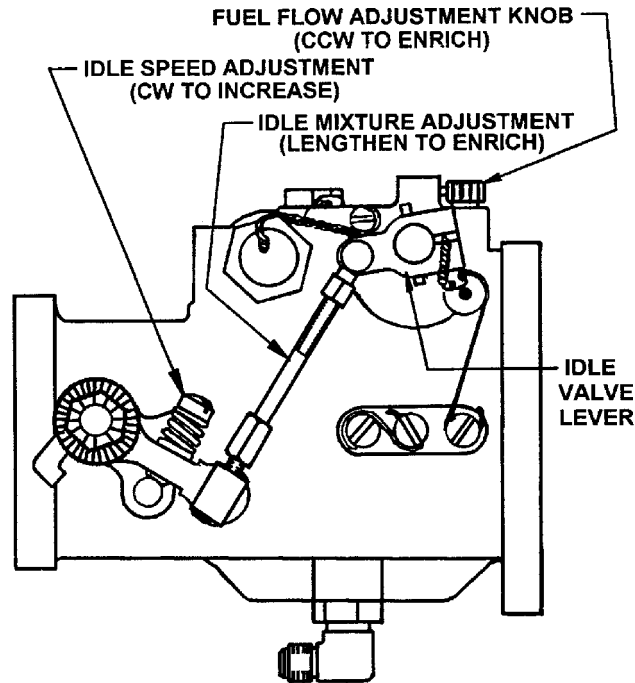
Fuel Pump Adjustment (Seneca V)
Figure 6

- (b) Engine driven fuel pump check. Check the engine driven fuel pump as follows:

With the engines operating at 2575 - 2600 rpm and 37.5 - 38.0 inches Hg. manifold pressure mixtures set to 24.0 to 25.5 gallons per hour, and the emergency fuel pumps in the off position, verify that the engine-driven fuel pump discharge pressure is set to 40 to 50 psig (measured between the fuel flow transducer and the fuel servo inlet). If the engine driven fuel pump pressure does not fall within this range, the fuel pressure may be adjusted by the following method:

- 1 Loosen "jam nut" (see Figure 6) on fuel pressure adjustment screw located on end of fuel pump.
- 2 Adjust screw clockwise to increase pressure or counter clockwise to decrease fuel pressure.
- 3 Repeat static run-up and readjust fuel pressure as required to obtain fuel pump discharge pressure of 40 to 50 psig.

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Fuel Servo Adjustment (*Seneca V*)
Figure 7

(3) Idle Performance (See Figure 7.)

(a) Idle Mixture

Check and adjust idle mixture as follows:

- 1 Operate the engine at 1500 to 1800 rpm until cylinder head temperatures are 250 °F to 350 °F and the oil temperature is 160 °F to 180 °F.
- 2 Reduce the engine speed and stabilize it at 775 ± 25 rpm.
- 3 Slowly, but positively, move the mixture control from full rich to idle cut-off. The engine speed shall increase 25 to 50 rpm before beginning to drop toward zero.
- 4 If the engine speed increase is less than 25 rpm, adjust the idle mixture adjustment to enrich the mixture. If the engine speed increase is more than 50 rpm, adjust the idle mixture to lean the mixture. The idle mixture adjustment is made by lengthening (richening) or shortening (leaning) of the linkage between the throttle lever and the idle valve lever. Recheck as required to ensure the idle mixture is adjusted within the limits specified above. Each time an adjustment is made, clear the engine by running it up to approximately 2000 rpm before making another mixture check.

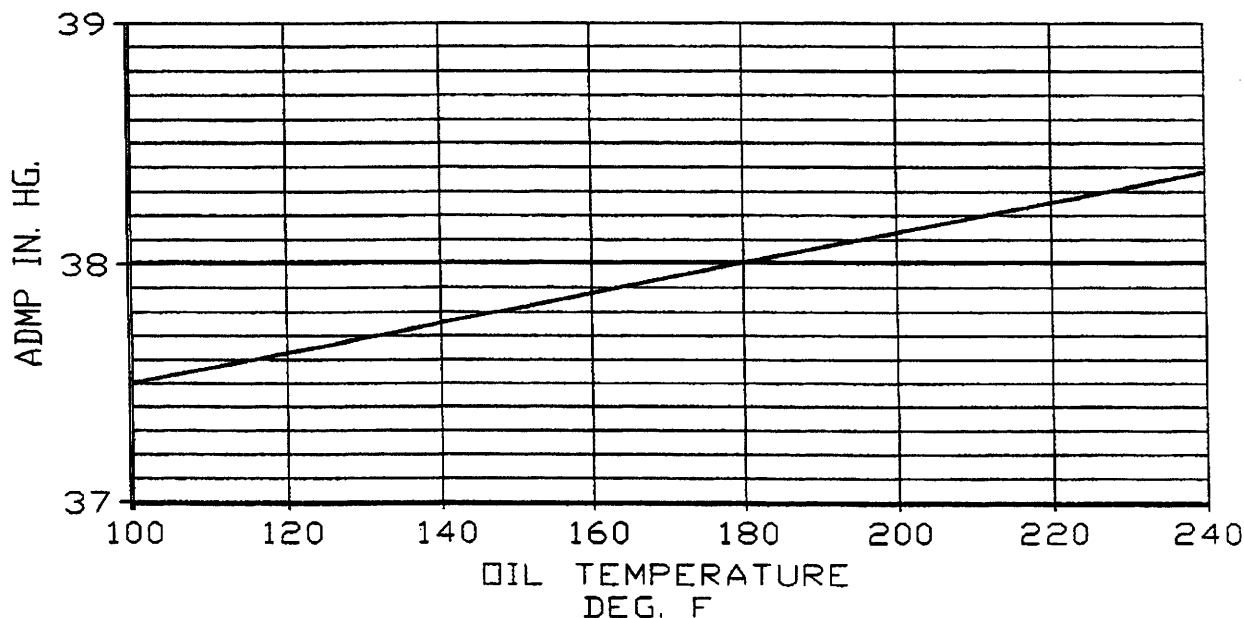
(b) Idle Speed

Check and adjust idle speed as follows:

- 1 Operate the engine at 1500 to 1800 rpm until cylinder head temperatures are 250 °F to 350 °F and the oil temperature is 160 °F to 180 °F.
- 2 Reduce the engine speed and stabilize it at 775 ± 25 rpm.
- 3 Adjust the idle speed screw located on the aft side of the throttle lever until contact is made with the throttle arm stop.

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CHART 4
MANIFOLD PRESSURE SETUP (SENECA V)



(4) Full Power Performance:

(PIR-PPS50026-6, Rev. C.)

Check and adjust full power performance as follows:

- With the aircraft pointed in the direction of the prevailing wind, run both engines at 1500 to 1800 rpm until the oil temperature is 160 °F to 180 °F.
- With the propeller controls set to 2575 - 2600 rpm (using a digital handheld tachometer), set the manifold pressure with the throttles in the full forward position to the value shown in Chart 4 (- 0.5, + 0.0 In. Hg.) by turning the wastegate actuator linkage clockwise (shortening) to decrease critical altitude and counter-clockwise (lengthening) to increase critical altitude. Re-install & secure cotter pin.

NOTE: 1 ½ turns = approximately 500 FT.

- Set up the propeller governor as follows: With the manifold pressure set to 38 inches of manifold pressure and the propeller controls in the full forward position, adjust the stop screw on the governor and associated rod end if necessary to obtain 2600 rpm (+0, -25 RPM).
- With the rpm set at 2575 - 2600 rpm and the manifold pressure set at 37.5 - 38.0 In. Hg. and the mixture controls in the full rich position adjust the fuel flows to 24.0 to 25.0 gallons per hour. The fuel flow can be adjusted by turning the adjustment knob located on the top left-hand side of the RSA-5 fuel servo (see Figure 7). Turning the knob in the clockwise direction will result in a decrease in fuel flow while turning the knob in the counter-clockwise direction will result in an increase in fuel flow. Seven "clicks" of the adjustment knob will result in a fuel flow change of approximately one gallon per hour. Do not exceed twenty "clicks" of adjustment counterclockwise measured from the fully engaged position.

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(5) Recheck

Recheck as follows:

- (a) Recheck idle settings as specified in Idle Performance, above, and adjust as required.
- (b) Recheck full power settings as specified in Full Power Performance, above, and adjust as required.

(6) Clean-up

After all ground checks and adjustments have been completed, check to ensure all lines which were disconnected during the setup have been reconnected and torqued to their appropriate values. Safety wire the mixture adjustment knob. Tighten "jam nut" on controller adjustment screw to prevent the screw setting from changing. Tighten "jam nut" on the engine driven fuel pump pressure adjustment screw.

(7) Flight Checks

Perform the following flight checks as follows:

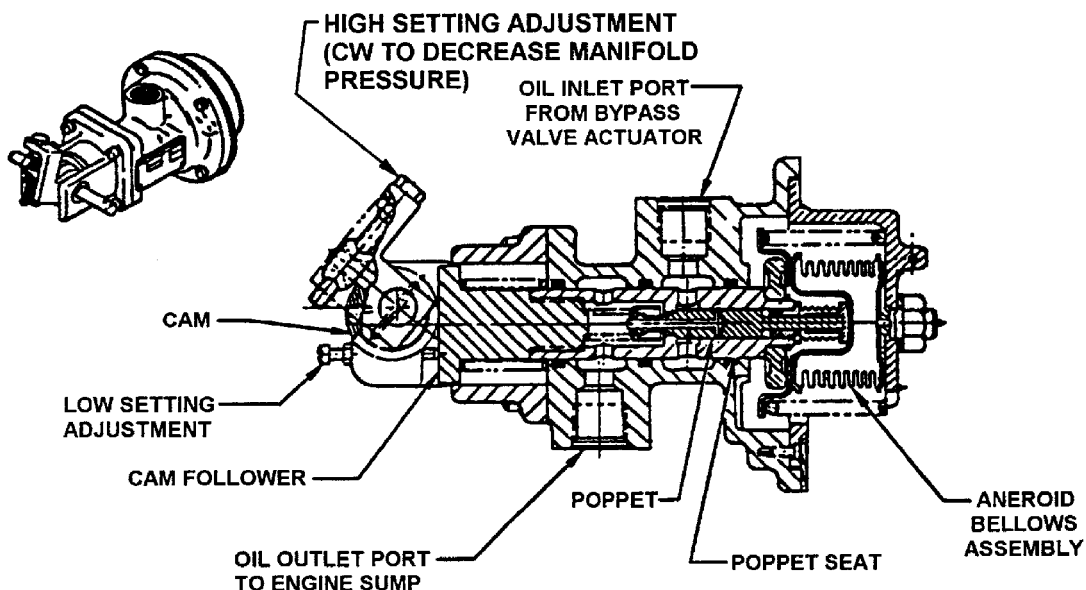
(a) Full Power Fuel Flow Check

Conduct a full power climb to critical altitude. The fuel flows shall fall within the limits specified in Chart 5.

NOTE: The maximum "split" between the LH and RH engines is not to exceed 1.0 GPH.

(b) Critical Altitude Check (See Figure 8 and Chart 5.)

The critical altitude for the left and right engines must be at least 19,500 ft (density) and may be adjusted down to meet the critical altitude of the lower engine. The "split" between the LH & RH engines shall be no more than 1500 ft. The engine with the higher critical altitude shall be adjusted down to meet the lower engine. The critical altitude may be adjusted by turning the high setting adjustment screw counterclockwise to increase manifold pressure or clockwise to decrease manifold pressure. One turn of the adjustment screw is approximately 1.0 In. Hg.

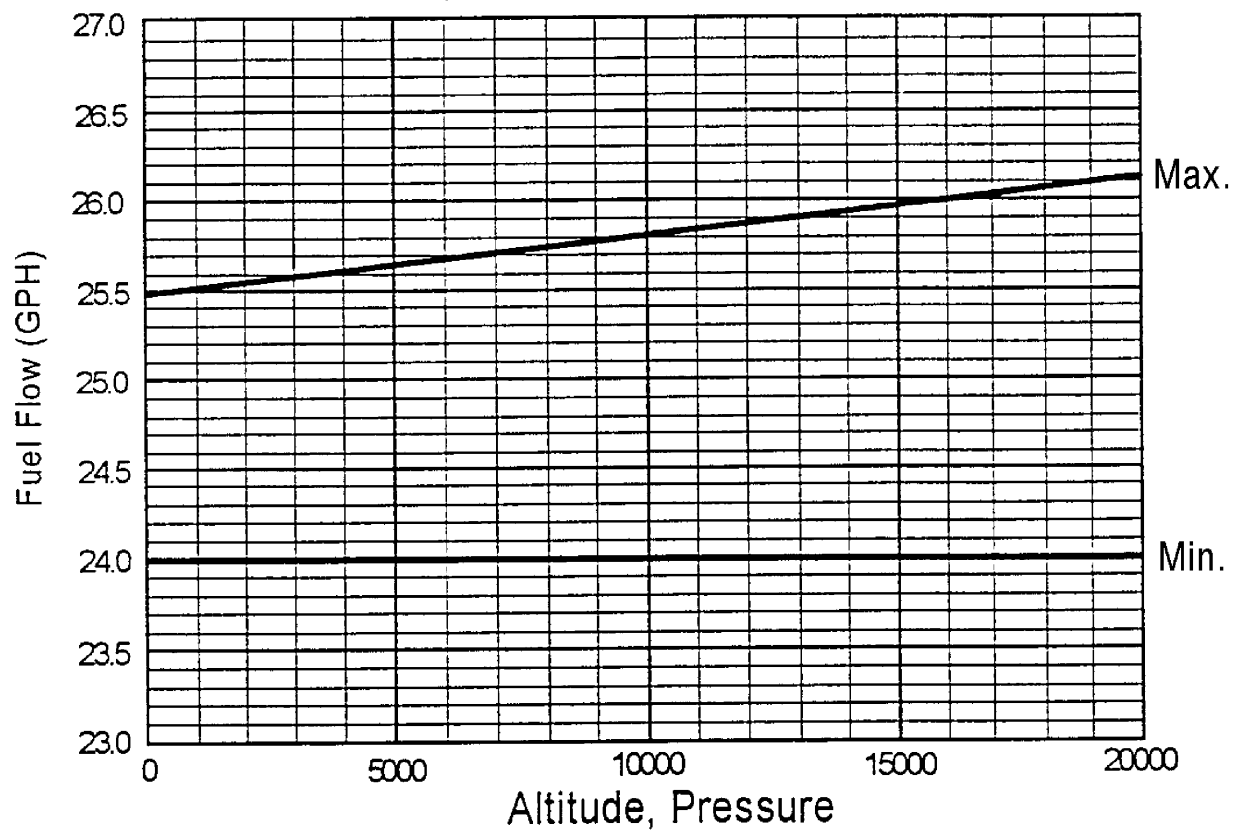


Controller Adjustment (Seneca V)
Figure 8

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CHART 5
FUEL FLOW VS. PRESSURE ALTITUDE (SENECA V)

38 In. Hg. MAP, 2600 RPM, Full Rich



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CHAPTER

77

ENGINE INDICATING

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CHAPTER 77 - ENGINE INDICATING

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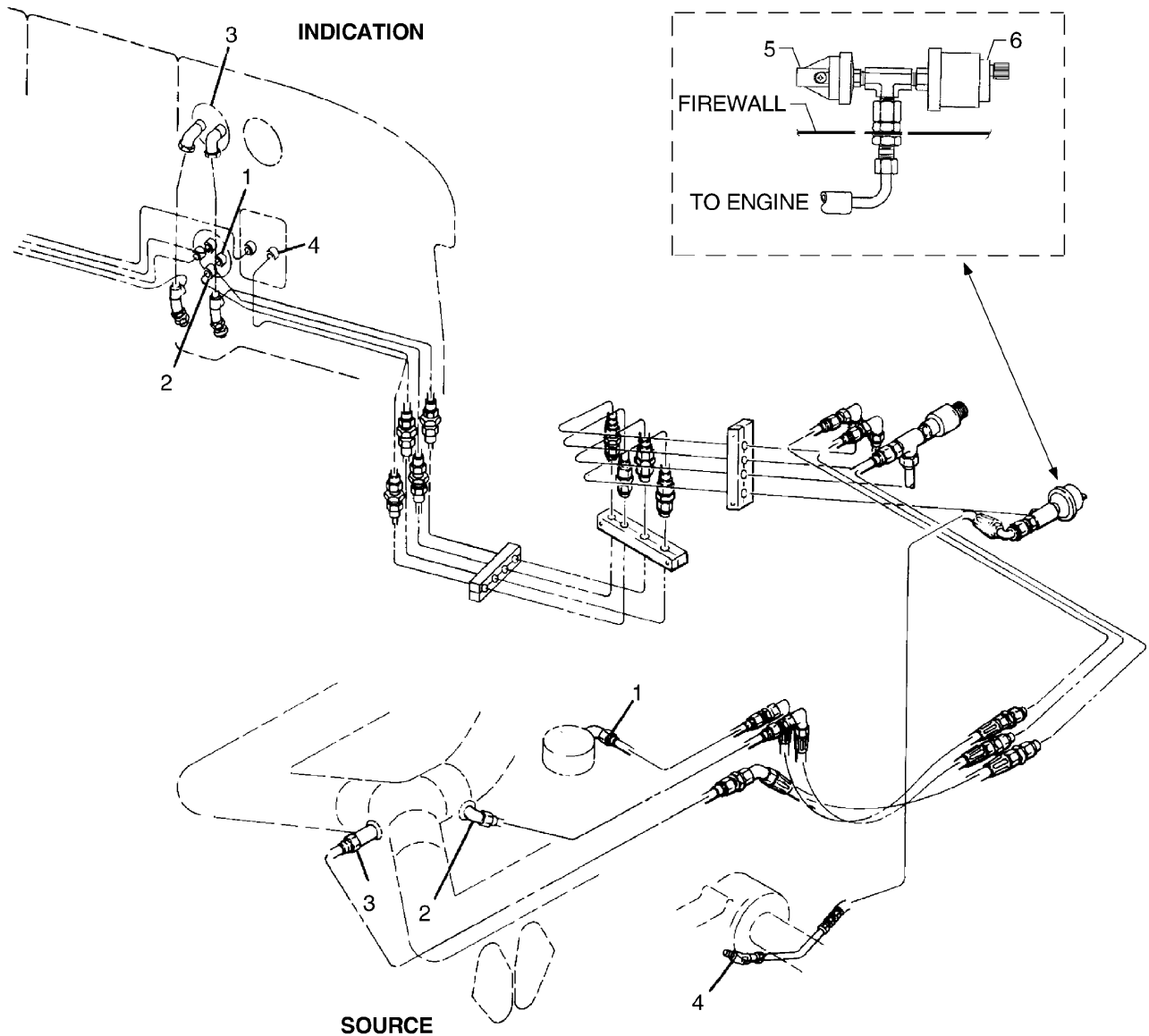
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GENERAL

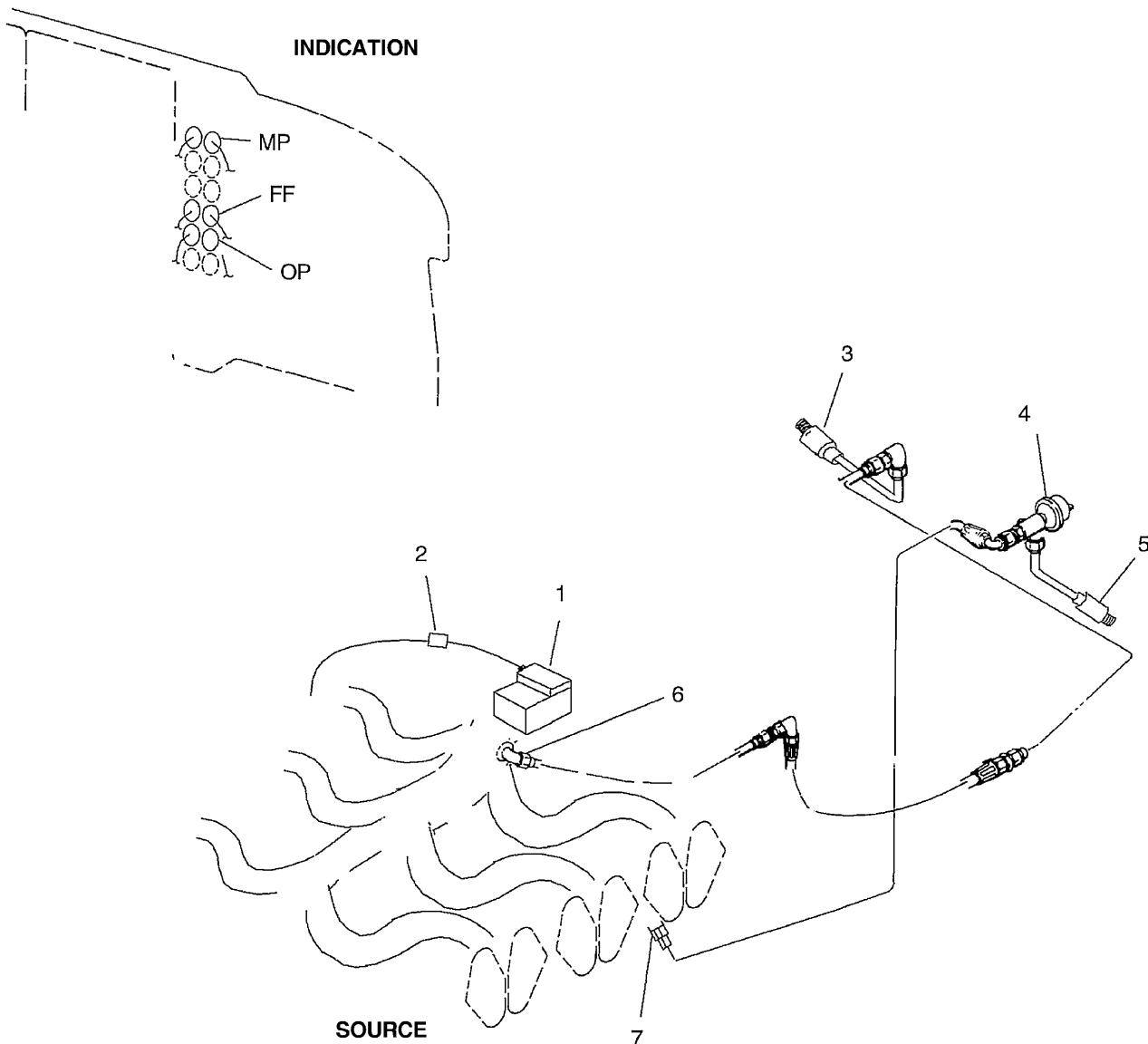


1. FUEL FLOW PRESSURE
2. FUEL FLOW VENT
3. MANIFOLD PRESSURE
4. OIL PRESSURE
5. SWITCH, OIL PRESSURE
6. SENDER, OIL PRESSURE

Engine Instrument Lines Installation
Figure 1 (Sheet 1 of 2)

[Effectivity](#)
[Seneca IV](#)

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1. RSA FUEL SERVO
2. TRANSDUCER, FUEL FLOW PRESSURE
3. TRANSDUCER, MANIFOLD PRESSURE
4. SWITCH, OIL PRESSURE
5. TRANSDUCER, OIL PRESSURE
6. MANIFOLD AIR FITTING
7. OIL GALLERY FITTING

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POWER

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1. Manifold Pressure Gauge (**Seneca IV**)

NOTE: For information on the manifold pressure gauge installed in Seneca V models, see 77-40-00.

A. Description

The dual manifold pressure gauge is a vapor proof, absolute pressure type instrument, calibrated from 10 to 50 inches of mercury. Incorporated in the gauge are switches that complete the annunciator panel circuit whenever engine manifold pressure exceeds 39.5 inches of mercury. The manifold pressure lines have drain valves located behind and below the fuel manifold pressure gauge. This allows any moisture which may have collected from condensation to be pulled into the engines. This is accomplished by depressing the two valves for 5 seconds while operating the engines at 1000 rpm.

NOTE: Do not depress the valves when manifold pressure exceeds 20 inches Hg.

B. Troubleshooting

See Chart 1.

**CHART 1
TROUBLESHOOTING MANIFOLD PRESSURE INDICATOR (**SENECA IV**)**

Trouble	Cause	Remedy
Excessive error at existing barometric pressure.	Pointer shifted.	Replace instrument.
Excessive error when engine is running.	Line leaking.	Tighten line connections.
Sluggish or jerky pointer movement.	Defective instrument.	Replace instrument.
Dull or discolored marking.	Age.	Replace instrument.
Incorrect reading.	Moisture or oil in line.	Depress line valves and/or disconnect lines at instrument and blow out.

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2. Tachometer (Seneca IV) (Refer to Figure 2.)

NOTE: For information on the tachometer installed in Seneca V models, see Figure 2 and 77-40-00.

A. Description

The electric tachometer system makes use of two tachometer generators (one on each engine) and a dual tachometer indicator. Each generator is mounted to the tachometer drive pad of the respective engine's accessory section. The generators are electrically interconnected with the tachometer secured to the instrument panel in the column of engine instruments.

The system functions through the reaction of the engine operating its tachometer generator. As the generator is activated by the engine, a pulse pattern (based on "4" pulses for each revolution of the generator) is sent to the tachometer which reacts to the incoming signals to indicate the engine rpm.

B. Troubleshooting

See Chart 2.

C. Removal and Installation

The tachometer is mounted to the instrument panel just below the dual manifold pressure gauge in the column of engine instruments.

- (1) Disconnect harness from back of instrument.
- (2) Support the instrument and remove the four retaining screws.
- (3) Withdraw the instrument. Install using the reverse order.

D. Tachometer Generator (Refer to Figure 2.)

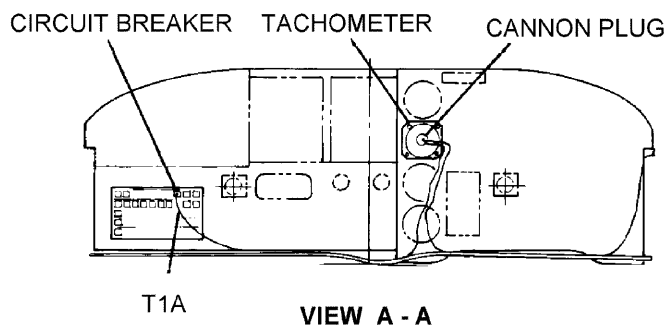
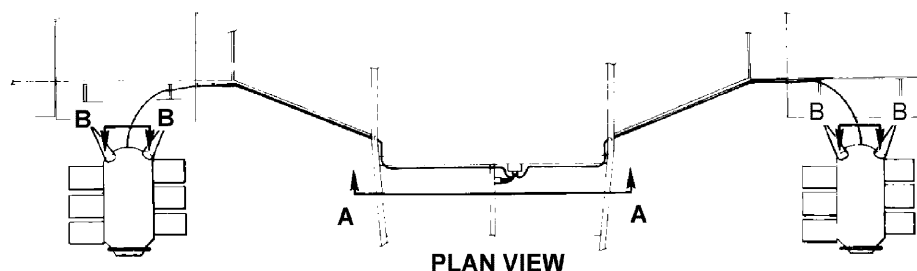
Removal and Installation

- (1) Remove the left and right cowl panels and upper support panel.
- (2) Locate the unit and follow the leads back to the connection and separate the connector.
- (3) Remove safety wire and unscrew the unit from the tachometer drive. Install using the reverse order.

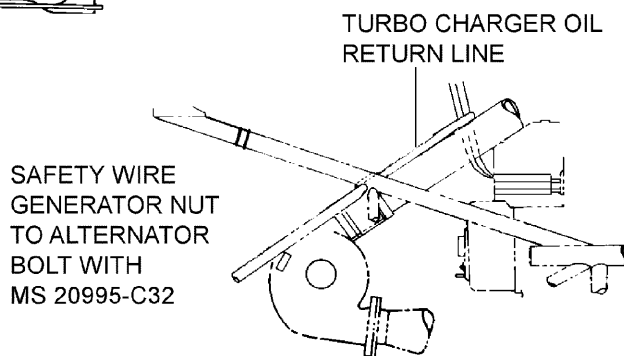
**CHART 2
TROUBLESHOOTING TACHOMETER (SENECA IV)**

Trouble	Cause	Remedy
Both pointers inoperative.	Circuit breaker tripped.	Reset.
One pointer inoperative.	Defective generator.	Replace generator.
One pointer inaccurate. indicator.	Defective indicator.	Replace tachometer
<p>CAUTION: THE ADJUSTMENTS WITHIN THE TACHOMETER INDICATOR MUST BE MADE ONLY BY A QUALIFIED INSTRUMENT REPAIR FACILITY.</p> <p>NOTE: With a tachometer generator removed from the engine, and electrical power applied, spinning the shaft with fingers should cause the pointer to deflect. This generally proves out the wiring. The tachometer generators receive an excitation voltage from the indicator.</p> <p>The generators can be exchanged from one engine to the other for troubleshooting.</p>		

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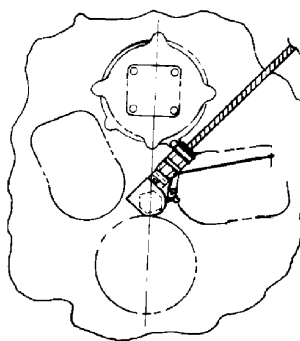


-- NOTE --
See Chapter 91 for
Electrical Schematic



TO CHECK CALIBRATION, SET GENERATOR
AND READ TACHOMETER AS SHOWN.

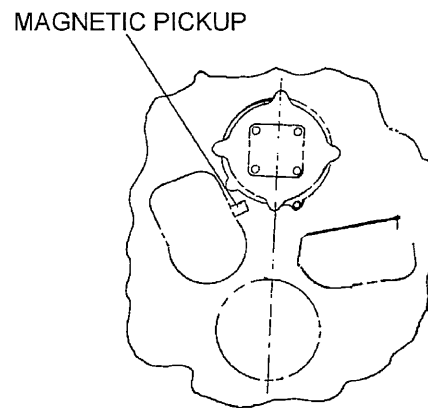
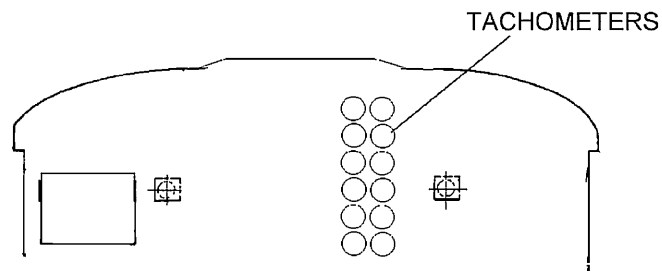
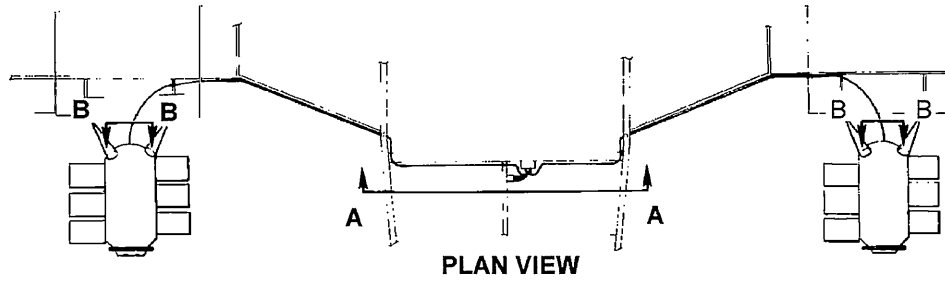
TACH. INDICATOR (RPM)	TACH. GENERATOR (RPM)
500 \pm 50	619
1000 \pm 50	1238
1500 \pm 50	1856
2000 \pm 25	2475
2500 \pm 25	3094
2600 \pm 25	3218
2800 \pm 25	3465
3000 \pm 25	3713
3500 \pm 50	4331



Tachometer Installation
Figure 1 (Sheet 1 of 2)

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-- NOTE --
See Chapter 91 for
Electrical Schematic

Tachometer Installation
Figure 1 (Sheet 2 of 2)

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TEMPERATURE

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NOTE: Seneca V models incorporate a Turbine Inlet Temperature (TIT) gauge. For information on the TIT gauge installed in Seneca V models, see 77-40-00.

1. Exhaust Gas Temperature (EGT) Gauge and Probes (Seneca IV)

A. Description

This instrument, which is commonly referred to as EGT, is used to aid the pilot in setting the economical fuel-air mixture for cruising flight at a power setting of 75% or less. It is a sensing device to monitor the temperature of exhaust gases leaving the engine cylinders. If it is found defective after checking with troubleshooting chart, it should be replaced. If the leads to the gauge are defective in any way, they must be replaced. When replacing leads, it is necessary to use the same type and length of wire, because the resistance of the leads is critical for the proper operation of this gauge.

B. Troubleshooting

See Chart 1.

C. Removal

- (1) Disconnect wires from the EGT gauge at the instrument panel.
- (2) Remove four bolts which secure the gauge to the instrument panel and remove the gauge.
- (3) Remove wires from the wire harness going to the engine.
- (4) Loosen the nut which secures the EGT probe to the exhaust transition area of the exhaust system, and remove the probe.

D. Installation

- (1) Install the probe into the hole in the transition area of the exhaust system, and secure with locknut.
- (2) Route thermocouple wires along with the existing wire harness to the instrument panel.
- (3) Install the EGT gauge into the instrument panel, and secure with four bolts.
- (4) Connect the thermocouple wires to the rear of the EGT gauge.

E. Cleaning and Inspection

Unless mechanical damage is evident such as broken glass, bent or broken pointer, or broken case, the following checks should be performed before removing the instrument:

CAUTION: DO NOT CONNECT OHMMETER ACROSS METER; IT WILL BURN OUT THE MOVEMENT OF THE METER.

- (1) Remove probe from exhaust transition area and check for broken weld (at tip end) or burnt off end. Measured resistance of probe should be .8 ohms. Clean the connections with steel wool before reassembly.
- (2) Disconnect lead wires at instrument. Resistance with lead wires connected to probe should be 3.3 ohms. Clean connections with steel wool before reassembly.
- (3) With leads connected to instrument, heat probe with propane torch to dull red. The meter should read up to the fourth graduation or approximately 1500°F. If meter still does not read, replace it. Adjustments should be made by qualified shop.

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**CHART 1
TROUBLESHOOTING EXHAUST GAS TEMPERATURE GAUGE (SENECA IV)**

Trouble	Cause	Remedy
Gauge inoperative.	Defective gauge, probe or wiring.	Check probe and lead wires for chafing, breaks or shorting between wires and/or metal structure.
	Adjusting potentiometer turned off scale.	Reset potentiometer.
Fluctuating reading.	Loose, frayed or broken electrical leads or faulty connections.	Clean and tighten connections. Repair or replace defective leads.

2. Cylinder Head Temperature (CHT) Gauge (Seneca IV)

NOTE: For information on the Cylinder Head Temperature (CHT) gauge installed in Seneca V models, see 77-40-00.

A. Description

The cylinder head temperature gauge is part of the combination engine gauge which also includes the oil temperature gauge and the oil pressure gauge. Each cylinder head temperature gauge measures the cylinder head temperature using a sender located in a cylinder head. The cylinder head used is determined by the engine manufacturer. This gauge is an electrical instrument and is wired through the instrument's circuit breaker.

B. Troubleshooting

See Chart 2.

**CHART 2
TROUBLESHOOTING CYLINDER HEAD TEMPERATURE GAUGE (SENECA IV)**

Trouble	Cause	Remedy
Instrument shows no	Engine is cold. indication.	Warm up engine.
	Power supply wire open.	Repair wire.
	Defective sender.	Replace sender.
	Defective instrument.	Replace instrument.
	Open circuit breaker.	Troubleshoot for fault.
Instrument goes all the way to upper stop.	Wire grounded between sender and gauge.	Repair wire.
	Defective sender.	Replace sender.

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INTEGRATED ENGINE INSTRUMENT SYSTEMS

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CAUTION: STATIC SENSITIVE DEVICES, HANDLE ONLY AT STATIC SAFE WORK STATIONS.

NOTE: This section applies exclusively to the Seneca V.

1. Description

A. Engine Instrument and Digital Display Monitoring Panel (DDMP) (See Figure 1.)

The Engine Instrument and Digital Display Monitoring Panel (DDMP) form a complete state of the art engine monitoring system. Each analog instrument accepts signals from a variety of engine sensors. The DDMP communicates with each instrument via a digital interface, constantly receiving data regarding the status of each instrument parameter. In addition, the DDMP receives data directly from sensors that monitor Outside Air Temperature, Cabin Air Temperature, Electrical System Parameters, and Cabin Static Pressure. The DDMP provides a digital readout of each parameter, continually monitors for out of range (exceedance) conditions, and utilizes the data provided for auxiliary functions including Fuel Management and Engine Percent Power Calculations.

B. Avidyne Multi-Function Display (MFD) (Optional)

For those airplanes equipped with the Avidyne FlightMax Entegra Electronic Flight Information System (EFIS), the Multi-Function Display (MFD) provides all engine instrumentation. See the Pilot's Operating Handbook (POH) Supplement and 34-20-00, Electronic Flight Information System (EFIS) - Avidyne Option, for more information.

2. Troubleshooting

A. Engine Instrument and Digital Display Monitoring Panel (DDMP)

See Charts 1 and 2.

B. Avidyne Multi-Function Display (MFD) (Optional)

See 34-20-00, Electronic Flight Information System (EFIS) - Avidyne Option, Maintenance.

3. Analog Instruments

The system uses conventional two (2) inch round engine instruments with either a single or dual pointer configuration. Instrument readings are displayed using a familiar rotating pointer against a fixed scale plate. An in-line pointer configuration is provided to minimize parallax and maximize viewing angle.

A. Instrument Self Test

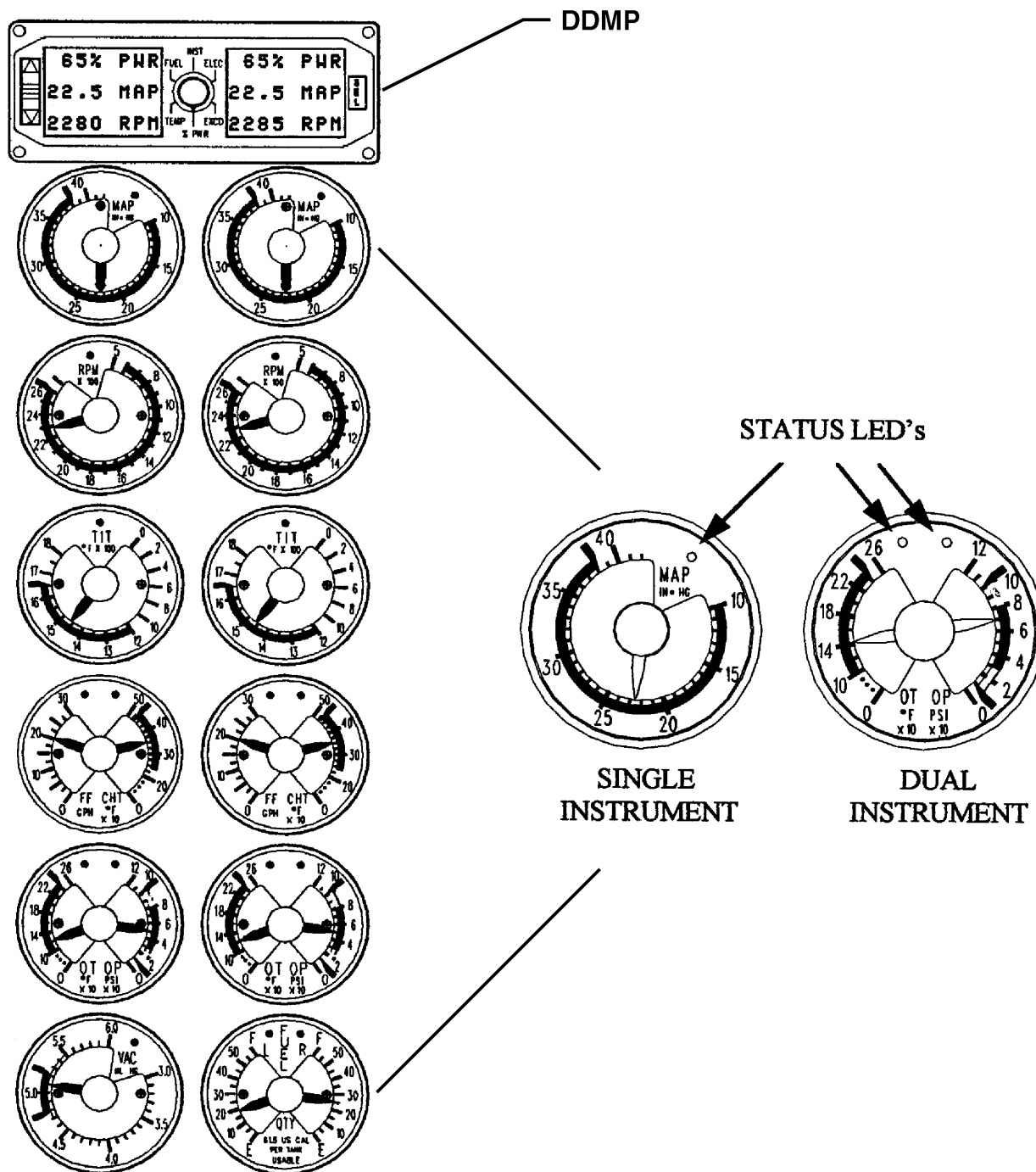
Each instrument is microprocessor based and performs a power on self test, a continuous self test, and a continuous sensor validity test. A two color (green/red) status LED is provided for each instrument. Upon initial power up, each instrument performs a power on self test. During this test, and prior to assuming normal operation, the status LED glows red then green and the pointer is driven to the full scale position, followed by the off scale zero position. The alarm audible alert is energized for one second at the end of the power on test.

B. Instrument Status LED

The status LED provides an instant indication of the instrument status as follows:

- (1) No LED Indication: Instrument is functioning normally. (If pointer is parked off scale low, no power to instrument)

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Engine Instrument & Digital Display Monitoring Panel
Figure 1

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- (2) Green LED glows constantly: The instrument is being displayed in digital form on the DDMP.
- (3) Red LED glows constantly: The parameter being measured is in an exceedance condition. (An Alarm Message is also displayed on the DDMP. See DDMP: Alarm Mode)
- (4) Red LED flashes quickly (4 times per second): The input sensor has failed, or is providing erroneous information.
- (5) Red LED flashes slowly (2 times per second): Self Test has identified a problem within the instrument. Instrument Failure.

CHART 1 (SENECA V)
TROUBLESHOOTING ENGINE INSTRUMENT AND
DIGITAL DISPLAY MONITORING PANEL (DDMP)

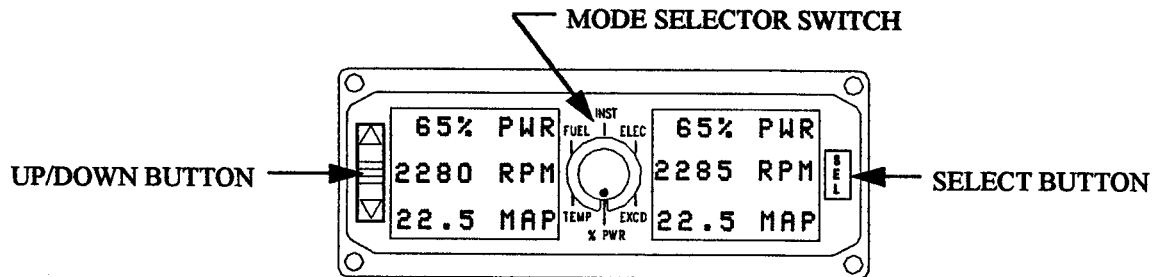
Symptom	Solution
Red LED Flashing on Instrument (4 times per second)	<ul style="list-style-type: none"> Input sensor providing erroneous information. Check input sensor.
Red LED Flashing on Instrument (2 times per second)	<ul style="list-style-type: none"> Self test has determined problem within the instrument. Cycle power and check if instrument resets.
Instrument pointer parked off scale	<ul style="list-style-type: none"> No status LED. Instrument not receiving power. Check power connection and circuit breakers. Cycle power to determine if instrument self test is initiated. Red LED flashing 4 times per second. Input-sensor providing erroneous information. Check input sensor. Red LED flashing 2 times per second. Self test has determined problem within the instrument. Cycle power and check if instrument resets.
"----" appears on DDMP display in Temperature or Electrical Mode	<ul style="list-style-type: none"> Check sensor inputs
"----" appears on DDMP display in Instrument Mode	<ul style="list-style-type: none"> Indicates Sensor, Instrument, or Communications Failure. Use status LED on Instrument to determine cause and verify as described above. If status LED is off, and instrument appears to be operating properly, Run Self Test to check communications.
"----" appears on DDMP in % Power Mode	<ul style="list-style-type: none"> If weight on wheels, DDMP functioning properly Check MAP, RPM and Fuel Flow Instruments for proper operation. Check communications using Self Test Check Pressure Altitude in the DDMP Maintenance Mode. Check OAT display in Temperature Mode
"----" appears on DDMP in Fuel Mode	<ul style="list-style-type: none"> Verify a valid file load was entered. Check Fuel Flow Instrument for proper operation. Check communications using Self Test. Check GPS Input
Instrument Fail message on DDMP following Power On Self Test. i.e "LT RPM FAIL"	<ul style="list-style-type: none"> Verify power to instrument. Check connection between Instrument and DDMP Run self test from Maintenance Mode

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**CHART 2
DDMP ERROR DECODER**

“Error Code” Reason
<p>“Error Showing Exceed Press SEL to Continue”</p> <p>Might show up in exceedance mode if there is a problem reading the EEPROM. Try deleting exceedances through the aux. Comm port to reset the state of the EEPROM.</p> <p>“Commun Error Err 256”</p> <p>There was bad communication between the DDMP and the Instrument during calibration. Check the connection between the two.</p> <p>“Data Not Valid Err 512”</p> <p>The instrument data was invalidated by the DDMP. Instrument and sensor failures can invalidate data. Old data eventually is marked as invalid. Check that the input to the instrument and connection to the DDMP are working.</p> <p>“Non-Valid Index Err 8”</p> <p>The instrument was asked to calibrate to a point for which it cannot. For example, if a Seneca DDMP is mistakenly being used to calibrate a Saratoga fuel gauge - the Saratoga instrument cannot calibrate 61 gallons.</p> <p>“Write Fail Bit Err 16”</p> <p>There was an error in the instrument’s attempt to write to it’s own EEPROM.</p> <p>“Command Disabled Err 128”</p> <p>The command the instrument was asked to perform is disabled.</p> <p>“Sensor Overflow Err 2”</p> <p>The raw sensor input is causing an overflow. The sensor signal is carefully offset and scaled in the instrument; check for correct input to the instrument.</p>
<p>There are a few messages indicating that the available range of trim for Fuel Quantity, MAP, TIT, either null or span has been exceeded. Check that the input to the instrument is correct for the adjustment being made.</p>
<p>“DDMP FAIL OP SYS SHUTDOWN CODE 1”</p> <p>This appears only if the OS attempts to interrupt itself. This could happen if a periodic timer value was corrupted (and as a result ran too fast) or the task that is running is taking too long to complete its job. This is a protection against non-terminating loops in the task code.</p> <p>“DDMP FAIL OP SYS SHUTDOWN CODE 2”</p> <p>This message appears when a task has been “blocked” too long. The OS has a prioritization scheme built in which selects the most important task waiting to be run and the runs it. If a lot of high priority task requests happen they could conceivably preempt a lower priority task from running. The system is designed for this not to happen but this message is the result of the “catch-all” code to deal with this occurrence, should it arise.</p> <p>To summarize, the two Op Sys Shutdown messages (above) are indications of some kind of software timing problem; either a piece of software is taking too long to execute (CODE 1) or waiting too long to be executed (CODE 2).</p>

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Digital Display Monitoring Panel (DDMP)
Figure 2

4. Digital Display Monitoring Panel (DDMP)

The DDMP continuously monitors each analog instrument via a digital communications link. Direct sensor inputs are provided for Outside Air Temperature, Cabin Air Temperature, Electrical System Inputs, and Cabin Static Pressure. A Global Positioning System input allows the DDMP to communicate with the aircraft GPS system to provide enhanced fuel management capabilities. The DDMP operates in one of six operating modes as explained below, and continuously monitors for exceedance conditions in the background. In the event that an exceedance condition is detected, an exceedance message will temporarily override the display of the selected mode of operation.

A. Self Test

Upon power on, the DDMP will perform an internal self test, and will test communications with each of the instruments. If failure codes are displayed, or the system does not appear to be functioning properly, see the error codes, and instructions on initiating a self test from a power on state.

B. DDMP Controls

The operating mode of the DDMP is selected using the rotary Mode Selector Switch located at the center of the instrument. Within a given mode, a cursor ">" is moved throughout different display locations to provide an easy to understand user interface. The Up, Down and Select Buttons are used in a multi-function manner as described in the following sections.

C. Alarm Mode

The DDMP goes into the Alarm Mode if an exceedance or instrument failure is detected. In the Alarm Mode, the alarm overrides the current DDMP display and a display similar to one of the ones illustrated in Figure 3 is shown.


The instrument will be identified on the side of the DDMP corresponding with right or left instrument failure.

To return to normal operation, press the SELECT Button to acknowledge the alarm. The DDMP will return to normal operation, and will not return to the ALARM MODE unless a new exceedance is detected. If an exceedance is still occurring when it is acknowledged, the Red LED will continue to glow on the instrument in exceedance, the DDMP will continue to record the exceedance, but no Alarm Message will appear on the DDMP until a new alarm condition occurs. To view the current exceedance on the DDMP, simply turn the Mode Selector Switch to "EXCD" (See DDMP: EXCEEDANCE MODE).


See Chart 3 for possible alarm conditions.

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INSTRUMENT FAILURE

ALARM SELECT MAP FAIL		MODE TO ACK
---------------------------------------	---	-------------------------

EXCEEDANCE CONDITION

ALARM SELECT 41 MAP		MODE TO ACK
-------------------------------------	---	-------------------------

Instrument Failure/Exceedance Condition
Figure 3

**CHART 3
DDMP ALARM MODES**

CONDITION	VISUAL ALARM	AUDIBLE ALARM
Instrument Exceedance	DDMP Display Red LED Glows on Instrument	Horn until acknowledged
DDMP Exceedance	DDMP Display	Horn for 3 seconds
Instrument Failure	DDMP Display Red LED flashes twice per second on instrument	Horn for 3 seconds
Sensor failure	DDMP Display Red LED flashes four times second on instrument	Horn for 3 seconds

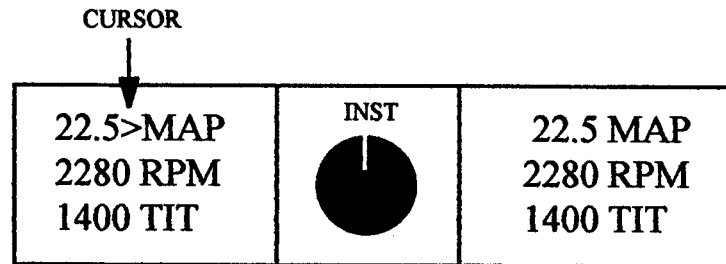
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D. Instrument Mode

In the Instrument Mode, each of the DDMP's two displays can be setup to display any three of the analog instrument values in a digital form. The left hand DDMP display can display any three of the instruments in the left column of instruments, plus the Left Fuel Quantity. The right hand DDMP display can display any three of the instruments in the right column of instruments, except for the Left Fuel Quantity.

To use the Instrument Mode, turn the Mode Selector Switch to "INST". On initial power up, the DDMP will default to the screen shown in Figure 4.

To change the configuration, use the SELECT Button to move the cursor to the location of the display you wish to modify. Press the UP or DOWN Buttons to scroll through the options for that display. Continue as above to select the configuration for the remaining five displays as desired. After completing your configuration, the DDMP will default to that configuration until power is turned off.

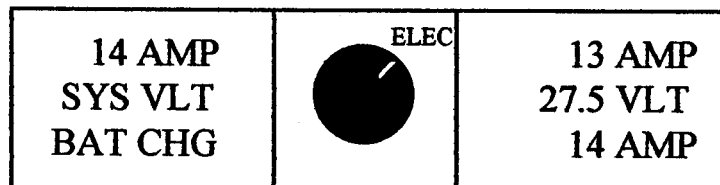


Instrument Mode
Figure 4

E. Electrical Mode

In the Electrical Mode, the DDMP displays System Voltage, Left Alternator Current, Right Alternator Current, and Battery Charge Current. To access the Electrical Mode, turn the Mode Selector Switch to "ELEC". The display shown in Figure 5 will appear.

NOTE: A special maintenance mode is accessed from the Electrical Mode using a button sequence password. The UP, DOWN, and SELECT Buttons serve no other purpose in the electrical mode. If a button is inadvertently pressed, an error message "INVALID KEY SEQUENCE SEL TO CONTINUE" will appear. Press SELECT to continue.



Electrical Mode
Figure 5

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F. Exceedance Mode

Each instrument continually monitors its input for out of limit, or exceedance conditions, and alerts the DDMP to such conditions. Over 200 exceedance events are stored in the DDMP memory. The exceedance mode is used to view and/or delete the exceedances that are stored in memory.

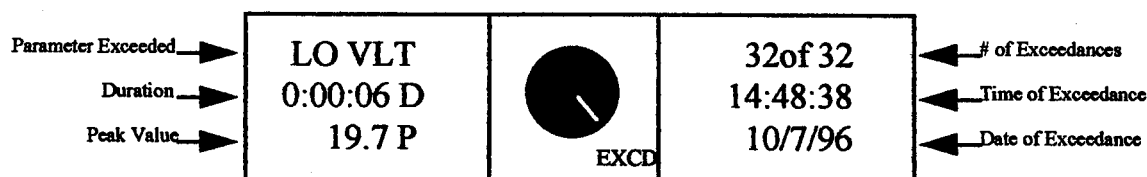
To view exceedances, turn the Mode Selector Switch to "EXCD". The DDMP automatically defaults to the most recent or current exceedance. A display similar to that shown in Figure 6 will appear.

To view additional exceedances, use the UP or DOWN Buttons to scroll through the exceedances stored in memory.

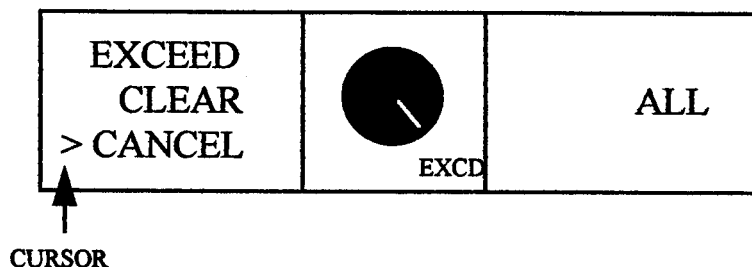
To delete exceedances, press the SELECT Button and the screen shown in Figure 7 appears.

Press the UP Button to move the cursor to CLEAR ALL and press SELECT to delete all exceedances. Move the cursor back to the CANCEL Position if you decide not to delete all exceedances.

After SELECT is pressed, the DDMP will default back to the original exceedance screen. If the exceedances were deleted, the message NO EXCEEDS will appear, otherwise the original exceedance screen will appear.



Exceedance Mode
Figure 6



Exceedance Mode
Figure 7

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The following abbreviations are used in the Exceedance Mode:

LO VLT	Low System Voltage
HI VLT	High System Voltage
LT MAP	High Left Manifold Pressure
RT MAP	High Right Manifold Pressure
LT RPM	High Left RPM
RT RPM	High Right RPM
LT TIT	High Left Turbine Inlet Temperature
RT TIT	High Right Turbine Inlet Temperature
LT CHT	High Left Cylinder Head Temperature
RT CHT	High Right Cylinder Head Temperature
LT OT	High Left Oil Temperature
RT OT	High Right Oil Temperature
LT LOP	Low Left Oil Pressure
RT LOP	Low Right Oil Pressure
LT HOP	High Left Oil Pressure
RT HOP	High Right Oil Pressure
LO VAC	Low Vacuum
HI VAC	High Vacuum
LFQ	Low Left Fuel Quantity
RFQ	Low Right Fuel Quantity

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G. Percent Power Mode

The DDMP displays the current Percent Power in 5% increments, and makes recommendations of desired MAP and Fuel Flow settings based on the current RPM to achieve the pilot's desired power setting.

To display the current Percent Power, turn the Mode Selector Switch to "% PWR. A display similar to that shown in Figure 8 will appear.

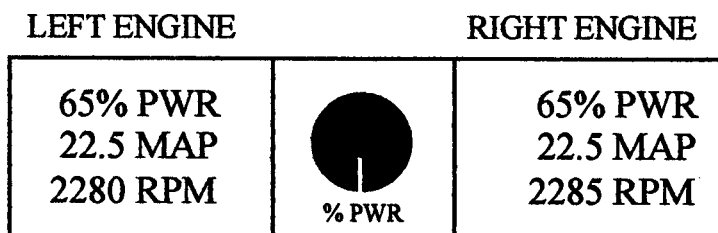
To estimate new engine settings for a given % Power, press the SELECT Button. The DDMP rounds the current settings to the nearest 5% Power and displays as shown in Figure 9.

Press the UP or DOWN Button to change the % Power setting and the DDMP estimates new MAP and FF settings for the desired % Power and current RPM.

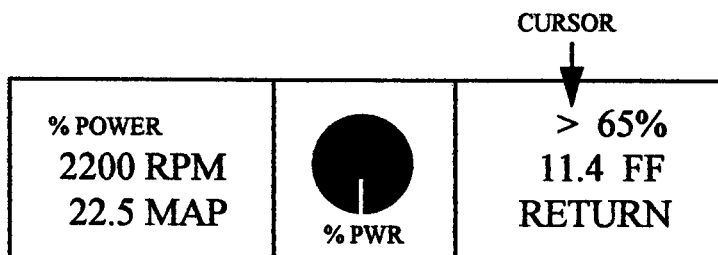
If the selected % Power is not obtainable at the current RPM setting, the DDMP will change the RPM to the nearest value within the range of the desired % Power. To select a new RPM value, press the SELECT Button to move the cursor to the RPM position. Using the UP or DOWN Button, select the desired value.

Adjust the engine MAP and FF settings to the recommended values and press SELECT two more times to return to the actual % Power screen.

The Percent Power function is only enabled when the aircraft is airborne. If the Percent Power Mode is entered while on the ground, or if an attempt is made to calculate estimated engine settings based on a combination of Fuel Flow, RPM, MAP, and Static Pressure values that are out of range, "----" will appear on the display.



Percent Power Mode
Figure 8



Percent Power Mode
Figure 9

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H. Temperature Mode

In the Temperature Mode, the DDMP displays Outside Air Temperature and Cabin Air Temperature. Turn the Mode Selector Switch to "TEMP" and the display shown in Figure 10 appears.

Press the SELECT Button to toggle between Degrees Fahrenheit and Degrees Celsius.

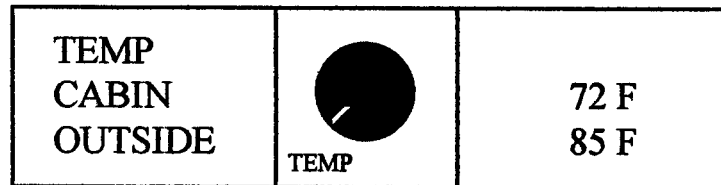
I. Fuel Mode

In the Fuel Mode the DDMP interfaces with the aircraft's Global Positioning System to calculate and display Flight Endurance, Fuel Remaining, Fuel Used, Nautical Miles Per Gallon, Estimated Fuel Required to Destination, and Estimated Fuel Remaining at Destination.

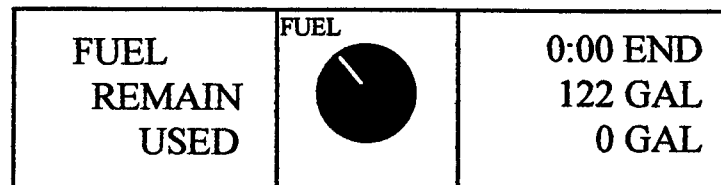
CAUTION: ALL OF THE FUEL CALCULATIONS ARE BASED ON THE PILOT MANUALLY ENTERING THE PROPER FUEL LOAD AFTER REFUELING. A MANUAL FUEL LOAD MUST BE ENTERED INTO THE DDMP FOR THE FUEL MODE TO FUNCTION PROPERLY. THERE IS NO CONSISTENCY CHECKING BETWEEN THE ENTERED FUEL LOAD AND THE ACTUAL FUEL QUANTITY.

After entering the fuel load, the DDMP performs all fuel calculation based on information from the Fuel Flow Instrument.

To enter the Fuel Mode, turn the Mode Selector Switch to "FUEL". The screen shown in Figure 11 will be displayed. Pressing SELECT will cycle the view to the next screen as shown in Figures 12 and 13.




Temperature Mode
Figure 10




Fuel Mode
Figure 11

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FUEL TO DEST AT DEST	FUEL 	9 M/G 82 GAL 40 GAL
----------------------------	---	---------------------------

Fuel Mode
Figure 12

FUEL FULL PARTIAL	FUEL 	LOAD > CANCEL
-------------------------	---	------------------

↑
CURSOR

Fuel Mode
Figure 13

FUEL CONFIRM YES	FUEL 	LOAD > NO
------------------------	---	--------------

↑
CURSOR

Fuel Mode
Figure 14

To enter a Fuel Load, use the UP/DOWN Button to position the cursor next to FULL or PARTIAL and press SELECT. FULL defaults to 122 gallons and allows the pilot to adjust the value starting with a full load. PARTIAL defaults to 0 gallons and allows the pilot to adjust the value starting with no load.

NOTE: Fuel load is the total fuel for both tanks, not a per tank value.

Press SELECT when the proper value has been entered and the screen shown in Figure 14 will appear.

Using the UP Key move the cursor to YES and press SELECT to accept the new value or press SELECT to reject the new value.

After SELECT the display will revert back to the first Fuel screen.

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5. RS-232 Interface

An RS-232 interface is available to connect to the DDMP. It can be used to connect the ship's system to a computer to download exceedance data, or to connect a laptop system to log data during flight. The RS-232 connector is located under the pilot's side of the instrument panel.

A. Hyperterminal Setup

The DDMP will communicate with any standard PC using the computer serial port, and any standard terminal emulation software such as Windows Hyperterminal, or Procomm. The following procedure uses Windows Hyperterminal.

- (1) Open Windows Hyperterminal (normally accessed by locating the Start Menu, then proceeding through Programs, and then to the Accessories folder).
- (2) Name the Connection "DDMP".
- (3) In the "Connect to" Window, change the "Connect Using" box to the proper serial port (normally COM1).
- (4) In the "COM1 Settings" Window, establish the following settings:
 - (a) 9600 Baud
 - (b) 8 Data bits
 - (c) No Parity
 - (d) 1 Stop bit
 - (e) No flow control
- (5) Click on "File" and "Properties".
- (6) In the "DDMP Properties" Window, select the "Settings" Tab, and "ASCII Setup".
- (7) Under ASCII Receiving, check "Append Line Feeds to Incoming Line Ends", and "Wrap Lines that Exceed Terminal Width".
- (8) Save Connection.

B. Establishing Connection:

- (1) Connect Aircraft RS-232 connections to Computer Serial Port.
- (2) Open "DDMP" Connection in Hyperterminal.
- (3) Apply Power to DDMP.
- (4) Press the Enter Key on the computer and the DDMP Menu should appear.

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6. Engine Instruments

CAUTION: REPLACEMENT OF THE FUEL QUANTITY INDICATOR REQUIRES THAT THE NEW INDICATOR BE CALIBRATED PER THE PROCEDURE IN 28-40-00.

NOTE: Calibration is not required if the existing instrument is simply removed and reinstalled.

A. Removal

- (1) From front of instrument panel, loosen the larger of the two screws next to the instrument. (No need to remove screw completely.)
- (2) Pull instrument out to gain access to connector on back of instrument.
- (3) Twist connector on back of instrument to disconnect connector from instrument.

B. Installation

- (1) Holding instrument in front of proper position at instrument panel, connect connector to back of instrument.
- (2) Insert instrument completely into instrument panel.
- (3) Tighten screw.

7. Digital Display Monitoring Panel (DDMP)

A. Removal

- (1) From front of instrument panel, loosen four screws securing DDMP to the instrument panel.
- (2) Pull DDMP out to gain access to connectors on back of DDMP.
- (3) Twist connectors on back of DDMP to disconnect connectors from DDMP.

B. Installation

- (1) Holding DDMP in front of proper position at instrument panel, connect connectors to back of DDMP.
- (2) Insert DDMP completely into instrument panel.
- (3) Tighten screws.

8. Instrument Calibration

See Chart 4 and 28-40-00.

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CHART 4
INTEGRATED ENGINE INSTRUMENTATION CALIBRATION

INDICATOR TYPE	SENSOR FULL SCALE OUTPUT (UNLESS NOTED)	CALIBRATION POINTS				
		EACH INDICATOR SHALL MEET THE CRITERIA SPECIFIED BELOW WITH ITS APPLICABLE SENDER UNIT				
OAT	84.23 TO 121.32 OHMS (- 40 TO 55 °C)	TEST POINT °C	- 40	0	20	55
		MAXIMUM OHMS	84.62	100.39	108.20	121.72
		MINIMUM OHMS	83.84	99.61	107.42	120.93
CAT ¹	- 1.527 TO 2.229 mV (- 40 TO 55 °C)	TEST POINT °C	- 40	0	20	55
		MAXIMUM mV	- 37	3	23	58
		MINIMUM mV	- 43	- 3	17	52
VOLTS	10 TO 32 VDC	TEST POINT VDC	10	16	22	28
		MAXIMUM VDC	10.2	16.2	22.2	28.2
		MINIMUM VDC	9.8	15.8	21.8	27.8
BATTERY ² AMPS	- 50 TO 50 mV	TEST POINT AMPS	- 99	- 50		50
		MAXIMUM mV	- 48.5	- 24	1	26
		MINIMUM mV	- 50.5	- 26	- 1	24
MAP ³	1.0 TO 5.0 VDC (0 TO 25 PSIG)	TEST POINT IN HG(ABS)	10	20	30	38
		MAXIMUM VDC	1.811	2.597	3.383	4.012
		MINIMUM VDC	1.761	2.547	3.333	3.962
RPM ⁴	12.50 HZ TO 67.50 HZ (500 TO 2700 RPM)	TEST POINT RPM	500	1400	2000	2500
		MAXIMUM HZ	13.05	35.55	50.55	63.05
		MINIMUM HZ	11.95	34.45	49.45	61.95
TIT	0 TO 1800 °F - 0.692 mV TO 40.581 mV	TEST POINT °F	200	1200	1600	1650
		MAXIMUM °F	218	1218	1618	1668
		MINIMUM °F	182	1182	1582	1632
FUEL FLOW	0 TO 201.84 HZ (0 TO 30 GPH)	TEST POINT GPH	7.5	15	25	30
		MAXIMUM HZ	55.374	106.694	172.204	203.707
		MINIMUM HZ	51.186	102.658	168.368	199.970
CHT	THERMISTOR CURVE Q 200 °F = 748 OHMS 500 °F = 32 OHMS	TEST POINT °F	200	460	500	
		MAXIMUM OHMS	762.96	41	32.64	
		MINIMUM OHMS	733.04	44	31.36	
OIL TEMPERATURE	THERMISTOR CURVE E 100 °F = 499 OHMS 250 °F = 34 OHMS	TEST POINT °F	100	160	200	240
		MAXIMUM OHMS	508.98	145.86	73.44	37.74
		MINIMUM OHMS	489.02	140.14	70.56	36.26
OIL PRESSURE	1.0 TO 5.0 VDC (0 TO 150 PSIG)	TEST POINT PSI		30	70	110
		MAXIMUM VDC	1.032	1.832	2.899	3.966
		MINIMUM VDC	0.968	1.768	2.835	3.902
VAC ⁵	3.0 TO 5.0 VDC (3.0 TO 6.0 IN HG)	TEST POINT IN HG	3.0	4.8	5.0	5.2
		MAXIMUM VDC	3.020	4.220	4.353	4.487
		MINIMUM VDC	2.980	4.180	4.313	4.447
FUEL QUANTITY	SEE SECTION 28-40-00	REF. 100624 Z				

1. Use temperature compensated calibrator to check calibration test points.
2. On 28 VDC common mode signal.
3. When the MAP indicator receives a signal from 37.1 IN HG to 38.9 IN HG, the digital indicator will snap to 38 IN HG. The analog MAP indicator will continue to display the actual IN HG.
4. When the RPM indicator receives a signal from 2560 RPM to 2640 RPM, the digital indicator will snap to 2600 RPM. The analog RPM indicator will continue to display the actual RPM.
5. When the vacuum indicator receives a signal below 3.0 IN HG, the digital indicator will snap to 0 IN HG.

NOTE: Fuel Quantity calibration specifications and procedures are in 28-40-00.

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CHAPTER

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OIL

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GENERAL

The oil system is a wet sump, force feed system with a capacity of 8 quarts. A conventional dipstick is provided for determining the oil quantity. [On Seneca V models](#), in order to remove the dipstick, it must be rotated 90° due to a D-shaped retaining ring at the top of the dipstick.

When the engine is running, oil is drawn through a screen and pick up tube which extends from the sump to a port in the crankcase. Oil then flows to the inlet of the gear type, engine driven oil pump and is forced under pressure through the pump outlet. A pressure relief valve prevents excessive oil pressure by allowing excess oil to be returned to the sump. After leaving the pump, the oil under pressure enters a full flow filter and is passed onto the oil cooler. If the filter element becomes blocked, a bypass relief valve will open to permit unfiltered oil to flow to the engine. An oil temperature control unit allows oil to bypass the oil cooler when the oil is cold. Some oil flows through the cooler to prevent congealing in cold weather. When the oil temperature reaches approximately 170°F, the oil temperature control unit actuates to close off the cooler bypass, forcing the oil to flow through the cooler.

From the oil cooler, oil enters the crankcase where it is directed to the bearing surfaces and other engine components requiring lubrication and cooling. The propeller governor boosts engine oil pressure for operation of the propeller. A tap in the side of the crankcase supplies oil pressure for lubrication of the turbocharger bearings. Oil is carried to the turbocharger through an external line. After lubricating the turbocharger bearings, it is drawn into a scavenge pump and forced back to the oil sump. Oil within the engine drains, by gravity, back into the sump.

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DISTRIBUTION

Oil Filter

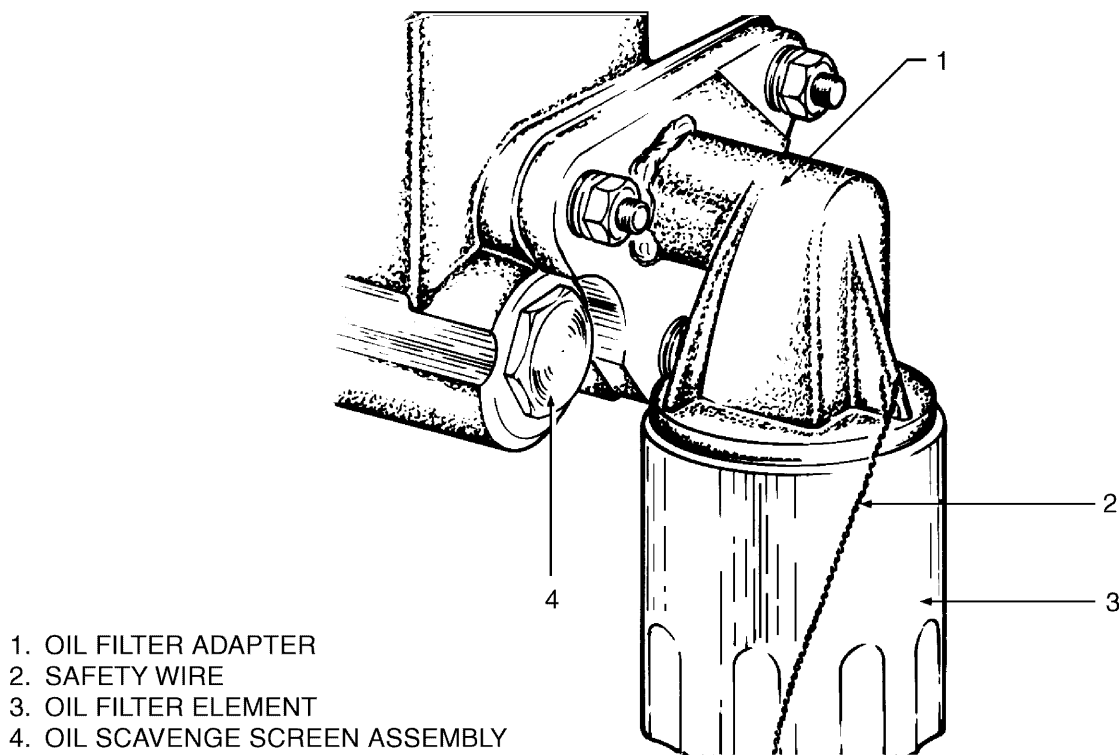
Replacement (Refer to Figure 1)

The oil filter element should be replaced after each 50 hours of engine operation. The filter element is mounted on the lower portion of the engine accessory case. Replace the filter element as follows:

- (1) Remove the lockwire between the nut on the filter and the oil filter adapter, and unscrew the filter element.
- (2) Before installing a new filter, lubricate the gasket on the filter with clean engine oil.

CAUTION: DO NOT OVER TORQUE.

- (3) Torque the filter 18 to 20 foot-pounds or 3/4 to 1 full turn after the gasket makes contact.
- (4) Run the engine and check for oil leaks; then install lockwire between nut on filter and adapter.



Oil Filter Installation
Figure 1

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INDICATING

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

1. Engine Oil Pressure ([Seneca IV](#))

NOTE: For information on the engine oil pressure gauge installed in Seneca V models, see 77-40-00.

A. Description

On [Seneca IV](#) models, the oil pressure gauge is part of the combination engine gauge which also includes the oil temperature gauge and the cylinder head temperature gauge. The oil pressure is transmitted to the gauge by means of an electrical transducer installed in the engine compartment.

Each oil pressure gauge is directly connected to the pressure side of its engine turbocharger oil supply line. See Figure 1, 77-00-00.

B. Troubleshooting

See Chart 1.

**CHART 1
TROUBLESHOOTING ENGINE OIL PRESSURE GAUGES ([SENECA IV](#))**

Trouble	Cause	Remedy
Excessive error at zero.	Pointer loose on shaft. Overpressure or seasoning of bourdon tube (if applicable).	Replace instrument.
Excessive scale error.	Improper calibration adjustment.	Replace instrument.
Excessive pointer oscillation.	Air in line (if applicable) or rough engine relief.	Disconnect line and fill with light oil (if applicable). Check for leaks (if applicable). If trouble persists, clean and adjust relief valve.
	Gauge malfunction.	Check gauge is properly grounded. Replace gauge.
Sluggish operation of pointer, or pressure fails to build up. NOTE: Gauge will take longer to indicate in cold weather.	Engine relief valve open.	Clean and check.
	Line restriction to instrument (if applicable).	Clean and check.
	Transducer (if applicable) gauge. Loss of oil in engine, or other engine failure.	Replace transducer or or gauge malfunction. Shut down engine. See Chart 2, 71-00-00.

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2. Engine Oil Temperature ([Seneca IV](#))

NOTE: For information on the engine oil temperature gauge installed in [Seneca V](#) models see 77-40-00.

A. Description

On [Seneca IV](#) models, the oil temperature gauge is part of the combination engine gauge which also includes the oil pressure gauge and the cylinder head temperature gauge. Each oil temperature gauge provides a temperature indication through a temperature bulb-mounted in the left side of its respective engine.

B. Troubleshooting

See Chart 2.

**CHART 2
TROUBLESHOOTING ENGINE OIL TEMPERATURE GAUGES ([SENECA IV](#))**

Trouble	Cause	Remedy
Instrument fails to show any reading.	Broken or damaged bulb, or open wiring.	Check engine unit and wiring to gauge.
Excessive scale error.	Improper calibration adjustment.	Check calibration. Repair or replace.
Pointer fails to move as engine is warmed up.	Broken or damaged bulb, or open wiring.	Check engine unit and wiring.
Dull or discolored marking.	Age.	Replace instrument.

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CHAPTER

80

STARTING

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CRANKING

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1. Description and Operation

Each starting motor consists of five major components; the commutator and head assembly, brush set and plate assembly, armature, and the drive end head assembly. When the starting circuit is energized, battery current is applied to the starting motor terminal. As current flows through the field coils, a strong magnetic field is created. At the same time, current flows through the brushes to the commutator through the armature windings to ground. The magnetic force created in the armature combined with that in the field windings turns the armature.

The starters are located on the back of each engine. Each starter is connected to the engine accessory gear box through a 90° gear box. Access to the starter must be made by removing the upper cowl panels.

2. Troubleshooting

See Chart 1.

3. Starter (See Figure 1.)

A. 100 Hour Inspection

The starting circuit should be inspected at regular intervals, the frequency of which should be determined by the amount of service and the condition under which the aircraft is operated. It is recommended that such inspection be made at each 100 hours and include the following:

(1) Battery

The battery should be checked with a hydrometer to be sure it is fully charged and filled to the proper level with approved water. A load test should be made to determine battery condition. If dirt and corrosion have accumulated on the battery, it should be cleaned with a solution of baking soda and water. Be sure none of the solution enters the battery cells.

(2) Voltage Loss Test

The starting circuit wiring should be inspected to be sure that all connections are clean and tight, and that the insulation is sound. A voltage loss test should be made to locate any high resistance connections that would affect starting motor efficiency. This test is made with a low reading voltmeter while cranking the engine or at approximately 100 amperes, and the following limits should be used:

(a) Voltage loss from insulated battery post to starting motor terminal -0.3-volt maximum.

(b) Voltage loss from battery ground post to starter frame -0.1-volt maximum.

NOTE: If voltage loss is greater than the above limits, additional tests should be made over each part of the circuit to locate the high resistance connections.

NOTE: If a solderless terminal on an aluminum cable is loose, corroded or otherwise unsatisfactory, it is recommended that the complete cable assembly be replaced instead of replacing or repairing the solderless terminal. Should replacement of the complete assembly not be practical, it is permissible to replace the aluminum cable assembly with a copper cable assembly which is two sizes smaller (EX: An AL-1 aluminum cable assembly is replaced with an AN-3 copper cable assembly). The new cable should be installed in accordance with AC-43-13-2A.

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**CHART 1 (Sheet 1 of 2)
TROUBLESHOOTING STARTER**

Trouble	Cause	Remedy
Starter fails to operate.	Low battery charge.	Check and recharge if necessary.
	Defective or improper wiring or loose connections.	Refer to electrical wiring diagram and check all wiring.
	Defective starter solenoid or control switch.	Replace faulty unit.
	Binding, worn, or improperly seated brush, or brushes with excessive side play.	Brushes should be a free fit in the brush boxes without excessive side play. Binding brushes and brush boxes should be wiped clean with a gasoline (undoped) moistened cloth. A new brush should be run in until at least 50% seated; however, if facilities are not available for running in brushes, then the brush should be properly seated by inserting a strip of number 000 sandpaper between the brush and commutator, with the sanded part next to the brush. Pull sandpaper in the direction of rotation, being careful to keep it in the same contour as the commutator.
	CAUTION: DO NOT USE COARSE SANDPAPER OR EMERY CLOTH. AFTER SEATING, CLEAN THOROUGHLY TO REMOVE ALL SAND AND METAL PARTICLES TO PREVENT EXCESSIVE WEAR. KEEP MOTOR BEARING FREE FROM SAND OR METAL PARTICLES.	
	Dirty commutator.	If commutator is rough or dirty, smooth and polish with number 0000 sandpaper. If too rough and pitted, remove and turn down. Blow out all particles.
	Shorted, grounded, or an open armature.	Remove and replace with armature known to be in good condition.
	Grounded or open field circuit.	Test, repair if possible or replace with a new part.

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**CHART 1 (Sheet 2 of 2)
TROUBLESHOOTING STARTER**

Trouble	Cause	Remedy
Low motor and cranking speed.	Worn, rough, or improperly lubricated gearing.	Disassemble, clean, inspect, and relubricate, replacing motor or starter ball bearings if worn.
	Same electrical causes as listed under "Motor Fails to Operate."	Same remedies listed for these troubles.
Excessive arcing of motor brushes.	Binding, worn or improperly seated brush, or brushes with excessive side play.	See previous page for information dealing with this trouble.
	Dirty commutator rough pitted or scored.	Clean as outlined above.
Excessive wear and arcing of motor brushes.	Rough or scored commutator.	Remove and turn commutator down on a lathe.
	Armature assembly not concentric.	Reface commutator.

(3) Lubrication

No lubrication is required on the starting motor except at the time of overhaul. Soak new absorbent bronze bearings in SAE 20 oil before installation. Saturate the felt oiling pad in the commutator end head with SAE 20 oil. Allow excess oil to drain out before installing end head on motor. Put a light film on Lubriplate 777 on the drive end of the armature shaft before and after installing the drive end head.

(4) Starter Drive Check

The starting motor should be operated for a few seconds with the ignition switch off. This is to determine that the starter engages properly and that it turns freely without binding or excessive noise. Start the engine two or three times to check the starter drive assembly.

NOTE: Refer to the engine manufacturer's service information concerning the starter drive mechanism.

B. Removal

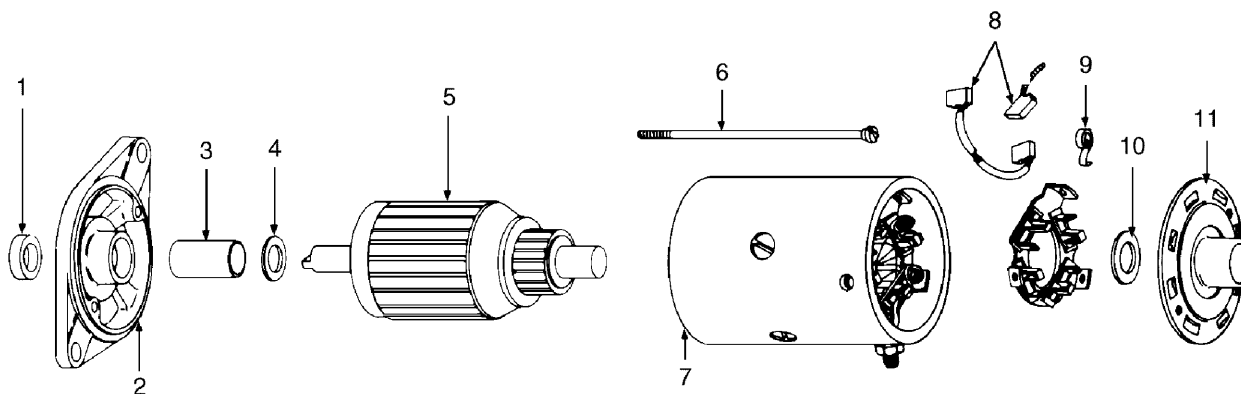
To remove the starting motor from the engine, first disconnect the ground cable from the battery post to prevent short circuiting. Disconnect the lead from the starting motor terminal, then remove retaining nuts from studs. The motor can then be pulled off and taken to the bench for overhaul.

C. Overhaul

If during the above inspection any starting motor difficulty is noted, the starting motor should be removed from the engine for cleaning and repair. Refer to Teledyne Continental Service Manual, Starting Motor section.

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1. OIL SEAL
2. DRIVE END HEAD ASSEMBLY
3. DRIVE END BEARING
4. THRUST WASHER
5. ARMATURE
6. THRU BOLT
7. FRAME & FIELD ASSEMBLY
8. BRUSH SET
9. BRUSH SPRING
10. THRUST WASHER
11. COMMUTATOR END HEAD ASSEMBLY



Exploded View of Starting Motor (Typical)
Figure 1

- D. Starting Motor Service Test Specifications
See Chart 2.

CHART 1
STARTING MOTOR TEST SPECIFICATIONS (TCM 6427)

No-Load Test (75°F)	
Volt	20
Amps	30-50
RPM	4300

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CHAPTER

81

TURBINES

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CHAPTER 81 - TURBINES

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**GRIDS 6K22 THRU 6K24
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TURBO-SUPERCHARGER

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY. (SEE INTRODUCTION - SUPPLEMENTARY PUBLICATIONS.)

1. Description and Operation

On **Seneca IV** models, the turbocharger system (Figure 2, Sheet 1) consists of a turbine and compressor assembly, ground adjustable exhaust bypass screw, and the necessary hoses and engine air intake ducts. The ground adjustable exhaust bypass screw allows exhaust gas to bypass the turbine and flow directly overboard. In the closed position, the bypass screw diverts the exhaust gases into the turbine. The turbocharger requires little attention between overhauls. However, the items outlined in the Inspection Report, 5-20-00, must be checked periodically.

On **Seneca V** models, the turbocharger system (Figure 2, Sheet 2) consists of a turbine and compressor assembly, hydraulic wastegate and controller, and the necessary hoses and engine air intake ducts. The hydraulic wastegate allows exhaust gas to bypass the turbine and flow directly overboard. The turbocharger requires little attention between overhauls. However, the items outlined in the Inspection Report, 5-20-00, must be checked periodically.

2. Troubleshooting

See Chart 1.

3. Nomenclature

Many unfamiliar terms may appear on the following pages of this manual. An understanding of these will be helpful, if not necessary, in performing maintenance and troubleshooting. Chart 2 is a list of commonly used terms and names as applied to turbocharging and a brief description.

4. Turbocharger

CAUTION: BEFORE REMOVING, CLEAN THE ENTIRE TURBOCHARGER, AIR PIPING, AND OIL LINE CONNECTIONS WITH A STIFF BRUSH OR WHISK BROOM, FOLLOWED BY WIPING WITH A CLOTH DAMPENED WITH CLEANING SOLVENT. THIS PRECAUTION IS NECESSARY TO PREVENT ENTRANCE OF FOREIGN MATERIALS INTO THE ENGINE AND TURBOCHARGER SYSTEM AFTER REMOVAL.

A. Removal

- (1) Remove the Upper Cowling.
- (2) Disconnect the oil supply and return lines from the center section of the turbo.
- (3) Disconnect the air ducts from the compressor inlet and outlet and the exhaust system from the turbine inlet and outlet.
- (4) Remove the bolts that attach the turbocharger to the mounting bracket and remove the turbocharger assembly.

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**CHART 1
TROUBLESHOOTING TURBOCHARGER**

Trouble	Cause	Remedy
Smoking engine exhaust, loss of engine power, low boost pressure.	Dirty air cleaner, undersize air cleaner.	Clean or replace air cleaner as required.
	Restricting intake manifold or piping.	Remove restriction.
	Foreign matter or dirt accumulation on impeller.	Clean impeller. See "Major Inspection and Cleaning."
	Damaged impeller or turbine wheel.	Rebuild unit.
	Excessive oil leakage from seals.	Rebuild unit.
	Leaking intake or exhaust manifold connections.	Tighten all connections and replace gaskets where required.
	Excess back-pressure on turbine outlet.	Reduce restriction in exhaust ducting.
Noisy rotating assembly.	Damaged bearing or other components, causing rotating assembly to rub against housing.	Rebuild unit.
Excess oil in intake manifold or exhaust stack.	Excessive oil leakage from from seals.	Rebuild unit.
Boost pressure low, power low, clean exhaust.	Insufficient fuel supply to engine.	Check fuel system or reset fuel pump.
Engine knock (gasoline).	Improper fuel.	Use recommended fuel.
	Oil leakage from compressor seal.	Rebuild unit.
	Ignition timing incorrect.	Reset to specified timing.

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CHART 2 (Sheet 1 of 2)
TURBO-SUPERCHARGER NOMENCLATURE

Term	Definition
Supercharge	To increase the air pressure (density) above or higher than ambient conditions.
Supercharger	A device that accomplishes the increase in pressure.
Turbo-supercharger	More commonly referred to as a "Turbocharger" this device is driven by a turbine. The turbine is spun by energy extracted from the engine exhaust gas.
Compressor	The portion of a turbocharger driven by the turbine that takes in ambient air and compresses it before discharging it to the engine.
Turbine	The exhaust driven end of the turbocharger unit.
Ground Boosted or Ground Turbocharged	These phrases indicate that the engine depends on a certain amount of turbocharging at sea level to produce the advertised horsepower. An engine that is so designed will usually include a lower compression ratio to avoid detonation.
Deck Pressure	The pressure measured in the area downstream of the turbo compressor discharge and upstream of the engine throttle valve. This should not be confused with manifold pressure.
Manifold Pressure	The pressure measured downstream of the engine throttle valve and is almost directly proportional to the engine power output.
Normalizing	If a turbocharger system is used only to regain power losses caused by decreased air pressure of high altitude, it is considered that the engine has been "normalized."
Overboost	An overboost condition means that manifold pressure is exceeding the limits at which the engine was tested and FAA certified, and can be detrimental to the life and performance of the engine. Overboost can be caused by malfunctioning controllers or improperly operating wastegate in the automatic system, or by pilot error in a manual controlled system.
Overshoot	Overshoot is a condition of the automatic controls not having the ability to respond quickly enough to check the inertia of the turbocharger speed increase with rapid engine throttle advance. Overshoot differs from overboost in that the high manifold pressure lasts only for a few seconds. This condition can usually be overcome by smooth throttle advance. A good method for advancing the throttle is as follows: After allowing the engine oil to warm up to approximately 140°F, advance the throttle to 28" to 30" manifold pressure, hesitate 1 to 3 seconds and continue advancing to full throttle slow and easy. This will eliminate any overshoot due to turbocharger inertia.

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CHART 2 (Sheet 1 of 2)
TURBO-SUPERCHARGER NOMENCLATURE

Term	Definition
Bootstrapping	This is a term used in conjunction with turbo machinery. If you were to take all the air coming from a turbocharger compressor and duct it directly back into the turbine of the turbocharger, it would be called a bootstrap system and if no losses were encountered, it would theoretically run continuously. It would also be very unstable because if for some reason the turbo speed would change, the compressor would pump more air to drive the turbine faster, etc. A turbocharged engine above critical altitude is similar to the example mentioned above, except now there is an engine placed between the compressor discharge and turbine inlet. Slight system changes cause the exhaust gas to change slightly, which causes the turbine speed to change slightly, which causes the compressor air to the engine to change slightly, which in turn again affects the exhaust gas, etc.
Critical Altitude	Altitude at which the engine can no longer maintain rated horsepower.

B. Installation

(1) **Seneca IV**

NOTE: The turbocharger is properly installed with the large diameter center clamp loose to allow rotation of the turbine housing during installation for proper alignment with the exhaust system inlet connection. Tighten clamp after alignment.

- (a) Position turbocharger assembly on the mounting bracket and secure with attaching hardware.
- (b) Align exhaust system manifold to the turbine inlet and secure with mounting bolts.

WARNING: WHEN TIGHTENING ANY OF THE THREE V-BAND CLAMPS, TAP THE CLAMP ALL AROUND ITS CIRCUMFERENCE TO ENSURE PROPER SEATING. DO NOT RELY ON TIGHTENING ALONE FOR PROPER CLAMP SEATING.

- (c) Tighten the large diameter center clamp securing the turbine housing to the turbocharger.
- (d) Place turbine housing insulation blanket in proper position and safety blanket to turbocharger attaching hardware.
- (e) Position the exhaust tail pipe and exhaust bypass screw to the turbine outlet, aligning the tail pipe with the hole cut out in the lower cowl provided for it.

NOTE: Check the position of the exhaust bypass adjustment screw (Figure 1). If 8 minimum, 9 maximum threads are showing below jam nut, no adjustment is required.

- (f) Tighten both turbine housing inlet clamps. (Refer to previous warning on tightening V-band clamps.)

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– NOTE –

REFER TO CHAPTER 76 PRIOR TO
RESETTING BYPASS.

EXHAUST BYPASS
ADJUSTMENT SCREW
CLOCKWISE - INCREASE
COUNTERCLOCKWISE - DECREASE

TORQUE JAM NUT
190 - 220 IN. LB.

.032 SAFETY WIRE
(IF THE JAM NUT IS NOT
DRILLED FOR SAFETY WIRE,
IT IS PERMISSIBLE TO SAFETY
ONLY BETWEEN THE EXHAUST
BOSS AND SCREW HEAD)

Exhaust Bypass Screw (Seneca IV)

Figure 1

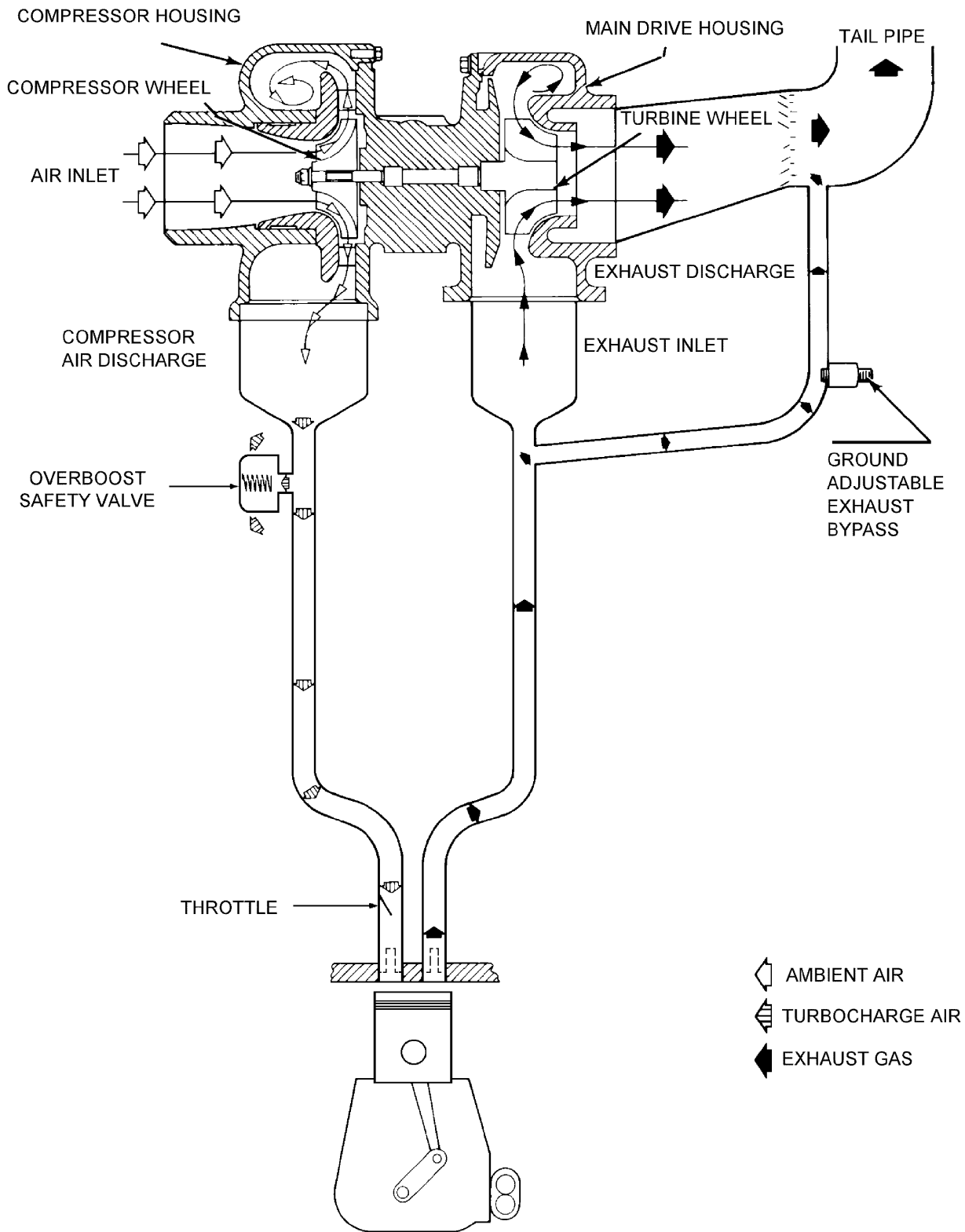
- (g) Position the engine induction tube to turbocharger compressor outlet connector, and the induction air inlet tube to the turbocharger compressor inlet connector, and tighten the clamps.
- (h) If previously removed, install the overboost valve assembly as follows:
 - 1 Install a new O-ring on the overboost mounting flange of the induction tube.
 - 2 Position the overboost valve assembly on the mounting flange, with the holes in the valve aligning with the holes in the flange.
 - 3 Install the four bolts and secure with plain washers and self-locking nuts.
- (i) Connect the oil supply and return lines to the turbocharger center housing. Connect the oil pressure cockpit gauge line if it was previously disconnected.
- (j) Perform engine ground run-up and check for normal engine functioning, excessive exhaust manifold leakage and oil leaks. Repair as necessary.
- (k) Install the upper cowling.

(2) [Seneca V](#)

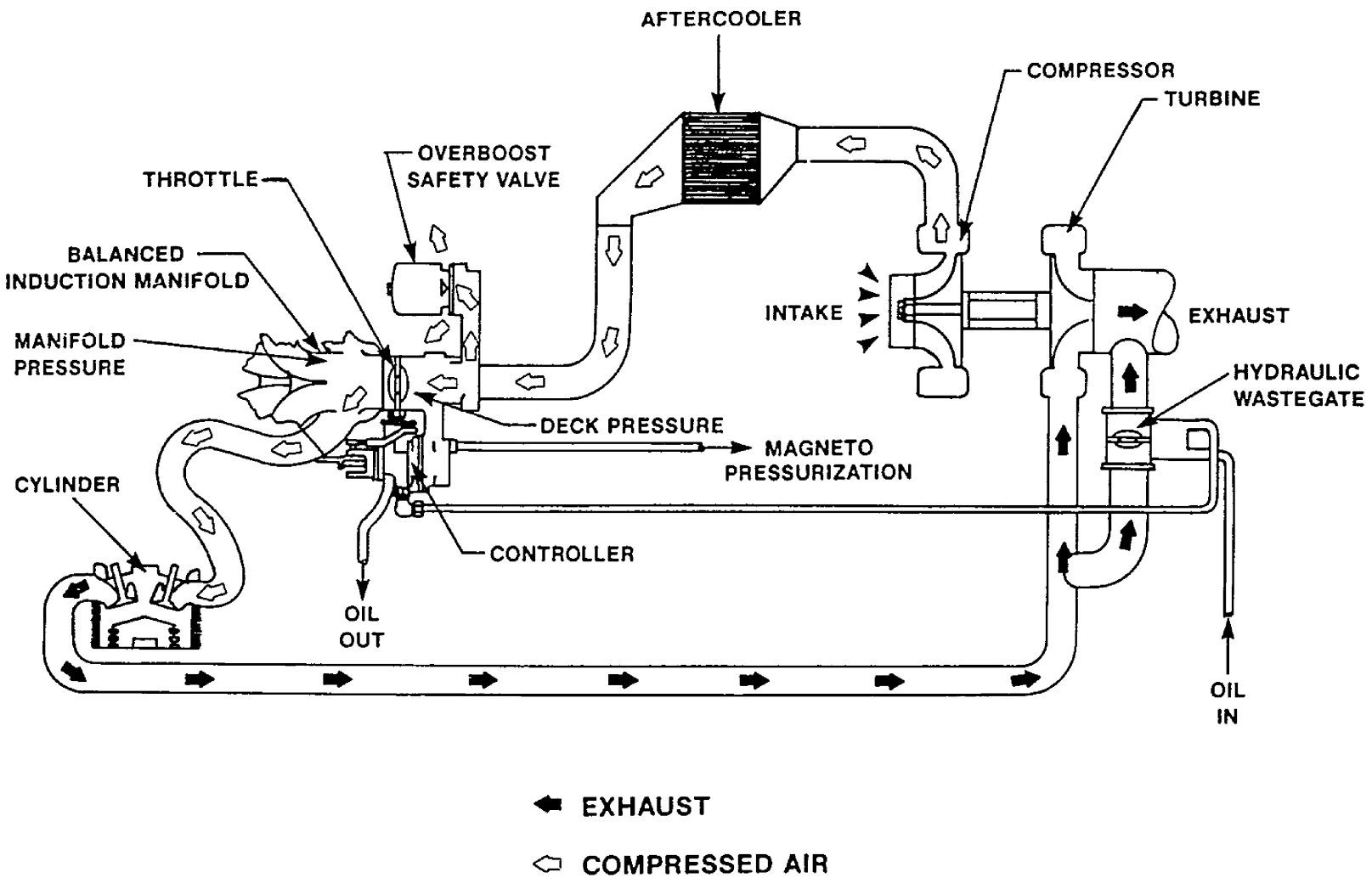
NOTE: The turbocharger is properly installed with the large diameter center clamp loose to allow rotation of the turbine housing during installation for proper alignment with the exhaust system inlet connection. Tighten clamp after alignment.

- (a) Verify that the turbocharger compressor and turbine housings are properly oriented to the center housing and locked.
- (b) Position turbocharger assembly on the mounting bracket and secure with attaching hardware.
- (c) Align exhaust system manifold to the turbine inlet and secure with mounting bolts.

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Turbocharger System Functional Schematic
Figure 2 (Sheet 1 of 2)



Turbocharger System Functional Schematic
Figure 2 (Sheet 2 of 2)

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WARNING: WHEN TIGHTENING ANY OF THE THREE V-BAND CLAMPS, TAP THE CLAMP ALL AROUND ITS CIRCUMFERENCE TO ENSURE PROPER SEATING. DO NOT RELY ON TIGHTENING ALONE FOR PROPER CLAMP SEATING.

- (d) Position the exhaust tail pipe to the turbine outlet, aligning the tail pipe with the hole cut out in the lower cowl provided for it.
- (e) Position the engine induction air duct to turbocharger compressor outlet connector, and the induction air inlet duct to the turbocharger compressor inlet connector, and tighten the clamps.
- (f) Connect the oil supply and return lines to the turbocharger center housing.
- (g) Perform engine ground run-up and check for normal engine functioning, excessive exhaust manifold leakage and oil leaks. Repair as necessary.
- (h) Install the upper cowl.

C. Inspection

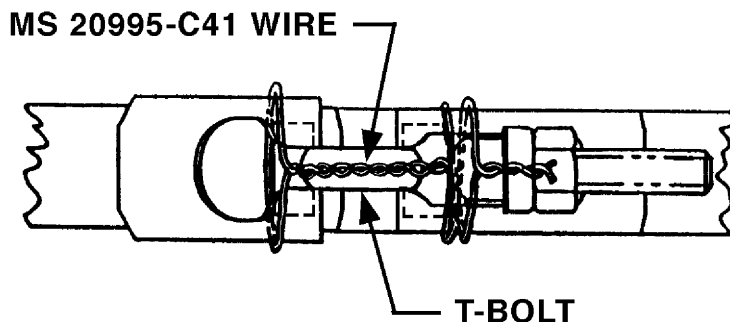
(1) Routine Inspection

Whenever routine service of the engine is performed, inspect the turbocharger as follows.

- (a) Inspect the hoses and tubing of the air intake system between the air cleaner and turbocharger, and from the turbocharger to the intake manifold. Check for leakage due to cracks, damaged gaskets, loose clamps or connections, and restrictions due to kinks, collapsed hoses, or dented tubing.
- (b) Inspect impeller blades on inlet and discharge side.
- (c) Inspect for exhaust leakage from a cracked exhaust manifold, damaged gaskets, or loose turbocharger mounting.
- (d) Inspect the oil lines and fittings for kinks, damage, and leakage. (On Seneca V models, include wastegate and controller.)
- (e) Note any unusual noises or vibration which would warrant further inspection of the turbocharger.
- (f) Observe engine exhaust. Excessive smoke may indicate a restricted air cleaner or intake piping, over fueling, or faulty turbocharger operation.

(2) V-Band Coupling 100 Hour Inspection (See Figure 3.)

Each 100 hours, inspect lockwiring on V-band couplings for condition and security. If lockwiring is found broken, inspect T-bolt for stretching, cracking, or any other damage. Replace coupling as required.



Lockwiring V-Band Couplings
Figure 3

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(3) 2000 Hour Inspection

WARNING: ON SENECA IV MODELS, MAJOR INSPECTION AND CLEANING MUST BE COMPLETED BY REFERENCING THE APPLICABLE RAJAY OVERHAUL MANUAL.

WARNING: ON SENECA V MODELS, MAJOR INSPECTION AND CLEANING MUST BE COMPLETED BY REFERENCING THE APPLICABLE GARRETT OVERHAUL MANUAL.

After every 2,000 hours of operation, or particularly if trouble is suspected in the turbocharger, a major inspection of the turbocharger should be performed. This requires removal of the turbocharger from the engine.

- (a) Remove the air cleaner piping from the turbocharger compressor housing inlet. Observe the condition of the impeller and housing. Carefully check the leading edges of the impeller blades for damage and for evidence of interference with the compressor housing.
- (b) Disconnect the oil lines and the intake manifold piping from the turbocharger. Support the turbocharger and remove the turbine housing clamp that secures the turbine housing to the bearing house assembly. Remove the turbocharger from the turbine housing, leaving the turbine housing mounted on the engine. Cover all openings to prevent the entrance of foreign materials.
- (c) Inspect the turbine wheel for cracks, erosion, nicked blade tips, and broken or missing blades. Inspect the turbine shield for warpage, rubbing, scoring, and erosion. Check for accumulation of carbon behind the turbine wheel and check for other defects that could interfere with proper turbocharger operation.

NOTE: The shield must be depressed against the tension of the spring ring to check for free rotation.

- (d) If the turbine and impeller do not rotate freely when the turbine shield is depressed away from the turbine wheel, the parts may be damaged or there may be interference due to foreign material. These conditions will necessitate the disassembly of the turbocharger for inspection.

D. Adjustment

Ssee 76-10-00, Engine Set Up Procedures.

NOTE: A complete inspection of the power plant system should be performed before any turbo adjustments are made

5. Overboost Valve

A. Removal

- (1) Remove the four self-locking nuts, plain washers and bolts.
- (2) Lift the overboost valve assembly from the induction tube (**Seneca IV**) or from the induction wing assembly (**Seneca V**).
- (3) Remove the O-ring from the seating surface of the overboost mounting flange on the induction tube.

B. Installation

- (1) Install a new O-ring on the overboost mounting flange of the induction tube.
- (2) Position the overboost valve assembly on the mounting flange with the holes in the valve aligning with the holes in the flange.
- (3) Install the four bolts and secure with plain washers and self-locking nuts.

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AIRPLANE MAINTENANCE MANUAL

CARD 7 OF 7

PA-34-220T

Seneca IV

(SN's 3447001 THRU 3447029)

SENECA

(SN's 3449001 AND UP)

THE NEW PIPER AIRCRAFT, INC.

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AEROFICHE REVISION STATUS

Revisions to Maintenance Manual (P/N 761-888) issued July 12, 1995, are as follows:

<u>Revision</u>	<u>Publication Date</u>	<u>Aerofiche Card Effectivity</u>
ORG950712	November 7, 1996	1, 2, 3, 4 and 5
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PR020531	May 31, 2002	1
CR050819	August 19, 2005	1, 2, 3, 4, 5, 6 and 7
PR051107	November 7, 2005	1, 2, 4 and 5
PR060428*	April 28, 2006	1, 2, 3, 4, 5, 6 and 7

*** PARTIAL REVISION OF MAINTENANCE MANUAL 761-888**

Revisions appear in Aerofiche Cards 1, 2, 3, 4, 5, 6, and 7. Accordingly, discard your existing Aerofiche Cards and replace them with the cards dated April 28, 2006.

Consult the Customer Service Information Aerofiche (P/N 1753-755) for current revision dates for this manual.

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INTRODUCTION

1. Instructions for Continued Airworthiness

WARNING: INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA) FOR ALL NON-PIPER APPROVED STC INSTALLATIONS ARE NOT INCLUDED IN THIS MANUAL. 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 ICA 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, THE PIPER PROVIDED ICA MAY NOT BE VALID FOR AIRPLANES SO MODIFIED.

The PIPER PA-34-220T Seneca IV / V Maintenance Manual constitutes the Instructions for Continued Airworthiness (ICA) as required by Federal Aviation Regulations (FAR) Part 23, Appendix G. Chapter 4 contains the Airworthiness Limitations section (4-00-00) and the Inspection Program is in Chapter 5 (5-20-00).

2. General

This publication is prepared in accordance with the General Aviation Manufacturers Association (GAMA) Specification No. 2, with respect to the arrangement and content of the System/Chapters within the designated Chapter/Section-numbering system.

WARNING: USE ONLY GENUINE PIPER AIRCRAFT PARTS OR PIPER AIRCRAFT APPROVED PARTS OBTAINED FROM PIPER APPROVED SOURCES, IN CONNECTION WITH THE MAINTENANCE AND REPAIR OF PIPER AIRPLANES.

This manual generally does not contain hardware callouts for installation. Hardware callouts are only indicated where a special application is required. To confirm the correct hardware used, refer to the PA-34-220T Parts Catalog, P/N 761-887, and FAR 43 for proper use.

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.

THE NEW PIPER AIRCRAFT, INC. expressly disclaims any responsibility for malfunctions, failures, damage or injury caused by use of non-PIPER approved parts.

NOTE: THE NEW PIPER AIRCRAFT, INC. expressly reserves the right to supersede, cancel and/or declare obsolete any part, part numbers, kits or publication that may be referenced in this manual without prior notice.

In any question concerning the care of your airplane, be sure to include the airplane serial number in any correspondence.

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3. Effectivity

This maintenance manual is effective for PA-34-220T Seneca IV airplanes, serial numbers 3447001 thru 3447029, and Seneca V airplanes, serial numbers 3449001 and up.

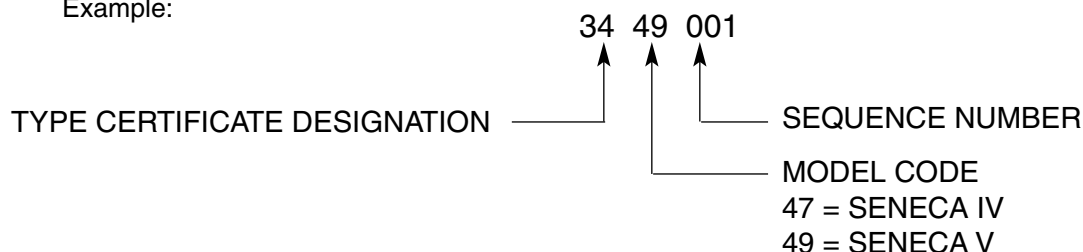
This encompasses the following model years:

NOTE: The following is provided as a general reference only.

<u>Model</u>	<u>Serial Numbers</u>	<u>Model Year</u>
Seneca IV	3447001 thru 3447012	1995
	3447013 thru 3447029	1996
Seneca V	3449001	Prototype
	3449002 thru 3449041	1997
	3449042 thru 3449096	1998
	3449097 thru 3449151	1999
	3449152 thru 3449195	2000
	3449196 thru 3449231	2001
	3449232,	2002
	3449237 thru 3449239, and	
	3449241 thru 3449268	
	3449269, 3449273, and	2003
	3449275 thru 3449300	
	3449301 thru 3449310	2004
	3449311 thru 3449322	2005
	3449323 and Up	2006

4. Serial Number Explanation

Example:



5. Assignment of Subject Material

This publication is divided into industry standard, three element, numeric subject groupings as follows:

- A. System/Chapter - The various groups are broken down into major systems such as Environmental Systems, Electrical Power, Landing Gear, etc. They are assigned a number, which becomes the first element of the standardized numbering system. Thus, the element "28" of the number 28-40-01 refers to the chapter "Fuel". Everything concerning the fuel system will be covered in this chapter.
- B. Sub-System/Section - The major systems/chapters of an airplane are broken down into subsystems. These sub-systems are identified by the second element of the standard numbering system. The element "40" of the number 28-40-01 concerns itself with the indicating section of the fuel system.

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- C. Unit/Subject - The individual units within a sub-system/section may be identified by the third element of the standard numbering system. The element "01" of the number 28-40-01 is a subject designator. This element is assigned at the option of the manufacturer and is normally zeroed out by PIPER.

Refer to paragraph 14, Chapter/Section Index Guide, for a complete breakdown and list. The material is arranged in ascending numerical sequence.

6. Pagination

The Chapter - Section (i.e. - 28-40-00) numbering system (explained above) forms the primary page numbering system for this manual. Within each Section, pages are numbered consecutively beginning with Page 1 (i.e. - 28-40-00, Page 1). Additionally, the aerofiche grid numbering system (explained below) is also used to indicate location within the manual.

7. Aerofiche Effectivity

- A. The General Aviation Manufacturers Association (GAMA) has developed specifications for microfiche reproduction of aircraft publications. The information compiled in this Aerofiche Maintenance Manual will be kept current by revisions distributed periodically. These revisions will supersede all previous revisions and will be complete Aerofiche card replacements and shall supersede Aerofiche cards of the same number in the set. The "Aerofiche Effectivity" page at the front of this manual lists the current revision for each card in this set.

- B. Conversion of Aerofiche alpha/numeric grid code numbers:

First number is the Aerofiche card number.

Letter is the horizontal row reference per card.

Second number is the vertical column reference per card.

Example: 2J16 = Aerofiche card number two, row J, column 16.

- C. To aid in locating information, the following is provided at the beginning of each aerofiche card:

- (1) A complete Introduction containing the Chapter/Section Index Guide for all fiche in this set.
- (2) A complete subject Index for all fiche in this set.

8. Identifying Revised Material

A revision to a page is defined as any change to the printed matter that existed previously. Revisions, additions and deletions are identified by a vertical line (i.e. - change bar) along the left-hand margin of the page opposite only that portion of the printed matter that was changed.

A change bar in the left-hand margin opposite the footer (i.e. - chapter/section/subject, page number and date), indicates that the text was unchanged but the material was relocated to a different page.

Example.

NOTE: Change bars are not used in the title pages, list of effective pages, or index.

9. Indexing

An alphabetically arranged subject Index follows this introduction to assist the user in locating desired information. In addition, each System/Chapter begins with an individual Table of Contents.

10. List of Effective Pages

Each System/Chapter has a List of Effective Pages preceding the Table of Contents to identify the effective revision date for each page in that chapter.

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11. Warnings, Cautions and Notes

These adjuncts to the text are used to highlight or emphasize important points when necessary. **Warnings** call attention to use of materials, processes, methods, procedures or limits which must be followed precisely to avoid injury or death to persons. **Cautions** call attention to methods and procedures which must be followed to avoid damage to equipment. **Notes** call attention to methods which make the job easier. Warnings and Cautions shall be located directly above and Notes directly beneath the text and be in line with the paragraphs to which they apply.

12. Accident/Incident Reporting

To improve our Service and Reliability system and aid in our compliance with FAR 21.3, knowledge of all incidents and/or accidents must be reported to Piper immediately. To expedite and assist in reporting all incidents and accidents, Piper Form 420-01 has been created. See Service Letter 1041 for latest revision. This procedure is to be used by all Dealers, Service Centers and Repair Facilities.

13. Supplementary Publications

The following publications/sources provide servicing, overhaul and parts information for the PA-34-220T Seneca IV / V airplanes and their various components. Use them to supplement this manual.

A. Piper Publications: (by Part Number)	Seneca IV	Seneca V
(1) Parts Catalog:	761-887	761-887
(2) Periodic Inspection Report:	230-1061	767-012
(3) Progressive Inspection Manual (50 Hour):	761-753	767-006

B. Vendor Publications:

WARNING: FAILURE TO CONSULT APPLICABLE VENDOR PUBLICATION(S), WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, MAY RENDER THE AIRCRAFT UNAIRWORTHY.

(1) AIR CONDITIONING COMPRESSOR:

Vendor:	Sanden International (USA), Inc. 601 South Sanden Blvd. Wylie, TX 75098-4999 http://www.sanden.com	PH: - (972) 442-8400
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(2) AUTOFLIGHT:

Vendor(s):	Honeywell One Technology Center 23500 W. 105th St., M/D #45 Olathe, Kansas 66061-1950 http://www.bendixking.com/	(or)	S-TEC Corporation One S-TEC Way Mineral Wells, Tx 76067 PH: - (940) 325-9406 www.s-tec.com
Flight Control:	Bendix/King		
System Flight Line Installation Manual:	KFC 150 P/N 006-0287-00		

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(3) BATTERY:

Vendor:	GILL Batteries	PH: - (800) 456-0070
	A Division of Teledyne Continental Motors	
	http://www.gillbatteries.com	

(4) BRAKES AND WHEELS:

Vendor:	Parker Hannifin Corp.	PH: - (800) 272-5464
	Aircraft Wheel and Brake Division	
	1160 Center Road	
	Avon, Ohio 44011	
	http://www.parker.com/cleveland/Universe/book.pdf	

(5) ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS):

Vendor:	Meggitt Avionics, Inc.	PH: - (603) 669-0940
	10 Ammon Drive	FAX: - (603) 669-0931
	Manchester, NH 03103-7406	
	http://www.meggittavi.com/	

Vendor:	Avidyne Corporation	PH - (800) 284-3963
	55 Old Bedford Road	
	Lincoln, MA 01773	
	http://www.avidyne.com/index.htm	

Instructions for Continued Airworthiness

Primary Flight Display and Magnetometer/OAT:	Document No. AVPFD-174
Multifunction Display:	Document No. AVMFD-167
Data Acquisition Unit:	Document No. AVSIU-011

(6) EMERGENCY LOCATOR TRANSMITTER:

Vendor:	Artex Aircraft Supplies	PH: - (800) 547-8901
	14405 Keil Road NE	
	Aurora, Oregon 97002	
	http://www.artex.net/	

(7) ENGINE:

Vendor:	Teledyne Continental Motors	PH: - (800) 718-3411
	Attn: Aircraft Products Division	FAX: - (251) 432-7352
	Mobile, Alabama 36601	

[SENECA IV](#)

Overhaul Manual =	CONTINENTAL - Form No. X-30030A
Parts Catalog =	CONTINENTAL - Form No. X-30031A
Operators Handbook =	CONTINENTAL - Form No. X-30553

[SENECA V](#)

Maintenance Manual =	CONTINENTAL - Form No. X-30645A
Overhaul Manual =	CONTINENTAL - Form No. X-30596A

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(8) FIRE EXTINGUISHER (PORTABLE):

Vendor:	H3R Inc. 43 Magnolia Ave # 4 San Francisco, California 94123-2911 http://www.h3r.com/index.htm	PH: - (800) 249-4289
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(9) FUEL CELLS:

Vendor:	Engineered Fabrics Corporation 669 Goodyear Street Rockmart, Georgia 30153-0548 http://www.kfefc.com/index.htm	PH: - (770) 684-7855 FAX: - (770) 684-7438
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(10) FUEL PUMP:

Vendor:	Weldon Pumps P.O. Box 46579 640 Golden Oak Parkway Oakwood Village, Ohio 44146 http://www.weldonpumps.com/index.html	PH: - (440) 232-2282 FAX: - (440) 232-0606
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(11) GEAR LOCKING ACTUATORS, HYDRAULIC PUMP, AND ALL HYDRAULIC COMPONENTS:

Vendor:	Parker Hannifin Corporation 6035 Parkland Boulevard Cleveland, OH 44124-4141 USA email: c-parker@parker.com	PH: - (800) C-PARKER (800) 272-7537 FAX: - (440) 266-7400
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(12) KEVLAR:

Vendor:	KEVLAR Special Products E.I. DuPont De Nemours & Co. Inc. Textile Fibers Department Centre Road Building Wilmington, Delaware 19898
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A Guide to Cutting and Machining Kevlar Aramid

(13) LIGHTS - NAVIGATION, STROBE, AND MAP LIGHTS:

Vendor:	Whelen Engineering Co. Inc. Route 145, Winthrop Rd. Chester, Connecticut 06412 http://www.whelen.com/	PH: - (860) 526-9504 FAX: - (860) 526-2009
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(14) MAGNETOS:

Vendor: TCM Aircraft Products PH: - (800) 718-3411
P. O. Box 90 FAX: - (251) 432-7352
Mobile, AL 36601
<http://www.tcmlink.com/>

Installation, Operation and Maintenance Teledyne Continental Motors (TCM)
Service Support Manual, P/N x42002

Instructions = S-20 / S-200 Series High Tension Magnets

or,

Vendor: Slick Aircraft Products PH: - (904) 739-4000
Unison Industries FAX: - (904) 739-4006
Attn: Subscription Service
7575 Baymeadows Way
Jacksonville, FL 32256
http://www.unisonindustries.com/news/service_documents.html

Installation, Operation and Maintenance F1100 MASTER SERVICE MANUAL,
4300/6300 SERIES MAGNETO MAINTENANCE AND
Instructions: OVERHAUL MANUAL - L-1363

(15) NAVIGATION, COMMUNICATIONS, AND GPS (NAV/COM/GPS):

Vendor: Garmin International PH: - (913) 397-8200
1200 East 151ST Street
Olathe, KS 66062
<http://www.garmin.com>

(16) OXYGEN SYSTEM:

Vendor: Scott Aviation PH: - (716) 683-5100
2225 Erie Street
Lancaster, New York 14086
<http://www.scottaviation.com/>

(17) PROPELLER:

Vendor: Hartzell Propeller Inc. PH: - (937) 778-4379
One Propeller Place FAX: - (937) 778-4321
Piqua, OH 45356-2634
<http://www.hartzellprop.com/index2.htm>

Overhaul Instructions: Manual No. 117

or,

Vendor: McCauley Accessory Division
3535 McCauley Drive
P.O. Drawer 5053
Vandalia, Ohio 45377-5053

McCAULEY C500 SERIES SERVICE MANUAL - P/N 810915

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(18) STANDBY ATTITUDE INDICATOR:

Vendor Address: Mid-Continent Instruments Co., Inc. PH - (316) 630-0101
9400 E. 34 TH Street N. FAX - (316) 630-0723
Wichita, KS 67226
<http://www.mcico.com/index.html>

Installation Manual and
Operating Instructions: Manual No. 9015762

(19) STARTER:

Electro Systems, Inc.
(see "Voltage Regulator," below)

(20) VACUUM PUMP:

Vendor: Aero Accessories, Inc. PH: - (800) 822-3200
1240 Springwood Avenue
Gibsonville, NC 27249
<http://www.aeroaccessories.com/index.html>

(21) VACUUM REGULATOR:

Vendor: Parker Hannifin Corp. PH: - (800) 382-8422
Airborne Division
711 Taylor Street
Elyria, Ohio 44035
<http://www.parker.com/cleveland/Universe/book.pdf>

(22) VOLTAGE REGULATOR:

Vendor: Electro Systems, Inc. PH: - (888) 461-6077
Airport Complex
P. O. Box 273
Fort Deposit, Alabama 36032
<http://www.kellyaerospace.com/index.htm/>

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14. Chapter/Section Index Guide

NOTE: The following GAMA Specification No. 2 standard chapters are not included in this Maintenance Manual: 23, 36, 38, 49, 53, 54, 60, 72, 75, and 83. These chapters are omitted because the subject system is either: not installed in these airplanes; adequately covered in vendor or other manuals; or, for ease of use, has been combined with another chapter.

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		20 Distribution	
		40 Heating	
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		80 Detection	
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32	LANDING GEAR		4C17
		00 General	
		10 Main Gear and Doors	
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		30 Extension and Retraction	
		40 Wheels and Brakes	
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	2	Aug 19/05			
	3	Aug 19/05			
	4	Aug 19/05			
	5	Aug 19/05			
	6	Aug 19/05			

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CHAPTER 91 - CHARTS & WIRING DIAGRAMS

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<u>ATA Code</u>	<u>Grid No.</u>	<u>ATA Code</u>	<u>Grid No.</u>
2120	7D15	3410	7I17
2140	7D17	3420	7I19
2150	7D20	3720	7J7
2300	7D23	6120	7J9
2430	7E7	7410	7J11
2440	7E15	7710	7J15
2460	7E19	7720	7J22
2520	7E21	7740	7K4
2560	7E23	7930	7K13
2730	7F1	8010	7K17
2750	7F5		
2820	7F9		
2840	7F15		
3010	7F19		
3040	7F21		
3060	7F23		
3080	7G3		
3120	7G5		
3130	7G9		
3150	7G11		
3260	7H7		
3310	7H13		
3320	7I1		
3340	7I7		

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WIRING DIAGRAMS (SCHEMATICS) (continued)

(See Note Below)

<u>Subject</u>	<u>Grid No.</u>	<u>Subject</u>	<u>Grid No.</u>
Accessories	7K17	Hour Meter	7G9
Air Conditioning	7D20	Instrument Panel Post Lights	7H14
Alternator Power	7E7	Landing Gear Control and Warning	7H7
Ammeter	7E12	Landing Lights	7I7
Annunciator	7G11	Lights	7H13
Artex 110-4	7E23	Low Volt Monitor	7E12
Avidyne EFIS Option	7I22	Magnetometer	7J3
Avionics Annunciator Dimming	7H1	Magnetos	7J11
Avionics Gear Switches	7H11	Manifold Pressure	7J18
Avionics Lights Dimming	7H13	Navigation Lights	7I13
Baggage Compartment Light	7I5	Oil Pressure	7K14
Baggage Door Annunciation	7H2	Oil Pressure Switch(es)	7G9
Battery Master	7E15	Oil Temperature	7K14
CHT	7J24	Overhead Flood Lights	7H18
Clock	7G5, 7G6	Pitot Heat	7F1
Courtesy / Reading Lights	7I1	Power Point	7E19
Cylinder Head Temperature	7J24	Propeller Deice	7F23
Data Acquisition Units	7K7	Propeller Synchrophaser	7J9
DAU's	7K7	Radio Master Switch	7D23
DDMP	7K4	Recognition Lights	7I11
Defrosting	7D17	Single-side EFIS Option (Meggit)	7I19
Deice	7F21	Stall Warning	7F1
Digital Display Monitoring Panel	7K4	Standby Attitude Indicator	7I18
Digital Voice Recorder	7G6	Standby Instruments	7I17
Emergency Locator Transmitter	7E23	Starter	7K17
Engine Gauges	7K13	Strobe Lights	7I13
Entertainment Console	7E21	Surface Deice	7F19
Exceedance Alert DAU Interface	7H6	Switch Lights Dimming	7H21
External Power	7E15	Tachometer	7J15
Flaps	7F5	Taxi Lights	7I7
Flux Detector	7J3	Turbine Inlet Temperature	7J22
Fresh Air Blower	7D15	Turn and Bank	7J5
Fuel Flow	7J24	Vacuum Annunciators	7H5
Fuel Pumps	7F9	Vacuum Gauge	7J7
Fuel Quantity	7F15	Windshield Deice	7F21
Ground Clearance Switch	7E3	Wing Ice Light	7G3
Heating	7D17		

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CHARTS

1. Torque Requirements

CAUTION: DO NOT OVERTORQUE FITTINGS.

NOTE: When installing flared fittings, verify that male threads are properly lubricated. Use torque fittings values in Chart 1.

The torque values given in Chart 2 are derived from oil-free cadmium-plated threads and are recommended for all airframe installation procedures where torquing is required, unless otherwise noted in sections where other values are stipulated. Engine torque values are found in the latest revision of Teledyne Continental Overhaul Manual, and propeller torque values are found in 61-10-00. Chart 1 lists the torque values for flared fittings of various sizes and material.

- A. Calibrate the torque wrench periodically to assure accuracy, and recheck frequently.
- B. Unless otherwise specified, torque all nuts to the applicable torque in Chart 2. If the nut (or bolt) is listed but not its mating fastener, use the lower torque in Chart 2 for the listed nut (or bolt).

NOTE: If normal operation requires movement between any of the components being clamped together, tighten the nut (or bolt) enough to insure intended operation of the assembly.

- C. Bolt and nut threads should be clean and dry unless otherwise specified. If the threads are to be lubricated, reduce the recommended nut torque given in Chart 2 (plus the friction drag torque) by 50%.
- D. For thread sizes 8 through 7/16, add the friction drag torque (in Chart 2) for all self-locking fasteners. For non-self locking fasteners, assume the friction drag torque to be zero.

**CHART 1
FLARE FITTING TORQUE VALUES**

TORQUE — INCH-POUNDS					
TUBING OD INCHES	ALUMINUM - ALLOY TUBING FLARE - AND 10061 OR AND 10078		STEEL TUBING FLARE AND 10061		HOSE END FITTING AND HOSE ASSEMBLIES
	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM	MINIMUM MAXIMUM
1/8	_____	_____	_____	_____	_____ _____
3/16	_____	_____	90	100	70 100
1/4	40	65	135	150	70 120
5/16	60	80	180	200	85 180
3/8	75	125	270	300	100 250
1/2	150	250	450	500	210 420
5/8	200	350	650	700	300 480
3/4	300	500	900	1000	500 850
1	500	700	1200	1400	500 1150
1-1/4	600	900	_____	_____	_____ _____
1-1/2	600	900	_____	_____	_____ _____
1-3/4	_____	_____	_____	_____	_____ _____
2	_____	_____	_____	_____	_____ _____

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- E. For other bolt sizes, determine the friction drag torque by attaching a scale type torque wrench to the nut and determining the torque required to turn the nut on the bolt. (Before the nut makes contact with the bearing surface.) Add the friction drag torque to the specified torque to get the final torque.

NOTE: If the bolt is stationary and the nut is torqued, use the lower side of the torque range. If the nut is stationary and the bolt is torqued use the higher side of the torque range.

- F. When torquing castellated nuts, begin with minimum torque plus friction drag torque, but do not exceed maximum torque plus friction drag torque when aligning cotter key hole with the castellations in the nut. If they do not align change washers and retorquer.

NOTE: When using castellated nuts on movable joints, do not torque as described above. Tighten nuts only enough to remove looseness in the joint and install the cotter pin.

- G. Unless otherwise specified, when parts are used on Continental engines, using Piper furnished or existing Continental threaded fasteners, use the torque specified in the appropriate Teledyne Continental Overhaul Manual, latest revision.

- H. After the final torque, apply slippage mark to the nut or bolt or screw head as applicable.

NOTE: For more details on torquing, refer to FAA AC 43.13-1, latest revision.

2. Conversion Tables

The following charts contain various conversion data that may be useful when figuring capacities, lengths, temperatures, and various weights and measures from the English system to the metric system or back again:

Chart 3, Torque Conversion

Chart 4, Decimal Conversions

Chart 5, Temperature Conversion

Chart 6, Weights and Measures Conversion

Chart 7, Metric Conversion

Chart 8, Drill Sizes

3. Hose Specifications

See Chart 9.

4. Consumable Materials

See Chart 10.

5. Vendor Contact Information

See Chart 11.

6. Electrical Wire Coding

See Chart 12.

7. Electrical Symbols

See Chart 13.

CHART 2 (Sheet 1 of 2)
RECOMMENDED NUT TORQUES

<p>TORQUES: The importance of correct application can not be overemphasized. Undertorque can result in unnecessary wear of nuts and bolts as well as the parts they are holding together. When insufficient pressures are applied, uneven loads will be transmitted throughout the assembly which may result in excessive wear or premature failure due to fatigue. Overtorque can be equally damaging because of failure of a bolt or nut from overstressing the threaded areas. The following procedures should be followed to assure that the correct torque is applied:</p> <p>1. Self-Locking Fasteners - Add the friction torque from Chart "A" for sizes 8 through 7/16 to the recommended torque from Chart "B" to get the final torque. This would be the actual reading on the torque wrench. To determine friction drag torque for sizes 1/2 through 1 1/4, turn the nut fully on to the bolt and determine the torque required to turn the nut. Add this friction drag torque to the torque given in Chart "B".</p> <p>2. Castellated and Non-Self Locking Nuts - Use only the torque given in Chart "B". Unless otherwise specified, when castellated nuts are used with a cotter pin on moving joints, do not torque the nut. Turn the nut onto the bolt until proper grip is established and alignment with the cotter pin hole is achieved. Then install the cotter pin.</p> <p>GENERAL REQUIREMENTS.</p> <p>1. Calibrate the torque wrench periodically to assure accuracy. Recheck frequently.</p> <p>2. Ascertain that the bolt and nut threads are clean and dry (unless otherwise specified by the manufacturers.) If the bolt or nut is required to be lubricated prior to tightening, the torque range should be reduced 50 percent.</p> <p>3. Use a bolt long enough to prevent bearing loads on the threads. The complete chamfer or end radius of the bolt or screw must extend through the nut.</p> <p>4. Unique torques specified in the text of this manual supercede the torques given in Charts "A" and "B".</p> <p>5. Refer o the latest revision of Lycoming Service Table Limits, SSP1776, for torques on parts used on Lycoming engines.</p> <p>6. A maximum of two AN960 washers may be added under bolt heads or nuts to correct for variations in material thickness within the tolerances permitted.</p> <p>7. Self-Locking Fasteners - Limitations of the use of self-locking nuts, bolts and screws including fasteners with non-metallic inserts are as follows:</p> <p>A. Fasteners incorporating self-locking devices shall not be reused if they can be run-up using only fingers. They may be reused if hand tools are required to required to run them up providing there is no obvious damage to the self-locking device prior to installation.</p> <p>B. Bolts 5/16 inch diameter and over with cotter pin holes may be used with self-locking nuts. Nuts with non-metallic locking devices may be used in this application only if the bolts are free from burrs around the cotter pin hole.</p> <p>C. Do not use self-locking nuts at joints which subject either the nut or bolt to rotate.</p> <p>D. Never tap or rethread self-locking fasteners. Do not use nuts, bolts or screws with damaged threads or rough ends.</p>				CHART B				
				COARSE THREAD SERIES				
				Nut-bolt size	BOLTS Steel Tension			
					AN 3 THROUGH AN 20 AN 42 THROUGH AN 49 AN 73 THROUGH AN 81 AN 173 THROUGH AN 186 MS 20033 THROUGH MS 20046 MS 20073 MS 20074 AN 509 NK9 MS 24694 AN 525 NK525 MS 27039			
					NUTS			
Steel Tension		Steel Shear						
Torque Limits in-lbs.	AN 310 AN 315 AN 363 AN 365 NAS 1021 MS 17825 MS 21045 MS 20365 MS 20500 NAS 679		AN 320 AN 364 NAS 1022 MS 17826 MS 20364					
	Min.		Max.					
	Min.		Max.					
	Min.		Max.					
8-32	12	15	7	9				
10-24	20	25	12	15				
1/4-20	40	50	25	30				
5/16-18	80	90	48	55				
3/8-16	160	185	95	110				
7/16-14	235	255	140	155				
1/2-13	400	480	240	290				
9/16-12	500	700	300	420				
5/8-11	700	900	420	540				
3/4-10	1,150	1,600	700	950				
7/8-9	2,200	3,000	1,300	1,800				
1-8	3,700	5,000	2,200	3,000				
1-1/8-8	5,500	6,500	3,300	4,000				
1-1/4-8	6,500	8,000	4,000	5,000				

CHART A		
BOLT SIZE	FRICTION DRAG TORQUE (IN. -LB.)	
	Coarse	Fine
8	15	--
10	18	18
1/4	30	15
5/16	60	60
3/8	80	80
7/16	100	100

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**CHART 2 (Sheet 2 of 2)
RECOMMENDED NUT TORQUES**

FINE THREAD SERIES												
	BOLTS Steel Tension				BOLTS Steel Tension				BOLTS Aluminum			
	AN 3 THRU AN 20 AN 42 THRU AN 49 AN 73 THRU AN 81 AN 173 THRU AN 186 MS 20033 THRU MS 20046 MS 20073 MS 20074 AN 509 NK9 MS 24694 AN 525 NK525 MS 27039				MS 20004 THRU MS 20024 NAS 144 THRU NAS 158 NAS 333 THRU NAS 340 NAS 583 THRU NAS 590 NAS 624 THRU NAS 644 NAS 1303 THRU NAS 1320 NAS 172 NAS 174 NAS 517				AN 3DD THRU AN 20DD AN 173DD THRU AN 186DD AN 509DD AN 525D MS 27039D MS 24694DD			
	NUTS Steel Tension Steel Shear				NUTS Steel Tension Steel Shear				NUTS Alum. Tension Alum. Shear			
	AN 310 AN 315 AN 363 AN 365 NAS 1021 MS 17825 MS 21045 MS 20365 MS 20500 NAS 679		AN 320 AN 364 NAS 1022 MS 17826 MS 20364		AN 310 AN 315 AN 363 AN 365 MS 17825 MS 20365 MS 21045 NAS 1021 NAS 679 NAS 1291		AN 320 AN 364 NAS 1022 MS 17826 MS 20364		AN 365D AN 310D NAS 1021D		AN 320D AN 364D NAS 1022D	
Nut-bolt size	Torque Limits in-lbs.		Torque Limits in-lbs.		Torque Limits in-lbs.		Torque Limits in-lbs.		Torque Limits in-lbs.		Torque Limits in-lbs.	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
8-36	12	15	7	9					5	10	3	6
10-32	20	25	12	15	25	30	15	20	10	15	5	10
1/4-28	50	70	30	40	80	100	50	60	30	45	15	30
5/16-24	100	140	60	85	120	145	70	90	40	65	25	40
3/8-24	160	190	95	110	200	250	120	150	75	110	45	70
7/16-20	450	500	270	300	520	630	300	400	180	280	110	170
1/2-20	480	690	290	410	770	950	450	550	280	410	160	260
9/16-18	800	1,000	480	600	1,100	1,300	650	800	380	580	230	360
5/8-18	1,100	1,300	660	780	1,250	1,550	750	950	550	670	270	420
3/4-16	2,300	2,500	1,300	1,500	2,650	3,200	1,600	1,900	950	1,250	560	880
7/8-14	2,500	3,000	1,500	1,800	3,550	4,350	2,100	2,690	1,250	1,900	750	1,200
1-14	3,700	4,500	2,200	3,300	4,500	5,500	2,700	3,300	1,600	2,400	950	1,500
1-1/8-12	5,000	7,000	3,000	4,200	6,000	7,300	3,600	4,400	2,100	3,200	1,250	2,000
1-1/4-12	9,000	11,000	5,400	6,600	11,000	13,400	6,600	8,000	3,900	5,600	2,300	3,650

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CHART 3
TORQUE CONVERSION

INCH POUNDS (IN.-LBS.) TO CENTIMETER KILOGRAMS (CMKG.)

CENTIMETER KILOGRAMS (CMKG.) TO INCH POUNDS (IN.-LBS.)

FOOT POUNDS (FT.-LBS.) TO METER KILOGRAMS (MKG.)

METER KILOGRAMS (MKG.) TO FOOT-POUNDS (FT.-LBS.)

IN.-LBS.	CMKG.	FT.-LBS.	MKG.	FT.-LBS.	MKG.	MKG.	FT.-LBS.
5	5.76	2.5	.346	115	15.900	1	7.23
10	11.52	5	.691	120	16.591	2	14.46
15	17.28	7.5	1.037	125	17.282	3	21.69
20	23.04	10	1.383	130	17.974	4	28.98
25	28.80	12.5	1.728	135	18.665	5	36.16
30	34.56	15	2.074	140	19.356	6	43.39
35	40.32	17.5	2.419	145	10.047	7	50.63
40	46.08	20	2.765	150	20.739	8	57.86
45	51.84	22.5	3.111	155	21.430	9	65.09
50	57.60	25	3.456	160	22.121	10	72.32
55	63.36	27.5	3.802	165	22.813	11	79.56
60	69.12	30	4.148	170	23.504	12	86.79
65	74.88	32.5	4.493	175	24.195	13	94.02
70	80.64	35	4.839	180	24.887	14	101.26
75	86.40	37.5	5.185	185	25.578	15	108.49
80	92.16	40	5.530	190	26.269	16	115.72
85	97.92	42.5	5.876	195	26.960	17	122.95
90	103.68	45	6.222	200	27.652	18	130.19
95	109.44	47.5	6.567	205	28.343	19	137.42
100	115.20	50	6.913	210	29.034	20	144.65
105	120.96	52.5	7.258	215	29.726	21	151.89
110	126.72	55	7.604	220	30.417	22	159.12
115	132.48	57.5	7.950	225	31.108		
120	138.24	60	8.295	230	31.800		
		62.5	8.641	235	32.491		
		65	8.987	240	33.182		
		67.5	9.332	245	33.873		
		70	9.678	250	34.565		
		72.5	10.024	255	35.256		
		75	10.369	260	35.947		
		77.5	10.715	265	36.639		
		80	11.060	270	37.330		
		82.5	11.406	275	38.021		
		85	11.752	280	38.713		
		87.5	12.097	285	39.404		
		90	12.443	290	40.095		
		92.5	12.789	295	40.786		
		95	13.134	300	41.478		
		97.5	13.480				
		100	13.826				
		105	14.517				
		110	15.208				
CMKG.	IN.-LBS.						
50	43.4						
100	86.8						
150	130.2						
200	173.6						
250	217.0						
300	260.4						
350	303.8						
400	347.2						
450	390.6						
500	434.0						
550	477.4						
600	520.8						
650	564.2						
700	607.6						

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**CHART 4
DECIMAL CONVERSIONS**

4ths	8ths	16ths	32nds	64ths	TO 3 PLACES	TO 2 PLACES	M.M. EQUIV
1/4	1/8	1/16	1/32	1/64	.016	.02	.397
					.031	.03	.794
				3/64	.047	.05	1.191
			3/32		.062	.06	1.587
				5/64	.078	.08	1.984
					.094	.09	2.381
				7/64	.109	.11	2.778
			3/16		.125	.12	3.175
				9/64	.141	.14	3.572
				5/32	.156	.16	3.969
				11/64	.172	.17	4.366
					.188	.19	4.762
				13/64	.203	.20	5.159
				7/32	.219	.22	5.556
				15/64	.234	.23	5.953
	3/8	5/16	9/32		.250	.25	6.350
				17/64	.266	.27	6.747
					.281	.28	7.144
				19/64	.297	.30	7.540
			11/32		.312	.31	7.937
				21/64	.328	.33	8.334
					.344	.34	8.731
				23/64	.359	.36	9.128
		7/16	13/32		.375	.38	9.525
				25/64	.391	.39	9.922
					.406	.41	10.319
				27/64	.422	.42	10.716
			15/32		.438	.44	11.112
				29/64	.453	.45	11.509
					.469	.47	11.906
				31/64	.484	.48	12.303
					.500	.50	12.700

4ths	8ths	16ths	32nds	64ths	TO 3 PLACES	TO 2 PLACES	M.M. EQUIV
3/4	5/8	9/16	17/32	33/64	.516	.52	13.097
					.531	.53	13.494
				35/64	.547	.55	13.891
			19/32		.562	.56	14.288
				37/64	.578	.58	14.684
					.594	.59	15.081
				39/64	.609	.61	15.478
		11/16	21/32		.625	.62	15.875
				41/64	.641	.64	16.272
					.656	.66	16.669
				43/64	.672	.67	17.065
			23/32		.688	.69	17.462
				45/64	.703	.70	17.859
					.719	.72	18.256
				47/64	.734	.73	18.653
	7/8	13/16	25/32		.750	.75	19.050
				49/64	.766	.77	19.447
					.781	.78	19.844
				51/64	.797	.80	20.241
			27/32		.812	.81	20.637
				53/64	.828	.83	21.034
					.844	.84	21.431
				55/64	.859	.86	21.828
		15/16	29/32		.875	.88	22.225
				57/64	.891	.89	22.622
					.906	.91	23.019
				59/64	.922	.92	23.416
			31/32		.938	.94	23.812
				61/64	.953	.95	24.209
					.969	.97	24.606
				63/64	.984	.98	25.003
					1.000	1.00	25.400

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**CHART 5
TEMPERATURE CONVERSION**

CENTIGRADE - FAHRENHEIT

Example: To convert 20°C, to Fahrenheit, find 20 in the center column headed (°F - °C); then read 68.0°F, in the column (°F) to the right. To convert 20°F, to Centigrade; find 20 in the center column and read -6.67°C, in the (°C) column to the left.

°C	°F - °C	°F	°C	°F - °C	°F
-56.7	-70	-94.0	104.44	220	428.0
-51.1	-60	-76.0	110.00	230	446.0
-45.6	-50	-58.0	115.56	240	464.0
-40.0	-40	-40.0	121.11	250	482.0
-34.0	-30	-22.0	126.67	260	500.0
-38.9	-20	-4.0	132.22	270	518.0
-23.3	-10	14.0	137.78	280	536.0
-17.8	0	32.0	143.33	290	554.0
-12.22	10	50.0	148.89	300	572.0
-6.67	20	68.0	154.44	310	590.0
-1.11	30	86.0	160.00	320	608.0
4.44	40	104.0	165.56	330	626.0
10.00	50	122.0	171.11	340	644.0
15.56	60	140.0	176.67	350	662.0
21.11	70	158.0	182.22	360	680.0
26.67	80	176.0	187.78	370	698.0
32.22	90	194.0	193.33	380	716.0
37.78	100	212.0	198.89	390	734.0
43.33	110	230.0	204.44	400	752.0
48.89	120	248.0	210.00	410	770.0
54.44	130	266.0	215.56	420	788.0
60.00	140	284.0	221.11	430	806.0
65.56	150	302.0	226.67	440	824.0
71.11	160	320.0	232.22	450	842.0
76.67	170	338.0	237.78	460	860.0
82.22	180	356.0	243.33	470	878.0
87.78	190	374.0	248.89	480	896.0
93.33	200	392.0	254.44	490	914.0
98.89	210	410.0	260.00	500	932.0

**THE NEW PIPER AIRCRAFT, INC.
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**CHART 6
WEIGHTS AND MEASURES CONVERSION**

MULTIPLY	BY	TO OBTAIN	MULTIPLY	BY	TO OBTAIN
CENTIMETERS	0.3937 0.03281	IN. FT.	KILOGRAMS	2.205 35.27 1000	LB. OZ. GRAMS
CU. CENTIMETERS	0.001 0.06102 0.0002642	LITERS CU. IN. U.S. GAL.	LITERS	1000 61.03 0.03532 0.2642 0.22 1.057	CU. CM. CU. IN. CU. FT. U.S. GAL. IMPERIAL GAL. QUARTS
CU. FT.	28.320 1.728 7.481 28.32	CU. CM. CU. IN. U.S. GAL. LITERS	METERS	39.37 3.281 1000	IN. FT. MM.
CU. IN.	16.39 0.01639 0.004329 0.01732	CU. CM. LITERS U.S. GAL. QUARTS	METER-KILOGRAM	7.233 9.807	FT.-LB. JOULES
CU. METERS	1000000 35.314 61.023 264.17 999.97	CU. CM. CU. FT. CU. IN. GAL. LITERS	OUNCES, AVDP	0.0625 28.35 437.5	LB., AVDP GRAMS GRAINS
FEET	0.3048 12.000 304.8 0.3333	METERS MILS MM. YARDS	OUNCES, FLUID	29.57 1.805	CU. CM. CU. IN.
FT.-LB.	0.1383 0.001285 0.000000376	M-KG BTU KW-HR	LB., AVDP	453.6 7000 16.0	GRAMS GRAINS OUNCES
FLUID OZ.	8 29.6	DRAM CU. CM.	SQUARE INCH	6.4516	SQ. CM.
GAL., IMPERIAL	277.4 1.201 4.546	CU. IN. U.S. GAL. LITERS	POUND PER SQUARE INCH (PSI)	0.0703	KG.-CM SQUARED
GAL., U.S. DRY	268.8 0.1556 1.164 4.405	CU. IN. CU. FT. U.S. GAL., LIQ. LITERS	STATUTE MILE	1.609 0.8684	KILOMETER NAUTICAL MILE
GAL., U.S. LIQ.	231.0 0.1337 3.785 0.8327 128	CU. IN. CU. FT. LITERS IMPERIAL GAL. FLUID OZ.	NAUTICAL MILE	1.151	STATUTE MILE
IN.	2.540 .08333	CM. FT.	QUART	.9463	LITER
JOULES	0.000948 0.7376	BTU FT.-LB.	MILLIMETER	1000	MICRON
			MICRON	0.001 0.000039	MILLIMETER INCH
			INCH POUNDS	11.521	METER GRAMS
			INCH OUNCES	0.72	METER GRAMS
			POUNDS	0.453	KILOGRAMS

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CHART 7
METRIC CONVERSION

Example: Convert 1.5 inches to millimeters.

- (1) Read down inches column to 1. inches.
- (2) Read across top inch column to 0.5.
- (3) Read down and across to find millimeters (1.5 inches is 38.10 millimeters).

INCHES TO MILLIMETER										
INCHES	0.0000	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009
	MILLIMETER									
0.000		0.0025	0.0050	0.0076	0.0101	0.0127	0.0152	0.0177	0.0203	0.0228
0.001	0.0254	0.0279	0.0304	0.0330	0.0355	0.0381	0.0406	0.0431	0.0457	0.0482
0.002	0.0508	0.0533	0.0558	0.0584	0.0609	0.0635	0.0660	0.0685	0.0711	0.0736
0.003	0.0762	0.0812	0.0838	0.0863	0.0889	0.0914	0.0939	0.0965	0.0990	0.1016
0.004	0.1016	0.1041	0.1066	0.1092	0.1117	0.1143	0.1168	0.1193	0.1219	0.1244
0.005	0.1270	0.1295	0.1320	0.1346	0.1371	0.1397	0.1422	0.1447	0.1473	0.1498
0.006	0.1524	0.1549	0.1574	0.1600	0.1625	0.1651	0.1676	0.1701	0.1727	0.1752
0.007	0.1778	0.1803	0.1828	0.1854	0.1879	0.1905	0.1930	0.1955	0.1981	0.2006
0.008	0.2032	0.2057	0.2082	0.2108	0.2133	0.2159	0.2184	0.2209	0.2235	0.2260
0.009	0.2286	0.2311	0.2336	0.2362	0.2387	0.2413	0.2438	0.2463	0.2489	0.2514
INCHES	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009
	MILLIMETER									
0.00		0.025	0.050	0.076	0.101	0.127	0.152	0.177	0.203	0.228
0.01	0.254	0.279	0.304	0.330	0.355	0.381	0.406	0.431	0.457	0.482
0.02	0.508	0.533	0.558	0.584	0.609	0.635	0.660	0.685	0.711	0.736
0.03	0.762	0.787	0.812	0.838	0.863	0.889	0.914	0.939	0.965	0.990
0.04	1.016	1.041	1.066	1.092	1.117	1.143	1.168	1.193	1.219	1.244
0.05	1.270	1.295	1.320	1.346	1.371	1.397	1.422	1.447	1.473	1.498
0.06	1.524	1.549	1.574	1.600	1.625	1.651	1.676	1.701	1.727	1.752
0.07	1.778	1.803	1.828	1.854	1.879	1.905	1.930	1.955	1.981	2.006
0.08	2.032	2.057	2.082	2.108	2.133	2.159	2.184	2.209	2.235	2.260
0.09	2.286	2.311	2.336	2.362	2.387	2.413	2.438	2.463	2.489	2.514
INCHES	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
	MILLIMETER									
0.0		0.254	0.508	0.762	1.016	1.270	1.524	1.778	2.032	2.286
0.1	2.540	2.794	3.048	3.302	3.556	3.810	4.064	4.318	4.572	4.826
0.2	5.080	5.334	5.588	5.842	6.096	6.350	6.604	6.858	7.112	7.366
0.3	7.620	7.874	8.128	8.382	8.636	8.890	9.144	9.398	9.652	9.906
0.4	10.160	10.414	10.668	10.922	11.176	11.430	11.684	11.938	12.192	12.446
0.5	12.700	12.954	13.208	13.462	13.716	13.970	14.224	14.478	14.732	14.986
0.6	15.240	15.494	15.748	16.002	16.256	16.510	16.764	17.018	17.272	17.526
0.7	17.780	18.034	18.288	18.542	18.796	19.050	19.304	19.558	19.812	20.066
0.8	20.320	20.574	20.828	21.082	21.336	21.590	21.844	22.098	22.352	22.606
0.9	22.860	23.114	23.368	23.622	23.876	24.130	24.384	24.638	24.892	25.146
INCHES	0.00	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	MILLIMETER									
0.0		2.54	5.08	7.62	10.16	12.70	15.24	17.78	20.32	22.86
1.0	25.40	27.94	30.48	33.02	35.56	38.10	40.64	43.18	45.72	48.26
2.0	50.80	53.34	55.88	58.42	60.96	63.50	66.04	68.58	71.12	73.66
3.0	76.20	78.74	81.28	83.82	86.36	88.90	91.44	93.98	96.52	99.06
4.0	101.60	104.14	106.68	109.22	111.76	114.30	116.84	119.38	121.92	124.46
5.0	127.00	129.54	132.08	134.62	137.16	139.70	142.24	144.78	147.32	149.86
6.0	152.40	154.94	157.48	160.02	162.56	165.10	167.64	170.18	172.72	175.26
7.0	177.80	180.34	182.88	185.42	187.96	190.50	193.04	195.58	198.12	200.66
8.0	203.20	205.74	208.28	210.82	213.36	215.90	218.44	220.98	223.52	226.06
9.0	228.60	231.14	233.68	236.22	238.76	241.30	243.84	246.38	248.92	251.46

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CHART 8
DRILL SIZES

Decimal/Millimeter Equivalents of Drill Sizes From 1/2" to No. 80											
Size	Decimal Equiv.	Millimeter Equiv.	Size	Decimal Equiv.	Millimeter Equiv.	Size	Decimal Equiv.	Millimeter Equiv.	Size	Decimal Equiv.	Millimeter Equiv.
1/2	0.500	12.7000	G	0.261	6.6294	5/32	0.1562	3.9687	51	0.067	1.7018
31/64	0.4843	12.3031	F	0.257	6.5278	23	0.154	3.9116	52	0.0635	1.6129
15/32	0.4687	11.9062	E-1/4	0.250	6.3500	24	0.152	3.8608	1/16	0.0625	1.5875
29/64	0.4531	11.5094	D	0.246	6.2484	25	0.1495	3.7973	53	0.0595	1.5113
7/16	0.4375	11.1125	C	0.242	6.1468	26	0.147	3.7338	54	0.055	1.397
27/64	0.4218	10.7156	B	0.238	6.0452	27	0.144	3.6576	55	0.052	1.3208
Z	0.413	10.4902	15/64	0.2343	5.9531	9/64	0.1406	3.5719	3/64	0.0468	1.1906
13/32	0.4062	10.3187	A	0.234	5.9436	28	0.1405	3.5687	56	0.0465	1.1811
Y	0.404	10.2616	1	0.228	5.7912	29	0.136	3.4544	57	0.043	1.0922
X	0.397	10.0838	2	0.221	5.6134	30	0.01285	3.2639	58	0.042	1.0668
25/64	0.3906	9.9212	7/32	0.2187	5.5562	1/8	0.125	3.1750	59	0.041	1.0414
W	0.386	9.8044	3	0.213	5.4102	31	0.120	3.048	60	0.040	1.016
V	0.377	9.5758	4	0.209	5.3086	32	0.116	2.9464	61	0.039	0.9906
3/8	0.375	9.5250	5	0.2055	5.2197	33	0.113	2.8702	62	0.038	0.9652
U	0.368	9.3472	6	0.204	5.1816	34	0.111	2.8194	63	0.037	0.9398
23/64	0.3593	9.1262	13/64	0.2031	5.1594	35	0.110	2.794	64	0.036	0.9144
T	0.358	9.1281	7	0.201	5.1054	7/64	0.1093	2.7781	65	0.035	0.899
S	0.346	8.7884	8	0.199	5.0546	36	0.1065	2.7051	66	0.033	0.8382
11/32	0.3437	8.7300	9	0.196	4.9784	37	0.104	2.6416	1/32	0.0312	0.7937
R	0.339	8.6106	10	0.1935	4.9149	38	0.1015	2.5781	67	0.032	0.8128
Q	0.332	8.4328	11	0.191	4.8514	39	0.0995	2.5273	68	0.031	0.7874
21/64	0.3281	8.3337	12	0.189	4.8006	40	0.098	2.4892	69	0.029	0.7366
P	0.323	8.2042	3/16	0.1875	4.7625	41	0.096	2.4384	70	0.028	0.7112
O	0.316	8.0264	13	0.185	4.699	3/32	0.0937	2.3812	71	0.026	0.6604
5/16	0.3125	7.9375	14	0.182	4.6228	42	0.0935	2.3749	72	0.025	0.635
N	0.302	7.6708	15	0.180	4.572	43	0.089	2.2606	73	0.024	0.0696
19/64	0.2968	7.5387	16	0.177	4.4958	44	0.086	2.1844	74	0.0229	0.58166
M	0.295	7.4930	17	0.173	4.3942	45	0.082	2.0828	75	0.021	0.5334
L	0.290	7.3660	11/64	0.1718	4.3656	46	0.081	2.0574	76	0.020	0.508
9/32	0.2812	7.1425	18	0.1695	4.3053	47	0.0785	1.9939	77	0.018	0.4572
K	0.281	7.1374	19	0.166	4.2164	5/64	0.0781	1.9844	1/64	0.0156	0.3969
J	0.277	7.0358	20	0.161	4.0894	48	0.076	1.9304	78	0.016	0.4064
I	0.272	6.9088	21	0.159	4.0386	49	0.073	1.8542	79	0.0145	0.3683
H	0.266	6.7564	22	0.157	3.9878	50	0.070	1.778	80	0.0135	0.3429
17/64	0.2656	6.7462									

DRILL SIZES AVAILABLE

Drill may be obtained in regular sizes to a 4 inch diameter, and increase in 64ths of an inch. The regular metric drills vary from 2 to 76mm and increase in 0.5mm variations.

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CHART 9
HOSE SPECIFICATIONS

SINGLE WIRE BRAID FABRIC COVERED

MIL PART NO.	TUBE SIZE O.D.	HOSE SIZE I.D.	HOSE SIZE O.D.	RECOMMENDED OPER. PRESS	MIN BURST PRESS	MAX PROOF PRESS	MIN BEND RADIUS
MIL-H-8794- 3-L	3/16	1/8	.45	3,000	12,000	6,000	3.00
MIL-H-8794- 4-L	1/16	3/16	.52	3,000	12,000	6,000	3.00
MIL-H-8794- 5-L	5/16	1/4	.58	3,000	10,000	5,000	3.38
MIL-H-8794- 6-L	3/8	5/16	.67	2,000	9,000	4,500	4.00
MIL-H-8794- 8-L	1/2	13/32	.77	2,000	8,000	4,000	4.63
MIL-H-8794-10-L	5/8	1/2	.92	1,750	7,000	3,500	5.50
MIL-H-8794-12-L	3/4	5/8	1.08	1,500	6,000	3,000	6.50
MIL-H-8794-16-L	1	7/8	1.23	800	3,200	1,600	7.38
MIL-H-8794-20-L	1 1/4	1 1/8	1.50	600	2,500	1,250	9.00
MIL-H-8794-24-L	1 1/2	1 3/8	1.75	500	2,000	1,000	11.00
MIL-H-8794-32-L	2	1 13/16	2.22	300	1,400	700	13.25
MIL-H-8794-40-L	2 1/2	2 3/8	2.88	200	1,000	300	24.00
MIL-H-8794-48-L	3	3	3.56	200	800	300	33.00

Construction: Seamless synthetic rubber inner tube reinforced with one fiber braid, one braid of high tensile steel wire and covered with an oil resistant rubber impregnated fiber braid.

Identification: Hose is identified by specification number, size number, quarter year and year, hose manufacturer's identification.

Uses: Hose is approved for use in aircraft hydraulic, pneumatic, coolant, fuel and oil systems.

Operating Temperatures:

Sizes -3 thru -12: Minus 65°F. to plus 250°F.

Sizes -16 thru -48: Minus 40°F to plus 275°F.

NOTE: Maximum temperatures and pressures should not be used simultaneously.

MULTIPLE WIRE BRAID RUBBER COVERED

MIL PART NO.	TUBE SIZE O.D.	HOSE SIZE I.D.	HOSE SIZE O.D.	RECOMMENDED OPER. PRESS	MIN BURST PRESS	MAX PROOF PRESS	MIN BEND RADIUS
MIL-H-8788- 4-L	1/4	7/32	.63	3,000	16,000	8,000	3.00
MIL-H-8788- 5-L	5/16	9/32	.70	3,000	14,000	7,000	3.38
MIL-H-8788- 6-L	3/8	11/32	.77	3,000	14,000	7,000	5.00
MIL-H-8788- 8-L	1/2	7/16	.86	3,000	14,000	7,000	5.75
MIL-H-8788-10-L	5/8	9/16	1.03	3,000	12,000	6,000	6.50
MIL-H-8788-12-L	3/4	11/16	1.22	3,000	12,000	6,000	7.75
MIL-H-8788-16-L	1.00	7/8	1.50	3,000	10,000	5,000	9.63

Hose Construction: Seamless synthetic rubber inner tube reinforced with one fabric braid, two or more steel wire braids, and covered with a synthetic rubber cover (for gas applications, request perforated cover).

Identification: Hose is identified by specification number, size number, quarter year and year, hose manufacturer's identification.

Uses: High pressure hydraulic, pneumatic, coolant, fuel and oil.

Operating Temperature:

Minus 65°F to plus 200°F.

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CHART 10 (Sheet 1 of 8)
CONSUMABLE MATERIALS

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
ABS-Solvent/Cements		Solarite, #11 Series	Solar Compounds Corp.
Adhesive		EC 801 EC 807 EC 1357 Scotch Grip 210 (Rubber Adhesive)	Minnesota Mining and Manufacturing Adhesive Coating and Sealers Division
Adhesive, Rubber Pedal Pad		EC-1300L (179-929)	3M
Anti-Galling Solution	MIL-A-907	Ease-Off	Taxacone Company
Anti-Seize Compound (Graphite Petrolatum)	MIL-T-5544	Armite Product	Armite Laboratories
		Anti-Seize Compound Royco 44	Exxon Oil Company Royal Lubricants Co.
Anti-Seize Compound (White Lead Base)	TT-A-580 (JAN-A-669)	Armite Product	Armite Laboratories
Anti-Seize Thread Compound "HIGH TEMPERATURE"		Fel-Pro C5-A	Fel-Pro Incorporated
Buffing and Rubbing Compounds		Automotive Type DuPont #7	DuPont Company
		Ram Chemical #69	Ram Chemicals
Compound for Polishing		Mirror Glaze	Mirror Bright Polish Co., Incorporated
Corrosion Inhibiting Compound		DINOL	DINOL International
Plexiglas Polish and Cleaner	P-P-560	Part Number 403D	Permatex Co., Inc.
Cleaners		Fantastic Spray Perchlorethylene VM&P Naphtha (Lighter Fluid)	Local Supplier
Deicer Boot Surface Coatings		Agemaster	B.F. Goodrich
Dry Lubricant	MIL-L-60326	MS-122-6075	Miller-Stephenson
Epoxy Patching Compound		Solarite #400	Solar Compounds Corp.
Gasket Cement		Permatex No. 2	Permatex Company, Inc.
Grease, Actuator		2196-74-1	Dukes Astronautics Co.

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**CHART 10 (Sheet 2 of 8)
CONSUMABLE MATERIALS**

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Grease, Aircraft Instrumentation, Gear and Actuator Screw (Temp. Range - (100°F to +250°F))	MIL-G-23827A (See Note at end.)	Supermil Grease No. A72832	Amoco
		Royco 27A	Royal Lubricants Co.
		Shell 6249 Grease	Shell Oil Company
		RR-28	Socony Mobil Oil Co.
		Castrolase A1	Burmah-Castrol LTD.
		Low-Temp. Grease E.P.	Texaco Incorp.
		5114 E.P. Grease AV55	Standard Oil of Calif.
		Aeroshell Grease 7 Braycote 627S	Shell Oil Company
		Mobil Grease 27	Mobil Oil Corporation
		B.P. Aero Grease 31B	B.P. Trading Limited
Grease, Aircraft Instrumentation, Gear and Actuator Screw (Temp. Range - 65°F to +250°F)	MIL-G-3278	Unitemp E.P.	Texaco Incorporated
		RPM Aviation Grease 5, Supermil Grease No. 8723	Standard Oil of Calif.
		Aeroshell Grease 7A	Shell Oil Corporation
		Royco 78	Royal Lubricants Company
		L-1212	Sinclair Refining Co.
Grease Ball and Roller Bearing	MIL-G-18709	1916 Uni-Temp Grease	California Texas Oil Corporation
		Regal ASB-2 Formula TG-10293	Texaco Incorporated
		Andok B	Exxon Company, U.S.A.
		Code 1-20481, Darina Grease 1 XSG-6213	Shell Oil Company
		Code 71-501, Darina Grease 2 XSG-6152	
		Code 71-502, Alvania Grease 2 XSG-6151	
		Code 71-012, Cyprina Grease 3 XSG-6280	
		Code 71-003	

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**CHART 10 (Sheet 3 of 8)
CONSUMABLE MATERIALS**

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Grease, General Purpose Wide Temperature	MIL-G-81322	Marfax All Purpose	Texaco Incorporated
		Aeroshell No. 6	Shell Oil Company
		Mobil Grease 77 or Mobilux EP2	Mobil Oil Corporation
		Shell Alvania EP2	Shell Oil Company
		Royco 22	Royal Lubricants Company
		Mobil Grease 28	Mobil Oil Corporation
		Aeroshell No. 22	Shell Oil Company
Grease, High Temperature	MIL-G-3545	High Temp. Grease, Marfak All Purpose	Texaco Incorporated
		Shellaire Grease HT Alvania E.P. Grease 2 Aeroshell Grease 5	Shell Oil Company
		Grease 77, Mobilux E.P. 2	Mobil Oil Corporation
		Royco 45A	Royal Lubricants Co.
		L-1231	Sinclair Refining Company
Grease, Aircraft General Purpose	MIL-G-7711	Regal AFB2 Regal Starfak Premium	Texaco Incorporated
		PED 3040	Standard Oil of Calif.
		Aeroshell Grease 6	Shell Oil Company
		Royco II	Royal Lubricants Company
Grease, Lubricating, Molybdenum Disulfide, Low and High Temperature	MIL-G-21164	Aeroshell Grease No. 17	Shell Oil Company
		Royco 64C	Royal Lubricants Co.
		Castrol MSA (c)	Burmah Castrol LTD.

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**CHART 10 (Sheet 4 of 8)
CONSUMABLE MATERIALS**

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Grease, Lubricating, Plug Valve, Gasoline and Oil Resistant	MIL-G-6032	Royco 32	Royal Lubricant Company
		Castrollease PV	Burmah Castrol LTD.
		Parker Fuel Lube 44	Parker Seal Company
		B.P. Aero Grease 32	B.P. Trading Limited
		L-237	Lehigh Tenneco Chemicals Co., Inc.
		Rockwell 950	Rockwell International
Grease, Waterproof, High and Low Temperature		Aero Lubriplate	Fiske Brothers Refining Company
"Hot Melt" Adhesive Polyamids and "Hot Melt" Gun.	Stick Form 1/2 in. diameter, 3 in. long		Sears, Roebuck and Company or most hardware stores.
Hydraulic Fluid	MIL-H-5606	Brayco 756D	Bray Oil Company
		TL-5874	Texaco Incorporated
		PED 3565	Standard Oil Company of California
		Aircraft Hydraulic Oil AA	Texaco Incorporated
		RPM Aviation Oil No. 2 Code PED 2585 PED 3337	Standard Oil Company of California
		Aeroshell Fluid 4, SL-7694	Shell Oil Company
		Aero HF	Mobil Oil Corporation
		Royco 756, 756A and 756B	Royal Lubricants Co.
Isopropyl Alcohol	Fed. Spec. TT-I-735		Local Supplier
Isocryl Tape	(PMS-C1012-2)		Schnee Moorehead Chemicals, Incorporated
Kevlar		Kevlar	Kevlar Special Products

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**CHART 10 (Sheet 5 of 8)
CONSUMABLE MATERIALS**

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Leak Detector Solution for Oxygen Systems	MIL-L-25567	ALPHA 73 Oxygen Leak Detector Type 1	U.S. Gulf Corporation
		Leak Tec #16-OX	American Gas and Chemical Co. LTD.
Loctite	MIL-S-22473 Grade AA	Loctite 290	Loctite Corporation
	MIL-S-22473 Grade H and HV	Loctite 222	
Methylethylketone (MEK)	Fed. Spec. TT-M-261		Local Supplier
Molybdenum Disulfide	MIL-M-7866	Molykote-Type G (Paste)	Dow Corning Corp.
		Molykote - Type 2 (Powder)	
Oil, Air Conditioner, HFC-134a	Piper P/N 923-384	PAG-21941	
Oil, Lubricating, Aircraft Reciprocating Engine (piston) grade as specified	MIL-L-6082	Castrolaero 113 (Grade 1065)	Castrol Oils, Inc.
		Chevron Aviation Oil-65	ChevronTexaco Corp.
		Mobil Aero White Band AVREX 101/1065	Mobil Oil Corp.
		Phillips 66 Aviation Engine Oil, Grade 1065	Conoco-Phillips
		Aeroshell Oil 65	Shell Oil Company
		Texaco Aircraft Engine	ChevronTexaco Corp.
Oil Lubricating, General Purpose, Low Temperature	MIL-L-7870	Caltex Low Temp. Oil	Caltex Oil Products Company
		Sinclair Aircraft Orbit Lube	Sinclair Refining Company
		1692 Low Temp Oil	Texaco Incorporated
		Aviation Instrument Oil	Standard Oil Company of California
		Royco 363	Royal Lubricants Co.

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**CHART 10 (Sheet 6 of 8)
CONSUMABLE MATERIALS**

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
O-Ring Lubricant		Parker O-Lube	Parker Seal Company
Rain Repellent	FSCM 50150	Repcon	Unelco Corporation
Safety Walk, Pressure Sensitive		Flexfred 300	Wooster Products, Incorporated
Sealant	MIL-S-11031B	PRC 5000 PRC 383	Products Research Company
Sealant, Fuel Tank Sealing		* RS-36b, Stripper (thin)	CEE BEE Chemical Co.
		* RS-24b, Stripper (thick)	
		* PR 1422 A-2 Sealant (Brushing Consistency)	
		* PR 1422 B-2 Sealant (Trowling Consistency)	
		* PR 1431G, Faying Surface Seal, Type 1	
		* PR 1321-B 1/2, Access Panel Sealant	
		* PR 1560 MK, Primer (Anti-Bacteriological Coating)	
		* BJO-0930, Phenolic Balloons	
		* ERL-2795, Epoxy Resin	
		* 22LA-0340 Polyamid Hardener	
	Class A-2	* Thiokol MC-236	
* NOTE: Use of Equivilent Sealant Approved.			
Sealant, Fuselage Structure	Class A-1/2, A-2, B-2 B-4, B-6, B-8		H.S. Bancroft Corp.
		EC 1239	Minnesota Mining and Manufacturing, Industrial Specialties Division
		EC 612 (Leak Marker or Weather Stripping, etc)	
		G.E.-SS-4004 (Primer) RTV-88 with RTV-9811	General Electric, Silicone Products Department

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**CHART 10 (Sheet 7 of 8)
CONSUMABLE MATERIALS**

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Sealant, Windshield & Windows	MIL-S-7502B B-1/4, B-1/2, B-2, B-4, B-8, B-12 Piper P/N 279-066	PR 1221 PR 1425 * Thiokol MC-236-B4	Products Research Company
Sealing Compound, Gasket and Joint		Tite-Seal	Radiator Specialty Co.
Sealer		PR 1321 B-1/2	Products Research Co.
Silicone Compound	MIL-S-8660 (MIL-C-21567)	DC-4, DC-6 Compound G-624	Dow Corning General Electric Co. Silicone Products Department
Solvents		Methylethyl Ketone (MEK) Methylene Chloride Acetone Y2900	Local Suppliers Union Carbide; Plastic Division Local Supplier
	Fed. Spec. PD 680 Type I - Stoddard Solvent Type II - High Temperature		Local Supplier
Propeller Slip Ring Cleaning Solvent		CRC-2-26	Corrosion Reaction Consultants, Inc.
Toluol	TT-M-261		Local Supplier
Trichlorethylene	MIL-T-7003	Perm-A-Clor Industries, Inc. Turco 4217	Dextrex Chemical Turco Products, Inc.
Teflon Tape	.003" x .5" wide/-1 .003" x .25" wide/-2		Minnesota Mining and Manufacturing Company Shamban W.S. and Co. Johnson & Johnson, Inc. Permcel Division
Thread Sealant for High Pressure Oxygen System	MIL-T-27730	Permcel 412	Johnson & Johnson, Inc. Permcel Division

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**CHART 10 (Sheet 8 of 8)
CONSUMABLE MATERIALS**

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Vinyl Foam	1 in. x 1/8 in.	530 Series, Type I	Norton Tape Division
Vinyl, Foam Tape	1/8 in. x 1 in.	501 Series, Type II	Norton Tape Division
Vinyl, Black Plastic	2 in. x 9 mil. and/or 1 1/2 in. x 9 mil.		
Corrosion Retardant Compounds	MIL-C-16173 D (Piper P/N 197-508)	LPS-3 Heavy Duty Rust Inhibitor	Holt Lloyd Corp.
	(Piper P/N 197-509)	Metal Parts Protector Protector Flex	Chemi-Cap. Chemical Packaging Corp.

NOTE: Take precautions when using MIL-G-23827 and engine oil. These lubricants contain chemicals harmful to painted surfaces.

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**CHART 11 (Sheet 1 of 3)
VENDOR CONTACT INFORMATION**

A

American Gas and
Chemical Co. LTD
220 Pegasus Avenue
Northvale, NJ 07647
201-767-7300

Amoco Oil Co.
200 E. Randolph Drive
Chicago, IL 60601
312-856-5111

Armite Laboratories
1845-49 Randolph Street
Los Angeles, CA 90001
213-587-7744

B

BP Trading Limited
Moore Lane
Brittanic House
London E.C. 2
England

Bray Oil Company
1925 N. Marianna Avenue
Los Angeles, CA 98103
213-268-6171

Burmah - Castrol Inc.
30 Executive Avenue
Edison, NJ 08817
201-287-3140

C

California Texas Oil Corp.,
380 Madison Avenue
New York, NY 10017

Caltex Oil Products Co.
New York, NY 10020

Castrol North America, Inc.
1500 Valley Road
Wayne, NJ 07470
800-462-0835

CEE BEE Chemical Co.
9520 E. CEE BEE Drive
Box 400
Downey, CA 92041

Chemi-cap
Chemical Packaging Corp.
1100 N.W. 70th Street
Ft. Lauderdale, FL 33309
305-665-9059

ChevronTexaco Corporation
6001 Bollinger Canyon Rd.
San Ramon, CA 94583
925-842-1000

Conoco-Phillips
800-234-6603
www.phillips66aviation.com/

Corrosion Reaction
Consultants, Inc.
Limekin Pike
Dresher, PA 19025

D

Dextrex Chemical
P. O. Box 501
Detroit, MI 48232

DINOL International
25200 Malvina
Box 1065
Warren, Michigan 48090

Dow Corning Corporation
Alpha Molykote Plant
64 Harvard Avenue
Stanford, CT 06902

Dukes Astronautics Co.
7866 Deering Avenue
Canoga Park, CA 91304

DuPont Company
Finishes Div.
DuPont Building
Wilmington, DE 19898
302-774-1000

E

Exxon Oil Company
1251 Avenue of the Americas
New York, NY 10020
212-398-3093

F

Fel-Pro Incorporated
7450 N. McCormick Blvd.
Box C1103
Skokie, IL 60076
312-761-4500

Fiske Brothers
Refining Company
120 Lockwood Street
Newark, NJ 07105
201-589-9510

G

General Electric Co.
Silicone Products Dept.
Waterford, NY 12188
518-237-3330

H

H. S. Bancroft Corp.
One Rockhill
Industrial Park
Cherry Hill, NJ 08003
609-854-8000

Holt Lloyd Corp.
4647 Hugh Howell Rd.
Tucker, GA 30084
404-934-7800

J

Johnson & Johnson, Inc.
Permacel Division
501 George Street
New Brunswick, NJ 08901
201-524-0400

K

Kevlar Special Products
E.I. DuPont de
Nemours & Co., (Inc.)
Textile Fibers
Department
Centre Road Building
Wilmington, DE 19898
302-999-3156

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**CHART 11 (Sheet 2 of 3)
VENDOR CONTACT INFORMATION**

L

Lehigh - Tenneco Chemicals
Co., Inc.
Chestertown, MD 21620
301-778-1991

Loctite Corporation
777 N. Mountain Road
Newington, CT 06111
800-243-8160
In CT 800-842-0225

M

Miller-Stephenson
George Washington Hwy
Danbury, CT 06810
203-743-4447

Minnesota Mining and MFG
3M Center
St. Paul, MN 55144
612-733-1110

Mirror Bright Polish Co., Inc.
Irvine Industrial Complex
P.O. Box 17177 Irvin, CA 92713
714-557-9200

Mobil Oil Corporation
150 E. 42nd Street
New York, NY 10017
212-883-4242

Morton Inc.
7341 Anaconda Ave
Garden Grove, CA 92641
724-373-2837
Fax 724-373-1913

N

Norton Tape Division
Department 6610Troy, NY 12181
518-273-0100

P

Parker Seal Company
2360 Palumbo Drive
Lexington, KY 40509
859-269-2351

Permatex Co., Inc.
P.O. Box 11915
Newington, CT 06111
203-527-5211

Products Research Co.
2919 Empire Avenue
Burbank, CA 91504
213-849-3992

R

Radiator Specialty Co.
P.O. Box 34689
Charlotte, NC 28234
704-377-6555

Ram Chemicals
201 E. Alondra Blvd.
Gardena, CA 90248
213-321-0710

Rockwell International
600 Grant Street
Pittsburgh, PA 15219
412-565-2000

Royal Lubricants Company
River Road
E. Hanover, NJ 07936
201-887-3100

S

Schnee Moorhead Chemicals, Inc.
PO Box 171305
Irving, TX 75017-1305
800-878-7876)
www.schneemorehead.com/

Shamban W.S. and Co.
1857 Centinela Avenue
Santa Monica, CA 90404
213-397-2195

Shell Oil Company
One Shell Plaza
Houston, TX 77003
713-220-6697

Sinclair Refining Co.
600 Fifth Avenue
New York, NY 10020

Socony Mobil Oil Co.
Washington 5, DC 20005
Solar Compounds Corp.
1201 W. Blancke Street
Linden, NJ 07036
201-862-2813

Standard Oil of California
225 Bush Street
San Francisco, CA 94104
415-894-7700

Sun Oil Company of Penna
5 Penn Center Plaza
Philadelphia, PA 19103
215-972-2000

T

Taxacone Company
P.O. Box 10823 TR
Dallas, TX 75208

Turco Products Inc.
24600 S. Main Street
Box 6200
Carson, CA 90749
213-835-8211

U

U.S. Gulf Corp.
P.O. Box 233
Stoney Brook, NY 11790
212-683-9221

Unelko Corporation
727 E. 110th Street
Chicago, IL 60628

Union Carbide; Plastic Div.
270 Park Avenue
New York, NY 10017
212-551-3763

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**CHART 11 (Sheet 3 of 3)
VENDOR CONTACT INFORMATION**

V

Virginia Chemical
3340 W. Norfolk Rd.
Portsmouth, VA 23703
703-484-5000

W

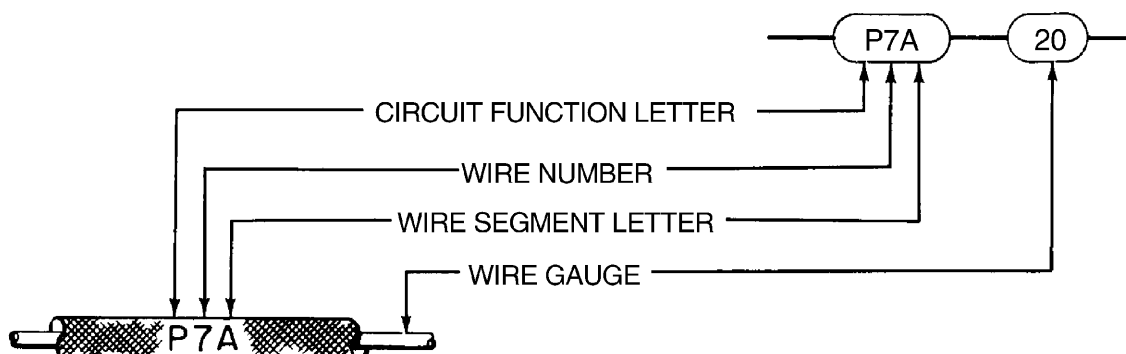
Wooster Products, Inc.
1000 Spruce Street
Wooster, OH 44691
800-321-4936
In OH 216-264-2844

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





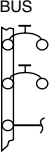



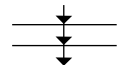


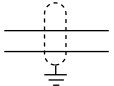
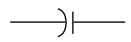






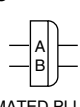




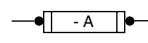




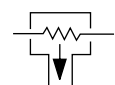






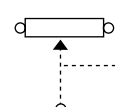


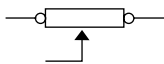

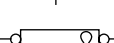


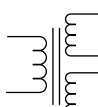

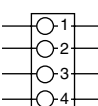
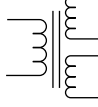






**CHART 12
ELECTRICAL WIRE CODING**



CIRCUIT FUNCTION LETTER	CIRCUIT
A	AUTOPILOT
AC	AIR CONDITIONING
C	FLIGHT CONTROL SURFACES
E	ENGINE INSTRUMENTS
F	FLIGHT INSTRUMENTS
G	LANDING GEAR
GB	VENT/DEFOGGER
H	HEATER,-VENTILATING
J	IGNITION
K	ENGINE CONTROL, STARTER
L	LIGHTING
M	MISC. EQUIPMENT (I.E. - CIGAR LIGHTER, HOUR METER, ETC.)
OX	OXYGEN
P	DC POWER
GND	GROUND
Q	FUEL & OIL QUANTITY
RP	RADIO POWER
RC	RADIO COOLING
RZ	RADIO AUDIO
RG	RADIO GND
S	STALL WARNING
FD	FLIGHT DIRECTOR
W	WARNING
WW	WINDSHIELD WIPER
WH	WINDSHIELD HEAT
PF	GENERATOR OR ALTERNATOR FIELD CONTROL AND POWER
PP	PROPELLER
X	AC POWER

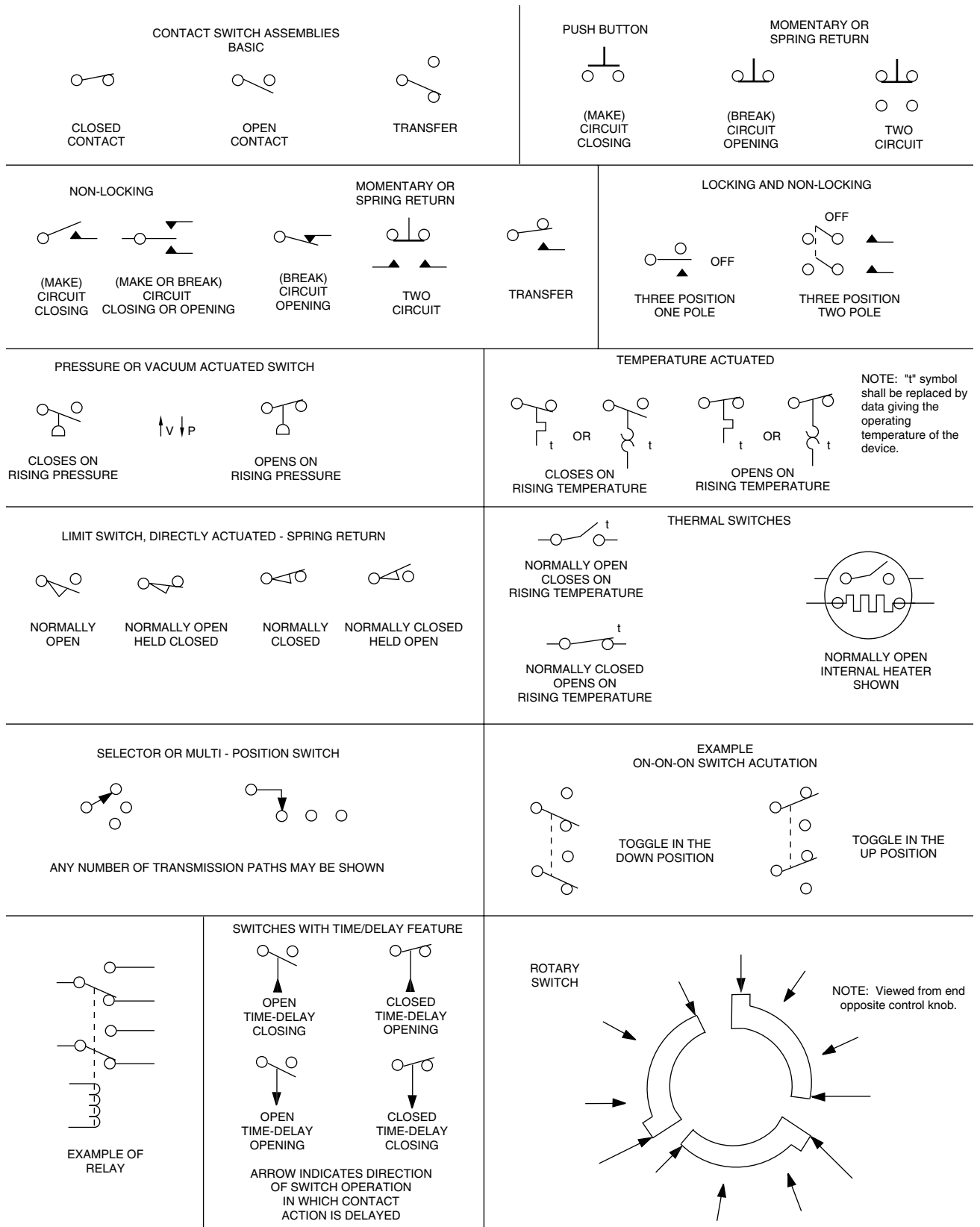
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CHART 13 (Sheet 1 of 2)
ELECTRICAL SYMBOLS

AIRCRAFT LOCATION SYMBOLS			ADJUSTABILITY		BATTERIES		BUS	
								
FUSELAGE STATION	WATER LINE	BUTT LINE	GENERAL		GENERAL	MULTICELL		
CABLES AND CONDUCTORS								
		OR						
GROUPING OF LEADS	TWISTED PAIR		TWISTED PAIR	TWISTED TRIPLE	SHIELDED SINGLE CONDUCTOR	COAXIAL CABLE	SHIELDED TWO CONDUCTOR W / GROUND	
CAPACITOR		CIRCUIT BREAKERS			CONNECTORS		CURRENT LIMITER	
	GENERAL		CB BASIC		PUSH BREAKER		PUSH-PULL BREAKER	
			SWITCH BREAKER		RECEPTACLE		PLUG	
					MATED PLUG & RECEPTACLE			
DIODES				FUSE		GROUNDS		
	GENERAL		ZENER, UNIDIRECTIONAL		ZENER, BIDIRECTIONAL		GROUND OR CIRCUIT RETURN	
					- A			
				OR			GROUND TO CHASSIS (WITH TERMINAL)	
								
HORN		HEATED ELEMENT		SQUIB ELECTRIC IGNITER		LAMPS		
							INDICATOR LIGHT (* LETTER DENOTES COLOR - ASTERISK IS NOT PART OF SYMBOL)	
							INCANDESCENT LAMP	
							FLUORESCENT LAMP	
MOTOR		METER		POLARITY		POTENTIOMETER		
	M		A		POSITIVE			
		* LETTER DENOTES THE TYPE OF METER i.e. A = AMMETER			NEGATIVE			
RELAY COIL		RESISTOR		RHEOSTAT		SPLICE		
							PERMANENT	
							DISCONNECT	
TRANSDUCER		TRANSFORMERS		SPICE		TERMINAL BOARD		
					GENERAL			
			SINGLE PHASE (3) WINDING W/CORE		NON SATURATING			
							PNP TYPE	
							NPN TYPE	
							THERMAL ELEMENT (TRANSDUCER)	
							GENERAL	
							ADJUSTABLE	

THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL

CHART 13 (Sheet 2 of 2)
ELECTRICAL SYMBOLS



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PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL**

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PA-34-220T, SENECA IV / V
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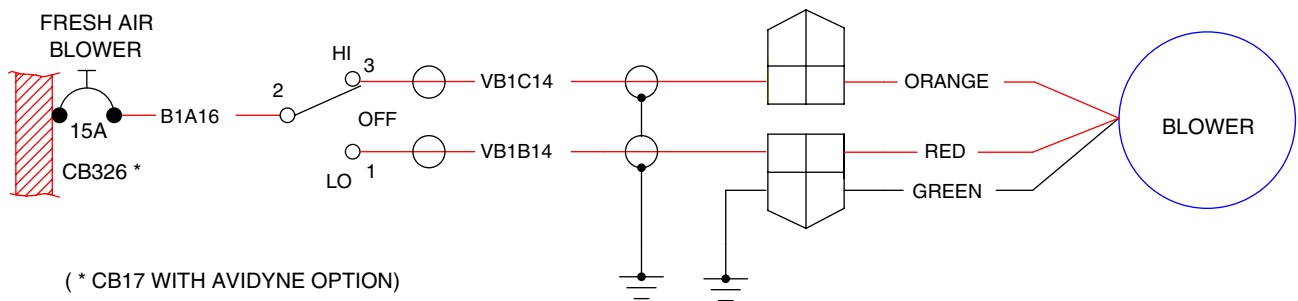
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THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL

83353 NEW/G
100651 NEW/T
101288 NEW/D
104229 C
104368 16.0 A/K
101840 10.0

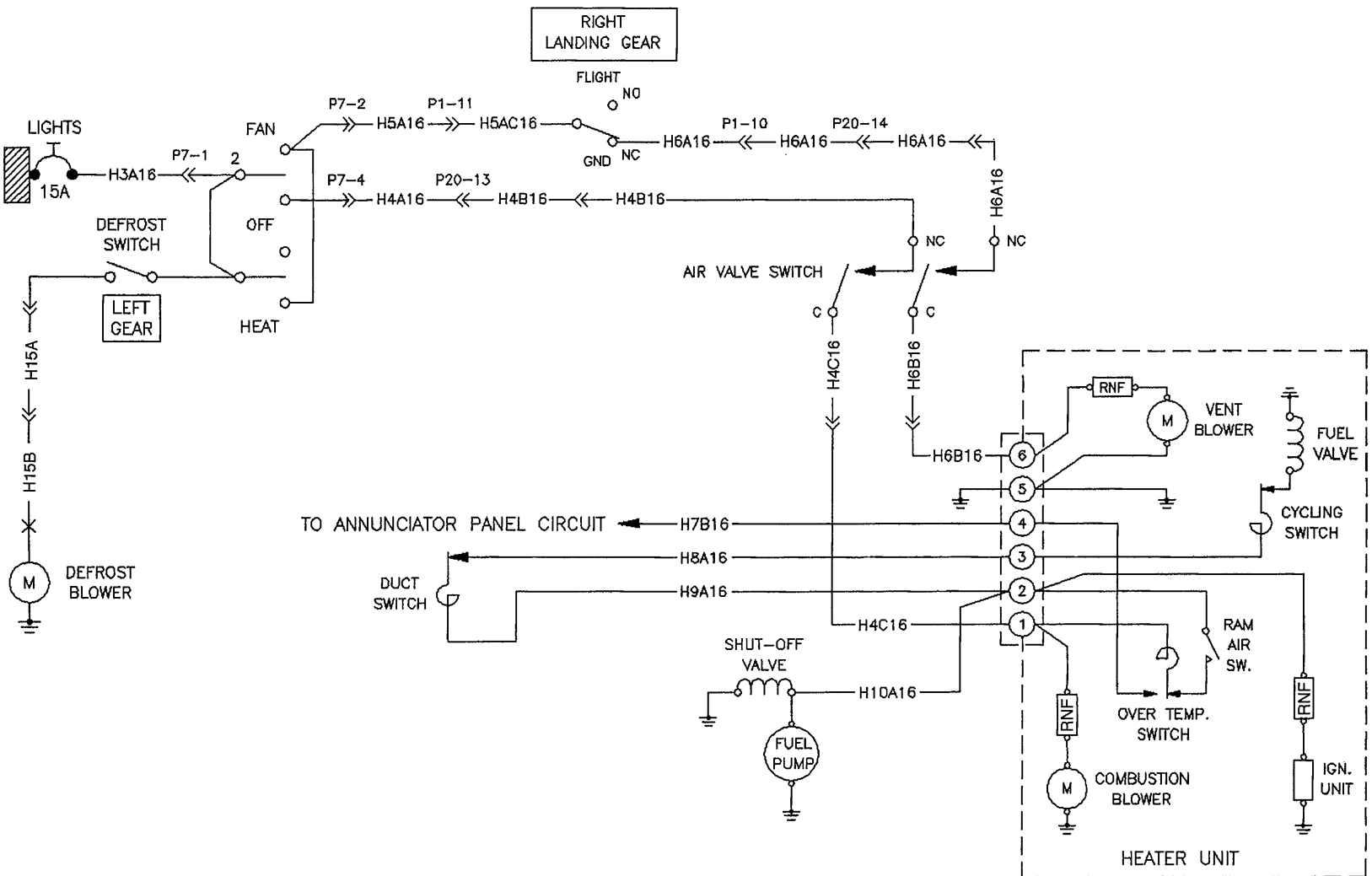


Fresh Air Blower
Figure 1

**THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL**

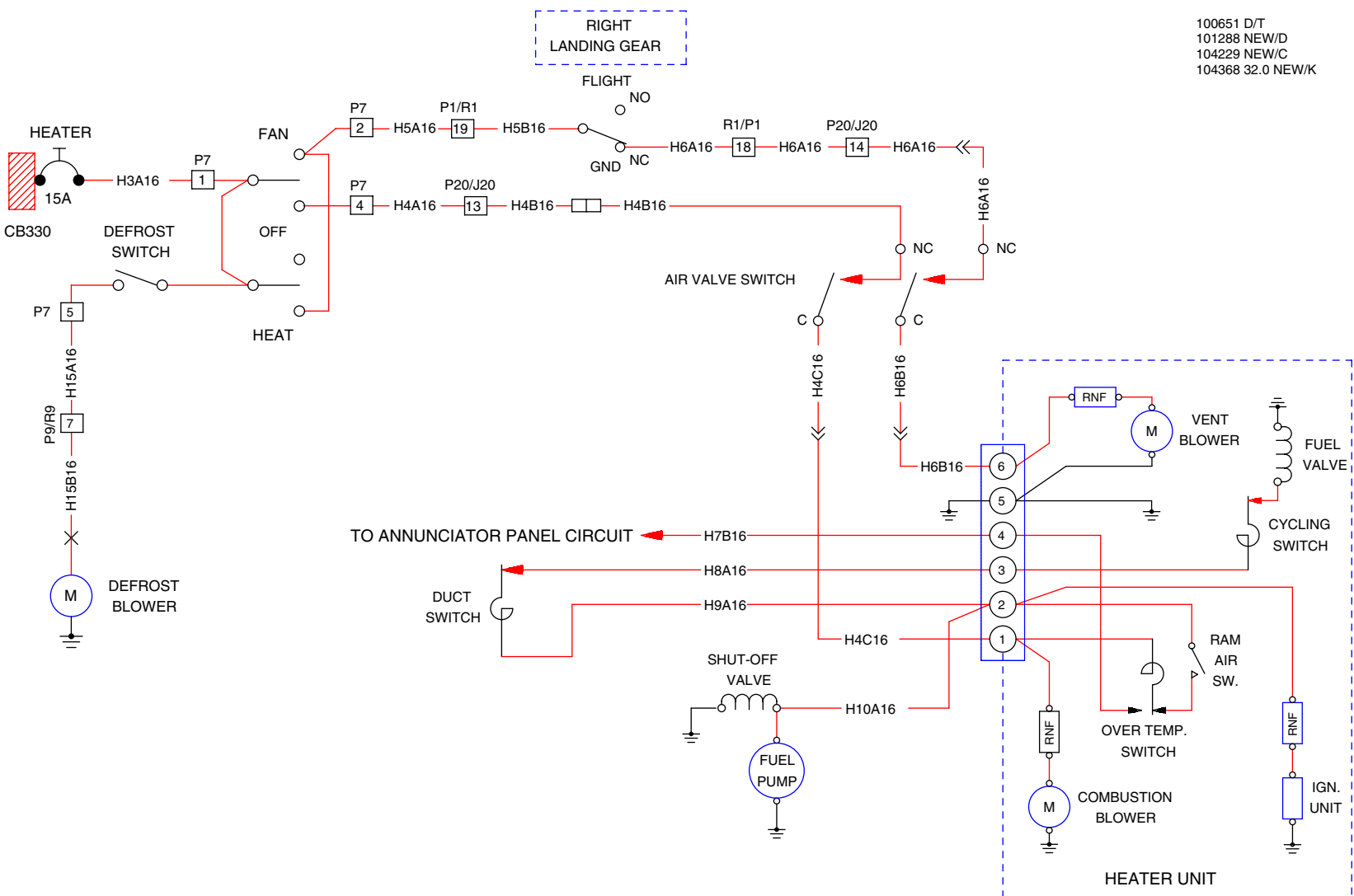
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83353 32.0 D/G



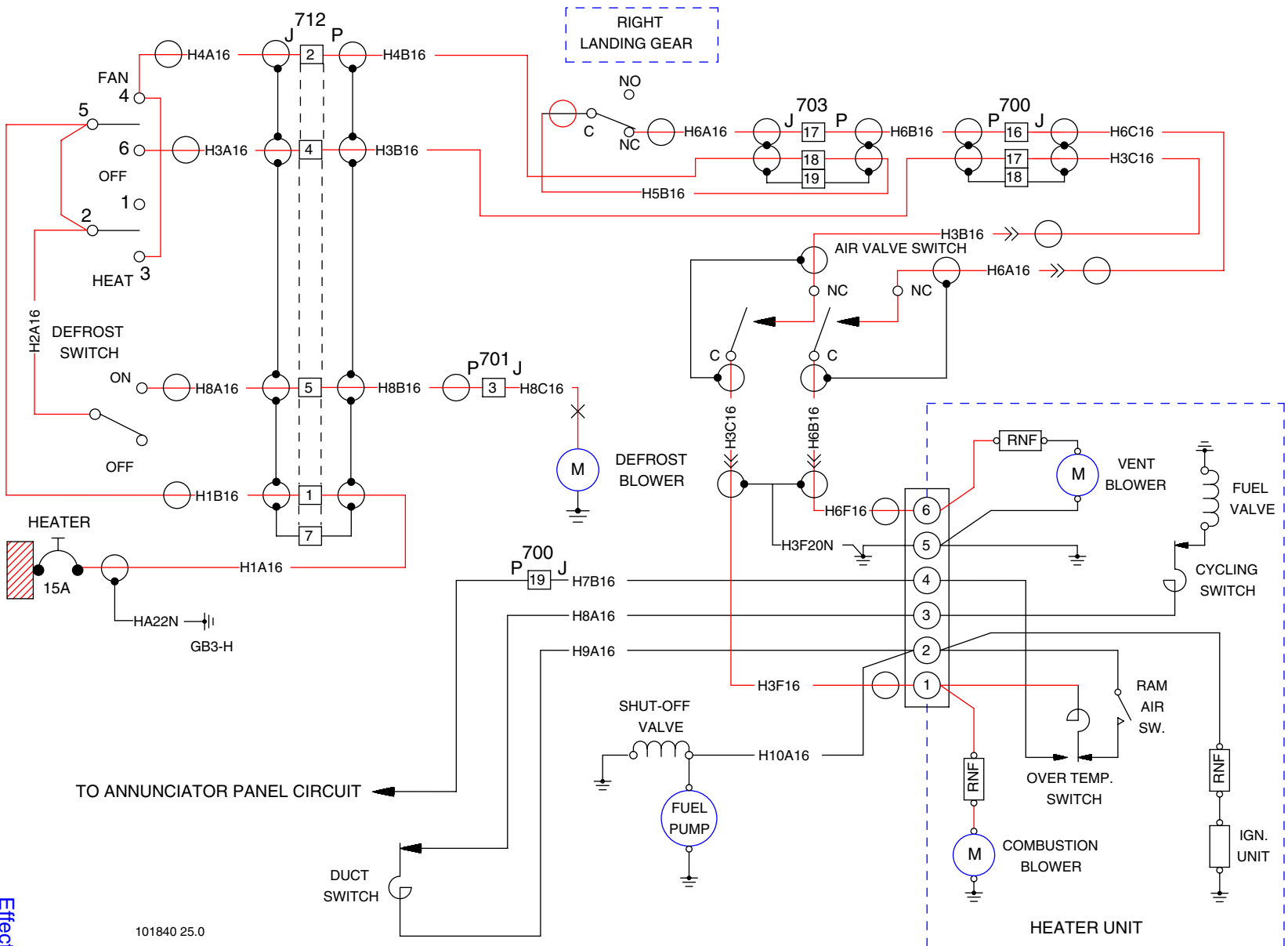
Heating and Defrosting
Figure 1 (Sheet 1 of 3)

100651 D/T
101288 NEW/D
104229 NEW/C
104368 32.0 NEW/K



Effectivity
Seneca V

Heating and Defrosting
Figure 1 (Sheet 2 of 3)

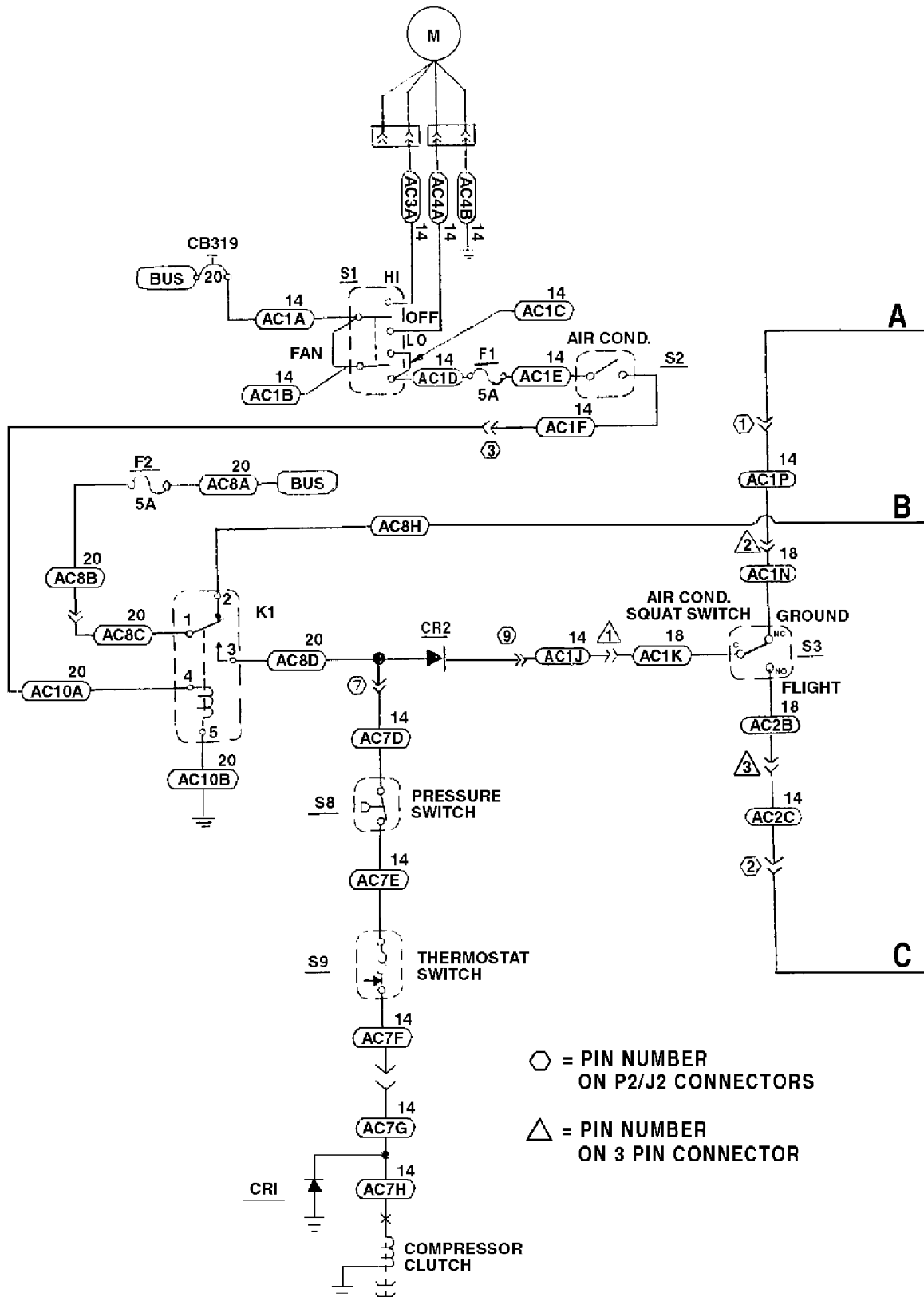


101840 25.0

Heating and Defrosting
Figure 1 (Sheet 3 of 3)

Effectivity
Seneca V
with Avidyne Option

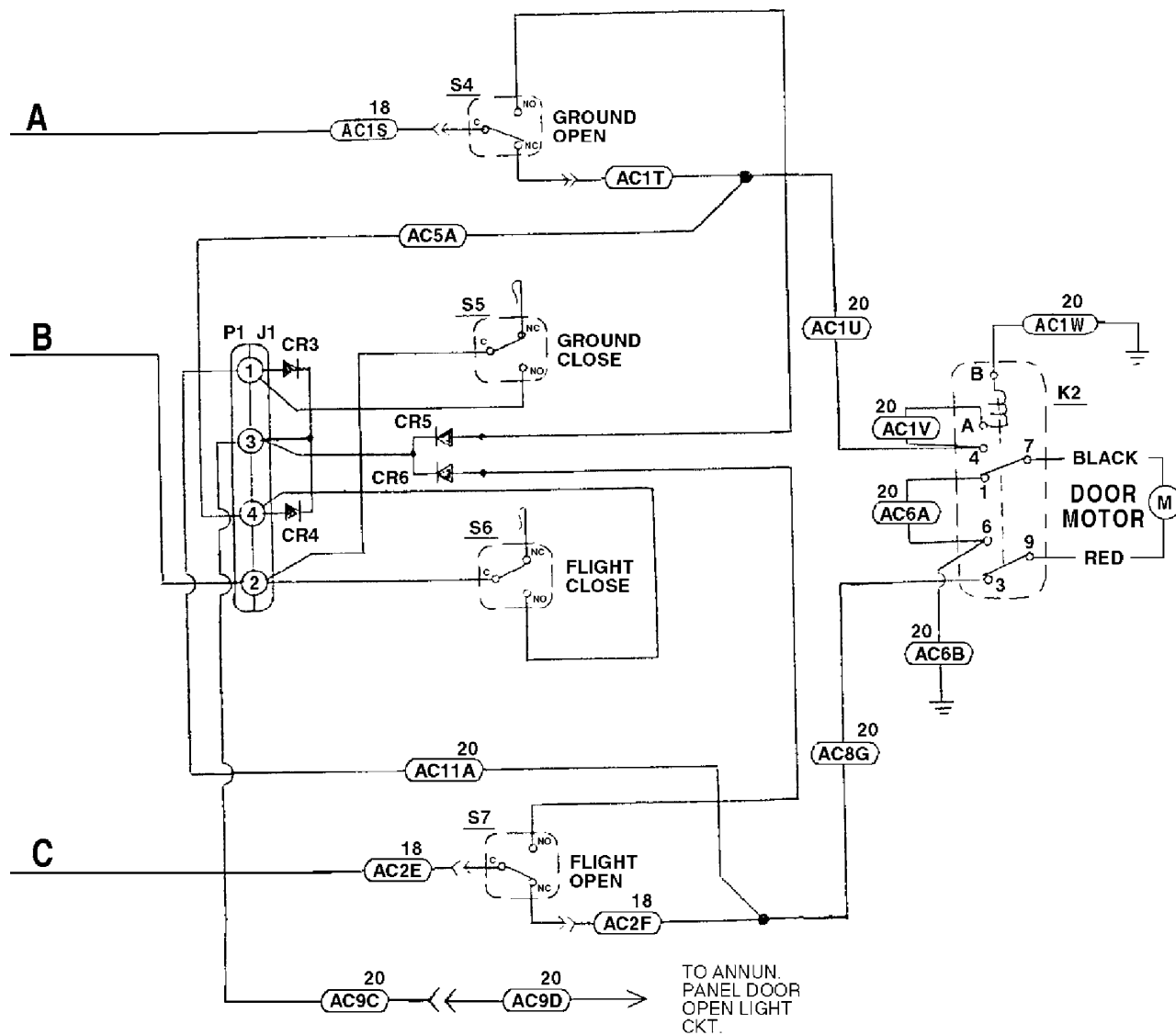
THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL



Air Conditioning (Optional)
Figure 1 (Sheet 1 of 2)

THE NEW PIPER AIRCRAFT, INC.
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MAINTENANCE MANUAL

AIR CONDITIONING SYSTEM SHOWN WITH POWER OFF,
AIRPLANE ON GROUND AND A/C DOOR FULLY CLOSED.



39654 K

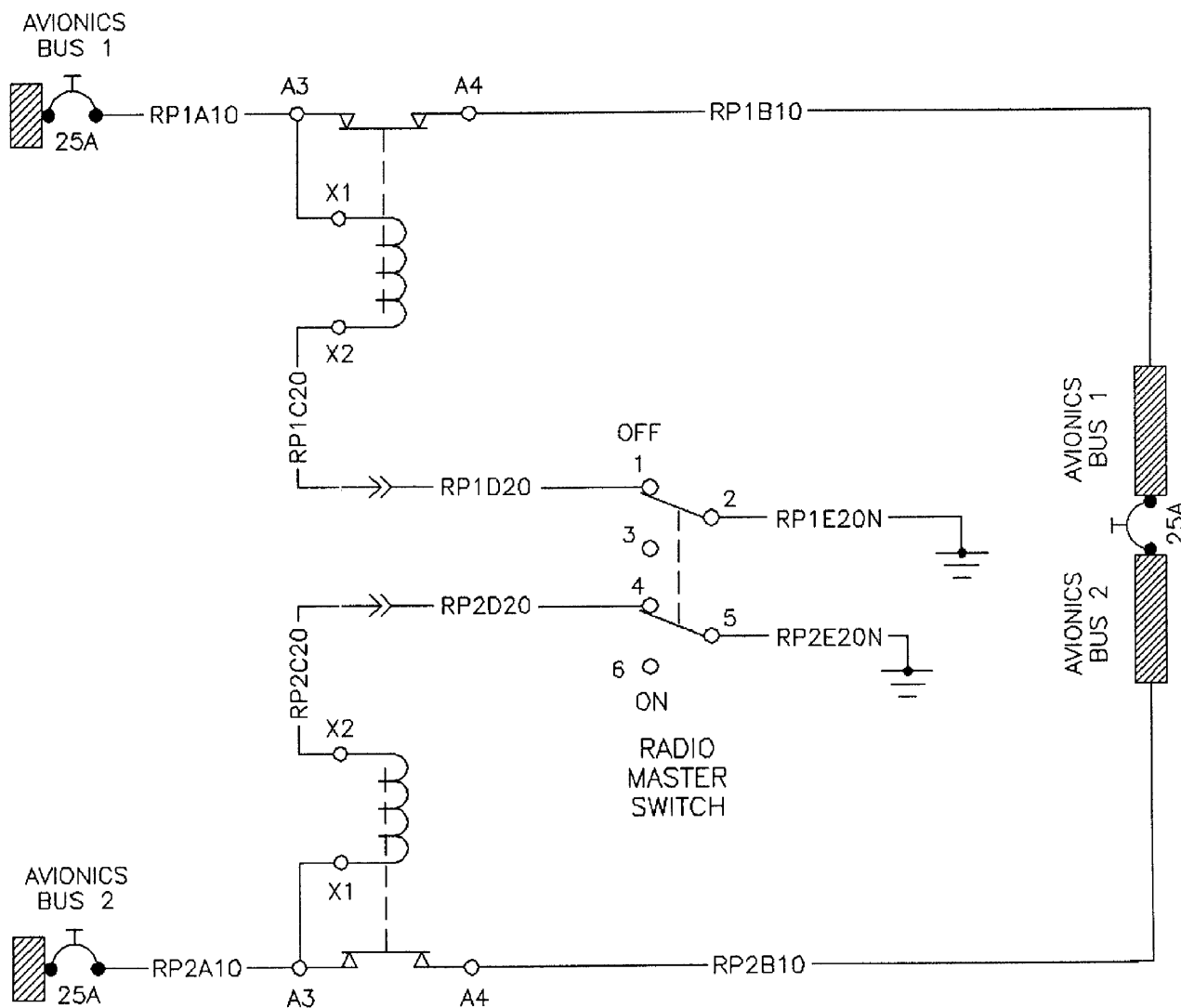
Air Conditioning (Optional)
Figure 1 (Sheet 2 of 2)

**THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL**

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THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL

83353 29.0 B/G



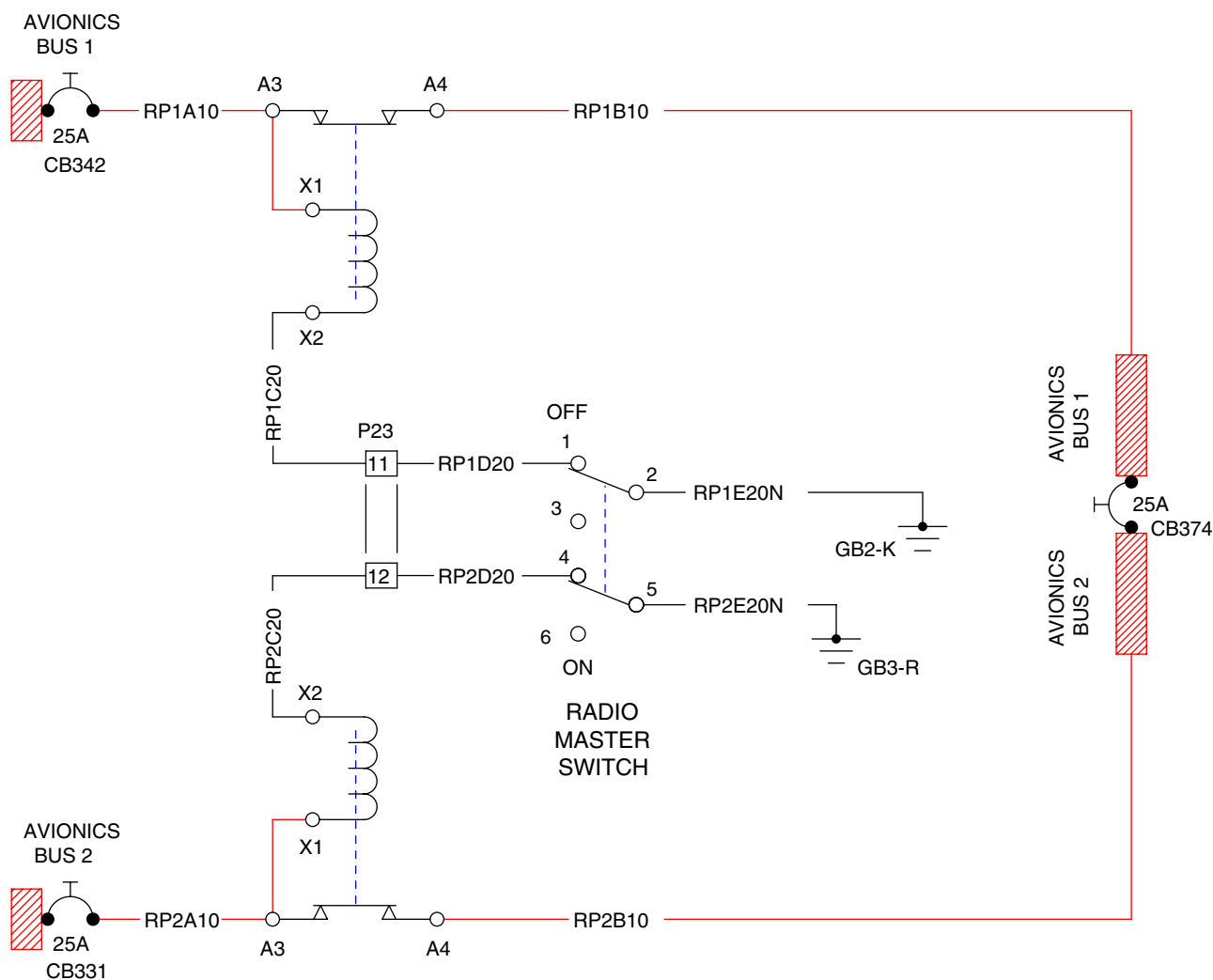
(SHOWN WITH POWER OFF)

Radio Master Switch
Figure 1 (Sheet 1 of 3)

Effectivity
Seneca IV

THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL

100651 NEW/T
101288 NEW/D
104229 C
104368 29.0 A/K



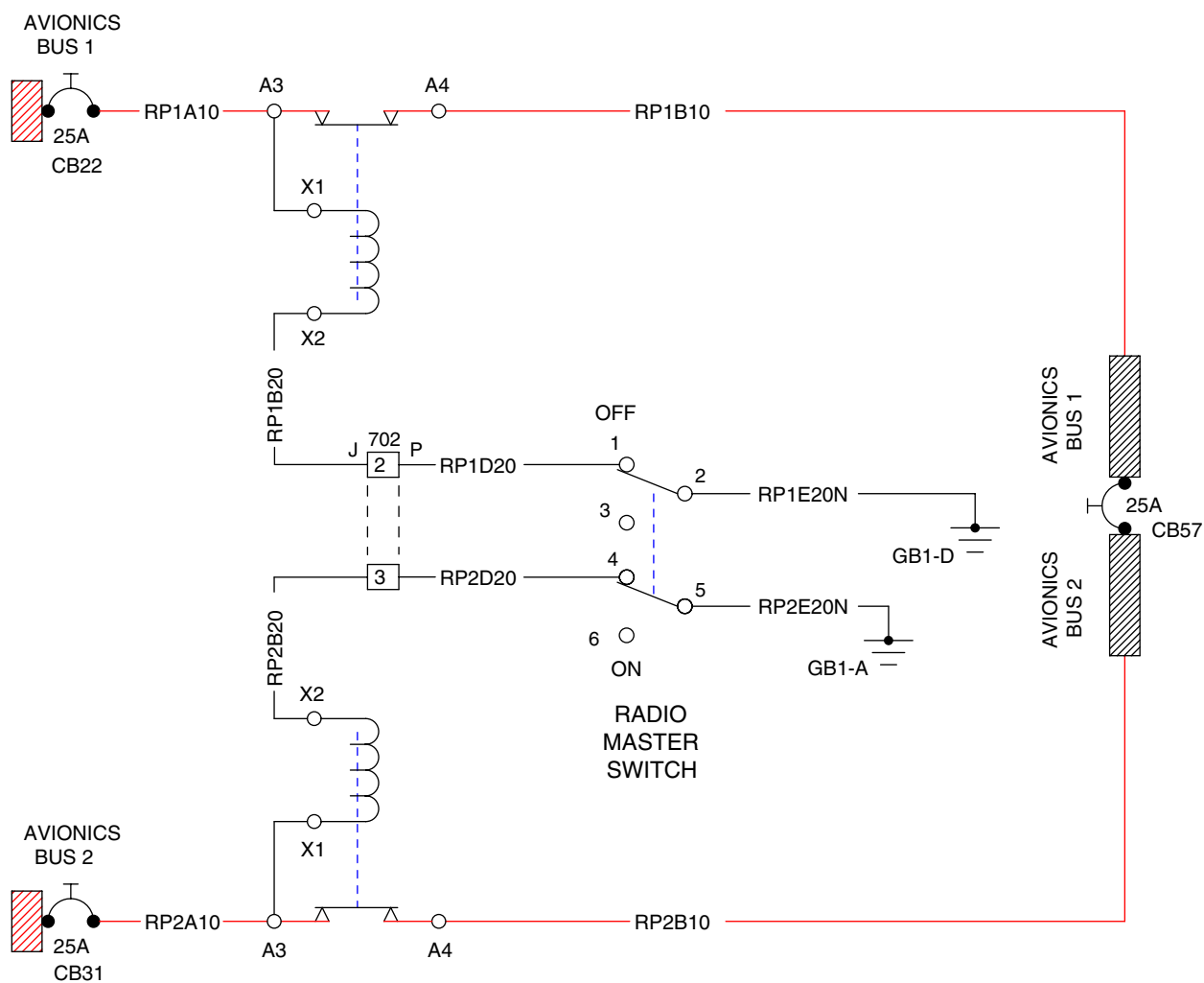
(SHOWN WITH POWER OFF)

[Effectivity](#)
[Seneca V](#)

Radio Master Switch
Figure 1 (Sheet 2 of 3)

THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL

101840 22.0



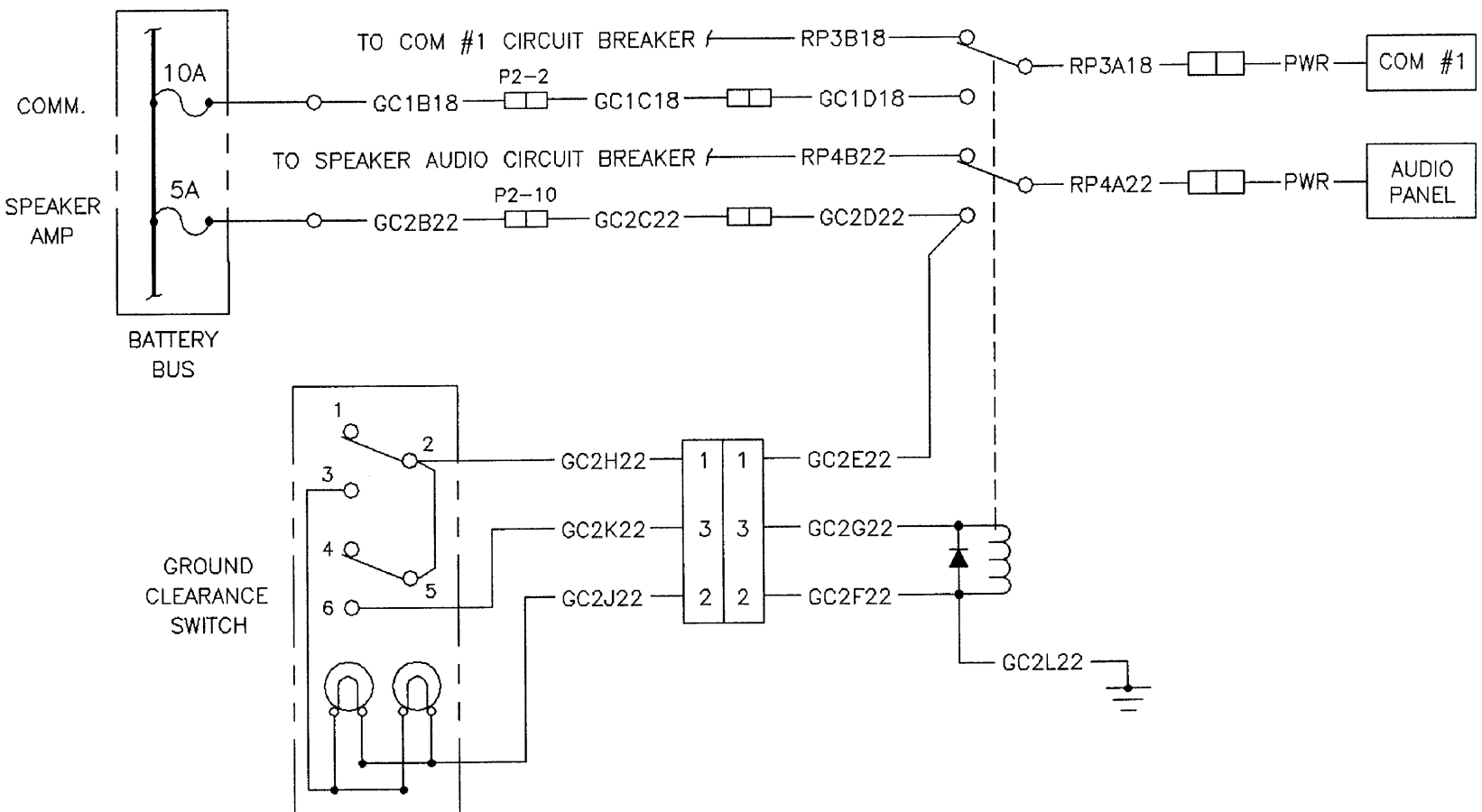
Radio Master Switch
Figure 1 (Sheet 3 of 3)

Effectivity
Seneca V
with Avidyne Option

**THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL**

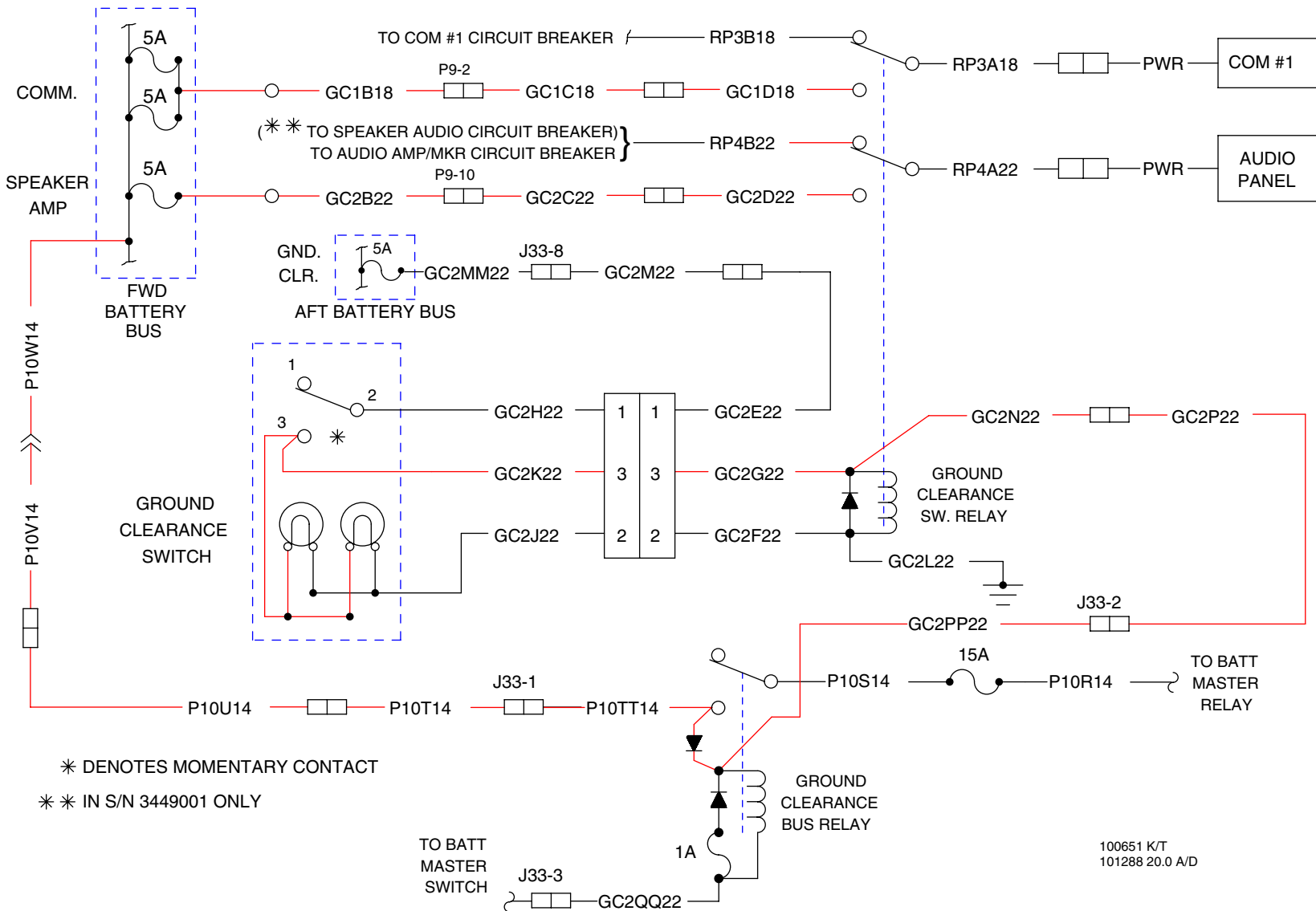
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83353 20.0 NEW/G



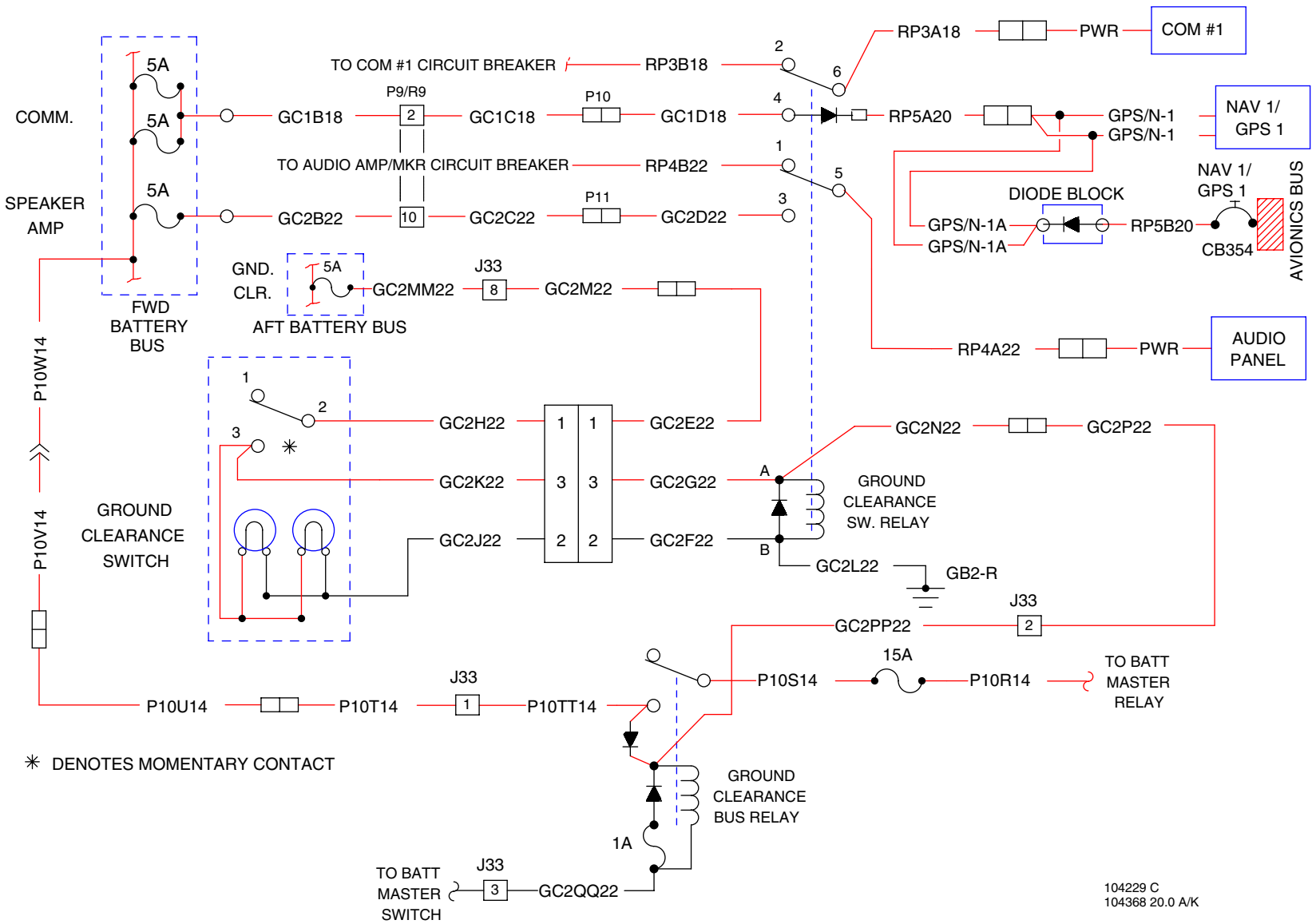
Ground Clearance Switch
Figure 2 (Sheet 1 of 4)

Effectivity
Seneca IV



Effectivity
3449001 thru 3449151

Ground Clearance Switch
Figure 2 (Sheet 2 of 4)

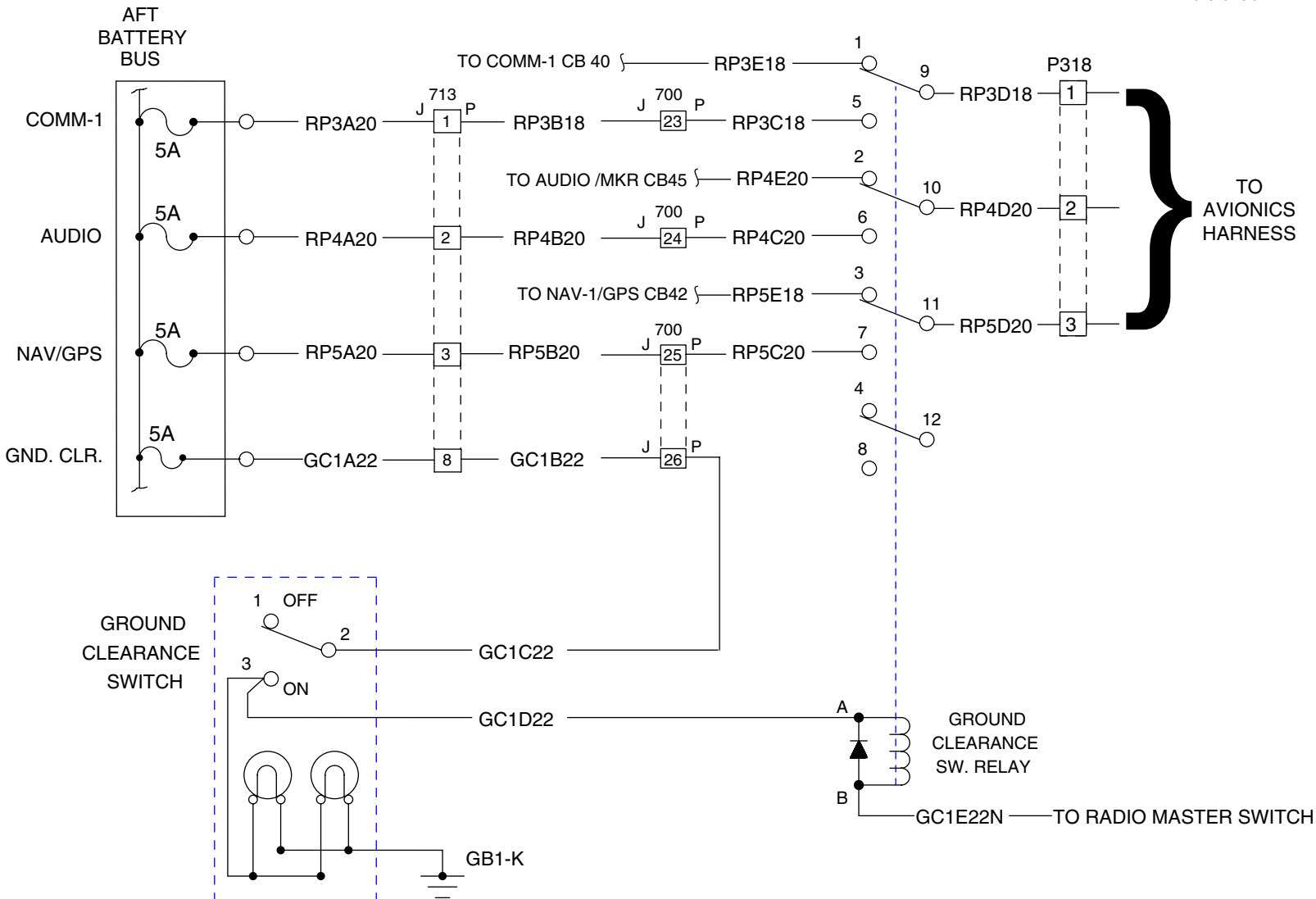


104229 C
104368 20.0 A/K

Ground Clearance Switch
Figure 2 (Sheet 3 of 4)

Effectivity
3449152 & up

101840 13.0

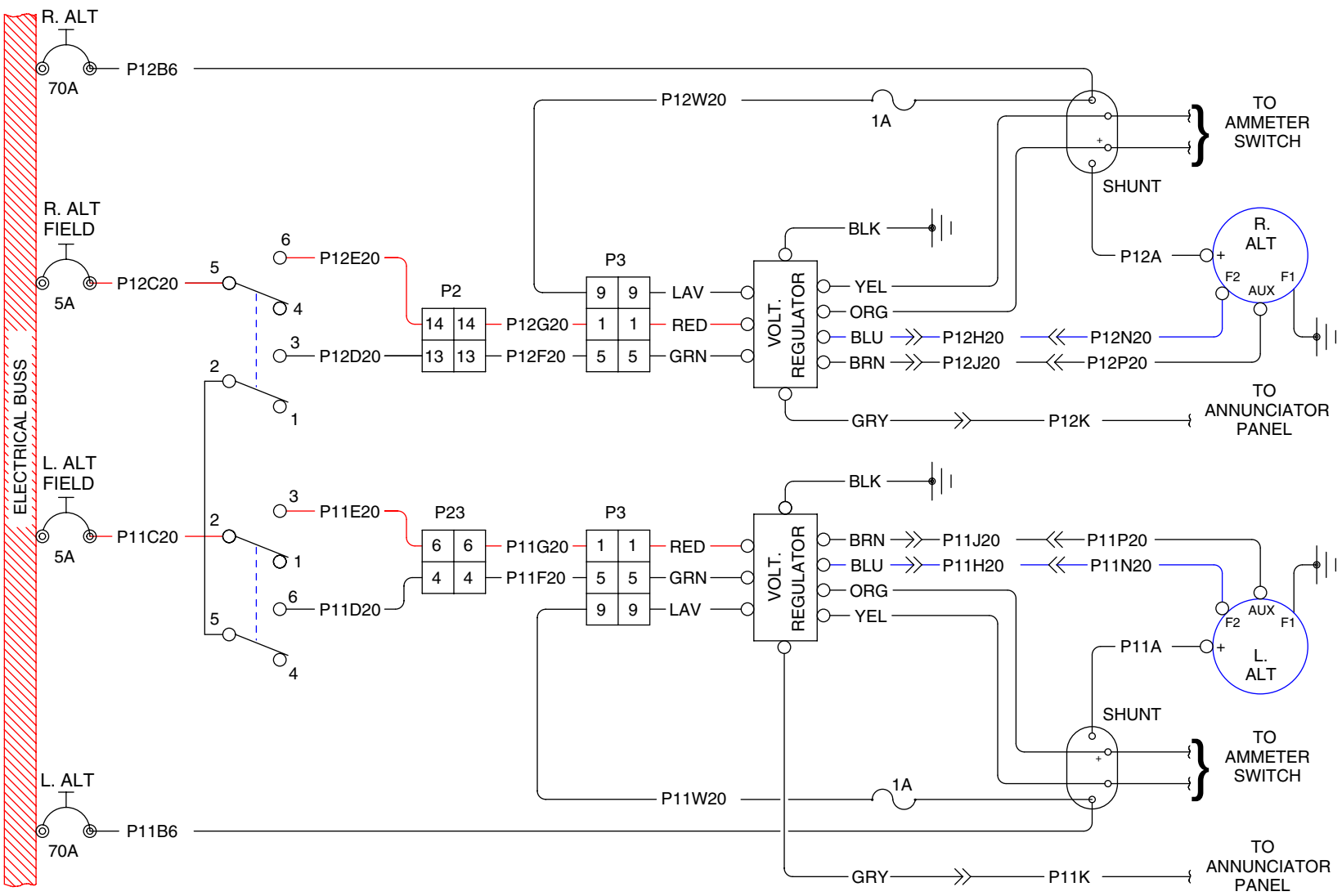


Effectivity
Seneca V
with Avidyne Option

Ground Clearance Switch
Figure 2 (Sheet 4 of 4)

83353 2.0 G

SHOWN AFTER COMPLIANCE WITH PIPER SERVICE BULLETIN NO. 1017

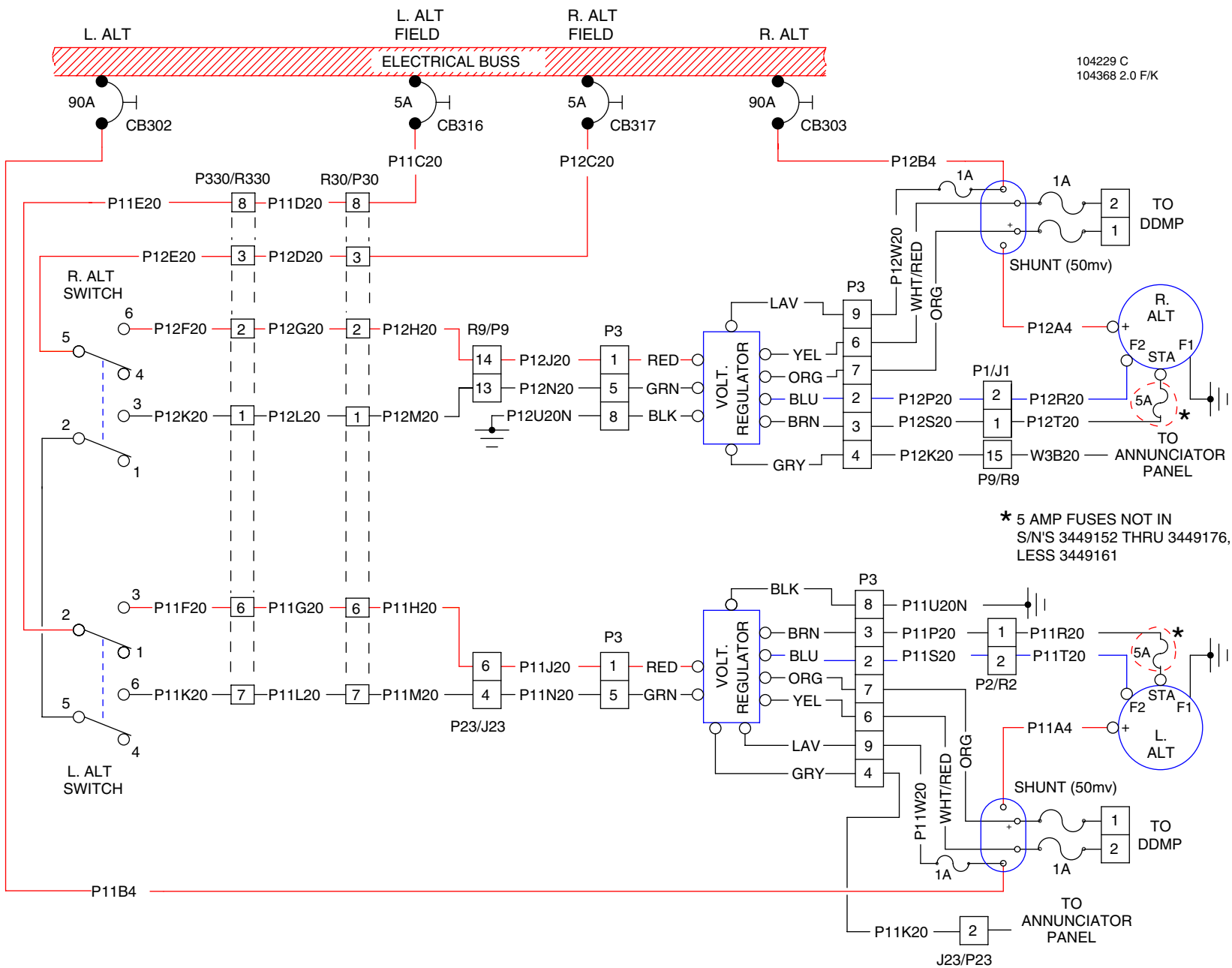


Alternator Power
Figure 1 (Sheet 1 of 4)

Effectivity
Seneca IV

FOR S/N'S 3449001 THRU 3449034, SHOWN AFTER COMPLIANCE WITH PIPER SERVICE BULLETIN NO. 1017.

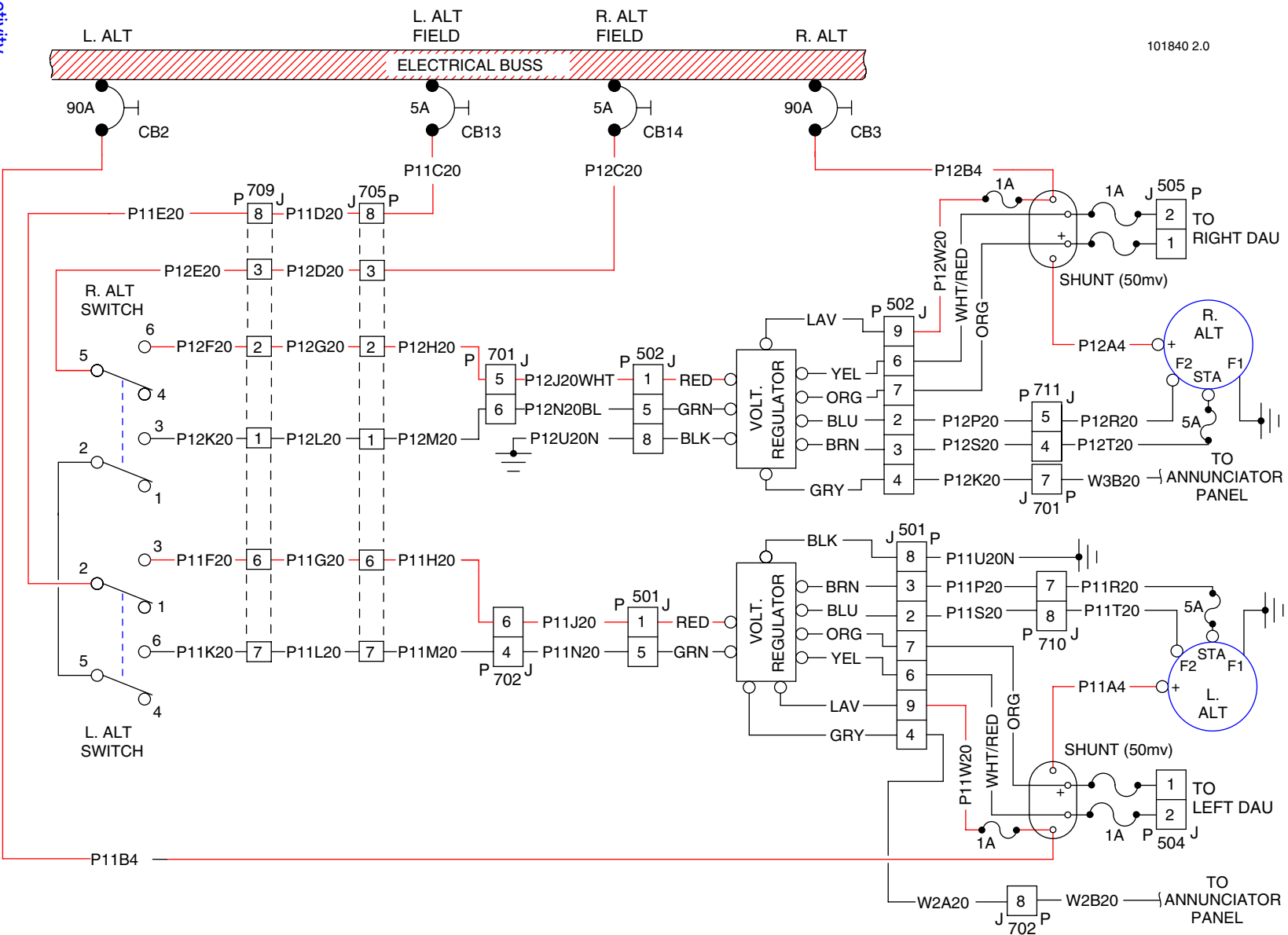
104229 C
104368 2.0 F/K



Alternator Power
Figure 1 (Sheet 3 of 4)

Effectivity
3449152 & up

101840 2.0



Effectivity
Seneca V
with Avidyne Option

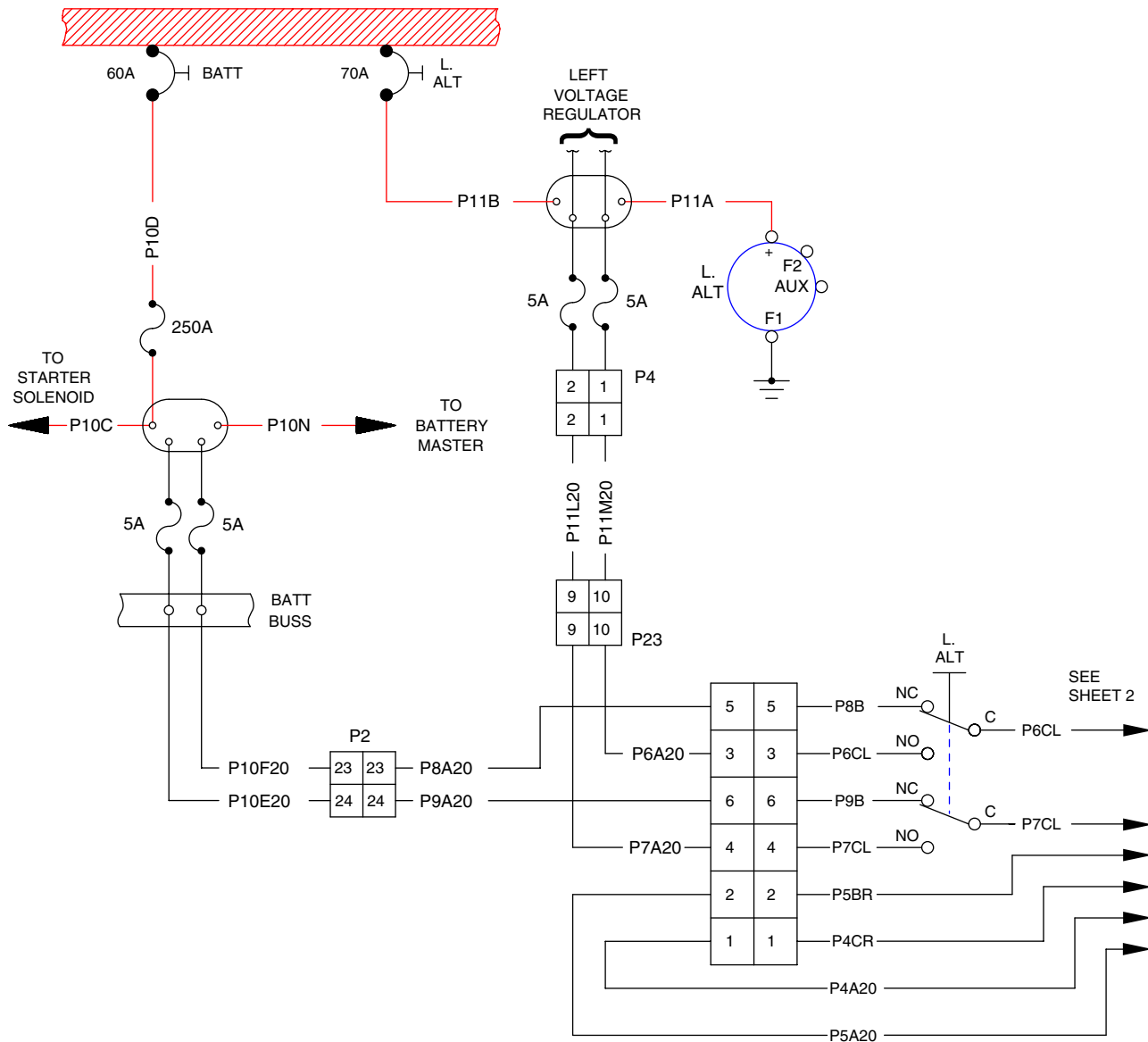
Alternator Power
Figure 1 (Sheet 4 of 4)

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PA-34-220T, SENECA IV / V
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83353 3.0 F/G



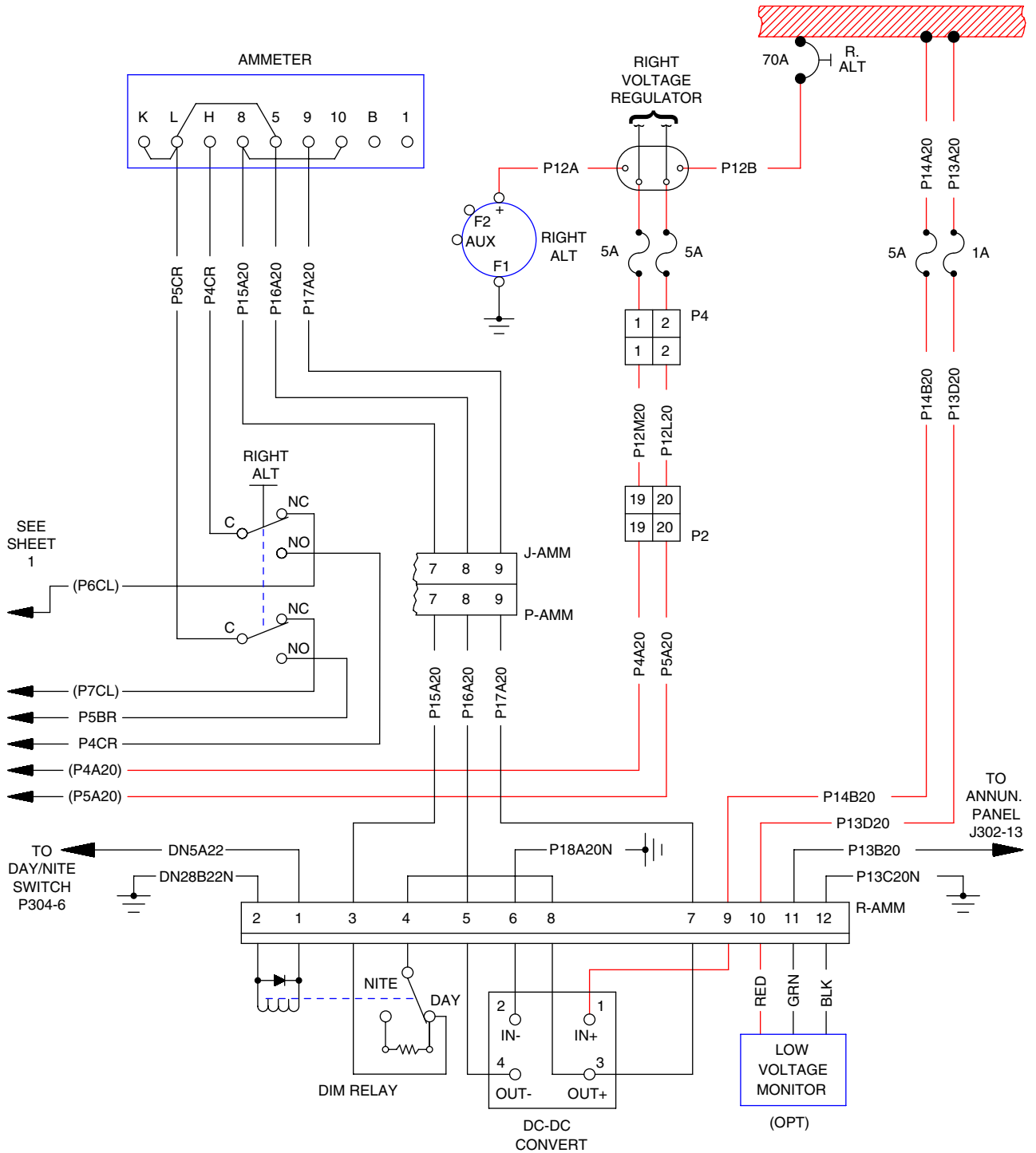
SHOWN AFTER COMPLIANCE WITH PIPER SERVICE BULLETIN NO. 1014.

Effectivity
Seneca IV

Ammeter / Low Volt Monitor
Figure 2 (Sheet 1 of 2)

THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL

83353 3.1 E/G



Ammeter / Low Volt Monitor
Figure 2 (Sheet 2 of 2)

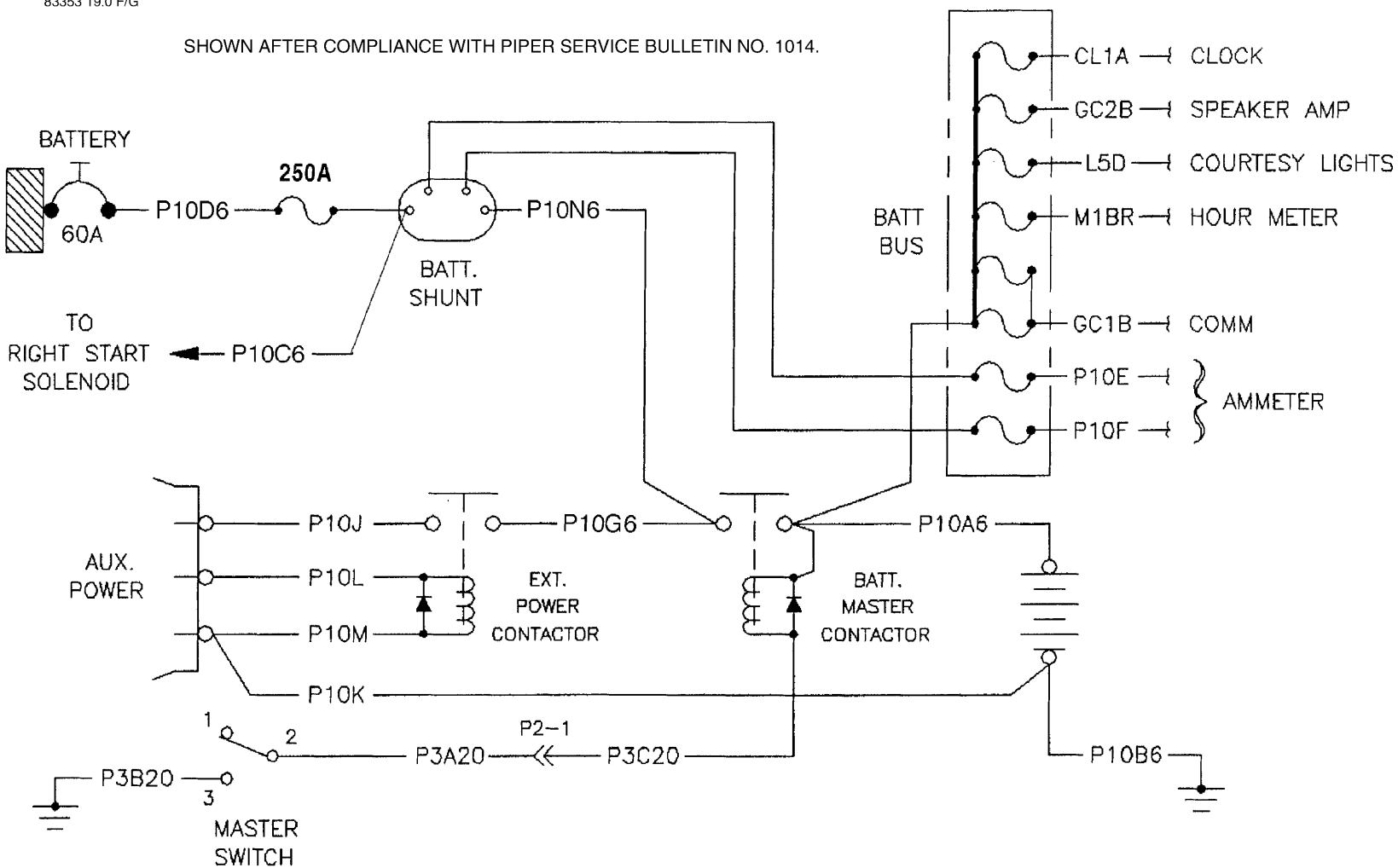
Effectivity
Seneca IV

**THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL**

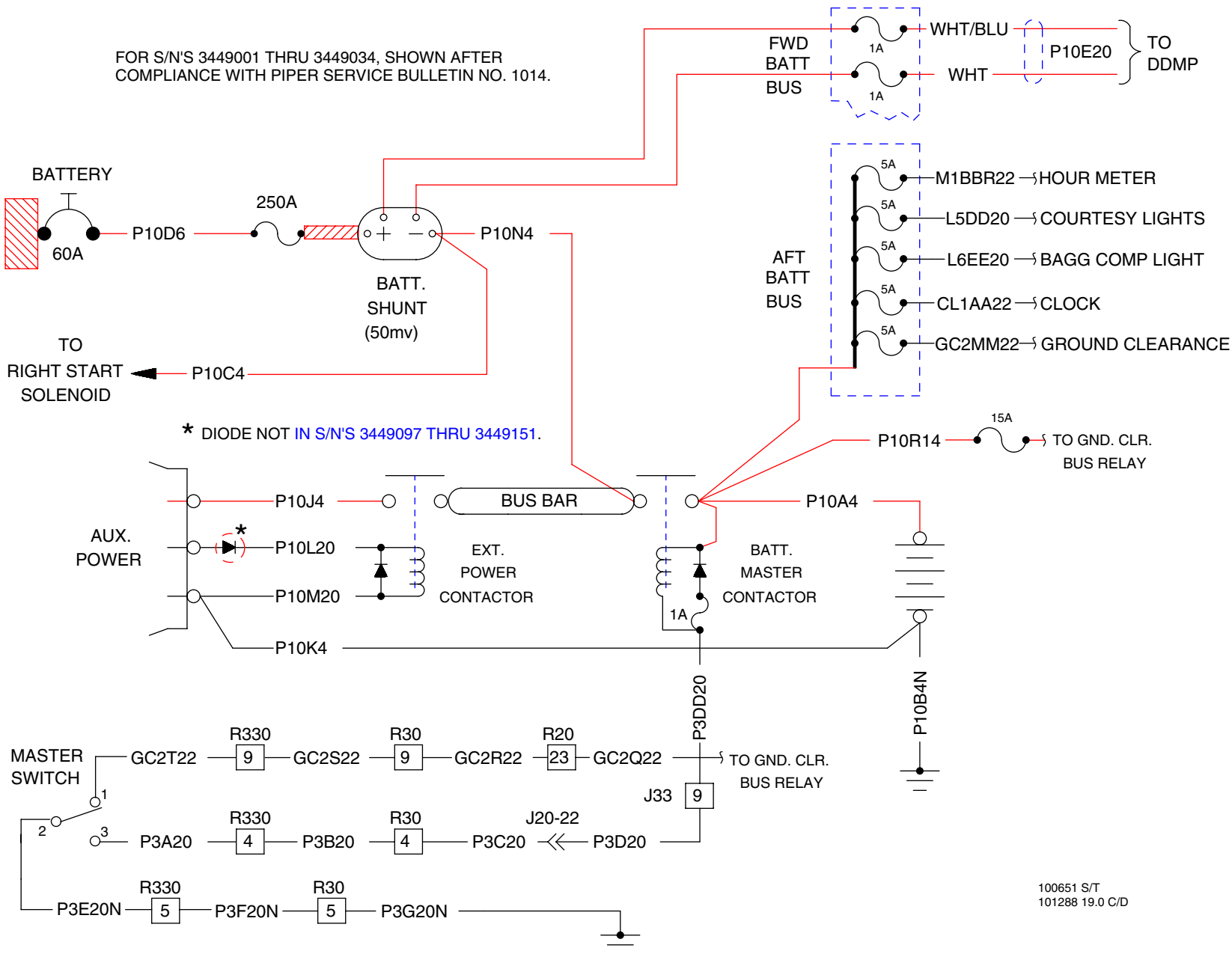
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83353 19.0 F/G

SHOWN AFTER COMPLIANCE WITH PIPER SERVICE BULLETIN NO. 1014.

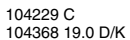


Battery Master / External Power
Figure 1 (Sheet 1 of 4)



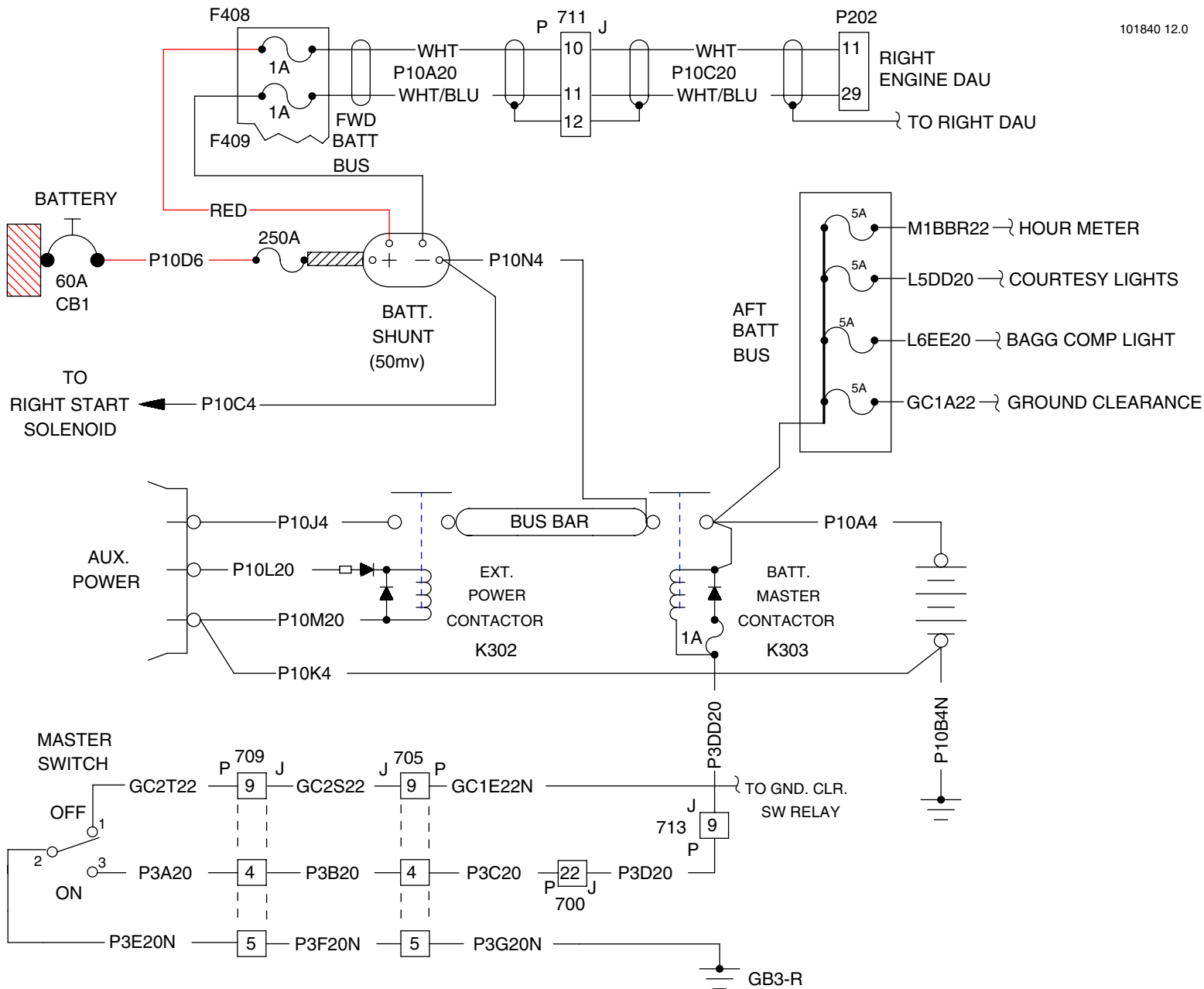
Effectivity
3449001 thru 3449151

Battery Master / External Power
Figure 1 (Sheet 2 of 4)



Effectivity
3449152 & up

101840 12.0

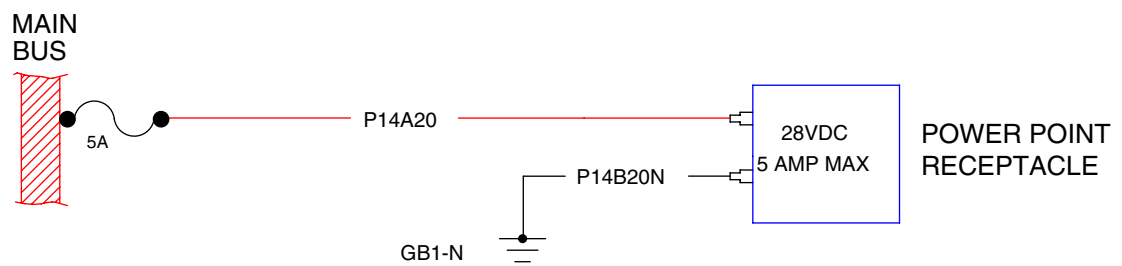


Effectivity
Seneca V
with Avidyne Option

Battery Master / External Power
Figure 1 (Sheet 4 of 4)

THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL

104229 NEW/C
104368 12.0 NEW/K



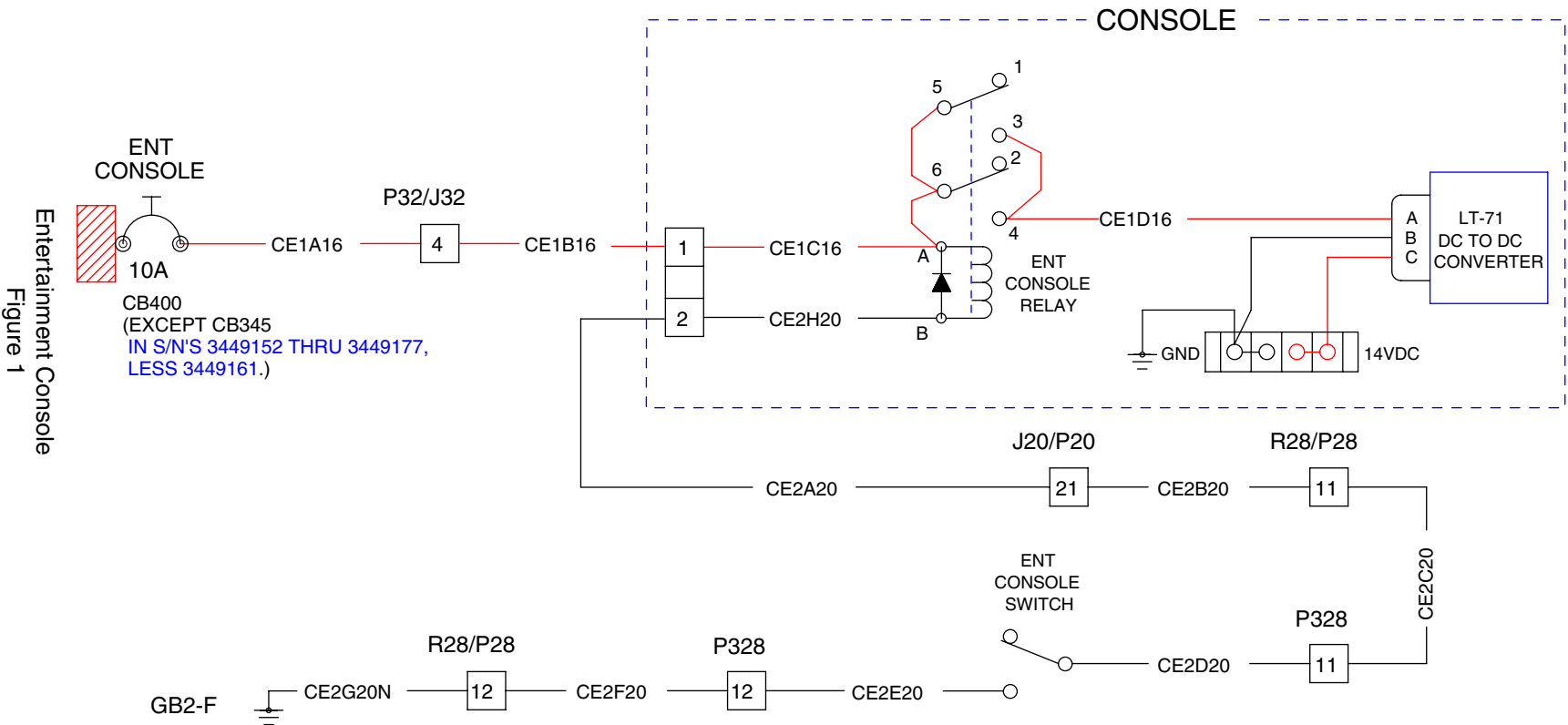
Power Point
Figure 1

[Effectivity](#)
3449152 & up

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PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL**

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100651 H/T
101288 NEW/D
104229 C
104368 44.0 NEW/K

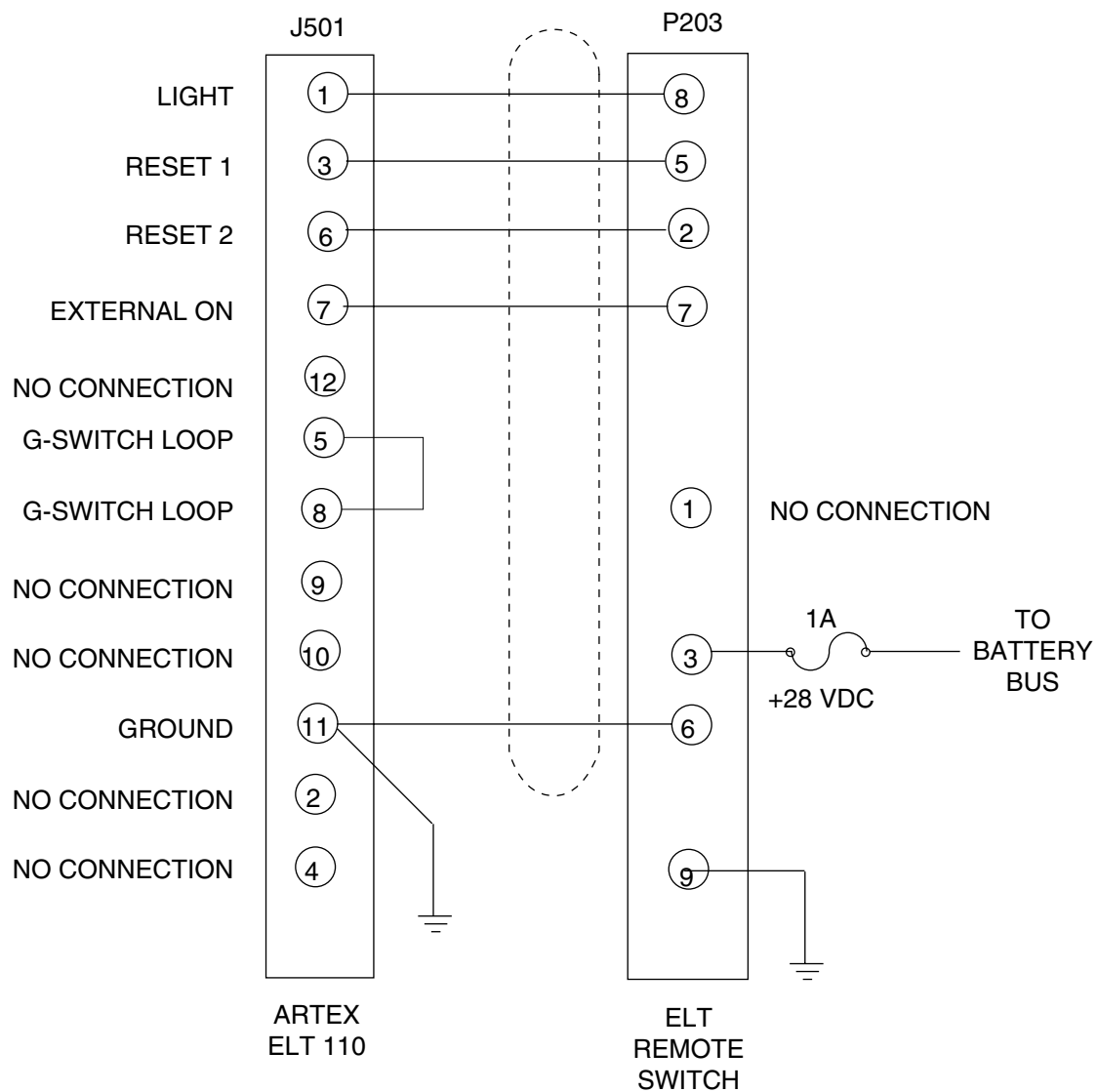


Entertainment Console
Figure 1

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MAINTENANCE MANUAL**

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MAINTENANCE MANUAL**

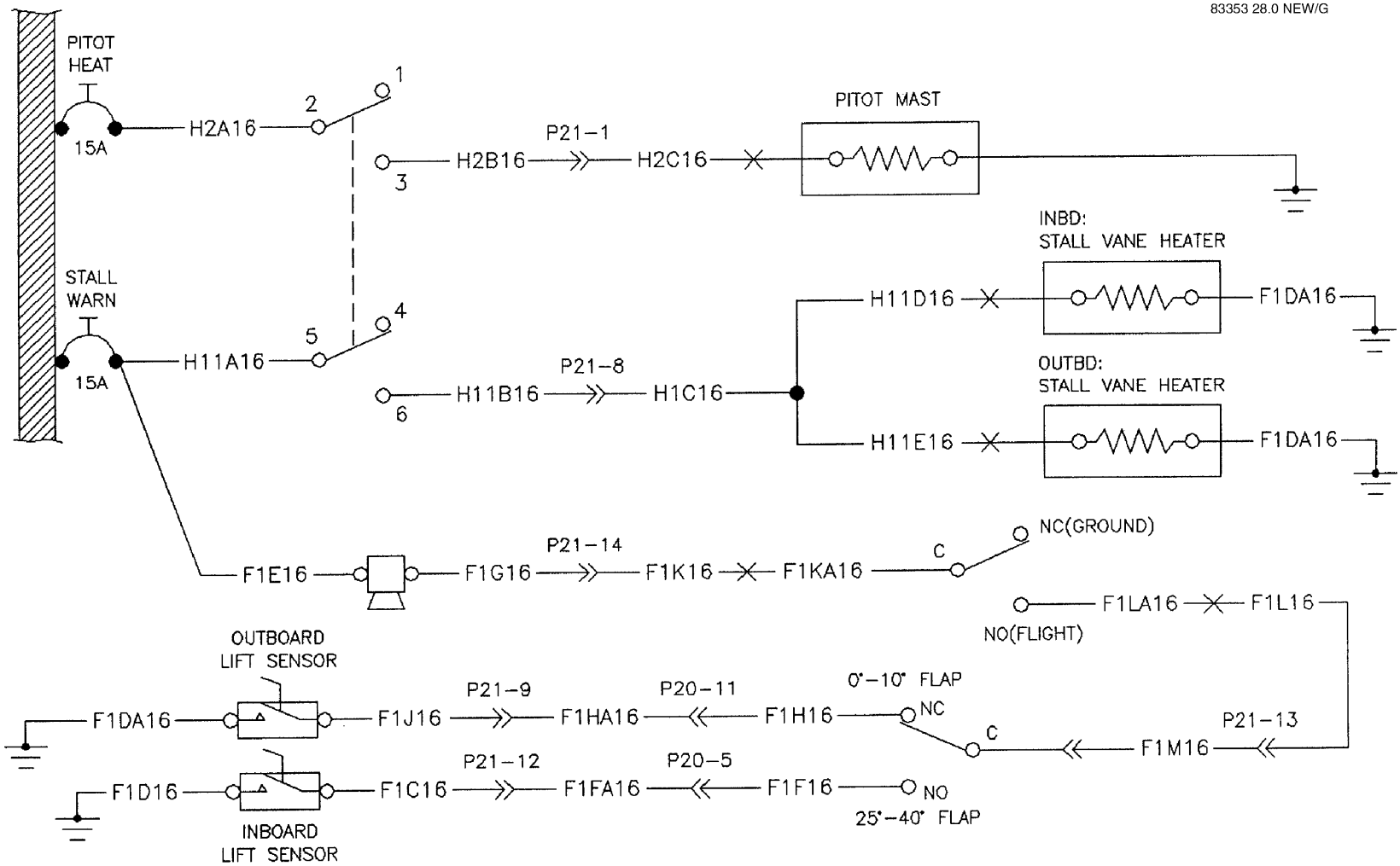


Emergency Locator Transmitter - Artex 110-4
Figure 1

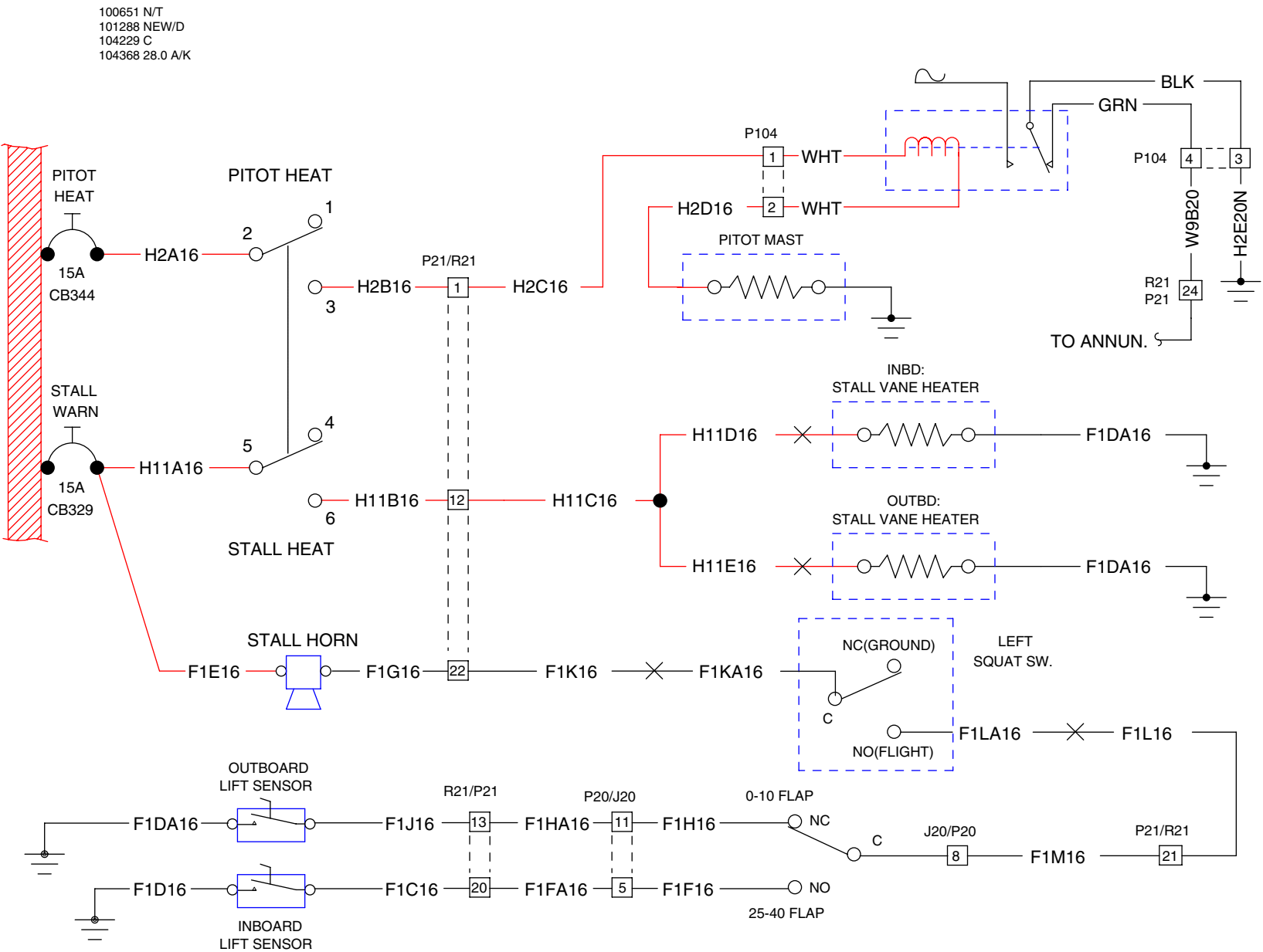
**THE NEW PIPER AIRCRAFT, INC.
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MAINTENANCE MANUAL**

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83353 28.0 NEW/G

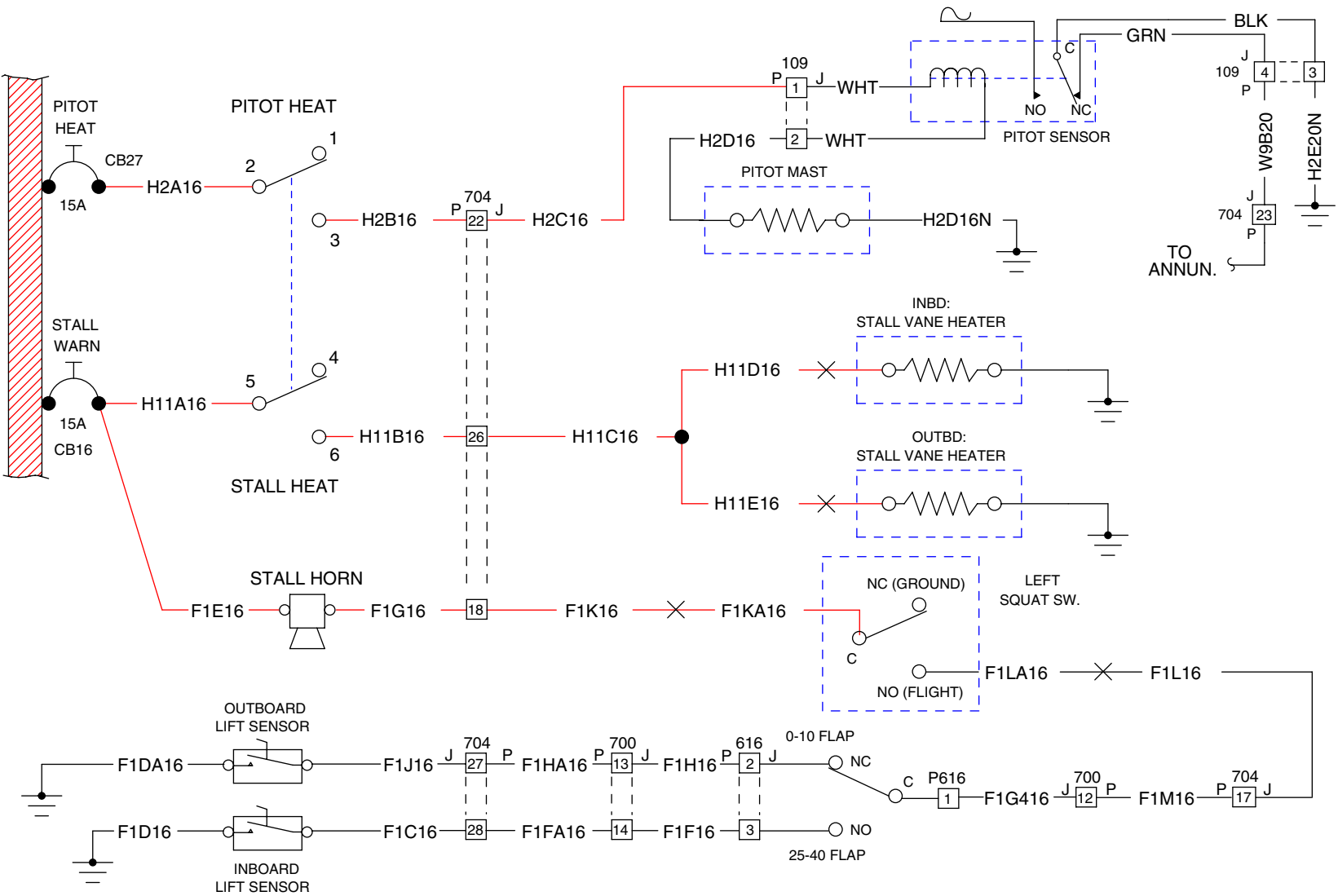


Pitot Heat and Stall Warning
Figure 1 (Sheet 1 of 3)



Effectivity
Seneca V

Pitot Heat and Stall Warning
Figure 1 (Sheet 2 of 3)



101840 21.0

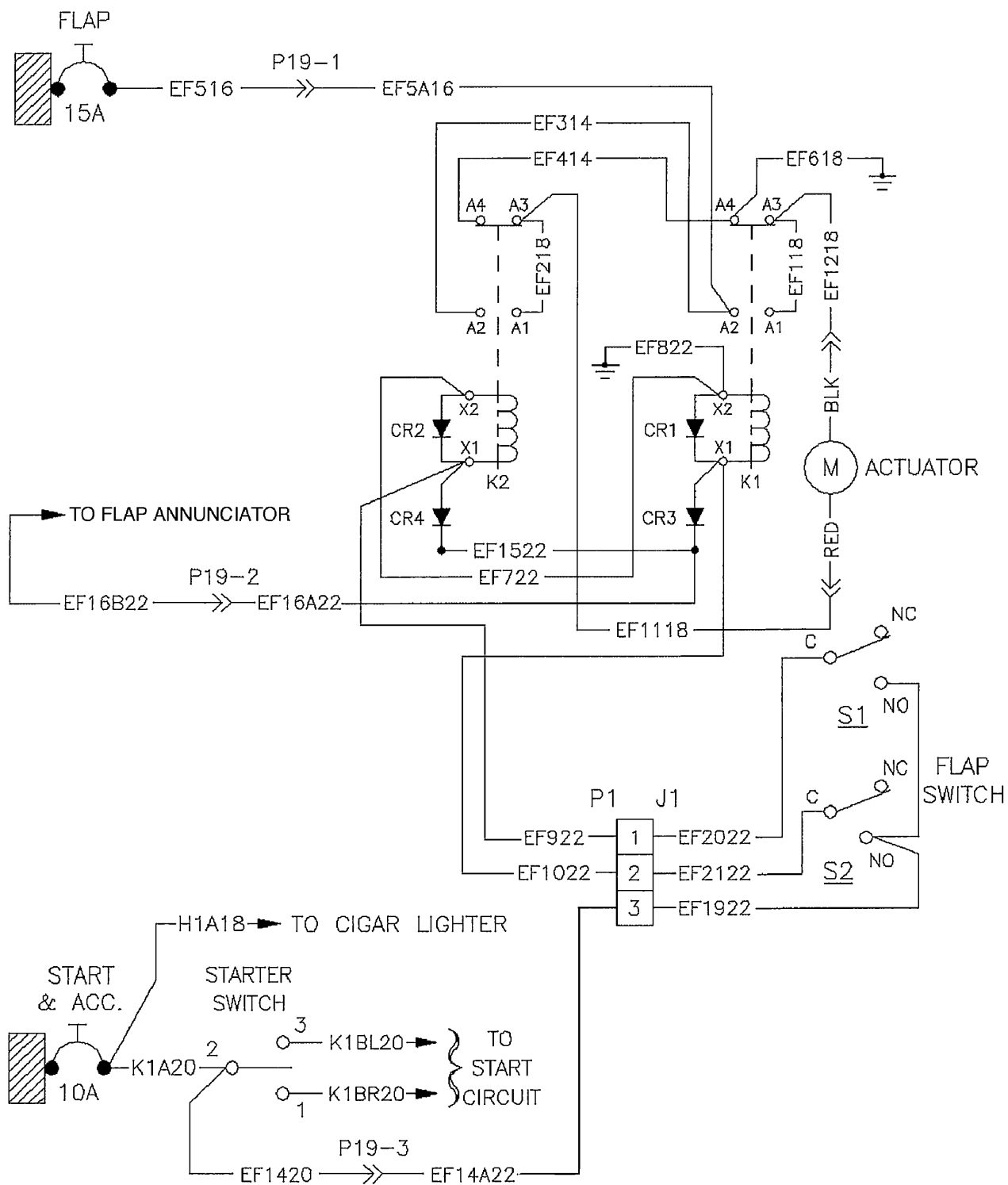
Pitot Heat and Stall Warning
Figure 1 (Sheet 3 of 3)

**THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL**

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MAINTENANCE MANUAL

83353 33.0 NEW/G



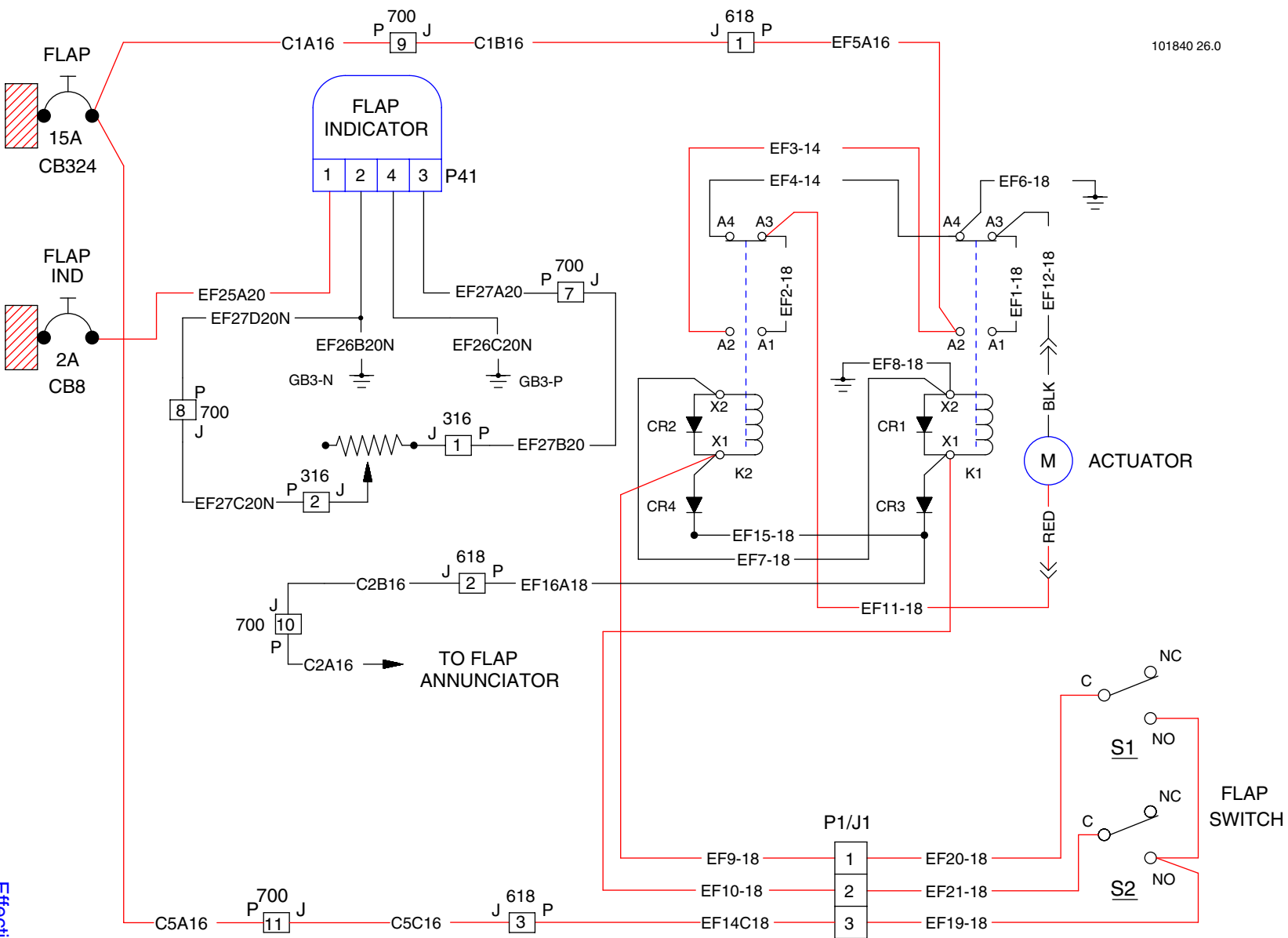
Electric Flaps
Figure 1 (Sheet 1 of 3)

Effectivity
Seneca IV



Electric Flaps
Figure 1 (Sheet 2 of 3)

101840 26.0



Electric Flaps
Figure 1 (Sheet 3 of 3)

Effectivity
Seneca V
with Avidyne Option

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PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL**

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83353 13.0 NEW/G

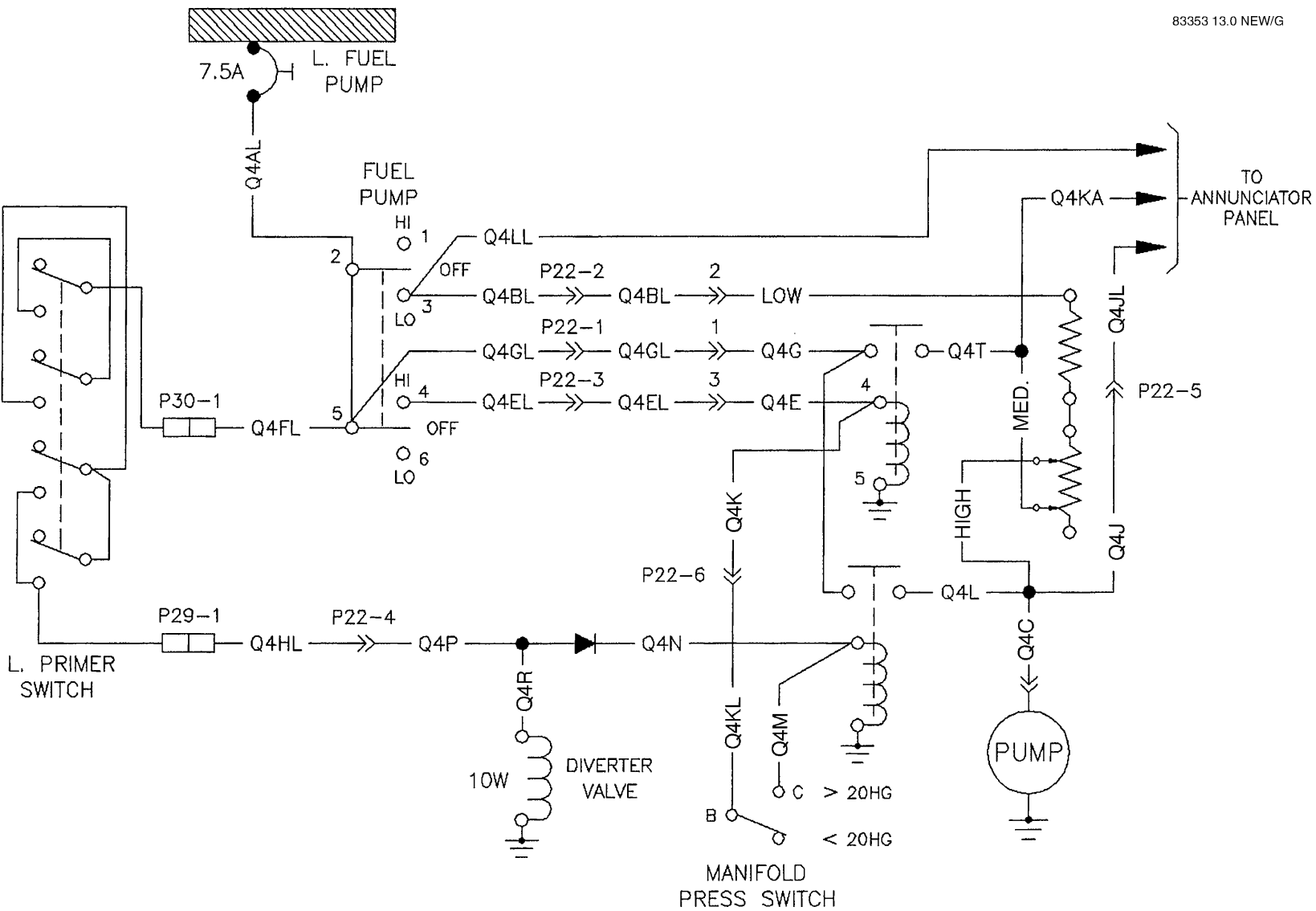
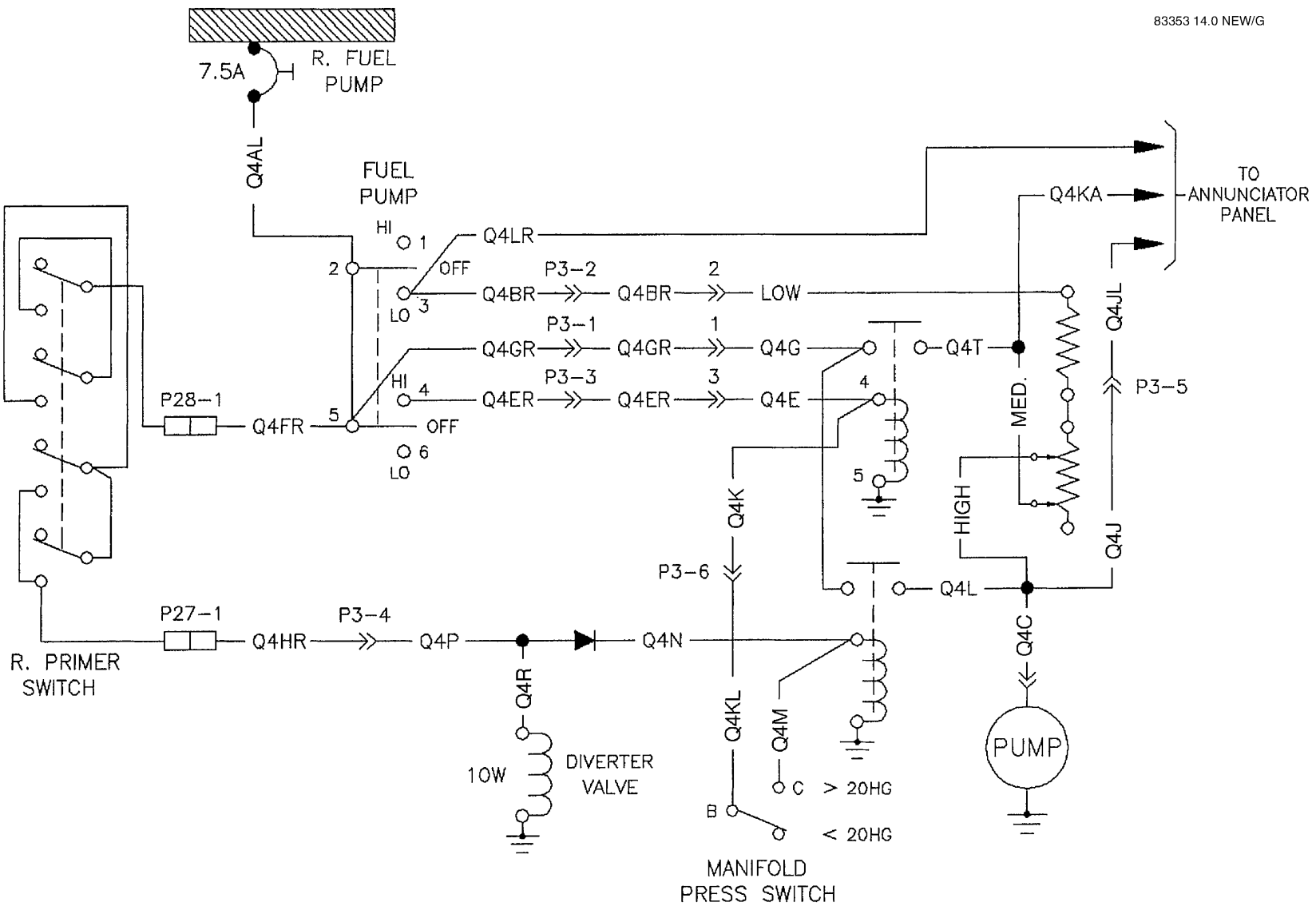
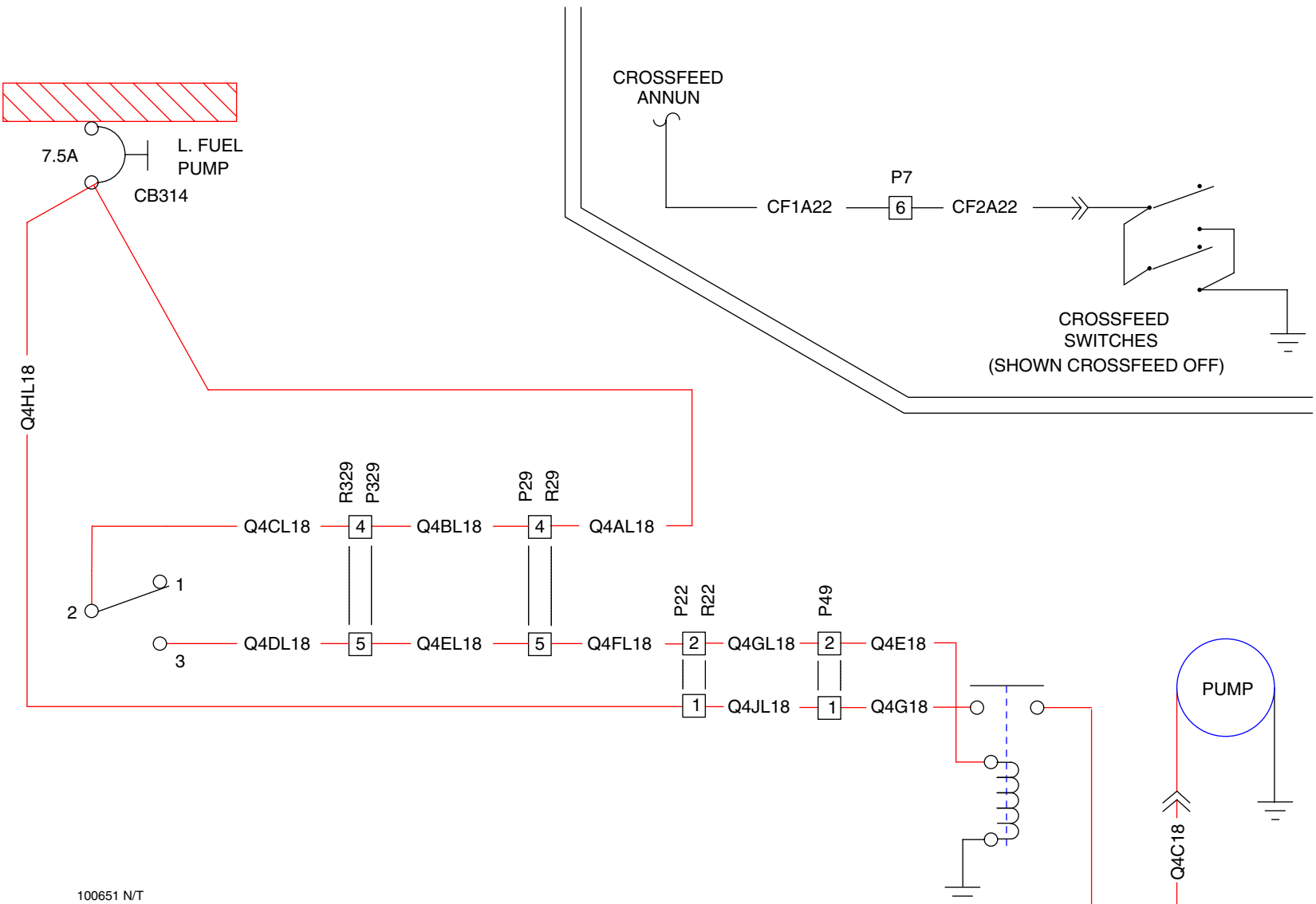


Figure 1 (Sheet 1 of 6)

Fuel Pumps
Figure 1 (Sheet 2 of 6)



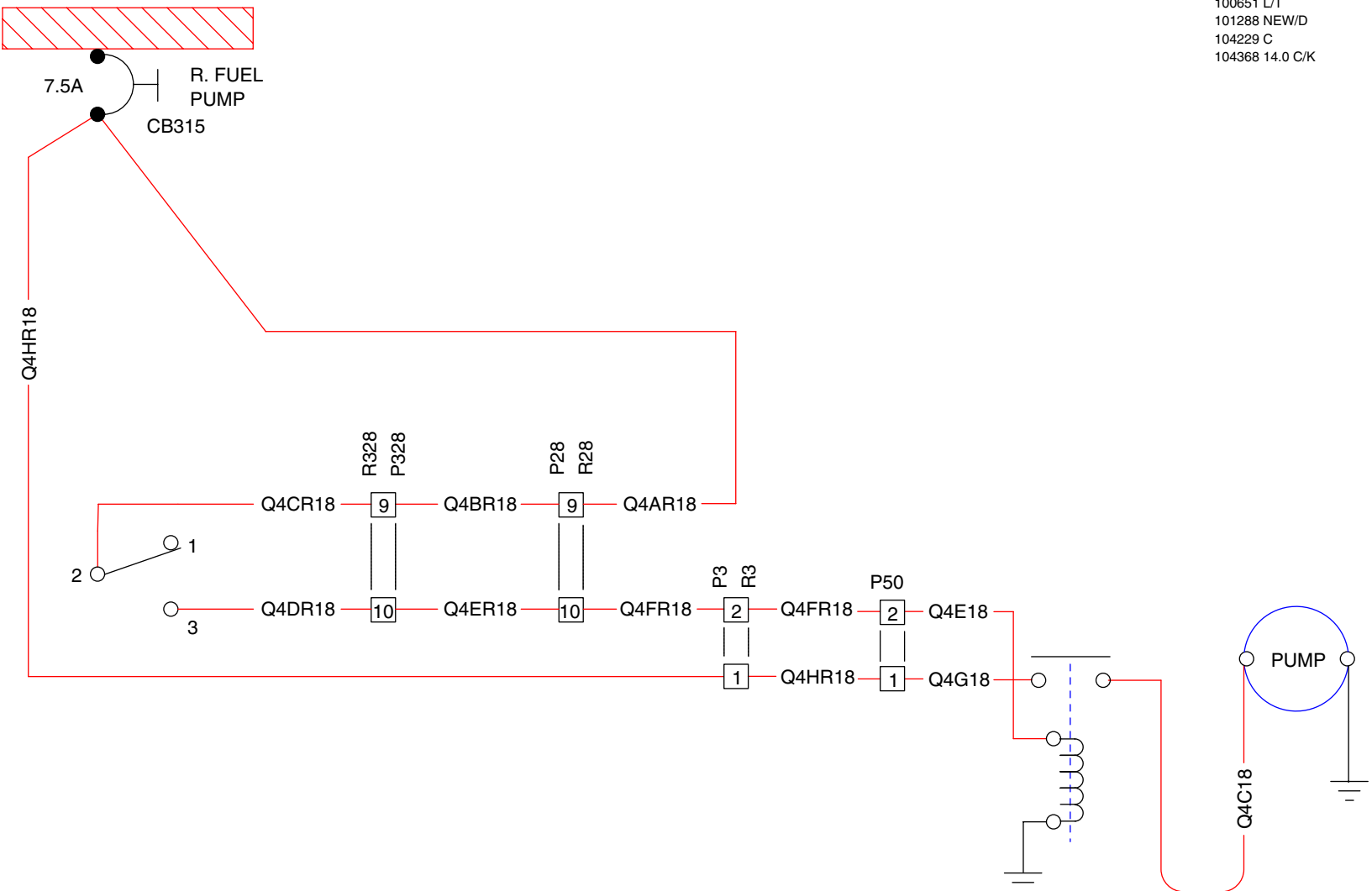


100651 N/T
101288 NEW/D
104229 C
104368 13.0 A/K

Fuel Pumps
Figure 1 (Sheet 3 of 6)

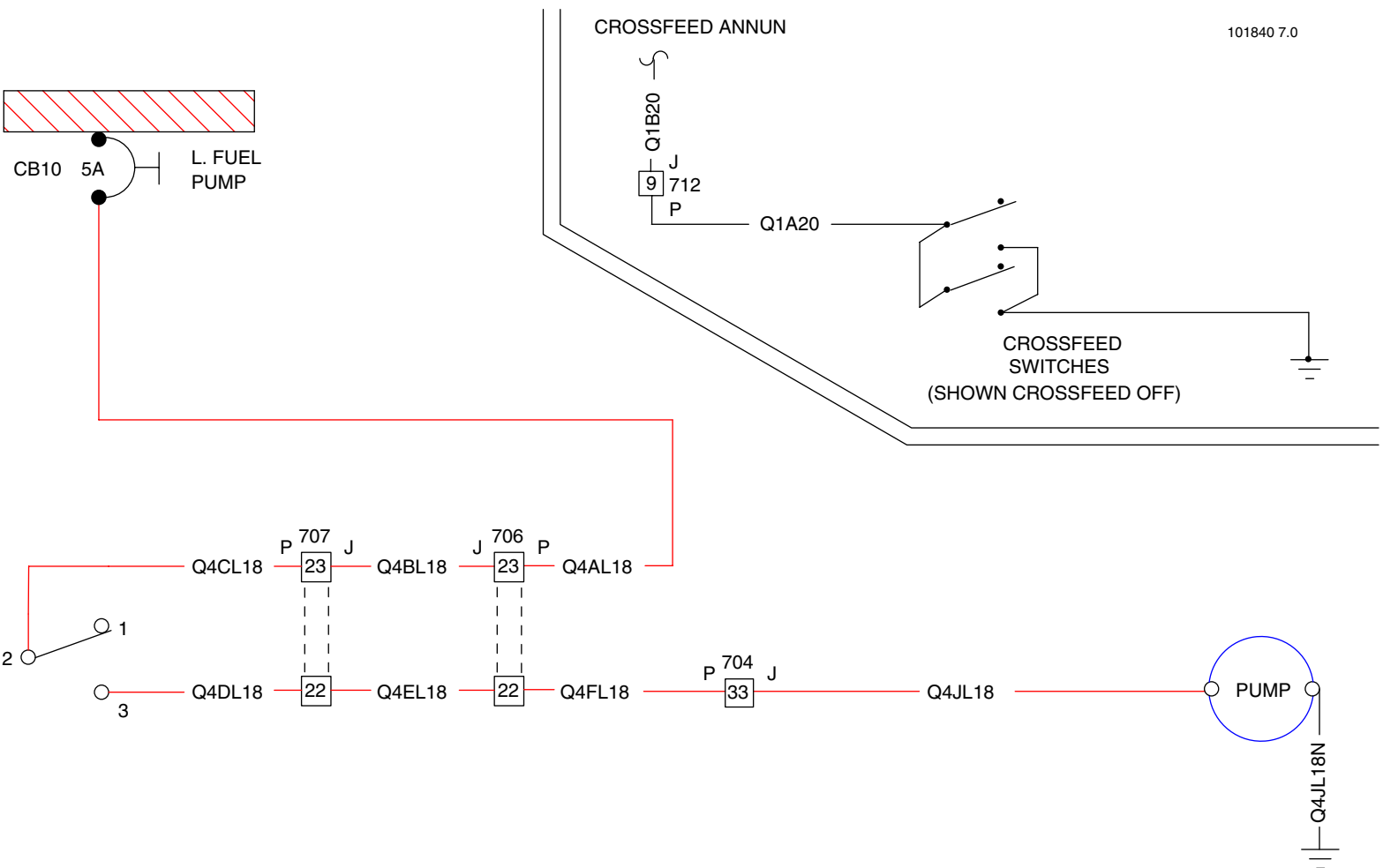
Effectivity
Left - Seneca V

100651 L/T
101288 NEW/D
104229 C
104368 14.0 C/K



Effectivity
Seneca V - Right
Fuel Pumps
Figure 1 (Sheet 4 of 6)

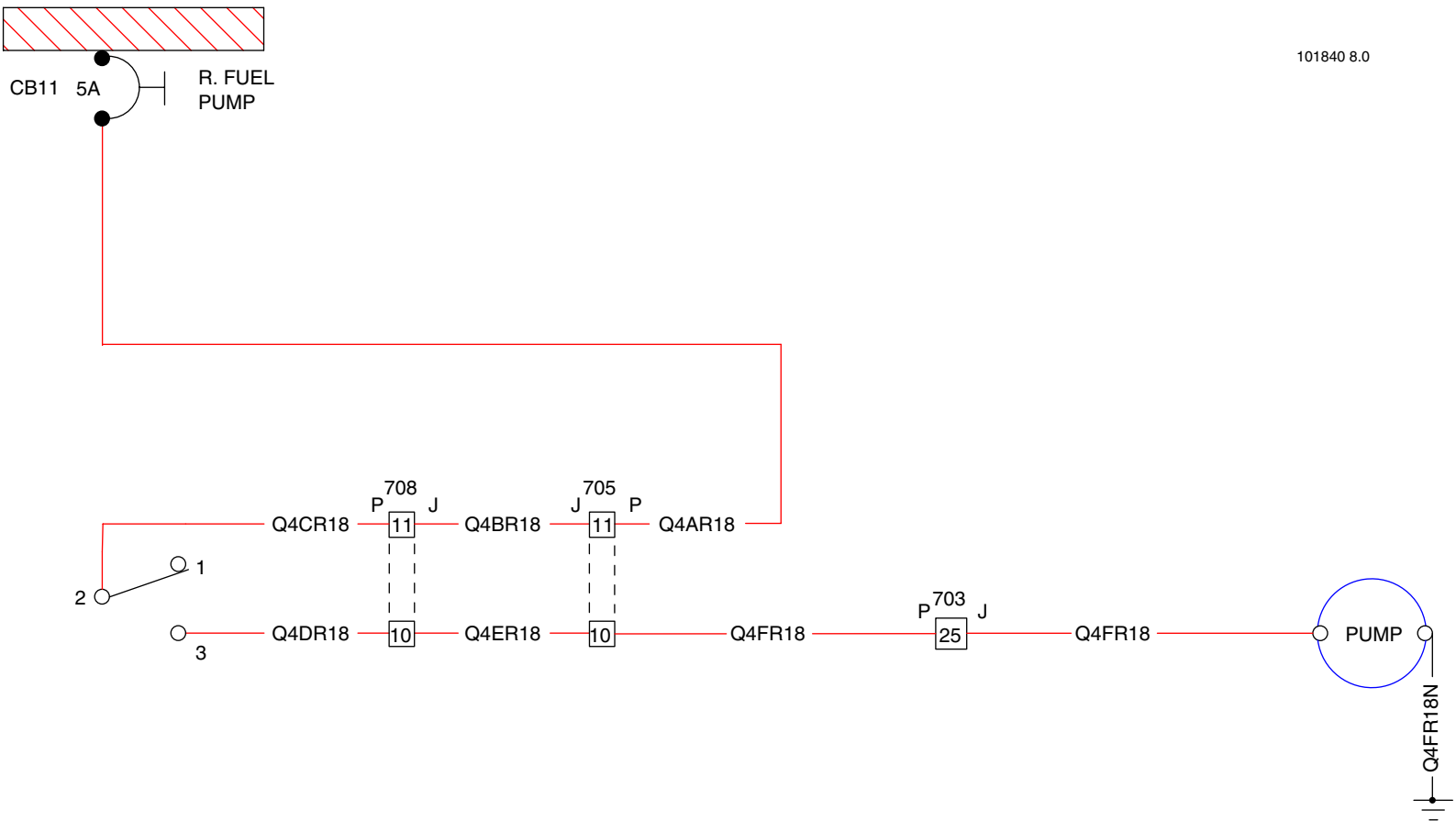
101840 7.0



Fuel Pumps
Figure 1 (Sheet 5 of 6)

Effectivity
Left - Seneca V
with Avidyne Option

101840 8.0

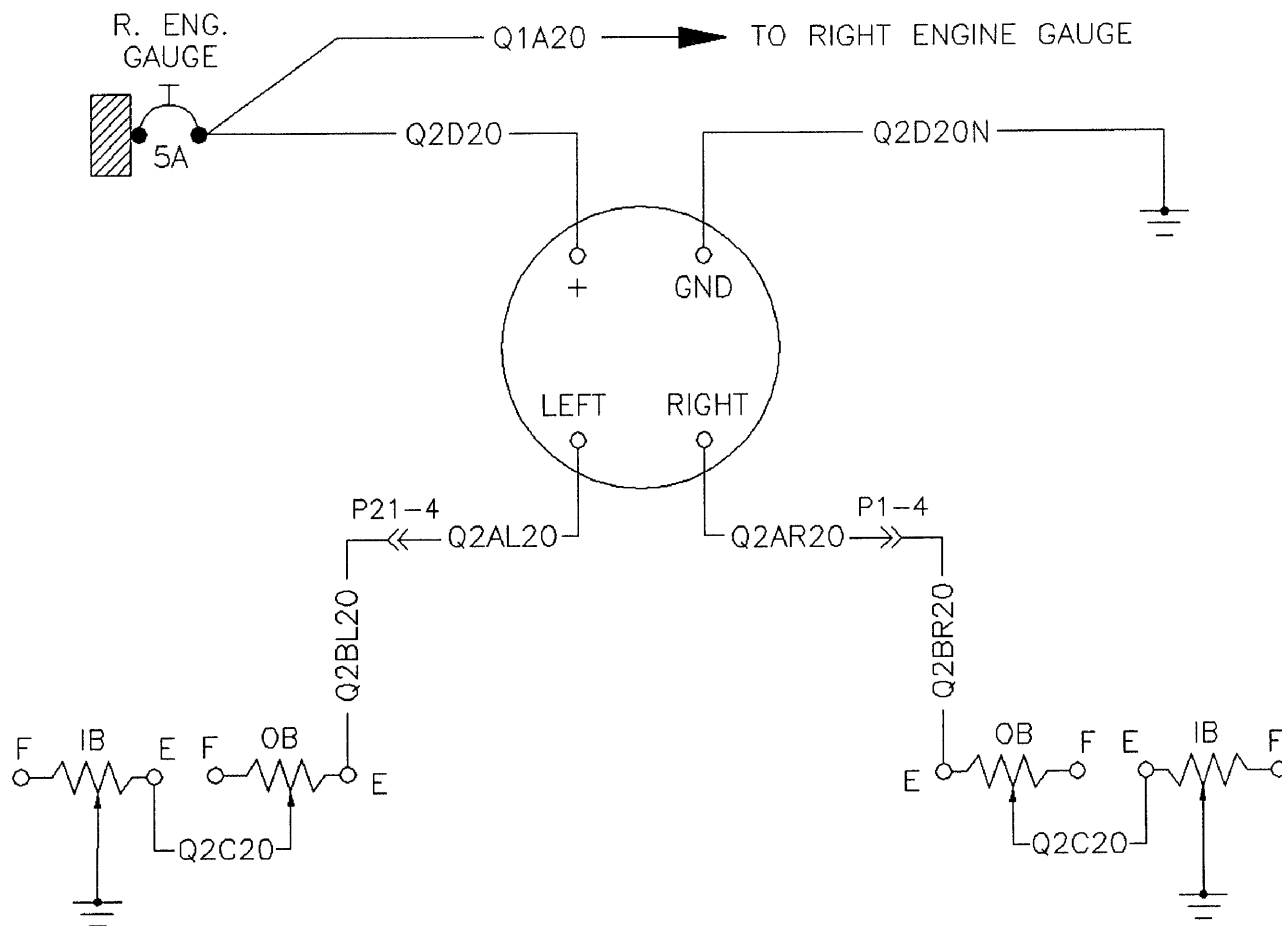


Effectivity
Seneca V - Right
with Avidyne Option

Fuel Pumps
Figure 1 (Sheet 6 of 6)

THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL

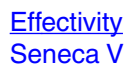
83353 7.0 NEW/G



Fuel Quantity
Figure 1 (Sheet 1 of 3)

[Effectivity](#)
[Seneca IV](#)

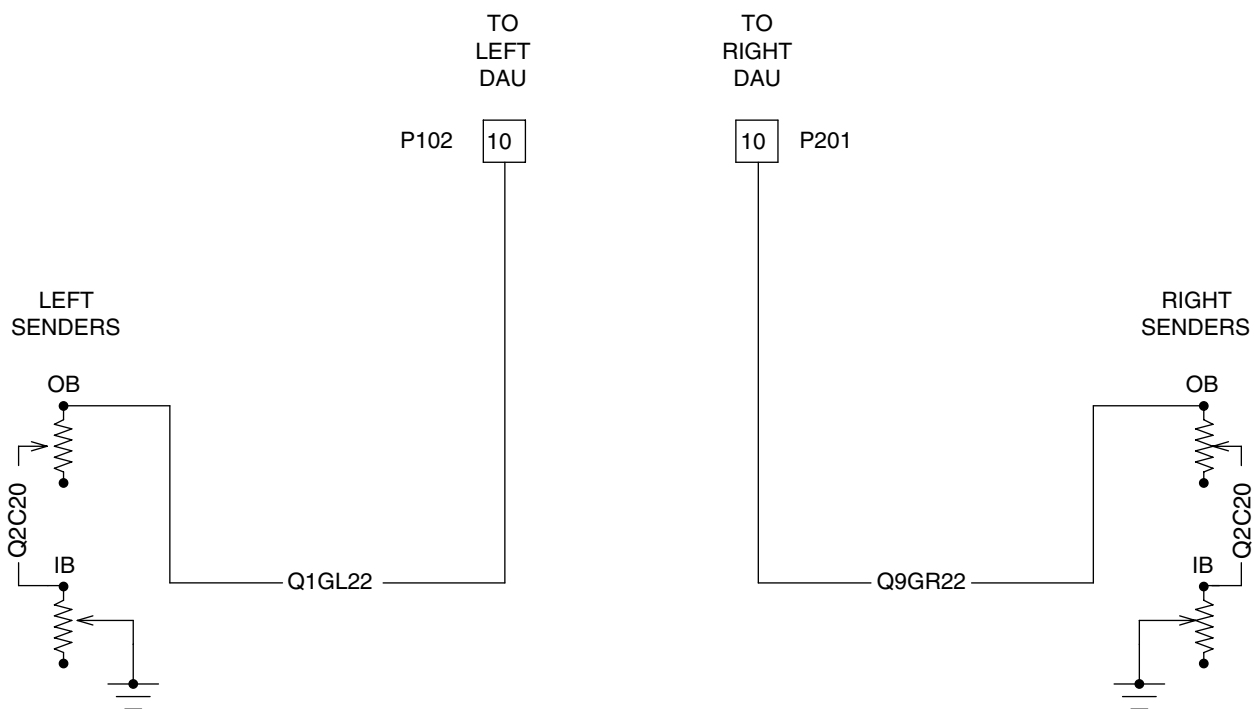
100651 B/K
101288 NEW/D
104229 NEW/C
104368 7.0 NEW/K



PAGE 2
Aug 19/05 **91-28-40**

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PA-34-220T, SENECA IV / V
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101840 5.0



Fuel Quantity
Figure 1 (Sheet 3 of 3)

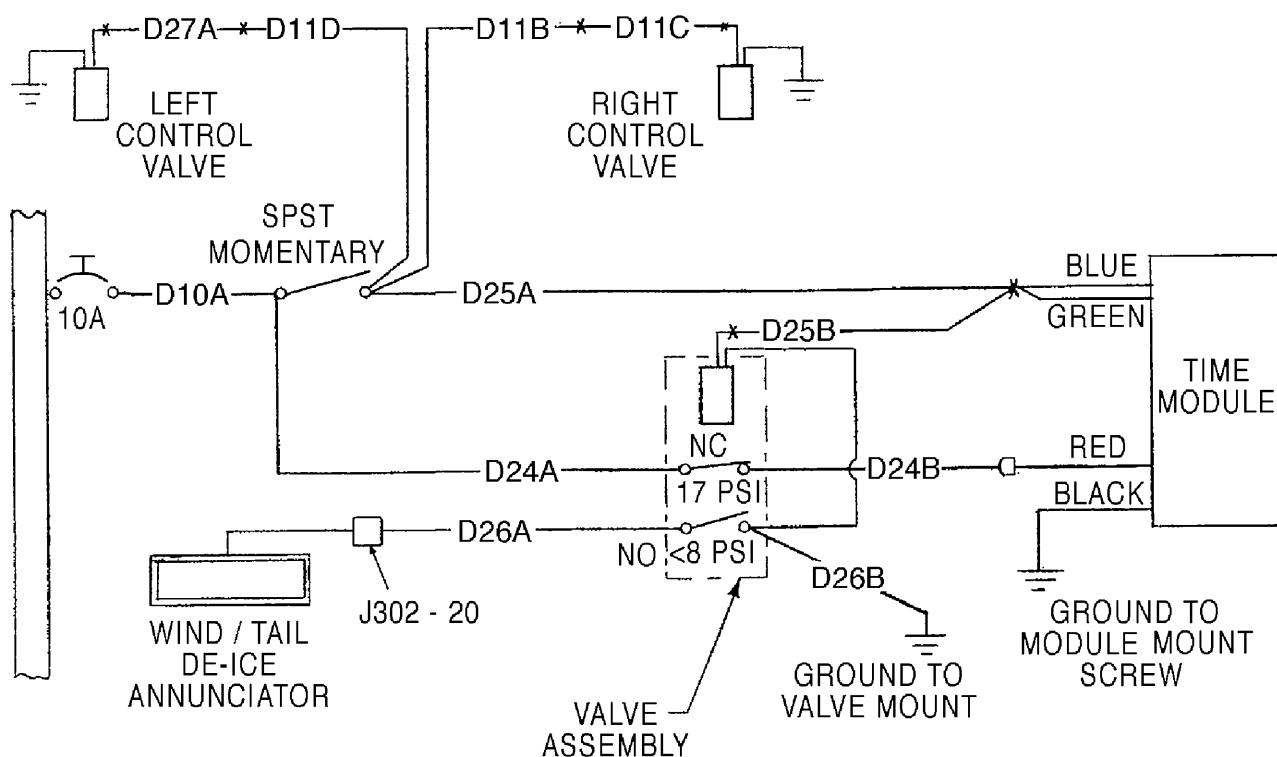
Effectivity
Seneca V
with Avidyne Option

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MAINTENANCE MANUAL**

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MAINTENANCE MANUAL

85186 W/AD



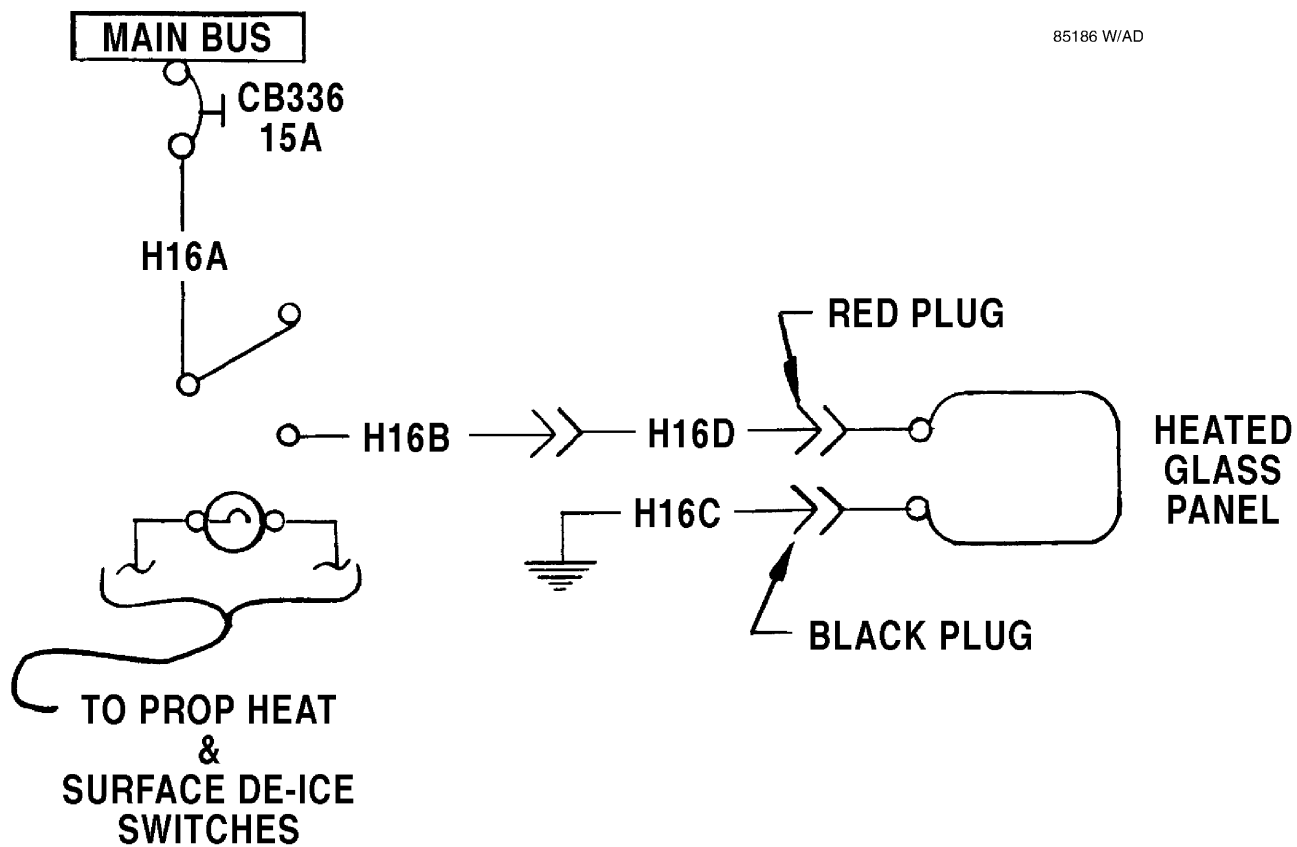
NOTE - 18 GAUGE WIRE THROUGHOUT

Surface Deice
Figure 1

**THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL**

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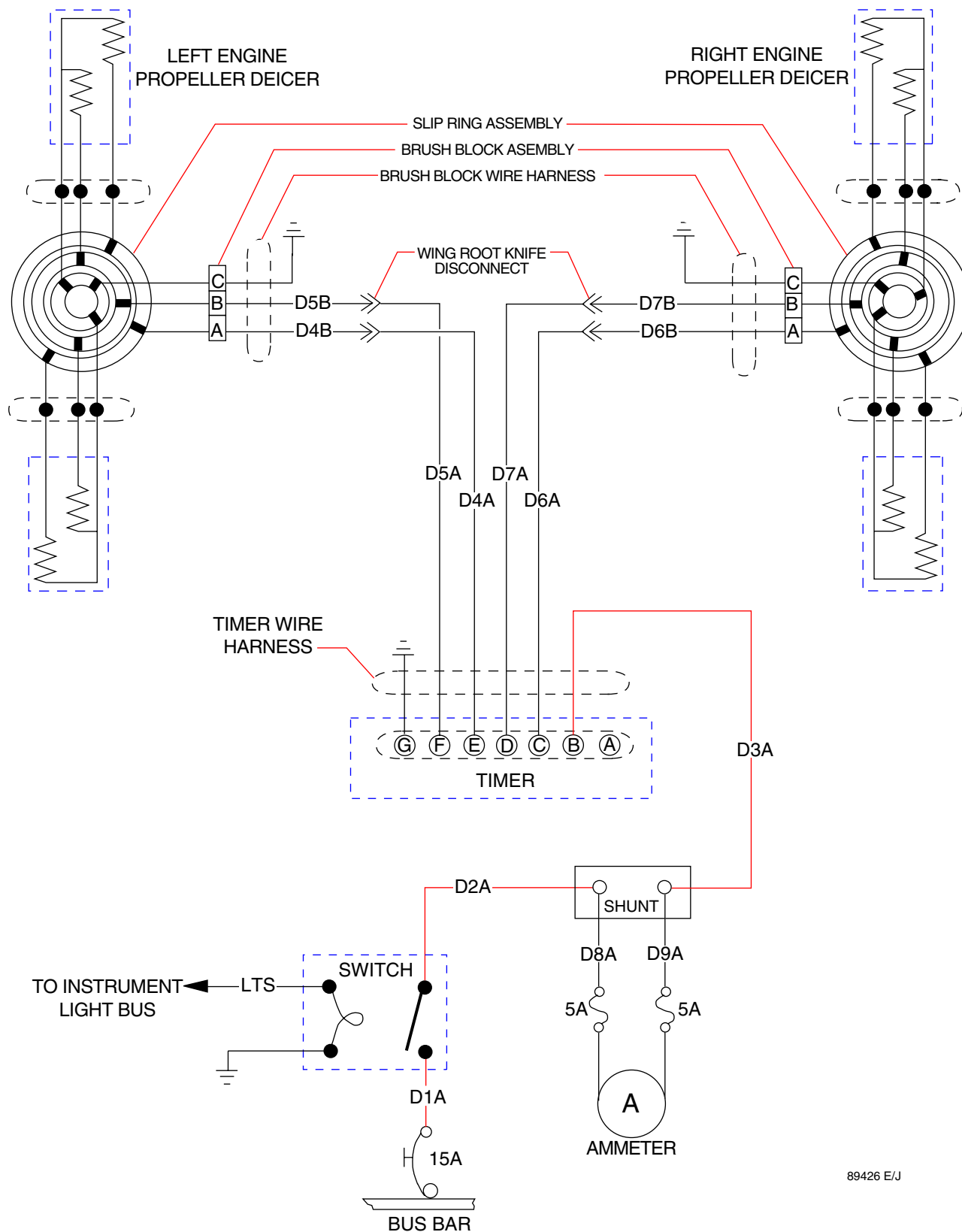
THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL



Windshield Deice
Figure 1

**THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL**

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89426 E/J

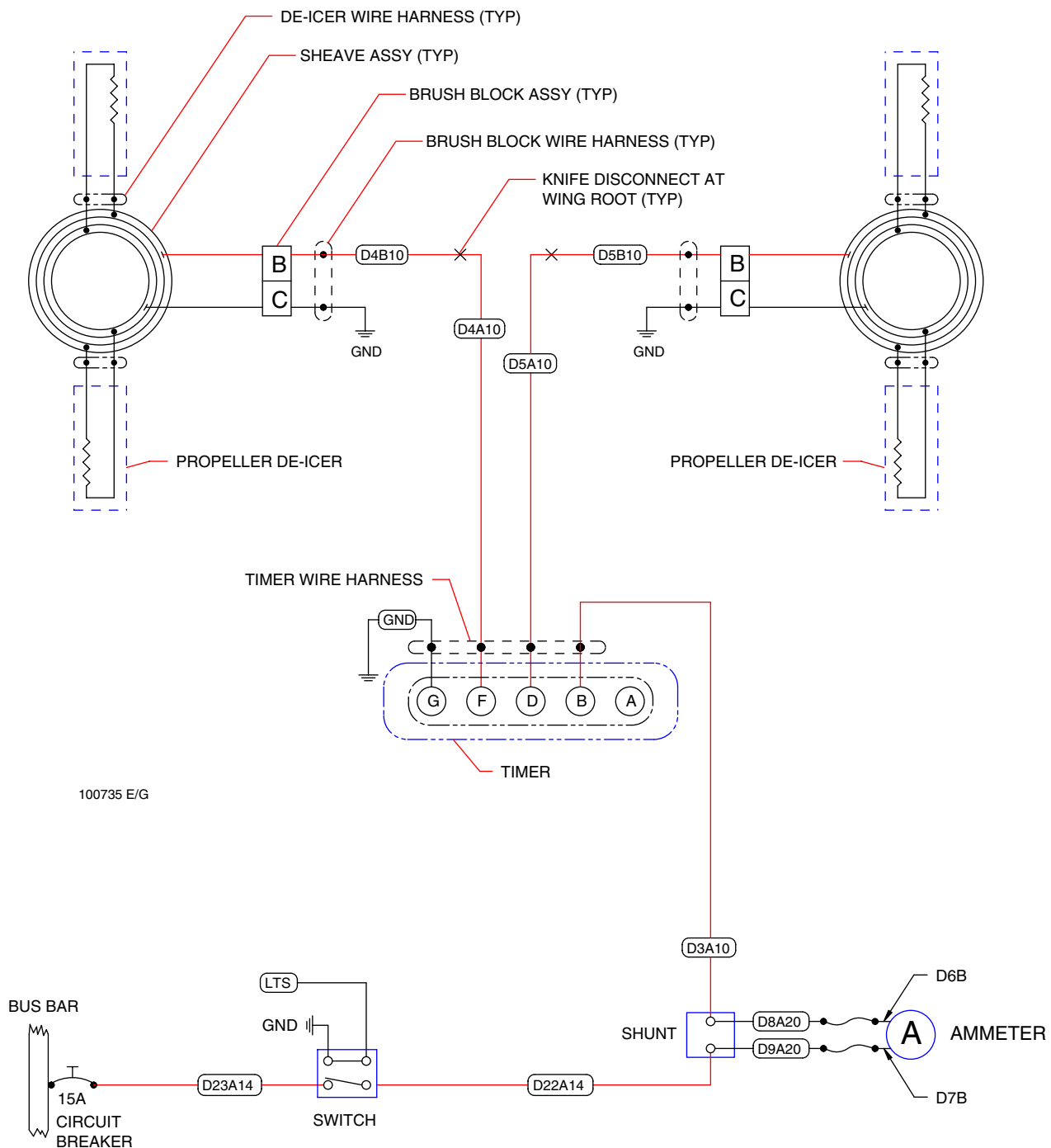
Propeller Deice
Figure 1 (Sheet 1 of 4)

Effectivity
Two-blade - Seneca IV

THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL

LEFT ENGINE

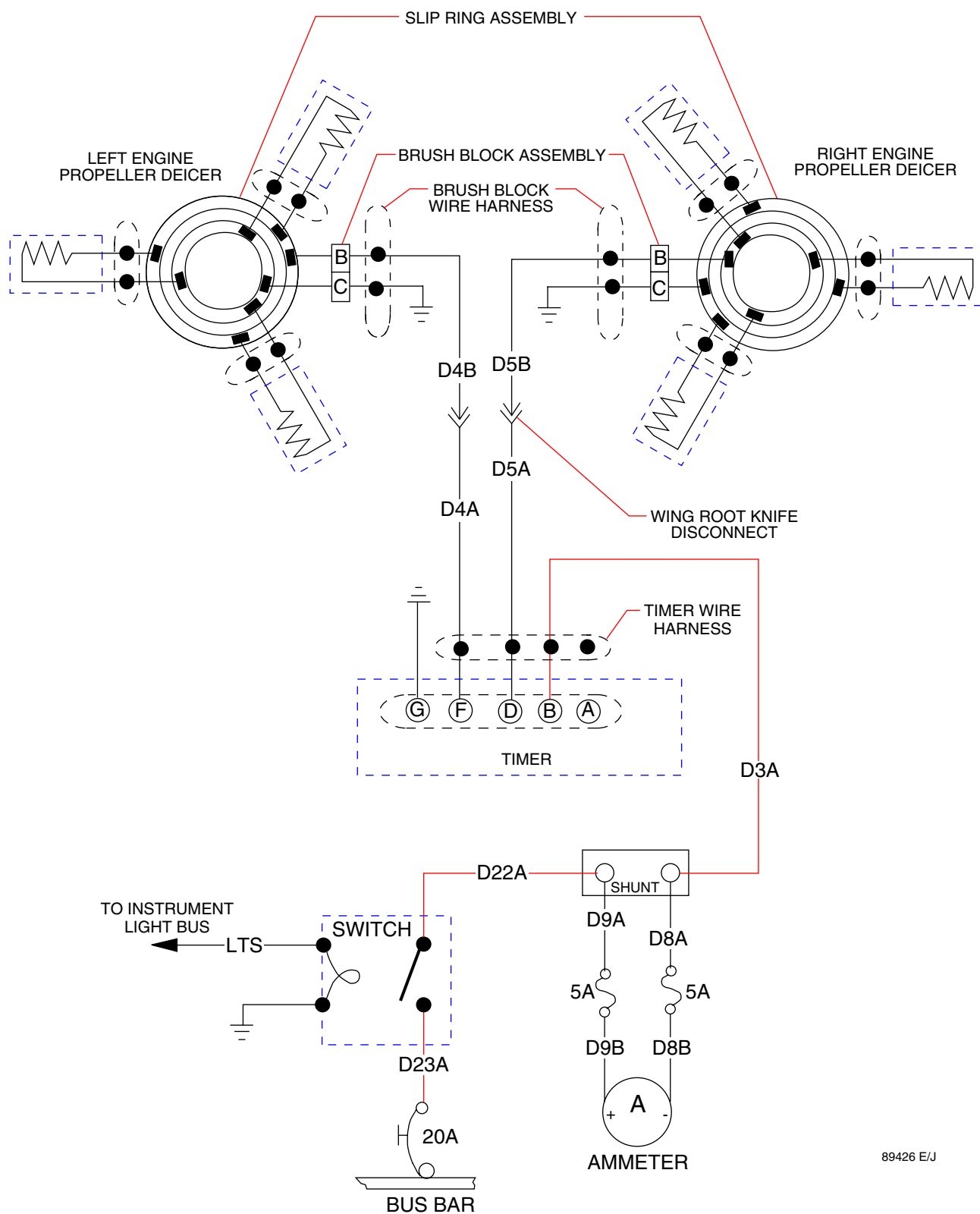
RIGHT ENGINE



Effectivity
Seneca V - (Two-blade)

Propeller Deice
Figure 1 (Sheet 2 of 4)

THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL

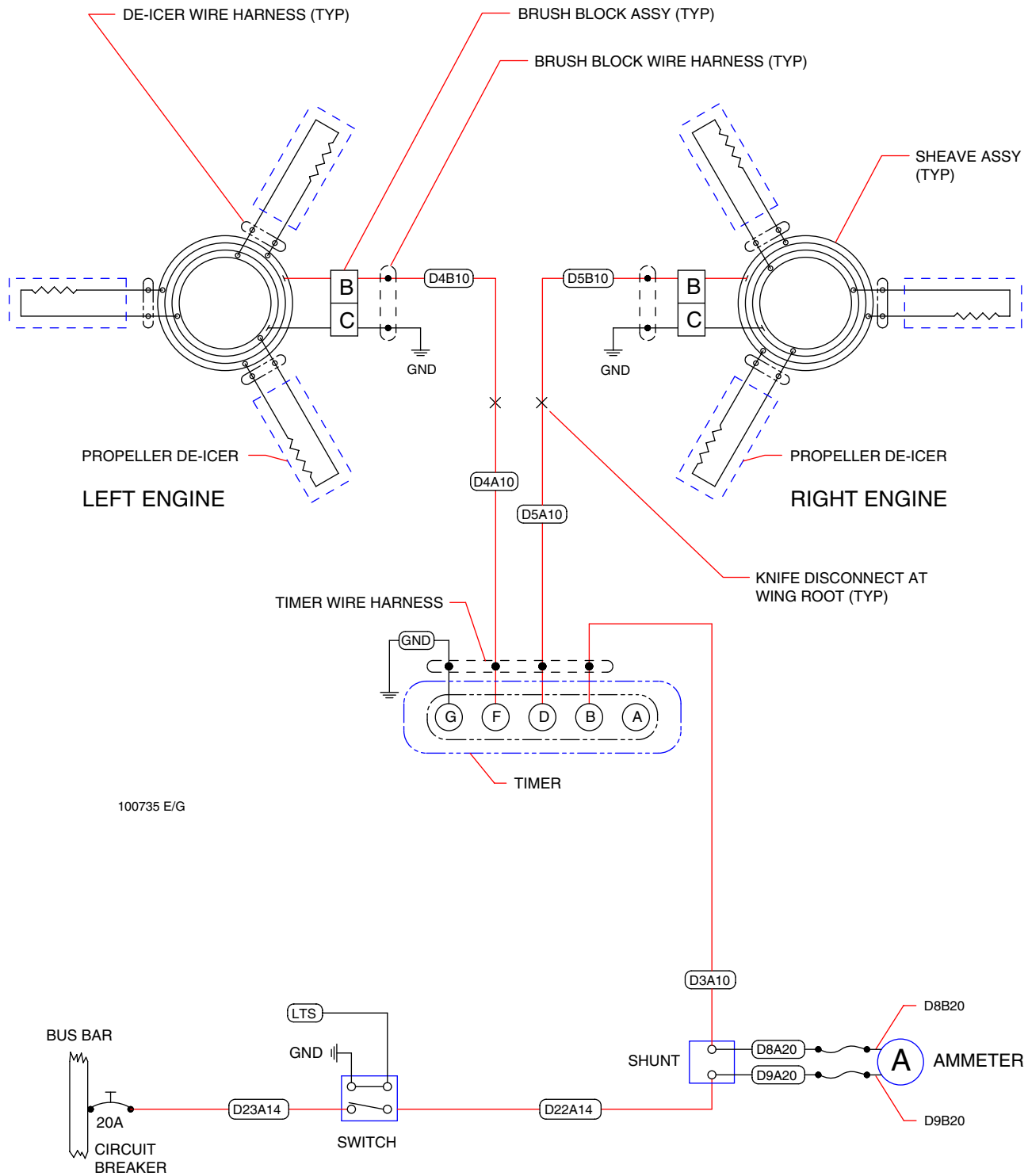


89426 E/J

Propeller Deice
Figure 1 (Sheet 3 of 4)

Effectivity
(Three-blade) - Seneca IV

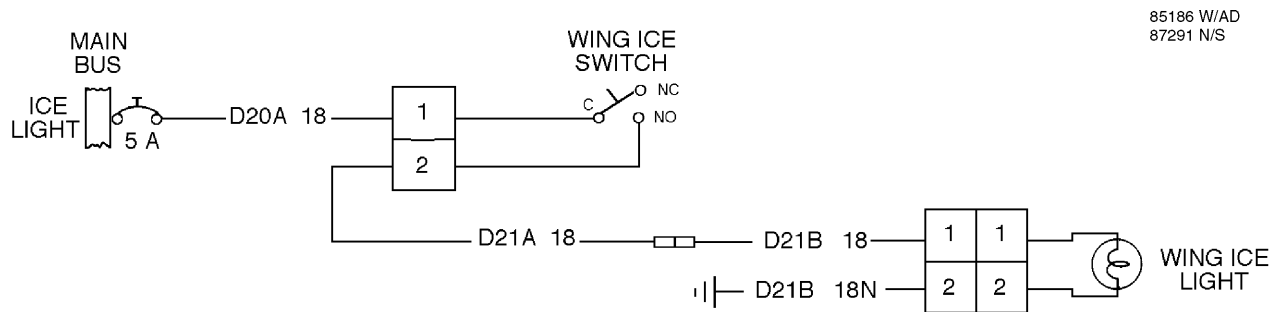
**THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL**



Effectivity
Seneca V - (Three-blade)

Propeller Deice
Figure 1 (Sheet 4 of 4)

THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL



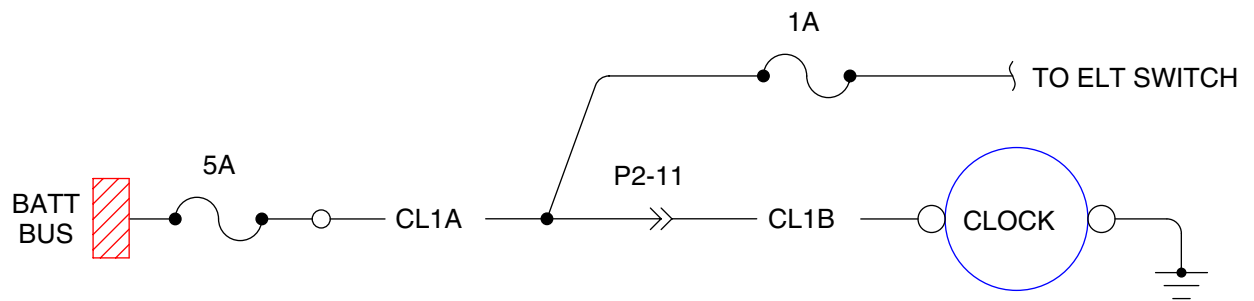
Wing Ice Light
Figure 1

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THE NEW PIPER AIRCRAFT, INC.
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MAINTENANCE MANUAL

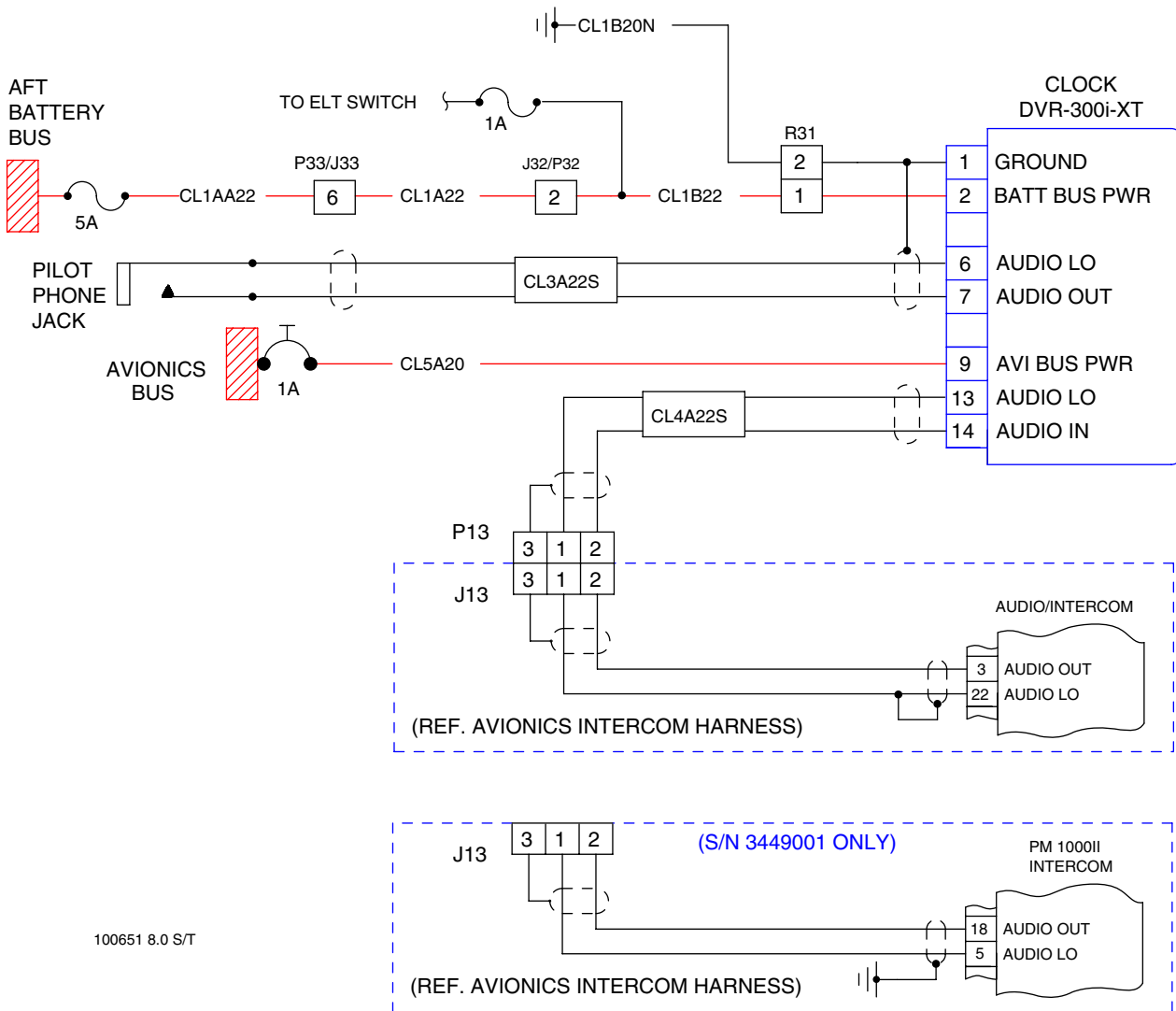
83353 8.0 E/G



Clock
Figure 1

[Effectivity](#)
[Seneca IV](#)

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PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL**

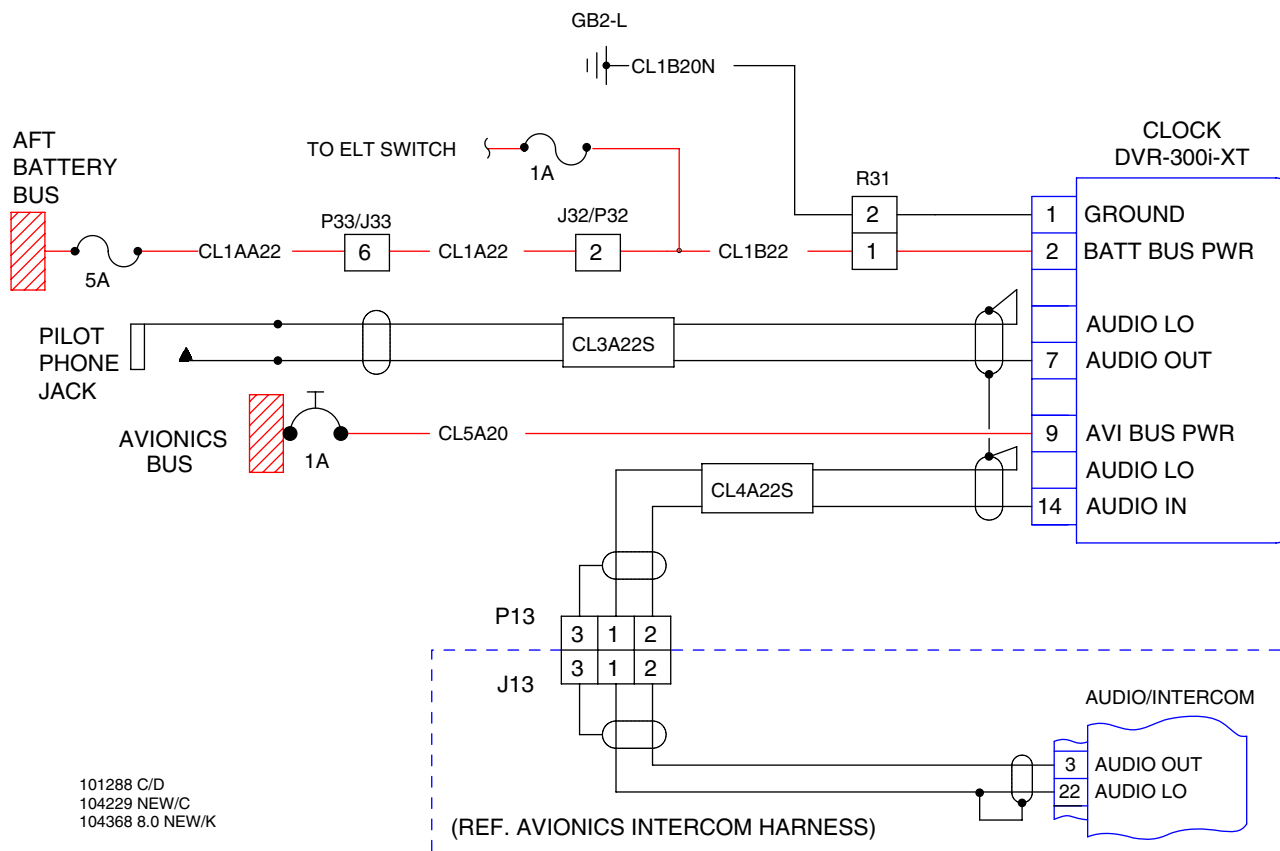


100651 8.0 S/T

[Effectivity](#)
3449001 thru 3449096

Digital Voice Recorder Clock
Figure 2 (Sheet 1 of 2)

**THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL**



Digital Voice Recorder Clock
Figure 2 (Sheet 2 of 2)

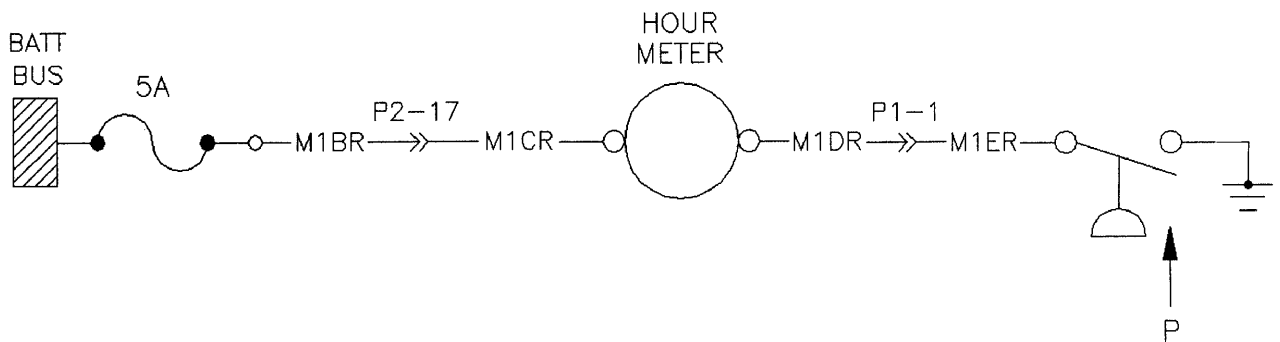
[Effectivity](#)
3449097 & up

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MAINTENANCE MANUAL

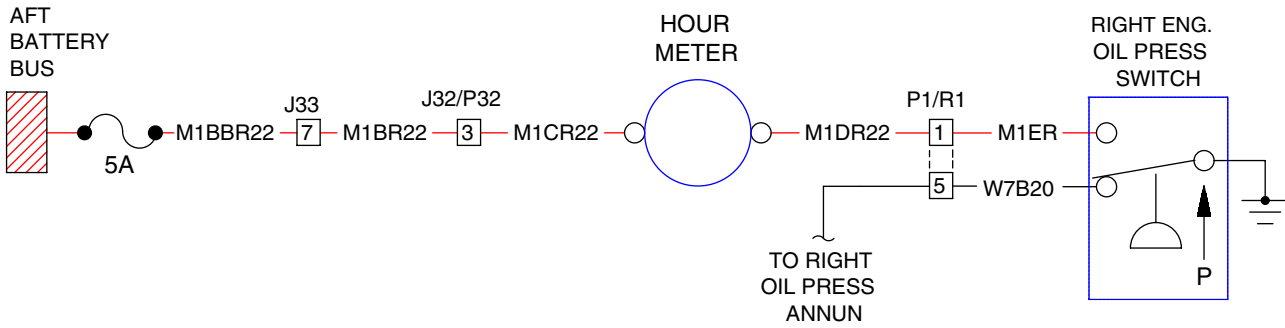
83353 15.0 NEW/G



Hour Meter and Oil Pressure Switch(es)
Figure 1 (Sheet 1 of 2)

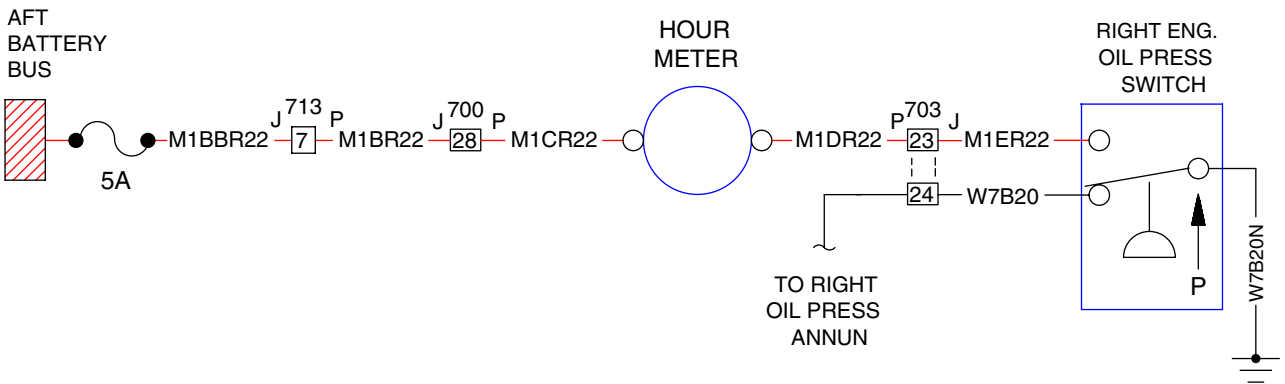
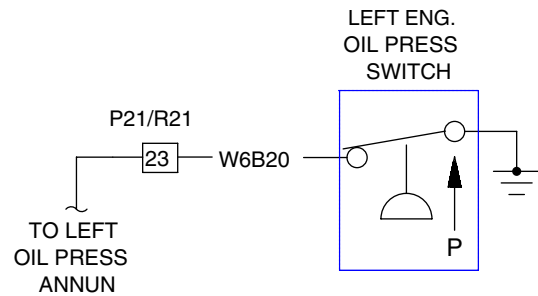
[Effectivity](#)
[Seneca IV](#)

THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL



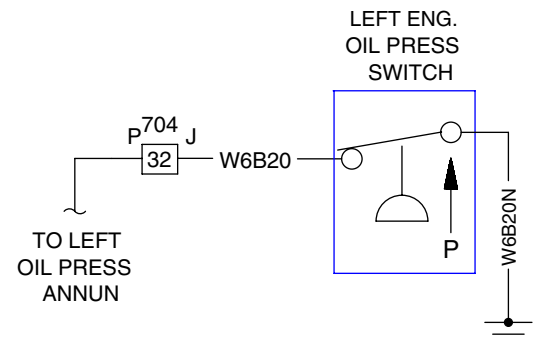
STANDARD

100651 K/T
101288 NEW/D
104229 NEW/C
104368 15.0 NEW/K



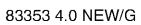
WITH AVIDYNE OPTION

101840 9.0

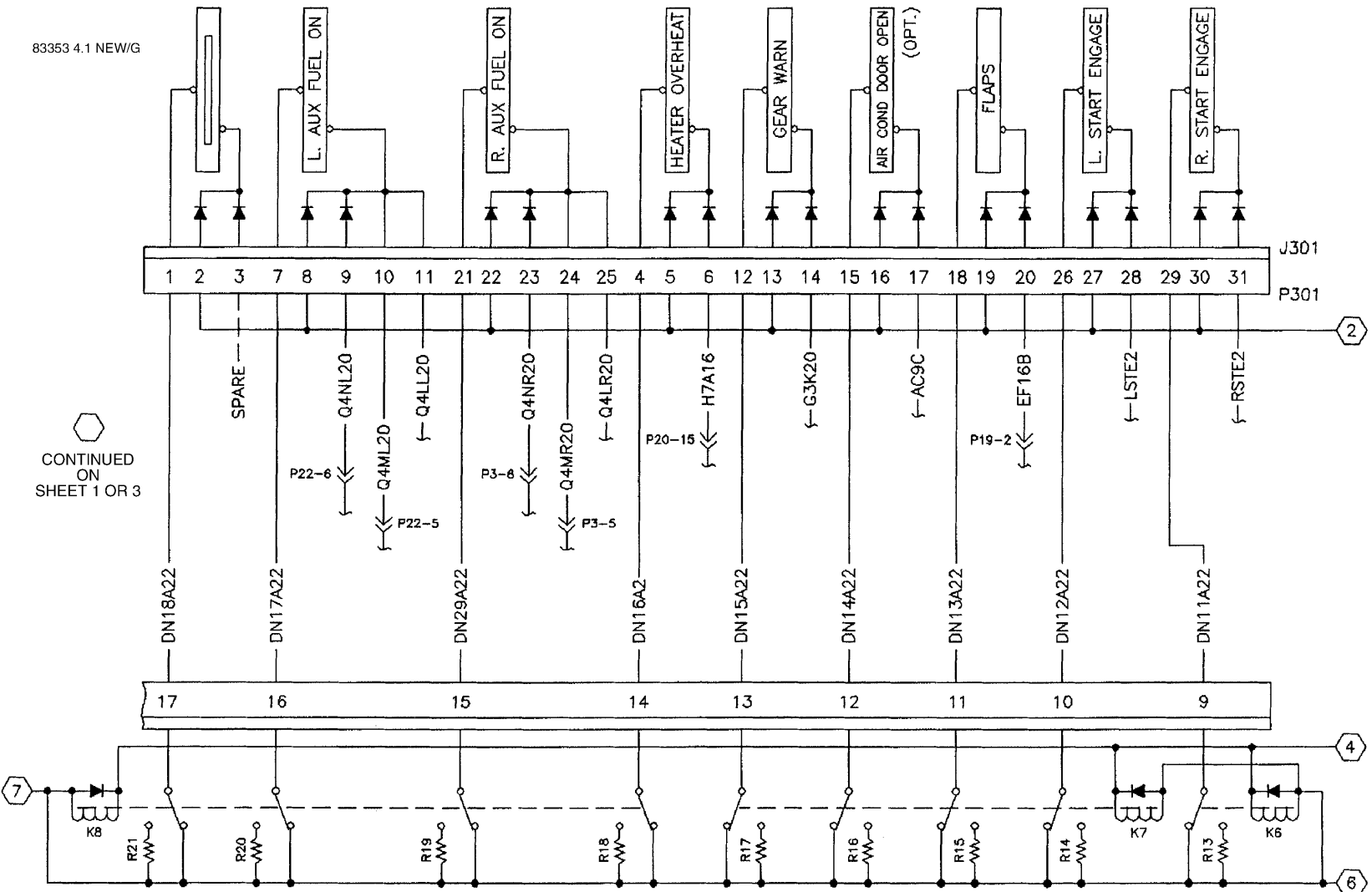


Effectivity
Seneca V

Hour Meter and Oil Pressure Switch(es)
Figure 1 (Sheet 2 of 2)



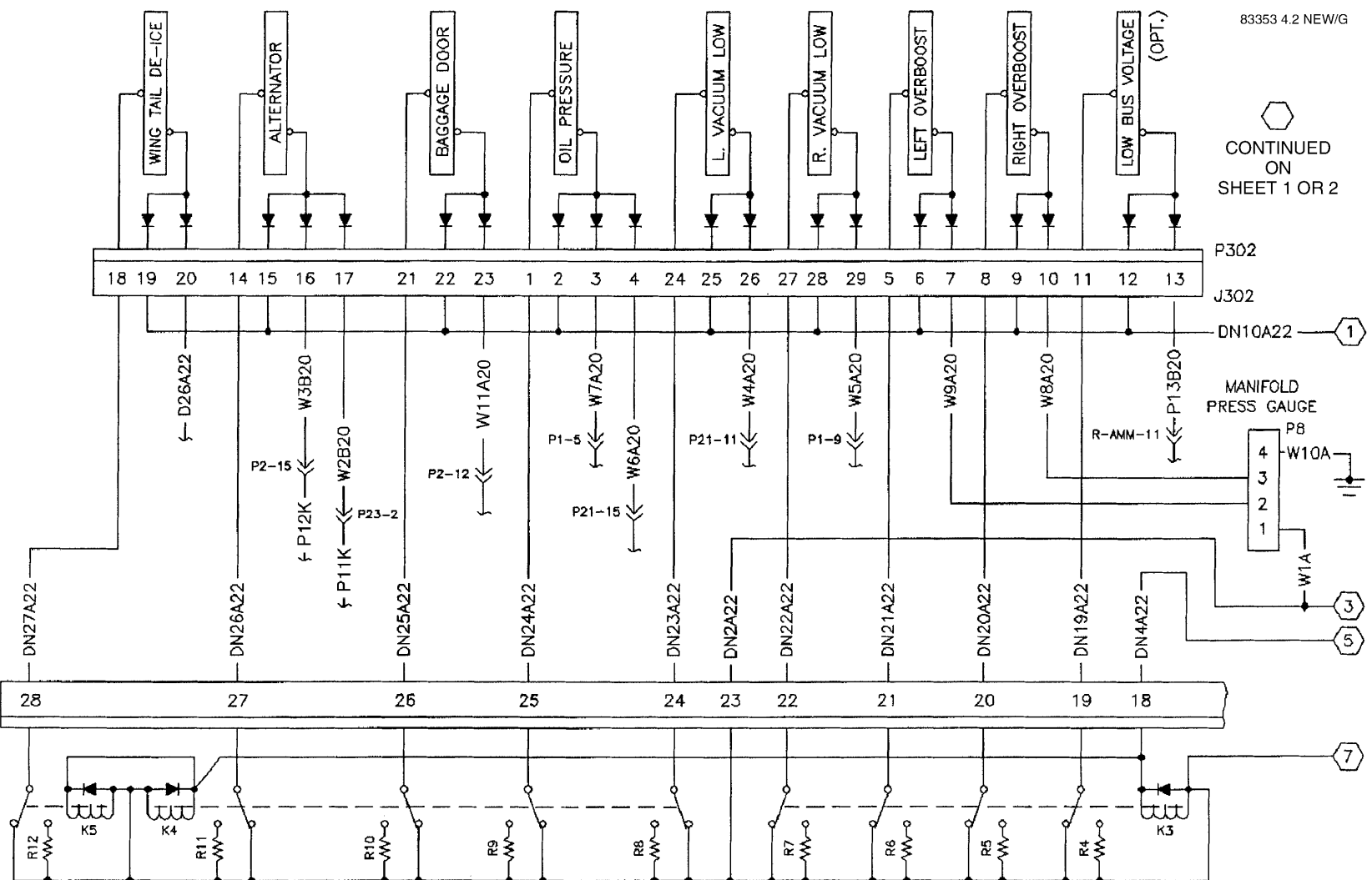
Effectivity



Annunciator
Figure 1 (Sheet 2 of 14)

83353 4.2 NEW/G

CONTINUED
ON
SHEET 1 OR 2



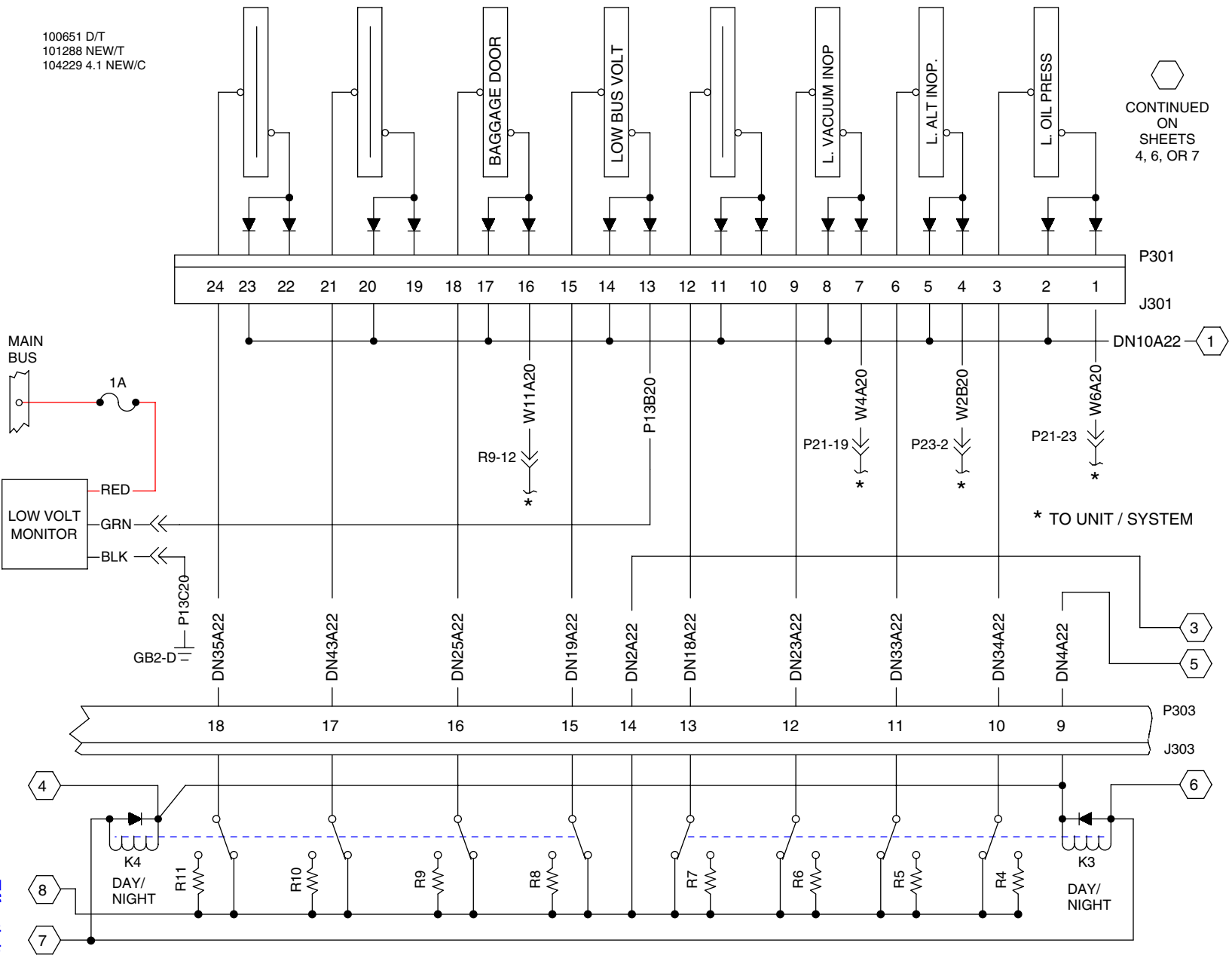
Annunciator
Figure 1 (Sheet 3 of 14)

Effectivity
Seneca IV



Annunciator
Figure 1 (Sheet 4 of 14)

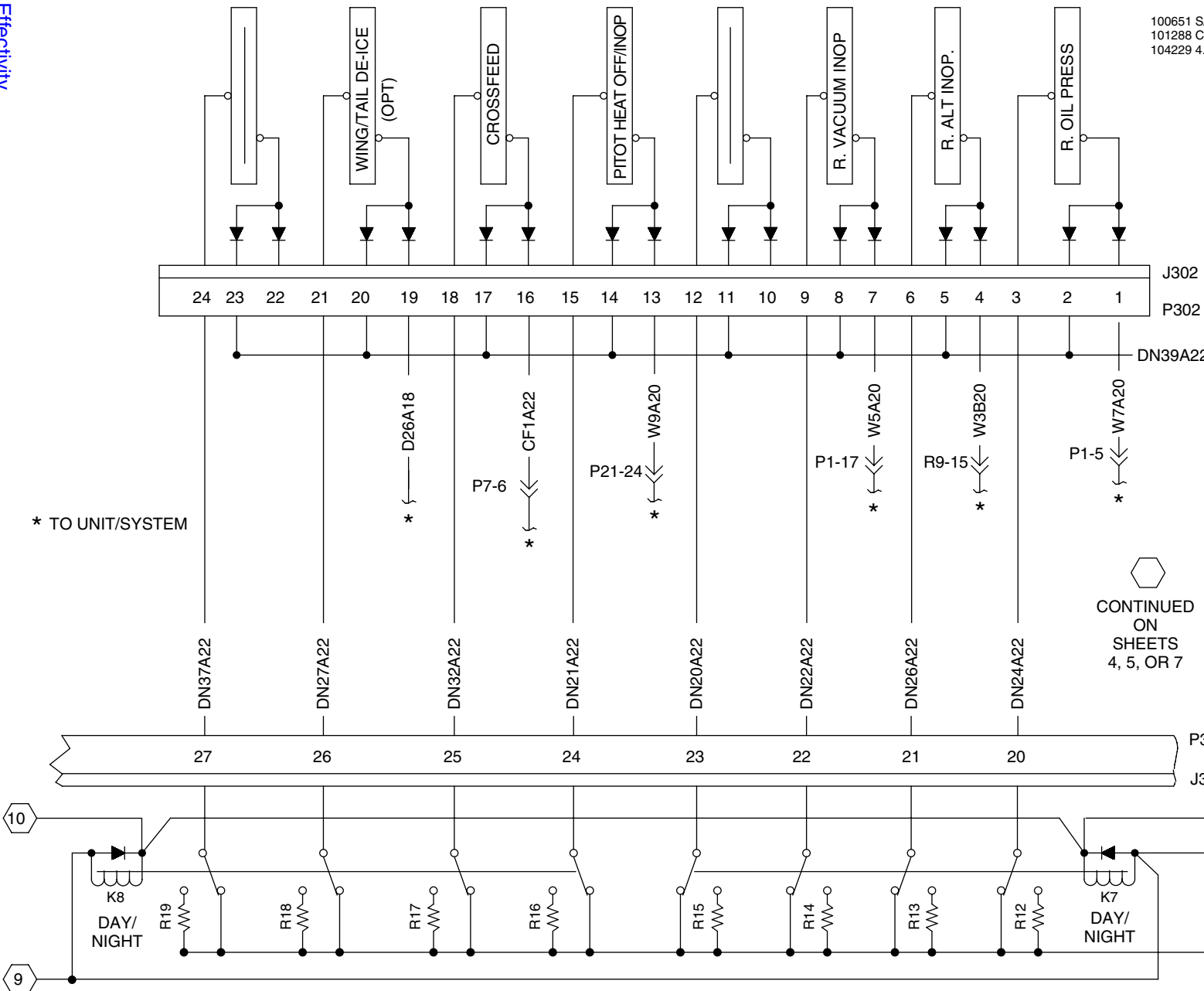
CONTINUED
ON
SHEETS
4, 6, OR 7



Annunciator
Figure 1 (Sheet 5 of 14)

Effectivity
3449001 thru 3449177,
less 3449161

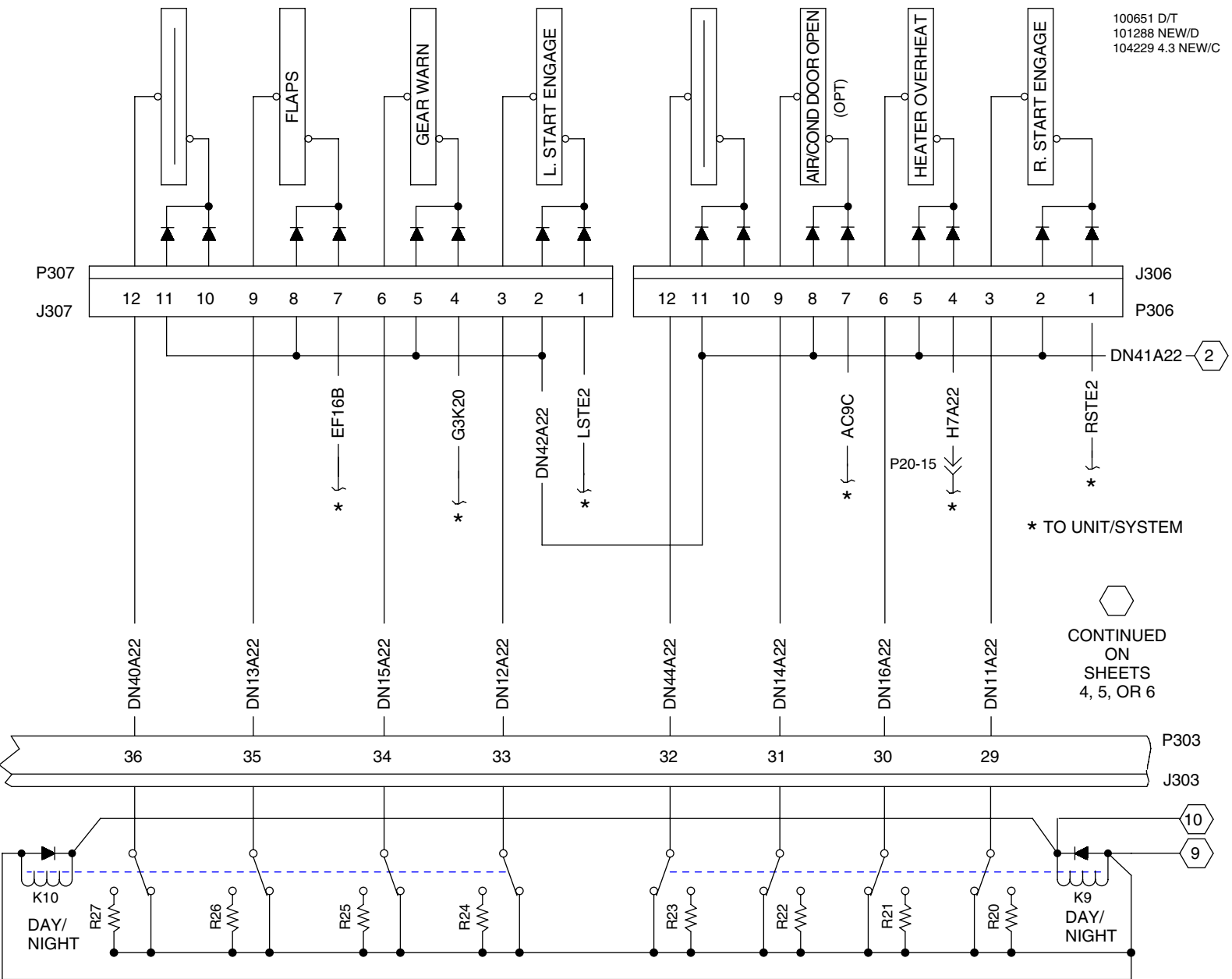
100651 S/T
101288 C/D
104229 4.2 NEW/C



Effectivity
3449001 thru 3449177,
less 3449161

Annunciator
Figure 1 (Sheet 6 of 14)

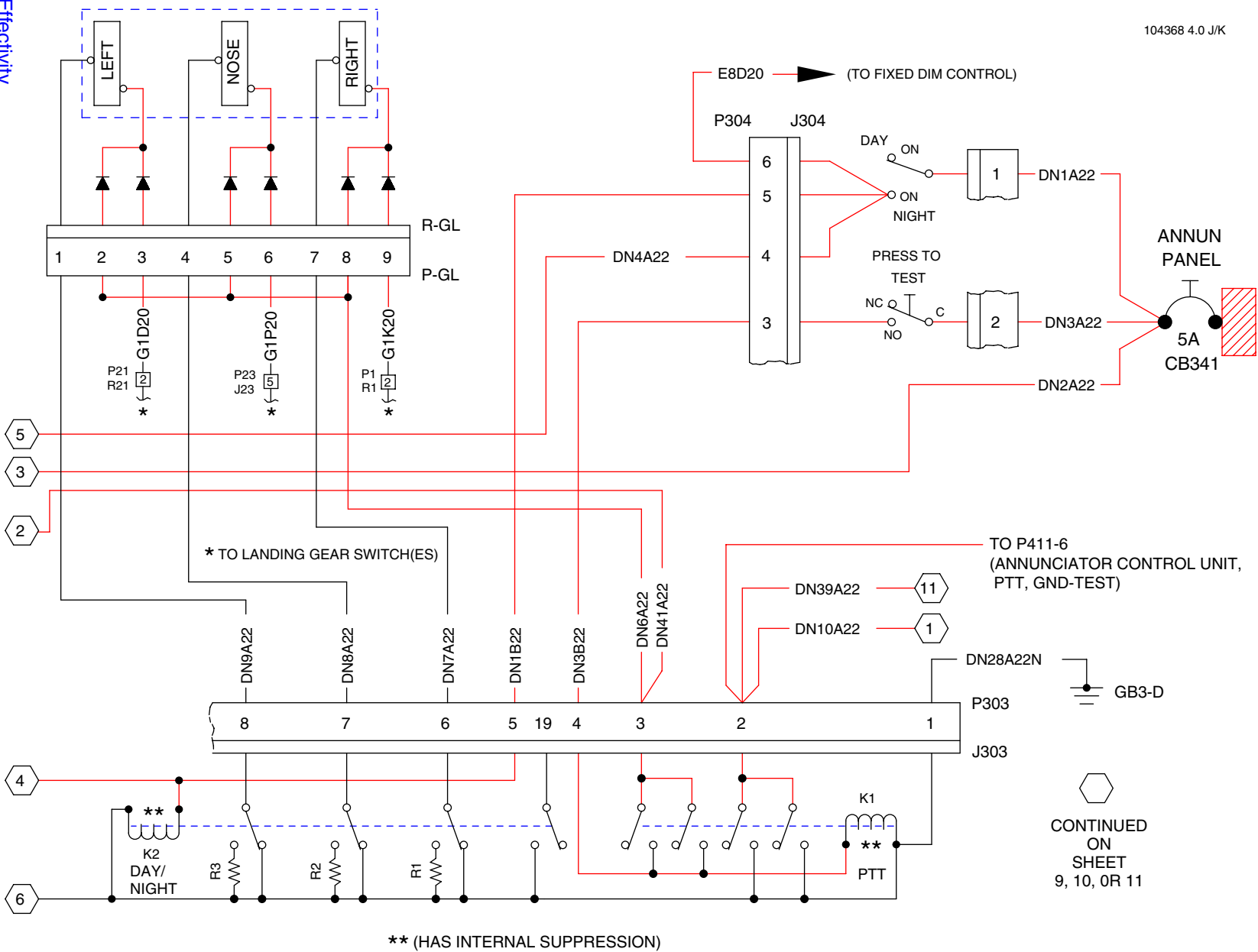
100651 D/T
101288 NEW/D
104229 4.3 NEW/C



Annunciator
Figure 1 (Sheet 7 of 14)

Effectivity
3449001 thru 3449177,
less 3449161

104368 4.0 J/K



CONTINUED
ON
SHEET
9, 10, OR 11

Effectivity
3449161 and,
3449178 & up
Figure 1 (Sheet 8 of 14)

104368 4.1 B/K

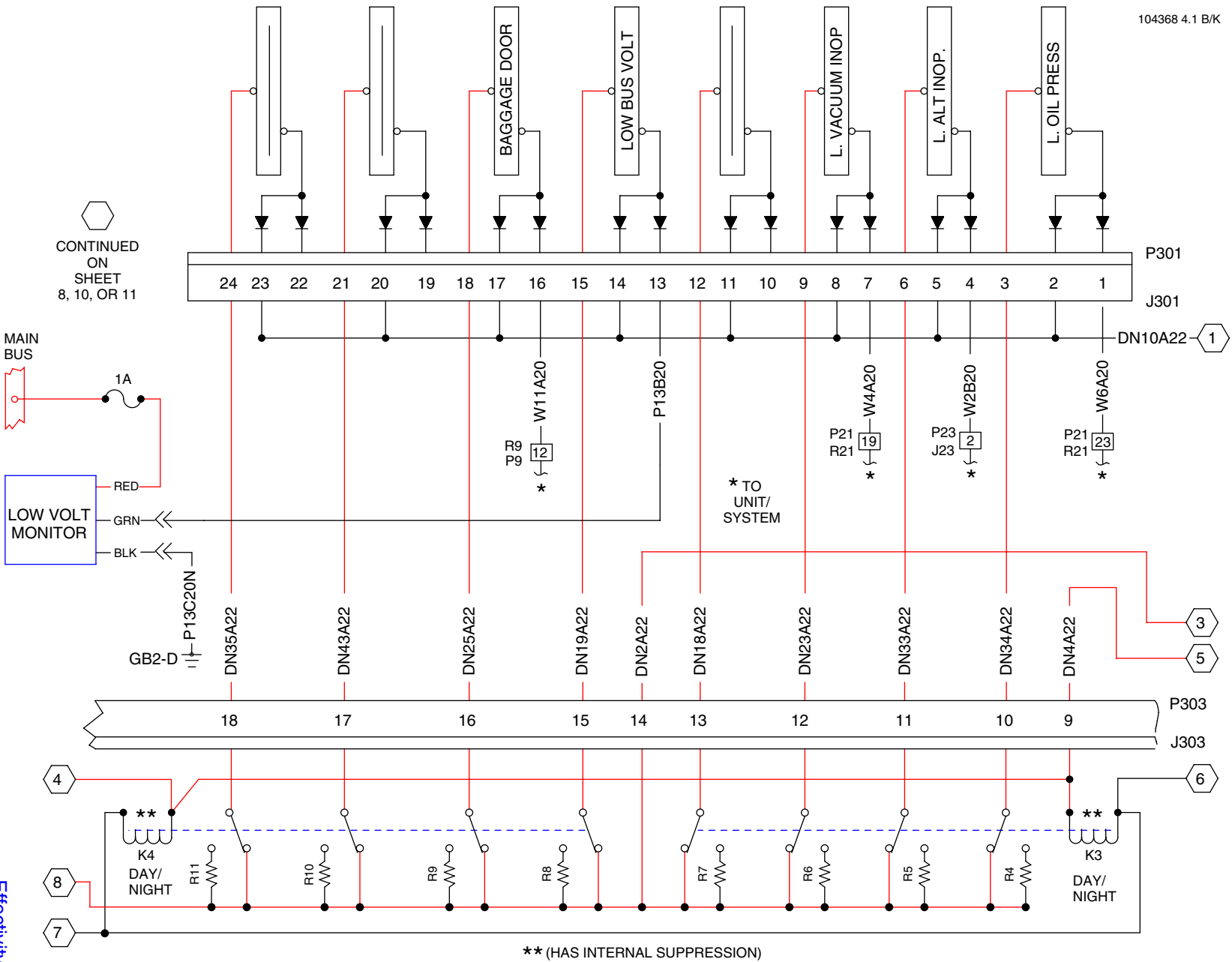
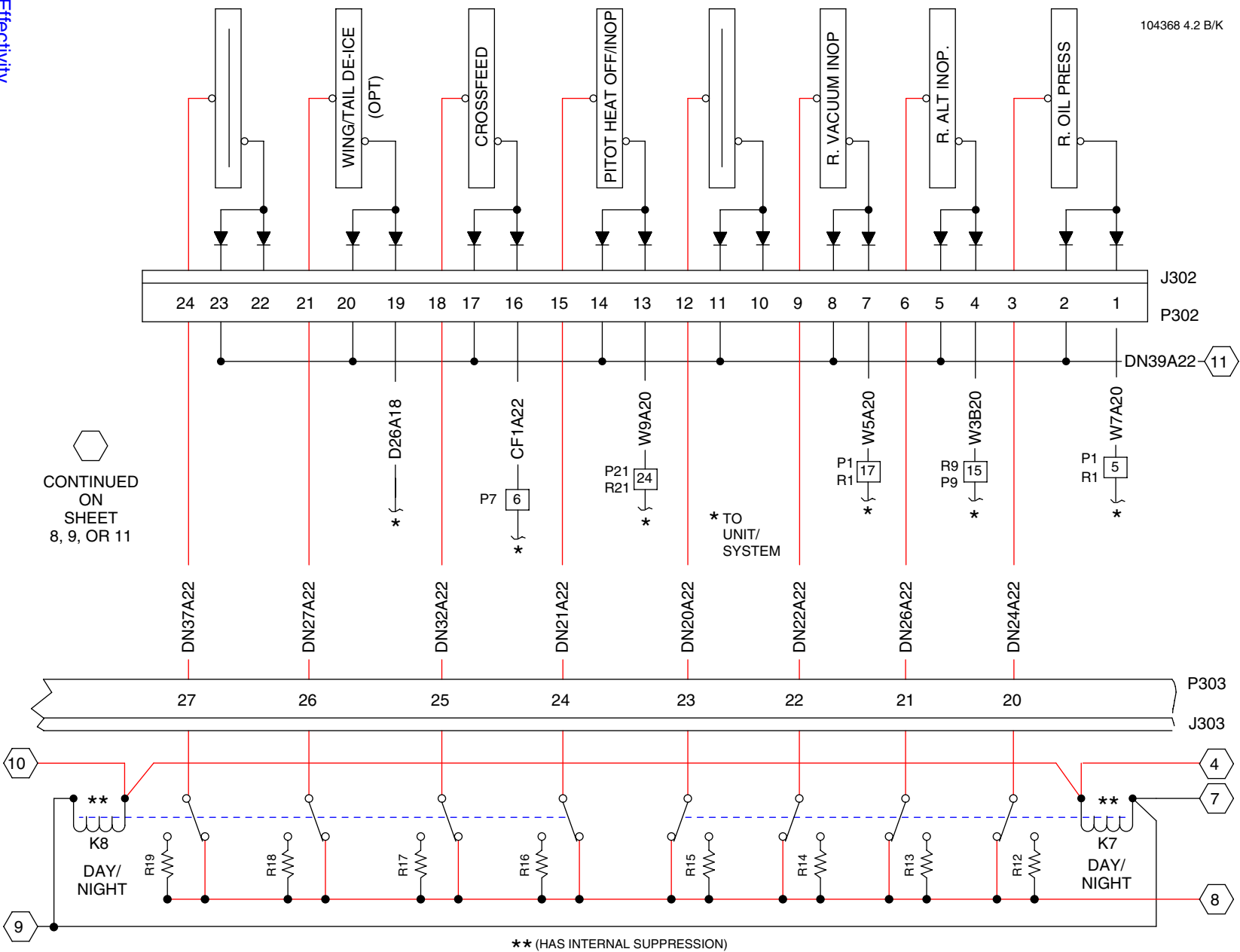


Figure 1 (Sheet 9 of 14)

Effectivity
3449161 and,
3449178 & up

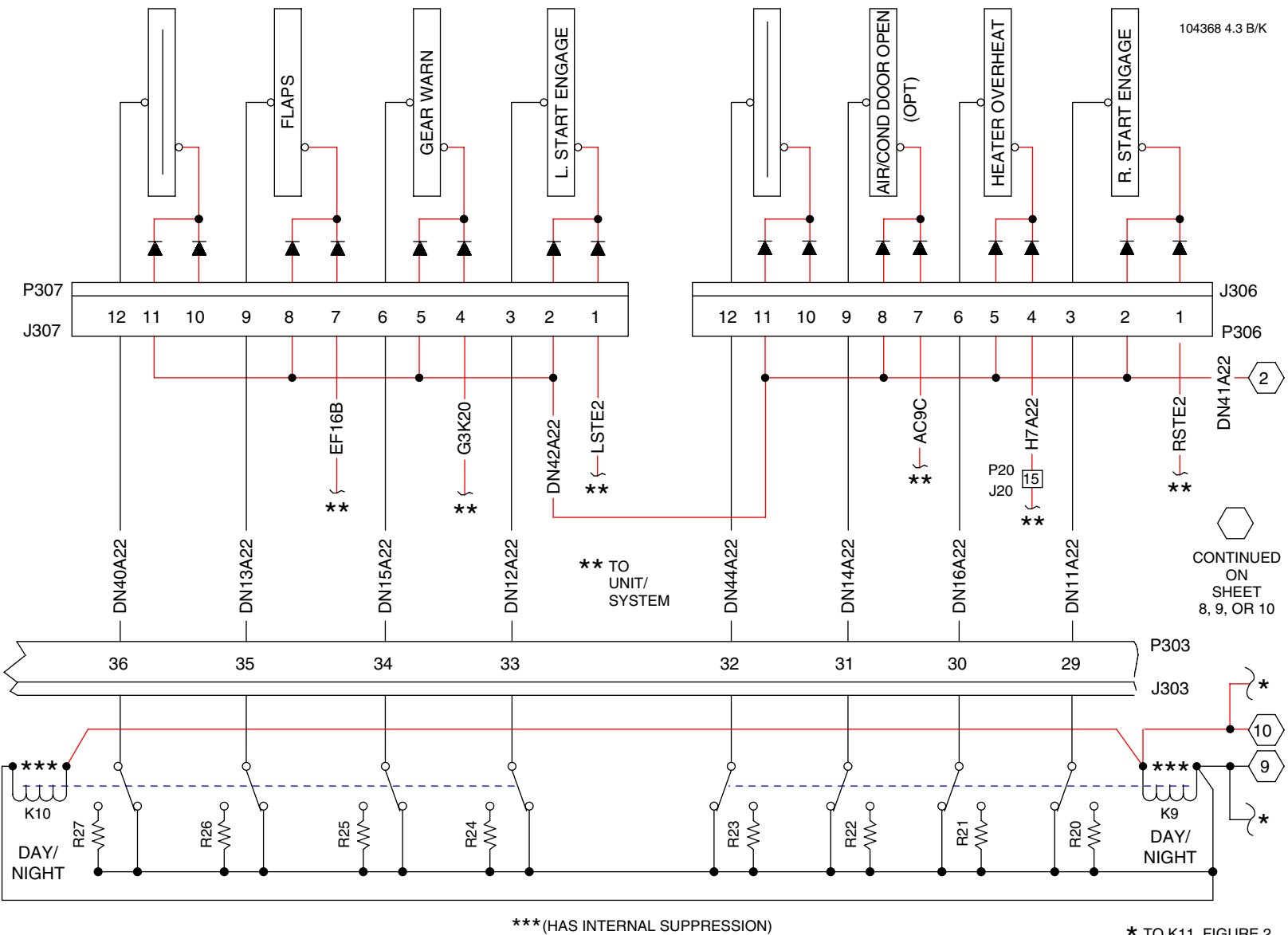
104368 4.2 B/K



Annunciator
Figure 1 (Sheet 10 of 14)

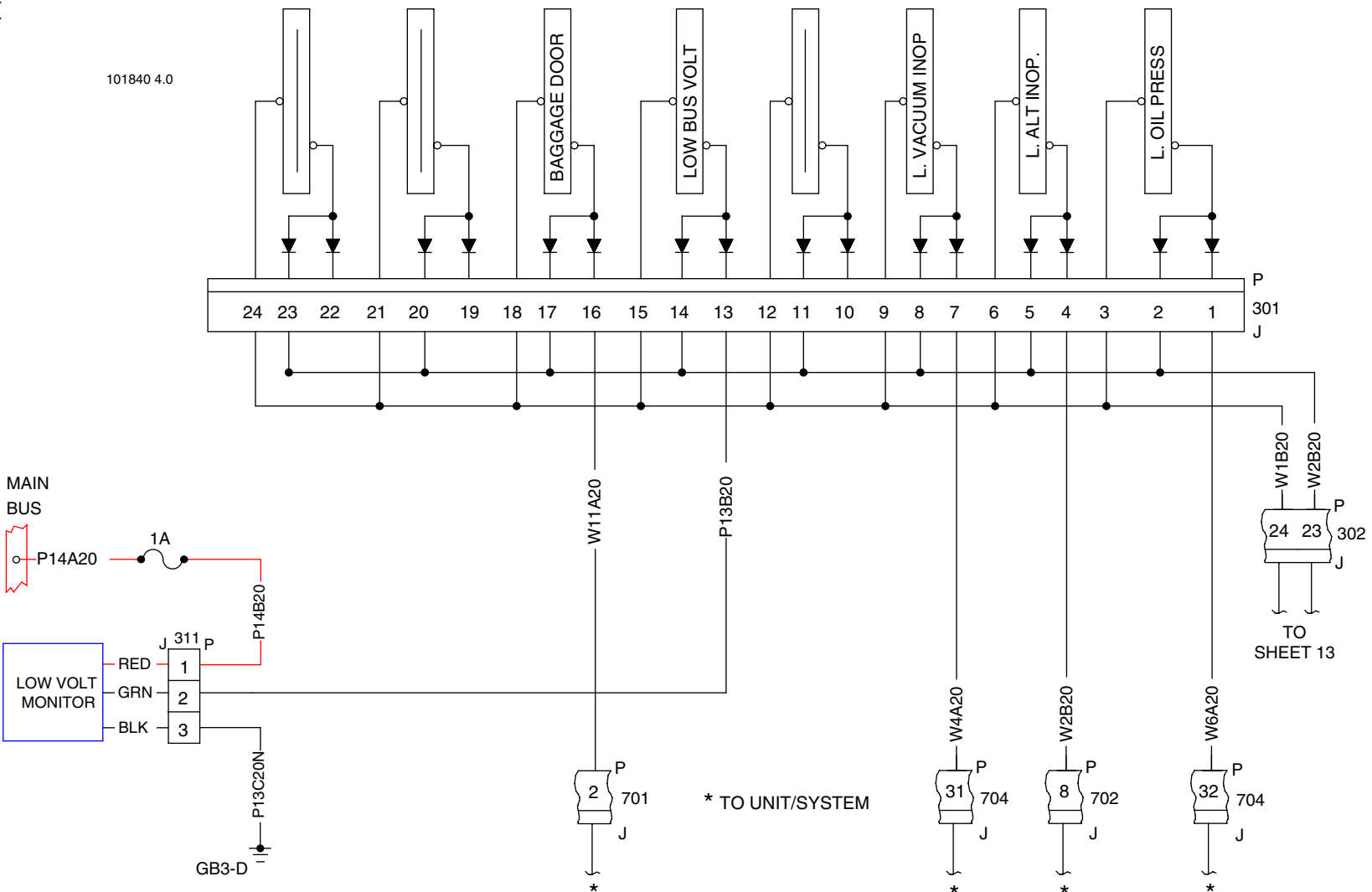
Effectivity
3449161 and,
3449178 & up

104368 4.3 B/K



Annunciator
Figure 1 (Sheet 11 of 14)

Effectivity
3449161 and,
3449178 & up



Annunciator
Figure 1 (Sheet 12 of 14)

Effectivity
Seneca V
with Avidyne Option

101840 4.1

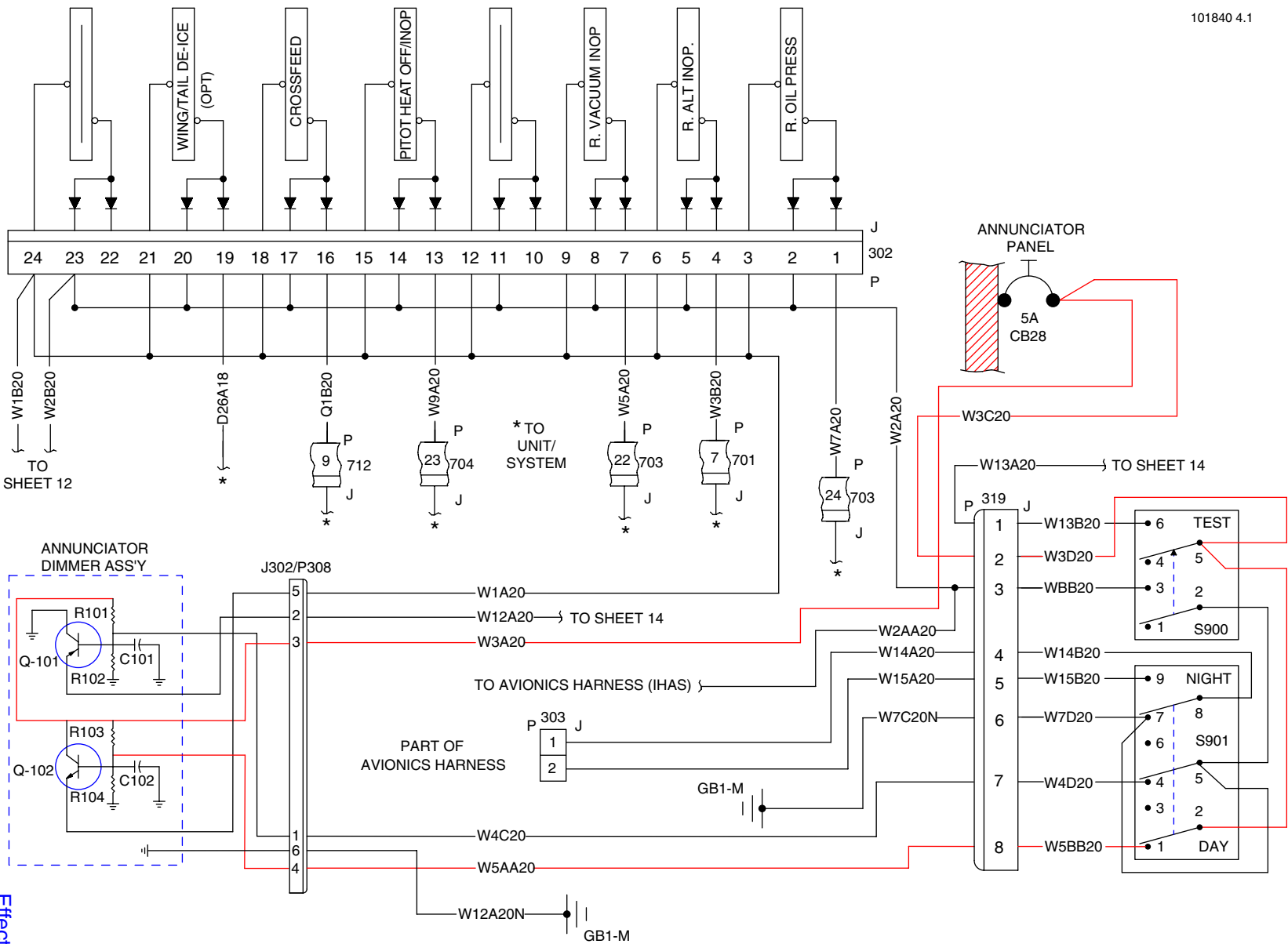
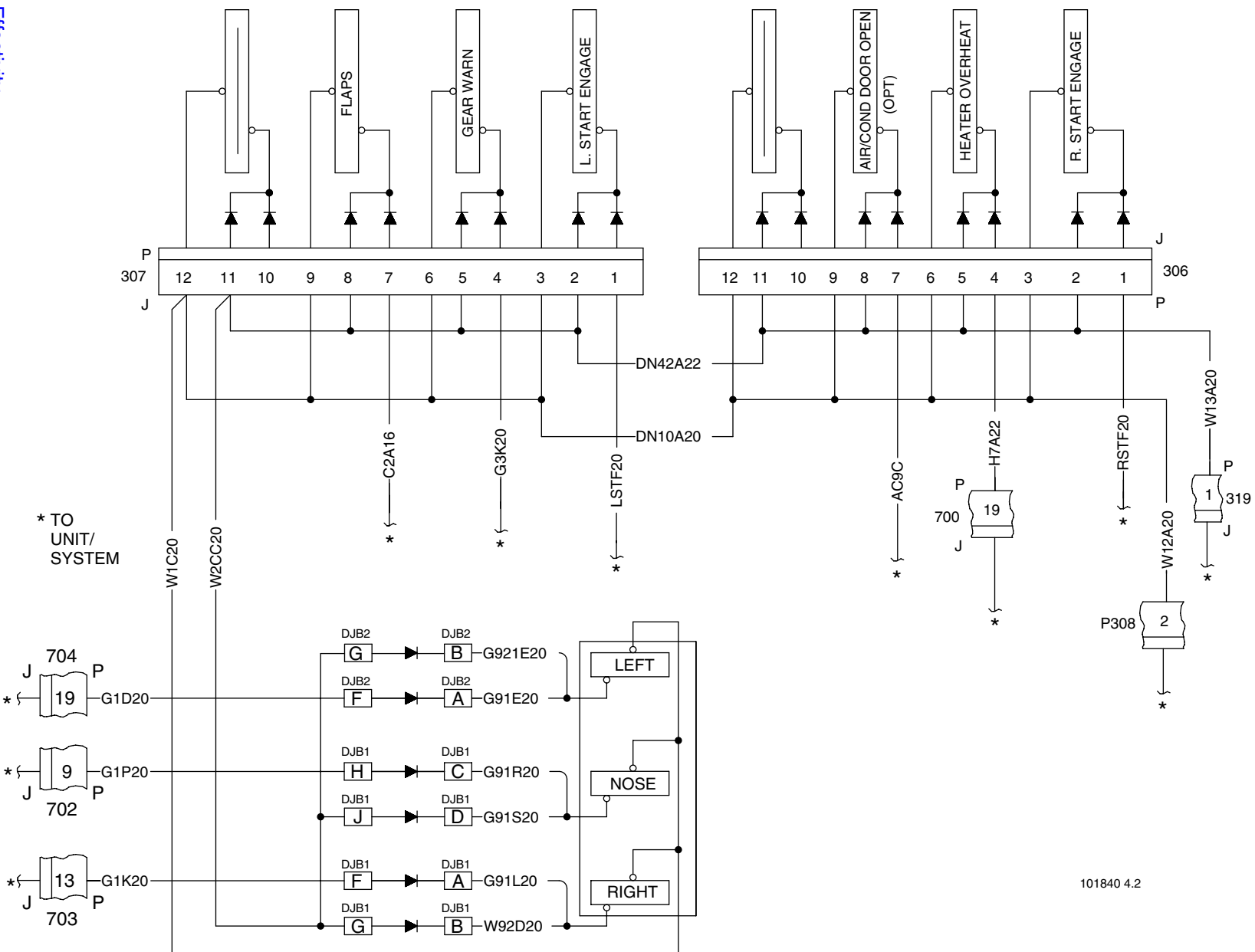


Figure 1 (Sheet 13 of 14)

Effectivity
Seneca V
with Avidyne Option

101840 4.2

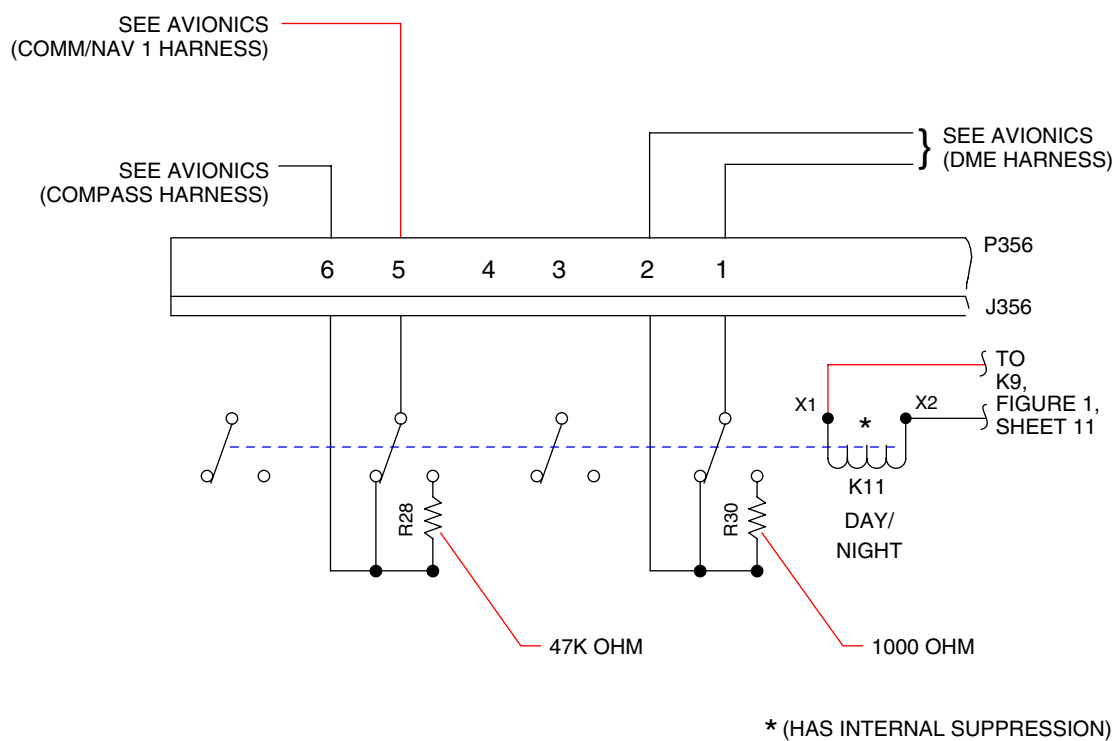


Annunciator
Figure 1 (Sheet 14 of 14)

Effectivity
Seneca V
with Avidyne Option

THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL

104368 4.4 E/K

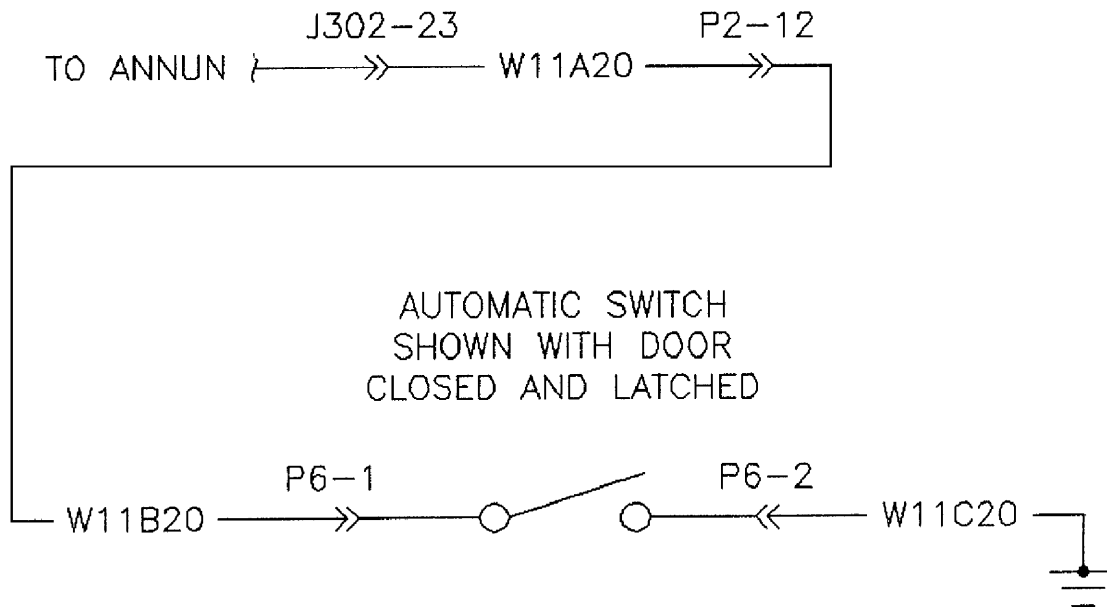


Avionics Annunciator Dimming
Figure 2

Effectivity
3449161 and,
3449178 & up

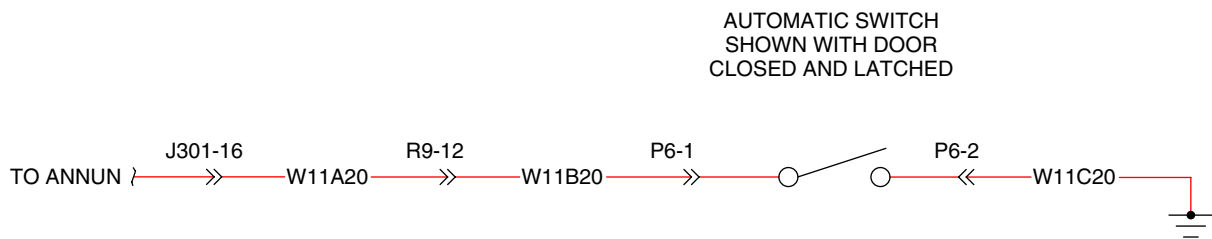
THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL

83353 17.0 NEW/G



THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL

100651 D/T
101288 17.0 NEW/D

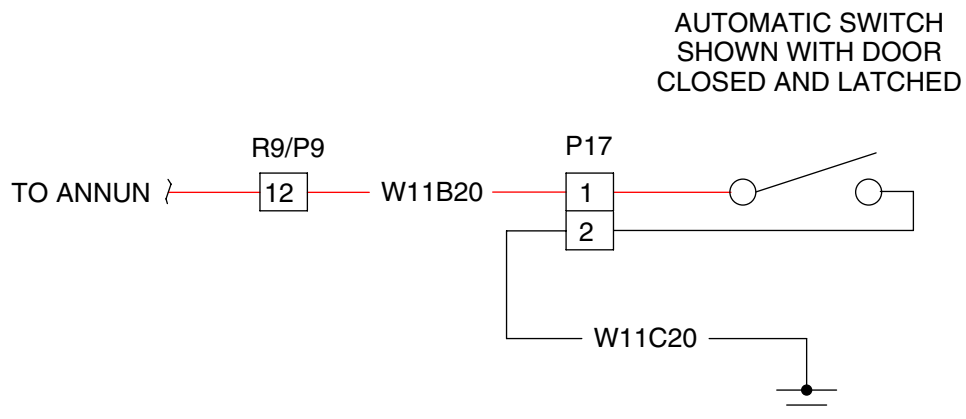


Baggage Door Annunciation
Figure 3 (Sheet 2 of 3)

[Effectivity](#)
3449001 thru 3449151

THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL

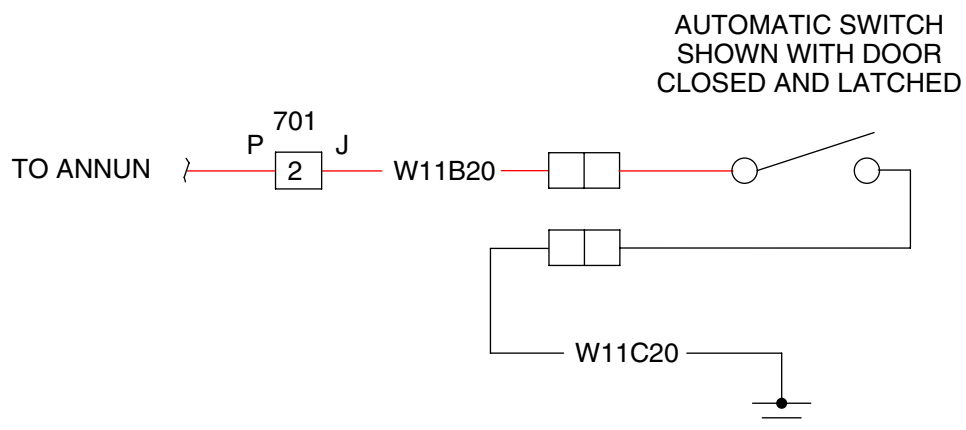
104229 NEW/C
104368 17.0 NEW/K



STANDARD

WITH AVIDYNE OPTION

101840 11.0

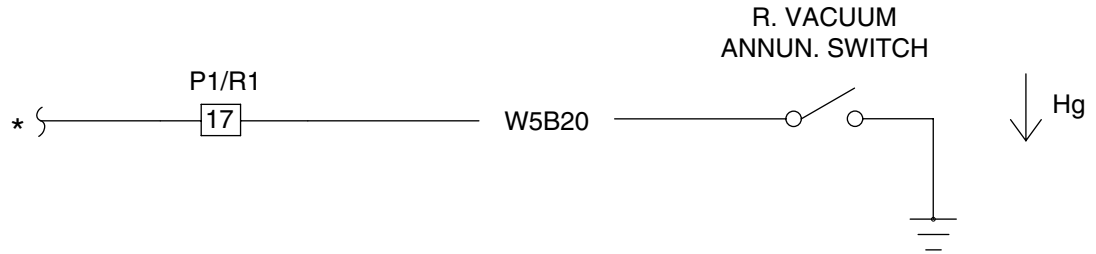


[Effectivity](#)
3449152 & up

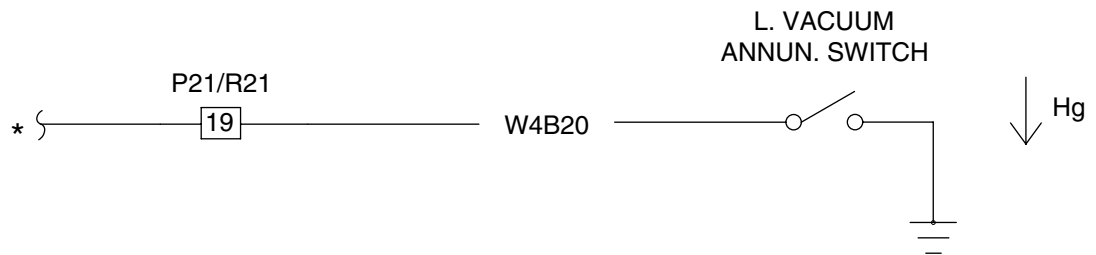
Baggage Door Annunciation
Figure 3 (Sheet 3 of 3)

**THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL**

100651 J/T
101288 NEW/D
104229 NEW/C
104368 3.0 NEW/K



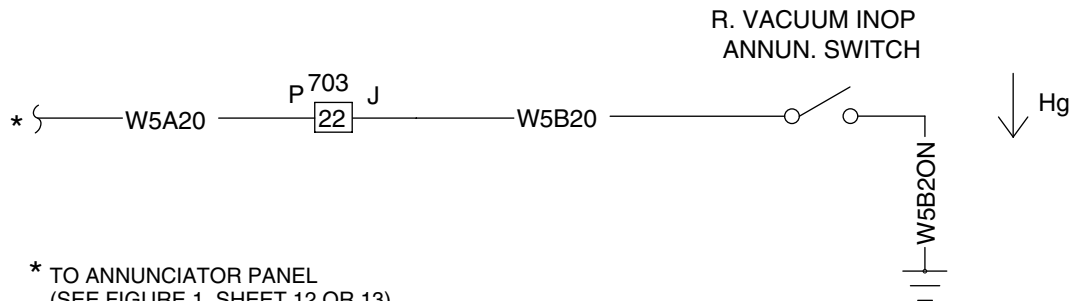
* TO ANNUNCIATOR PANEL
(SEE FIGURE 1, SHEETS 5 & 6 OR 9 & 10)



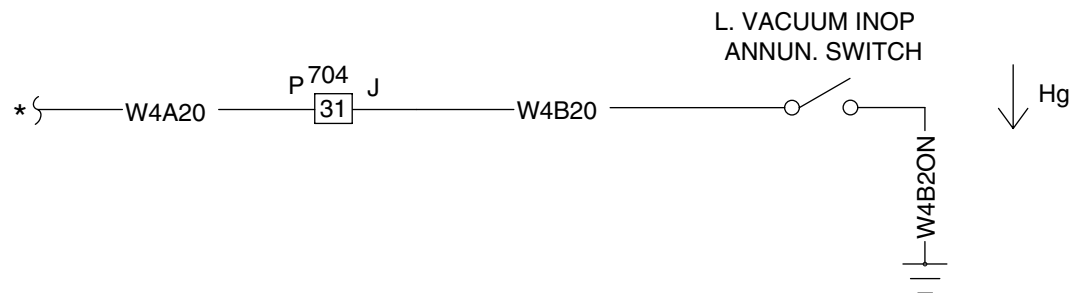
STANDARD

WITH AVIDYNE OPTION

101840 3.0



* TO ANNUNCIATOR PANEL
(SEE FIGURE 1, SHEET 12 OR 13)

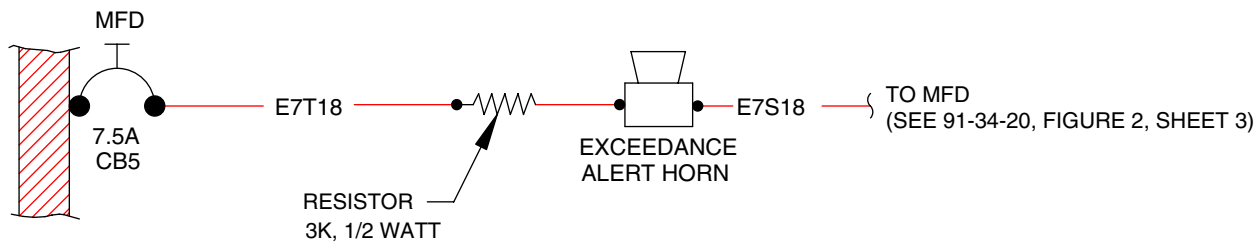


Vacuum Annunciators
Figure 4

[Effectivity](#)
[Seneca V](#)

THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL

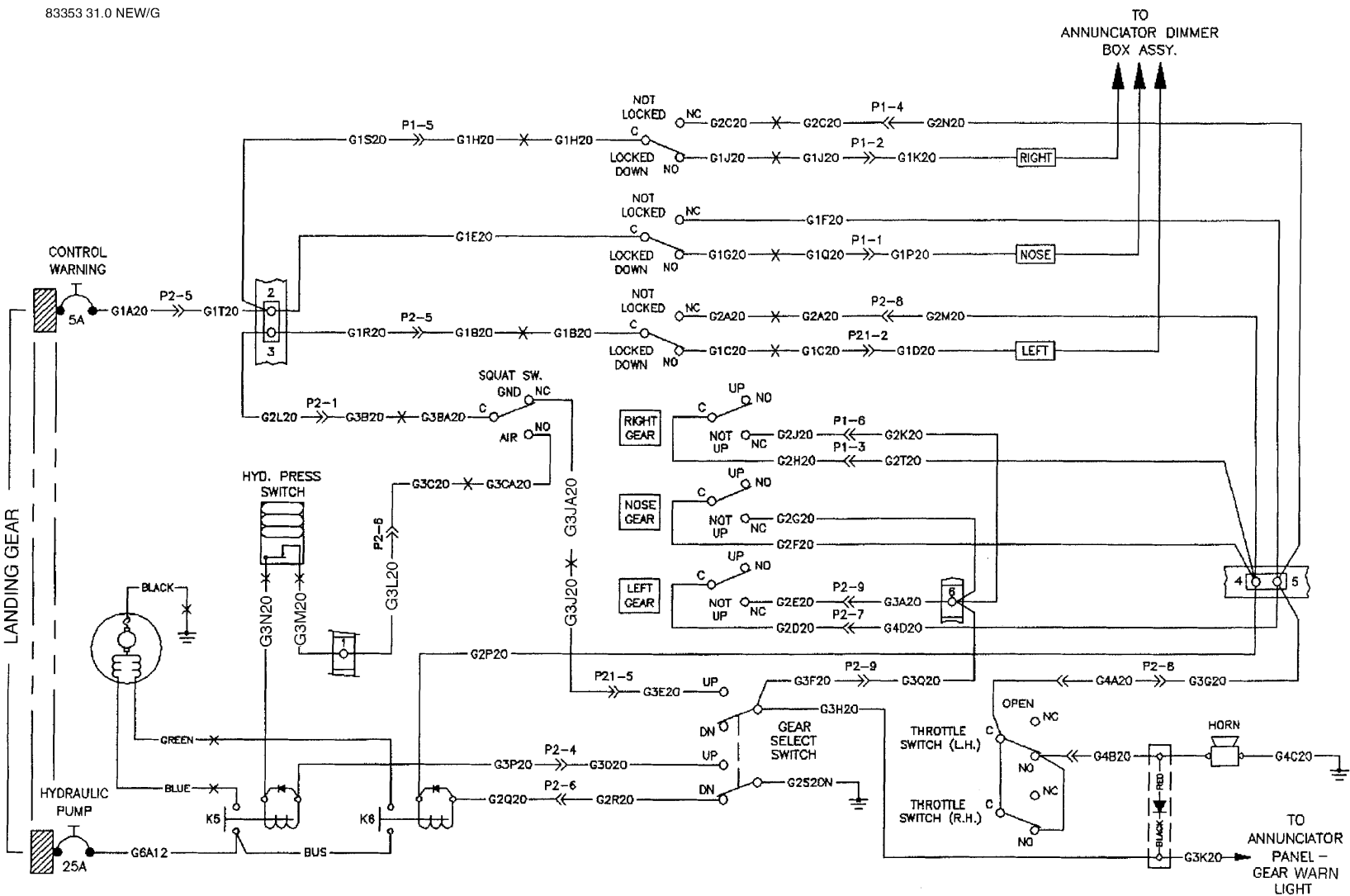
101840 4.4



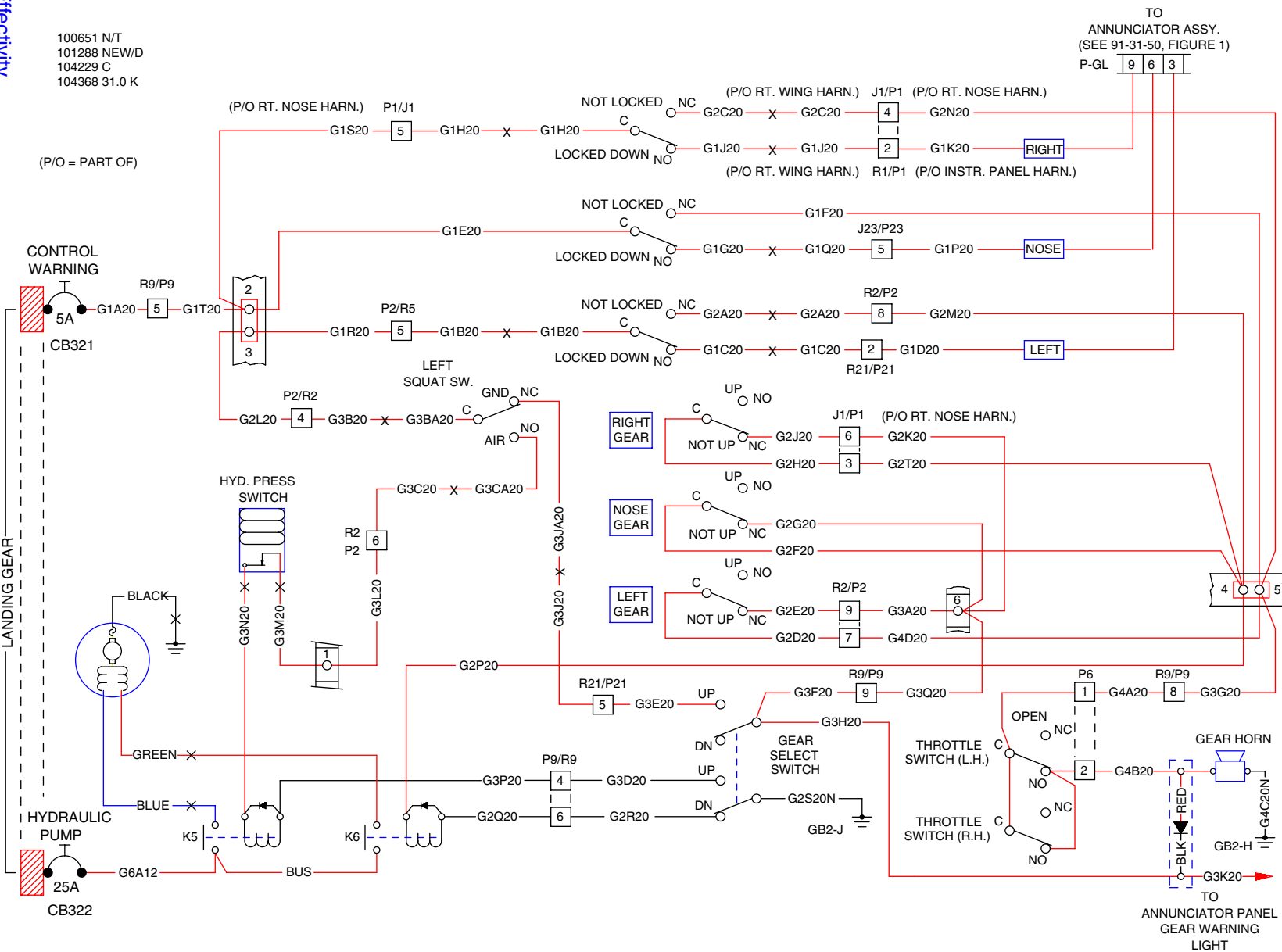
[Effectivity](#)
Seneca V
with Avidyne Option

Exceedance Alert DAU Interface
Figure 5

83353 31.0 NEW/G



Landing Gear Control and Warning
Figure 1 (Sheet 1 of 4)



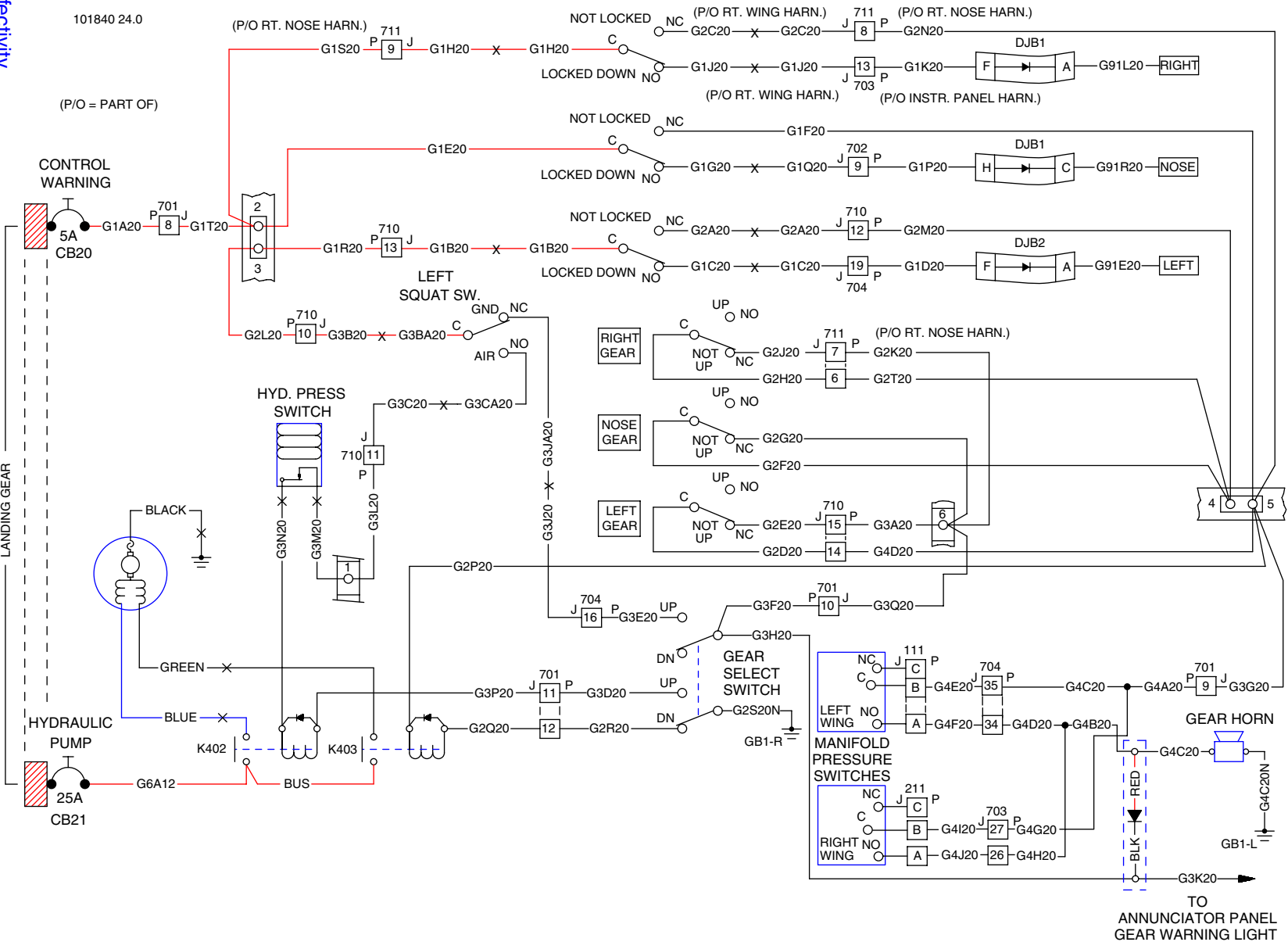
100651 N/T
101288 NEW/D
104229 C
104368 31.0 K

Effectivity
3449001 thru 3449300,
less 3449161

Landing Gear Control and Warning
Figure 1 (Sheet 2 of 4)



Effectivity
3449161 and,
3449301 & up

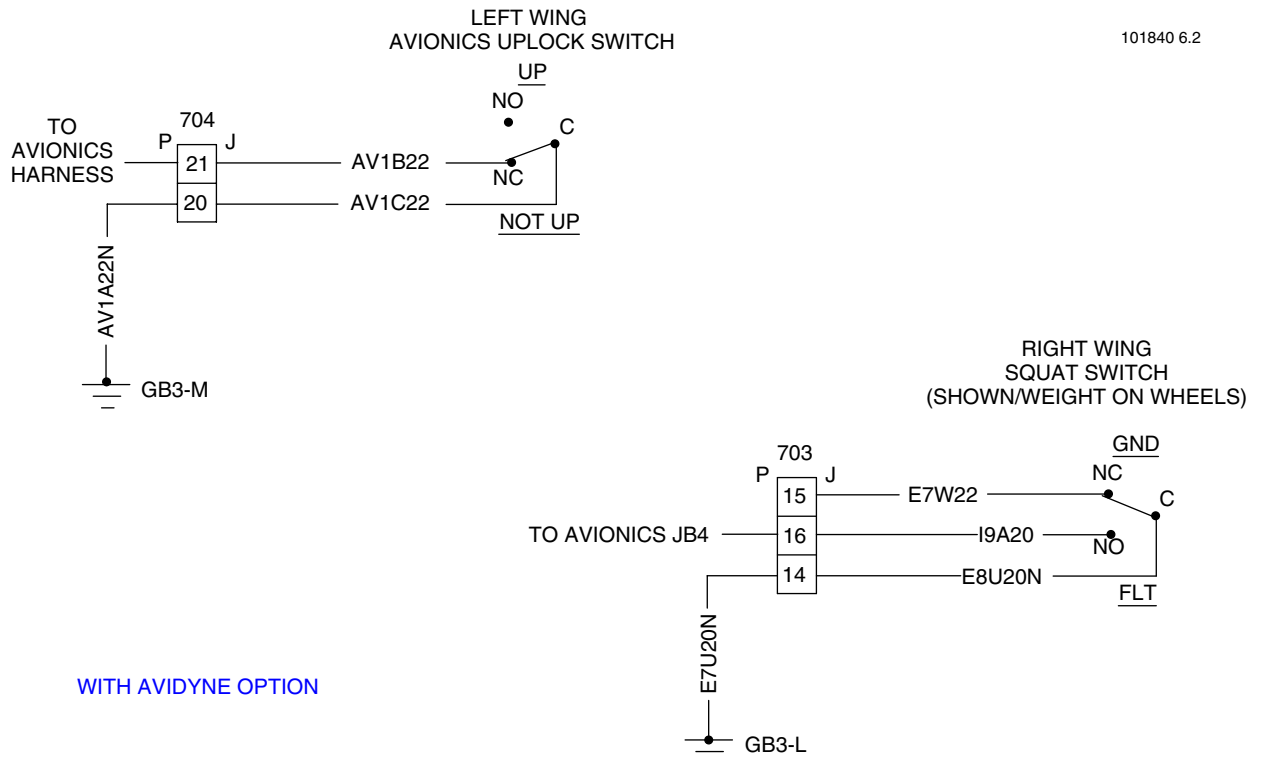
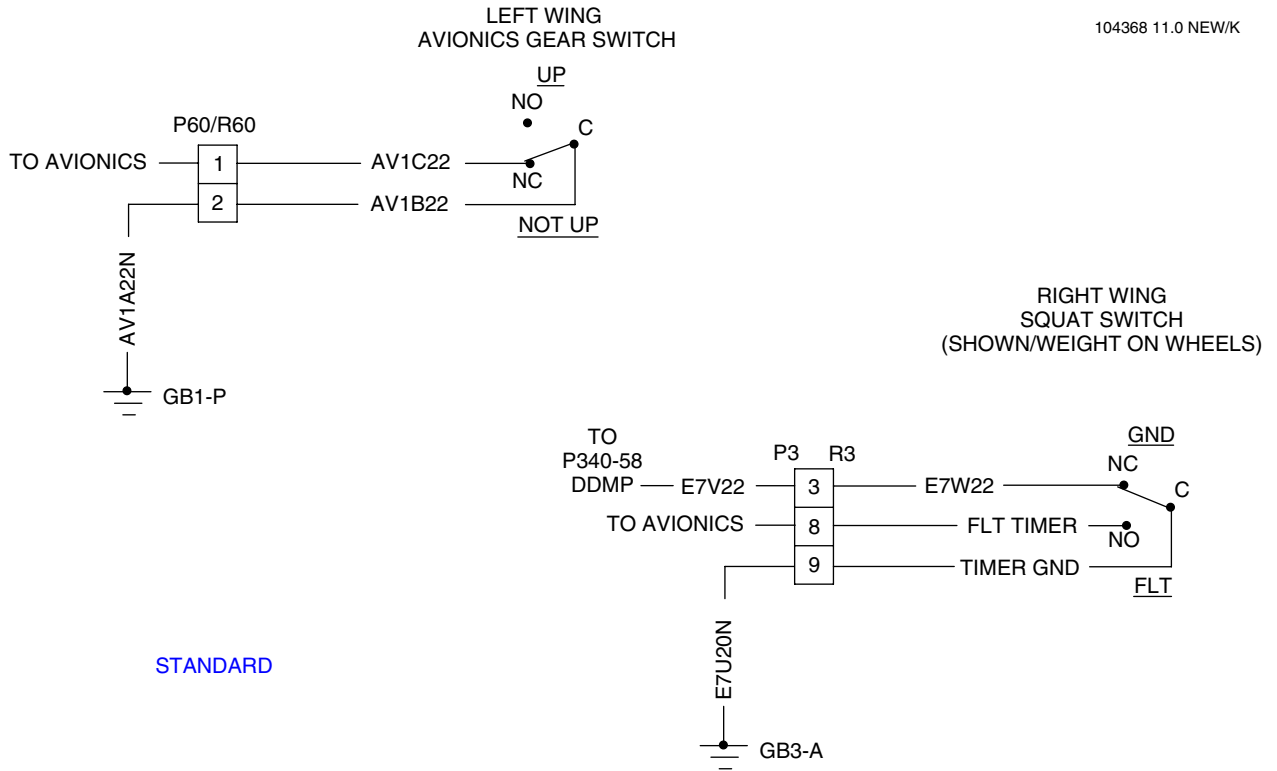


Effectivity
Seneca V
with Avidyne Option

Landing Gear Control and Warning
Figure 1 (Sheet 4 of 4)

**THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL**

104368 11.0 NEW/K



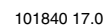
Avionics Gear Switches
Figure 2

[Effectivity](#)
3449161 and,
3449178 & up

**THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL**

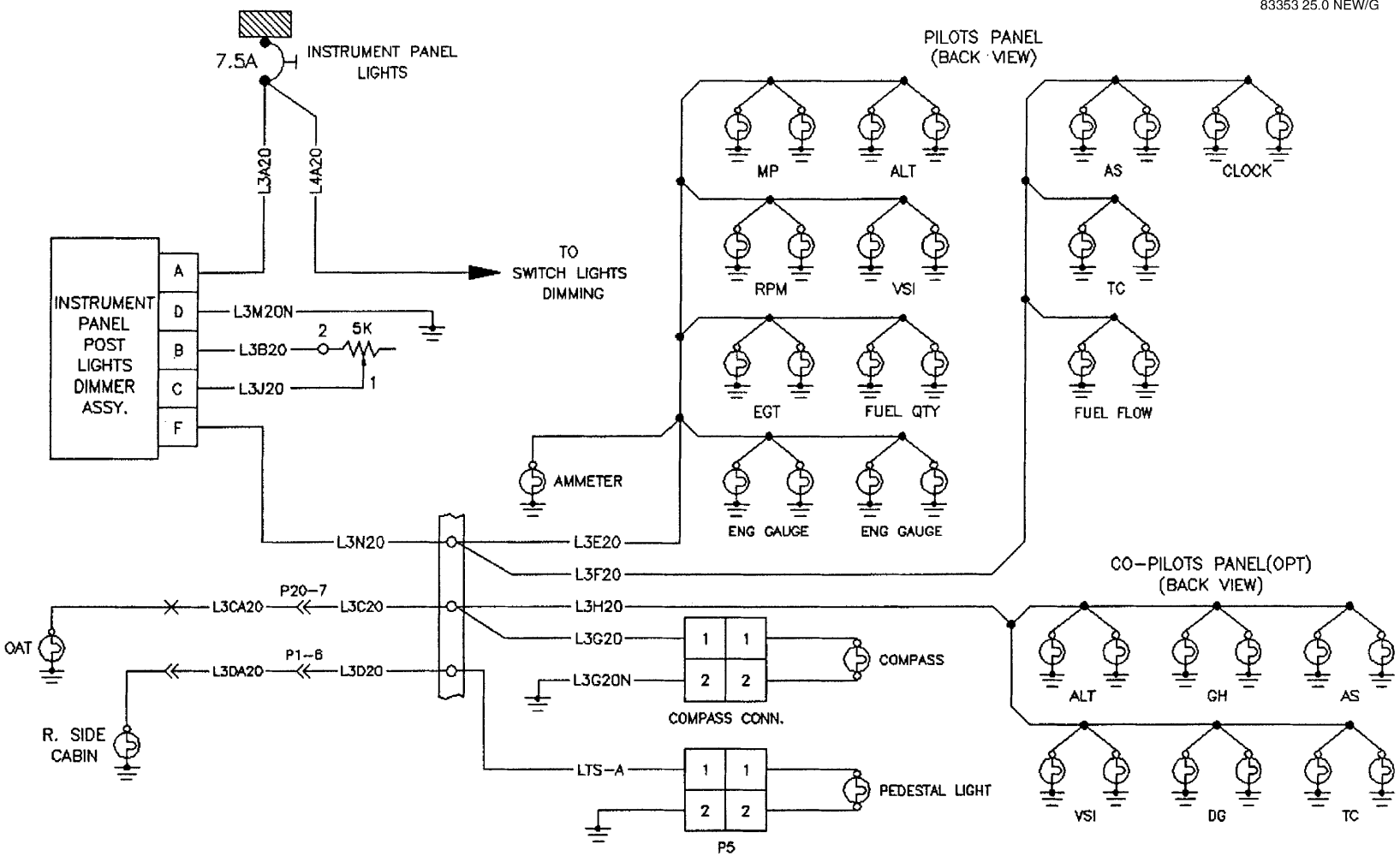
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83353 NEW/G
100651 NEW/T
101288 NEW/D
104229 C
104368 24.0 A/K



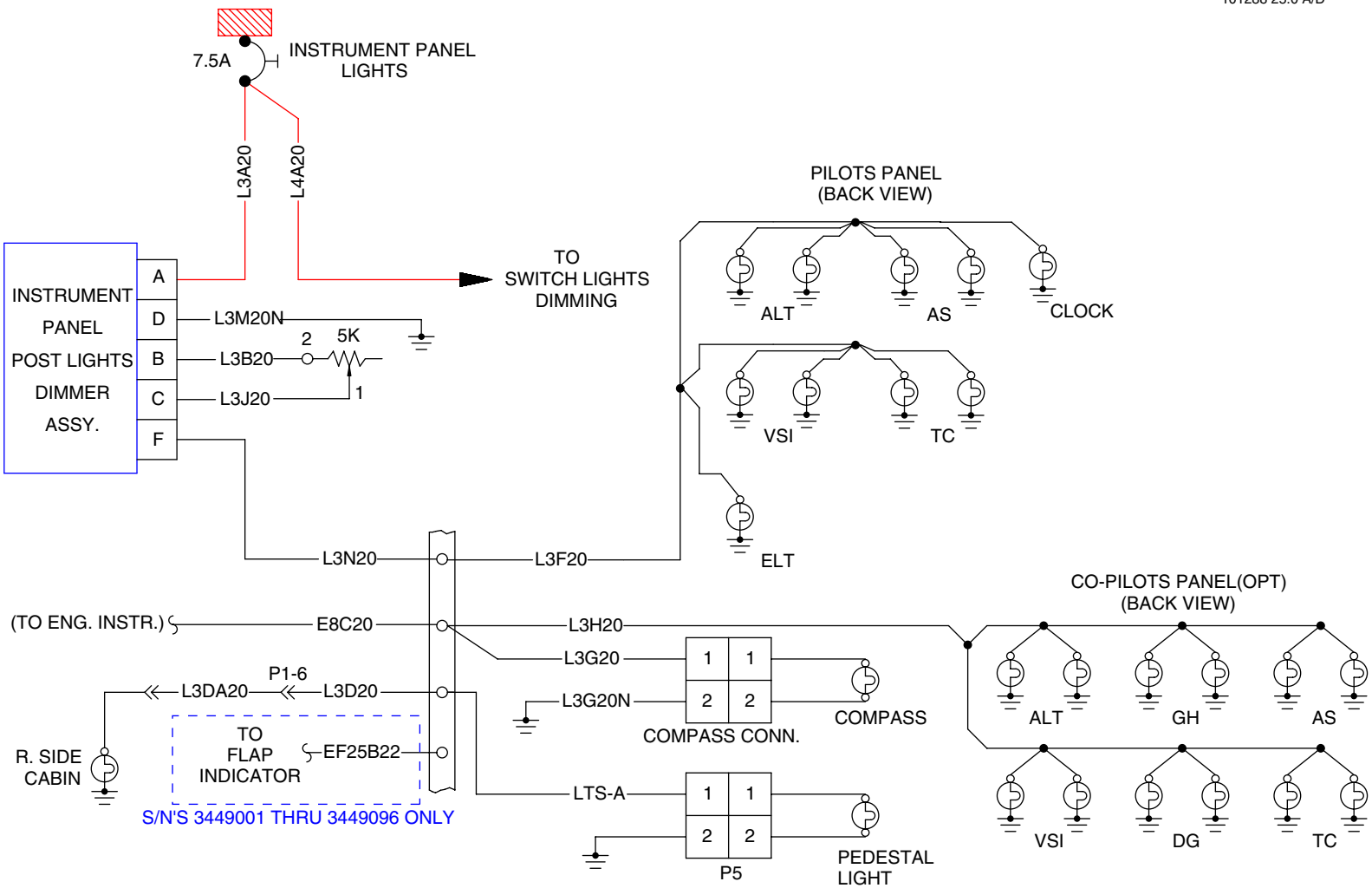
7H13

83353 25.0 NEW/G



Instrument Panel Post Lights
Figure 2 (Sheet 1 of 4)

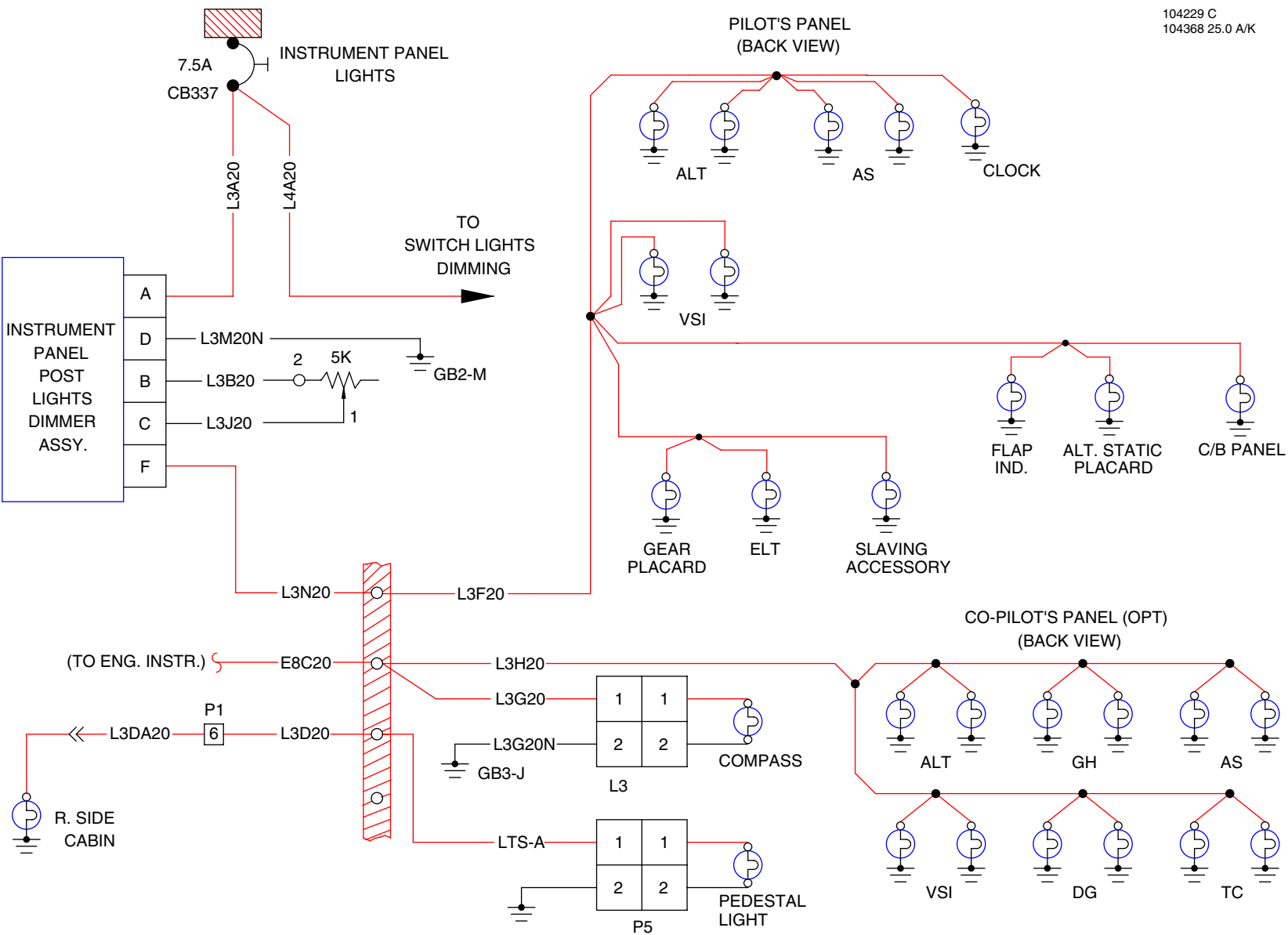
100651 K/T
101288 25.0 A/D



Instrument Panel Post Lights
Figure 2 (Sheet 2 of 4)

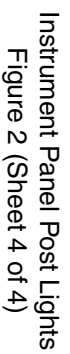
Effectivity
3449001 thru 3449151

104229 C
104368 25.0 A/K



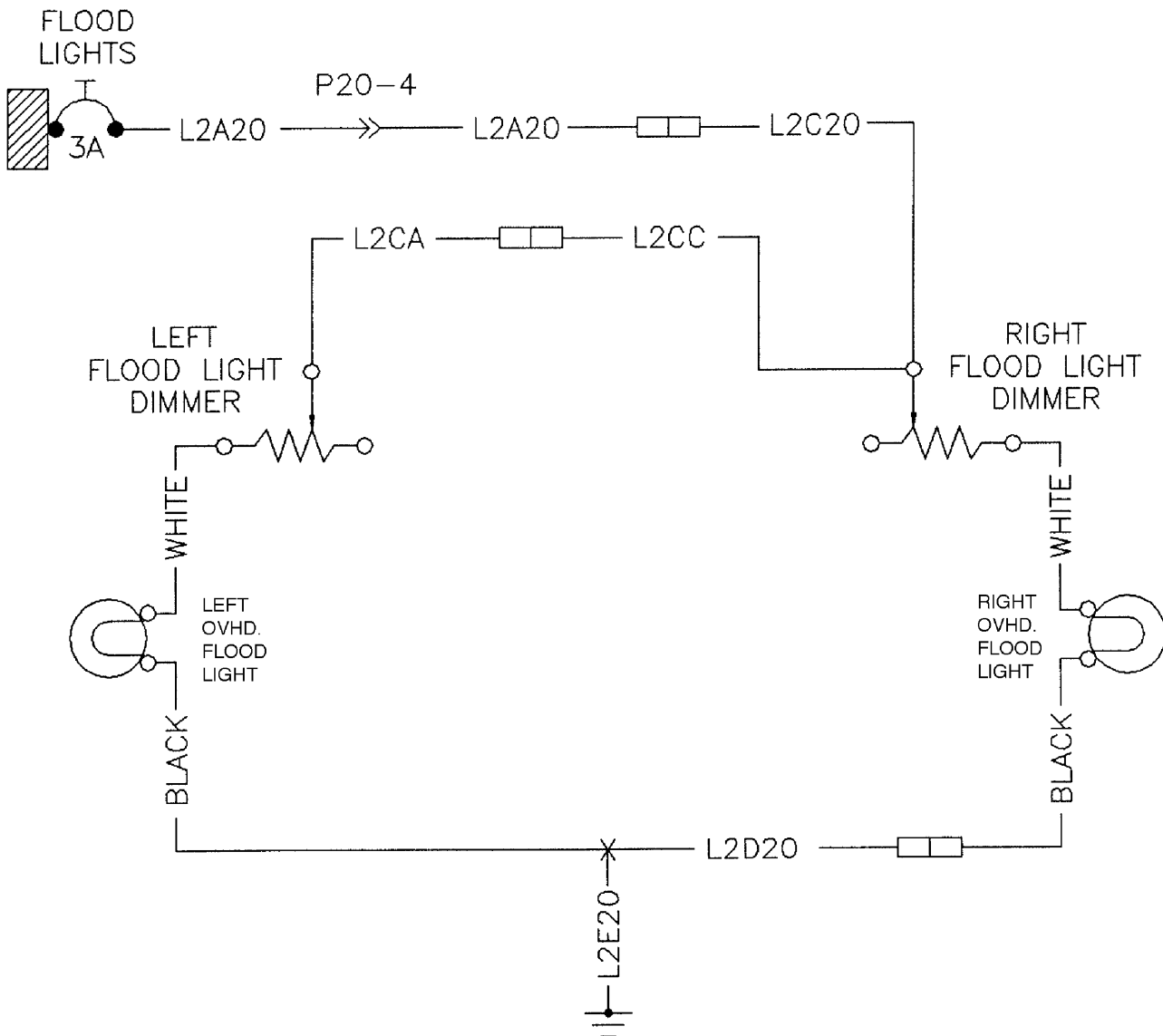
Effectivity
3449152 & up

Instrument Panel Post Lights
Figure 2 (Sheet 3 of 4)



THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL

83353 21.0 NEW/G

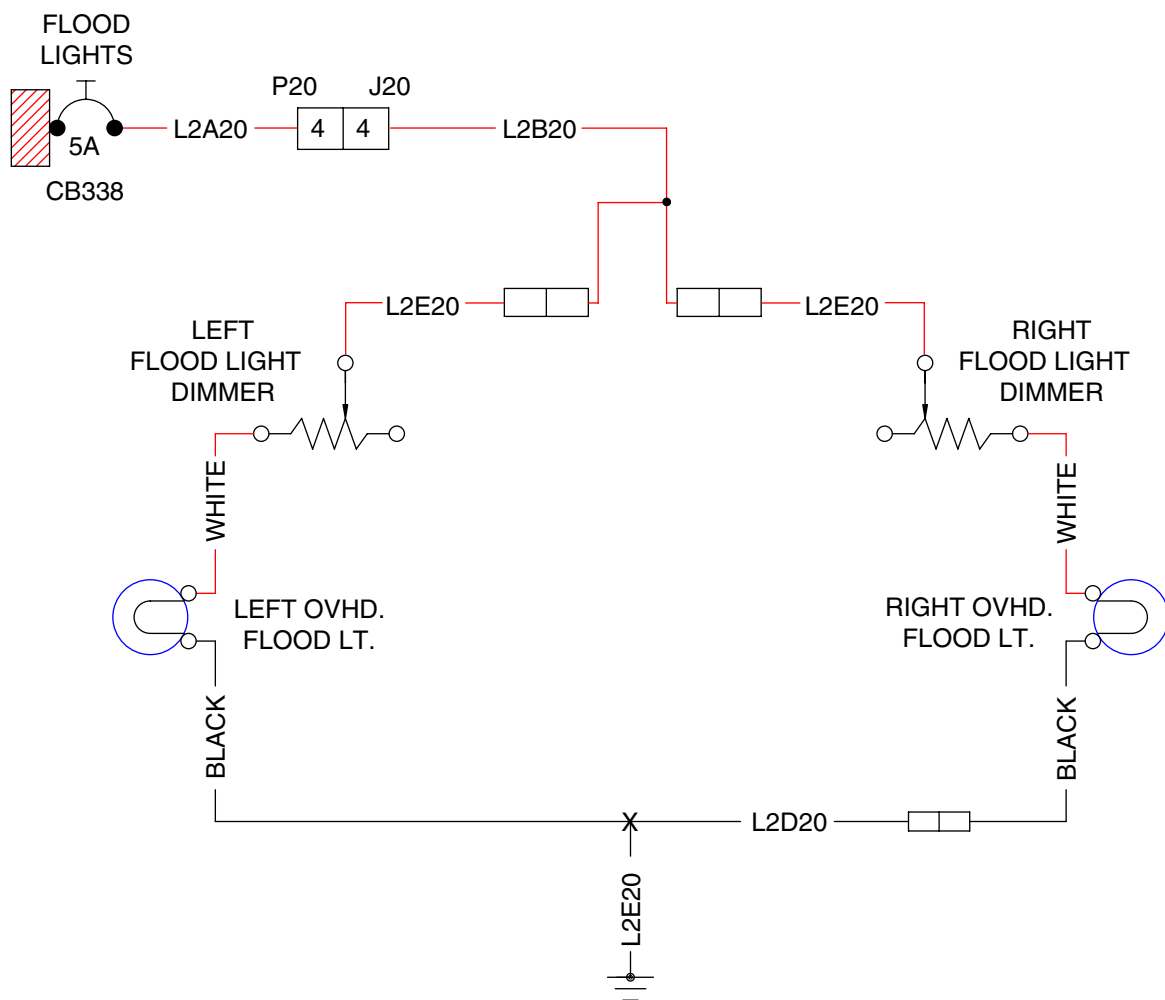


Effectivity
Seneca IV

Overhead Flood Lights
Figure 3 (Sheet 1 of 3)

THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL

100651 K/T
101288 NEW/D
104229 C
104368 21.0 A/K

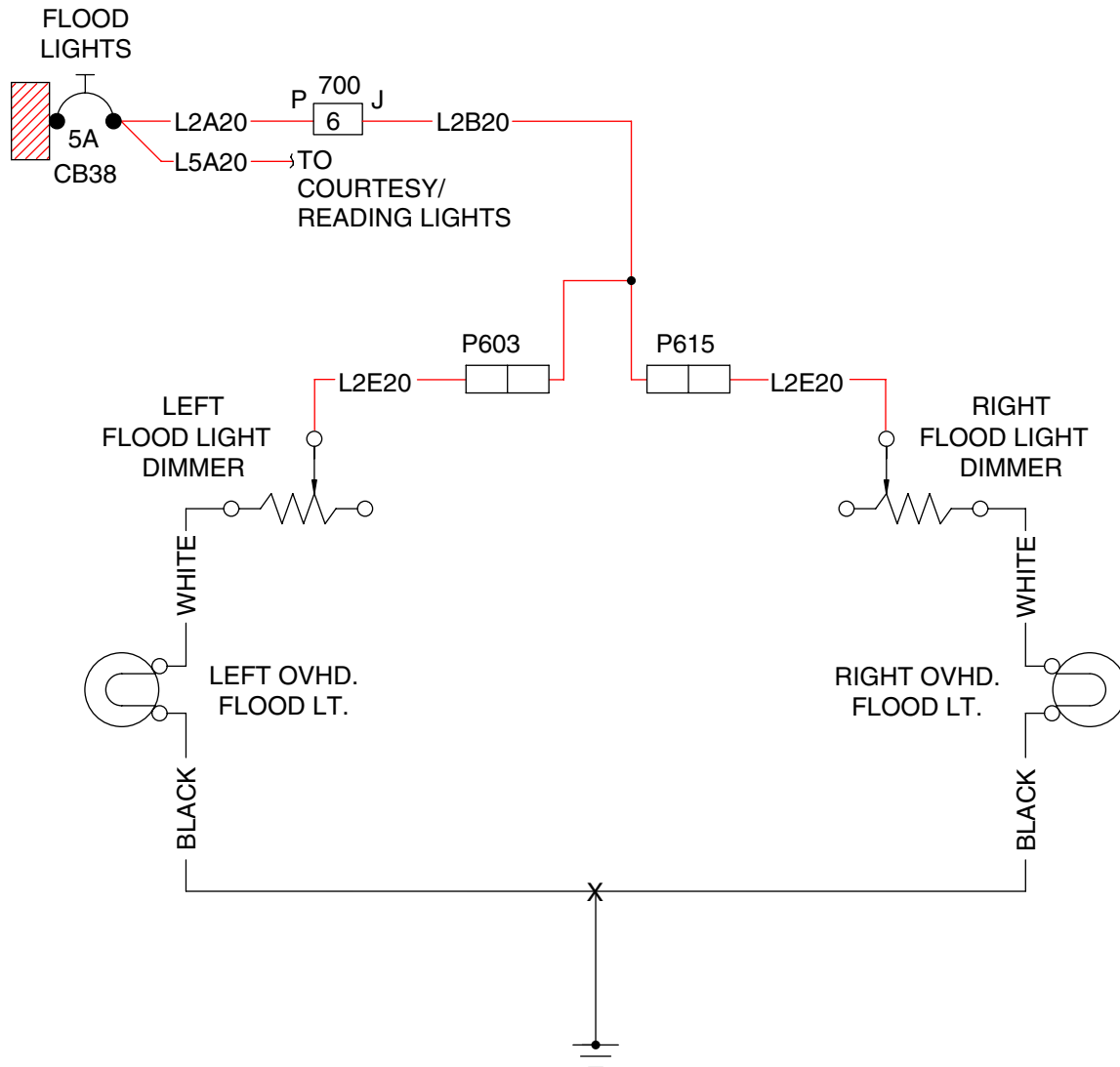


Overhead Flood Lights
Figure 3 (Sheet 2 of 3)

[Effectivity](#)
[Seneca V](#)

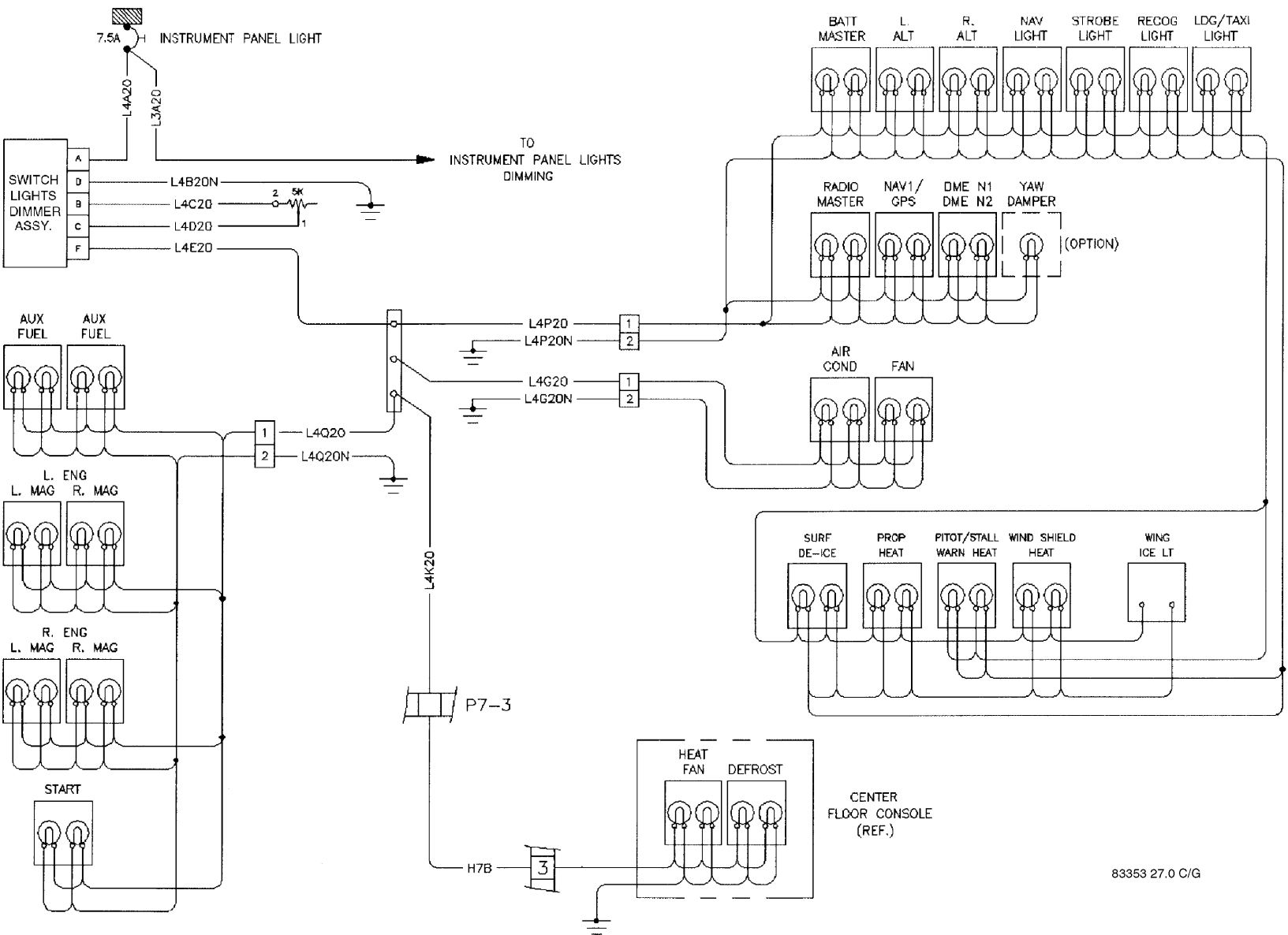
THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL

101840 14.0



[Effectivity](#)
[Seneca V](#)
[with Avidyne Option](#)

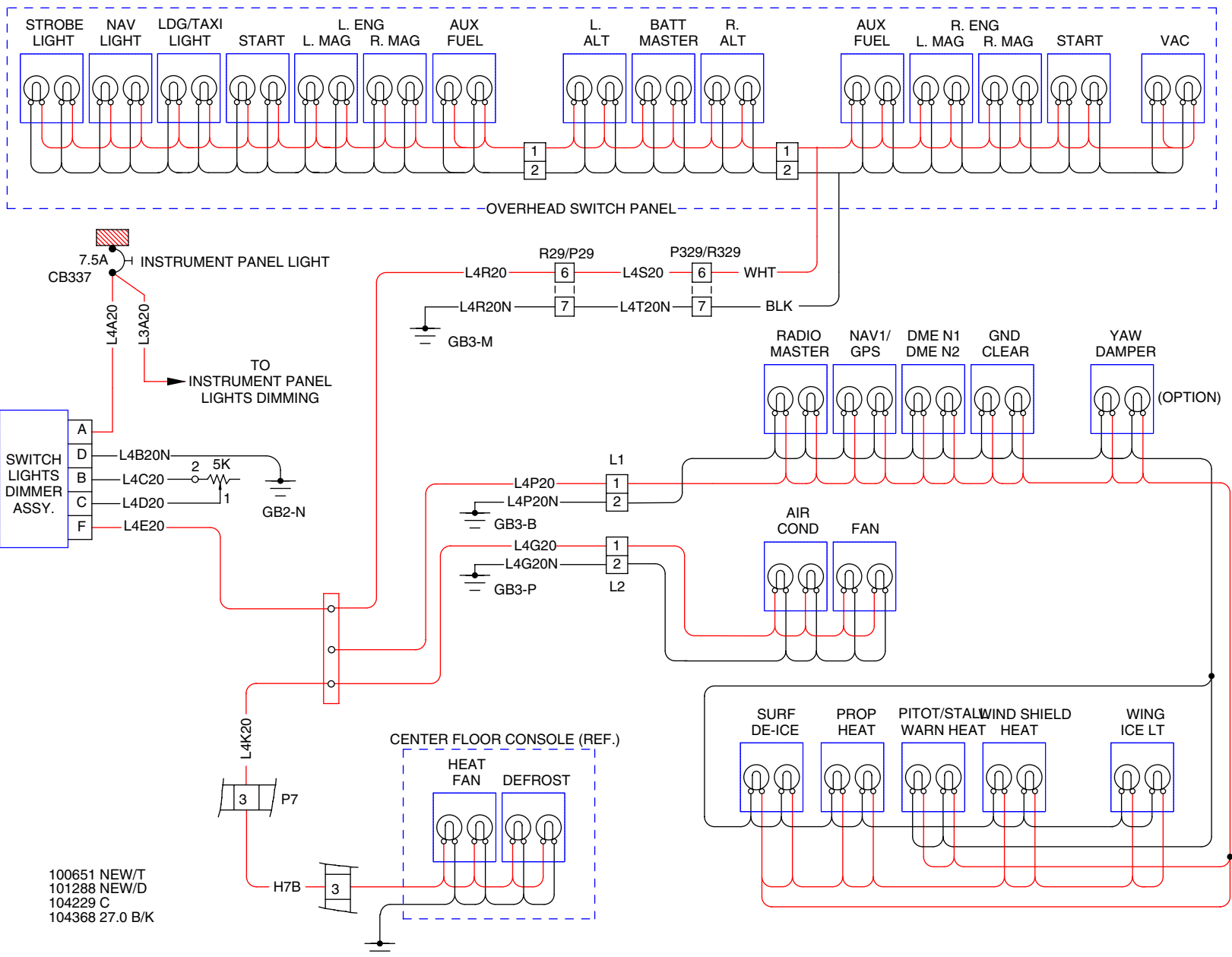
Overhead Flood Lights
Figure 3 (Sheet 3 of 3)



83353 27.0 C/G

Switch Lights Dimming
Figure 4 (Sheet 1 of 3)

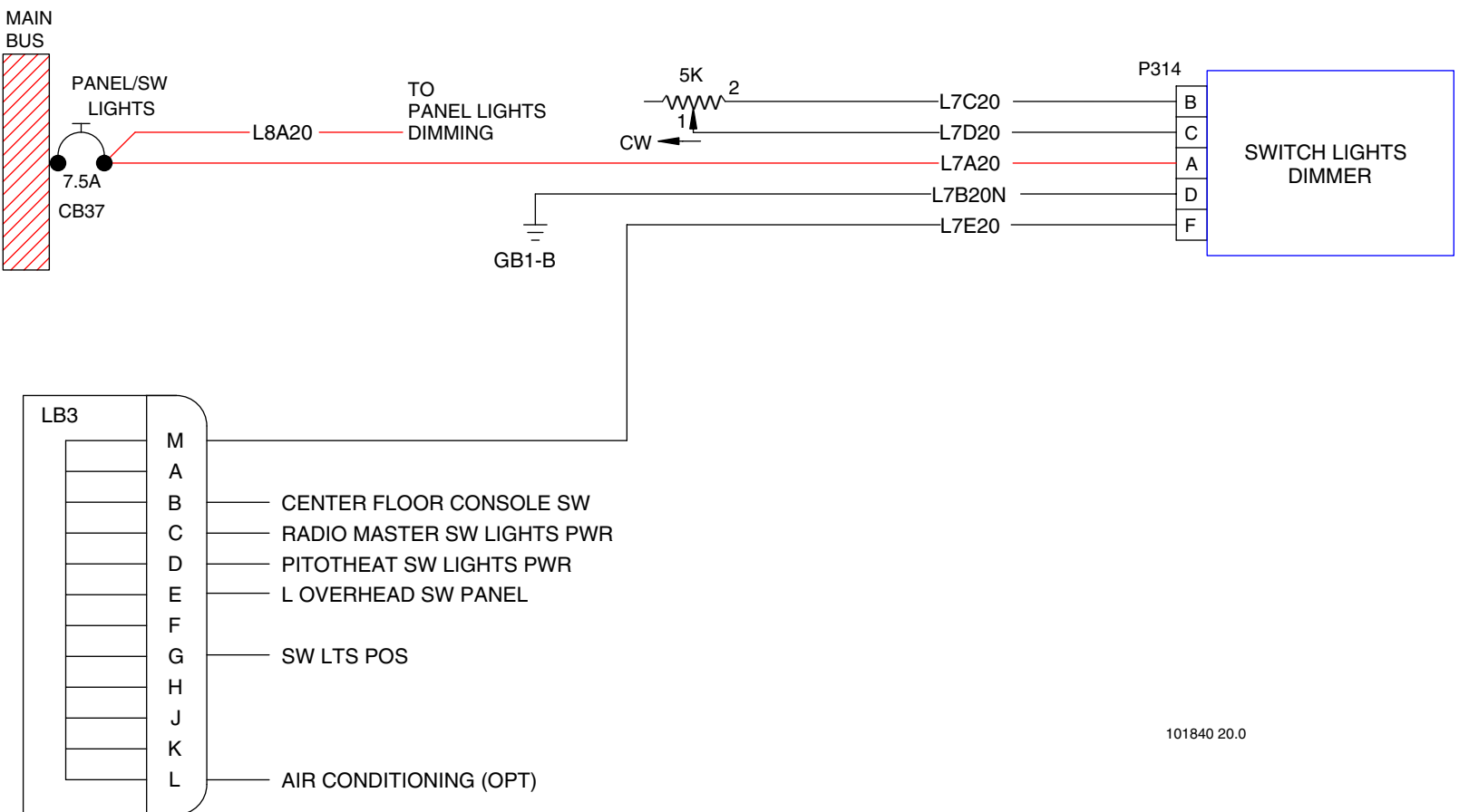
Effectivity
Seneca IV



Effectivity
Seneca V

Switch Lights Dimming
Figure 4 (Sheet 2 of 3)

100651 NEW/T
101288 NEW/D
104229 C
104368 27.0 B/K



101840 20.0

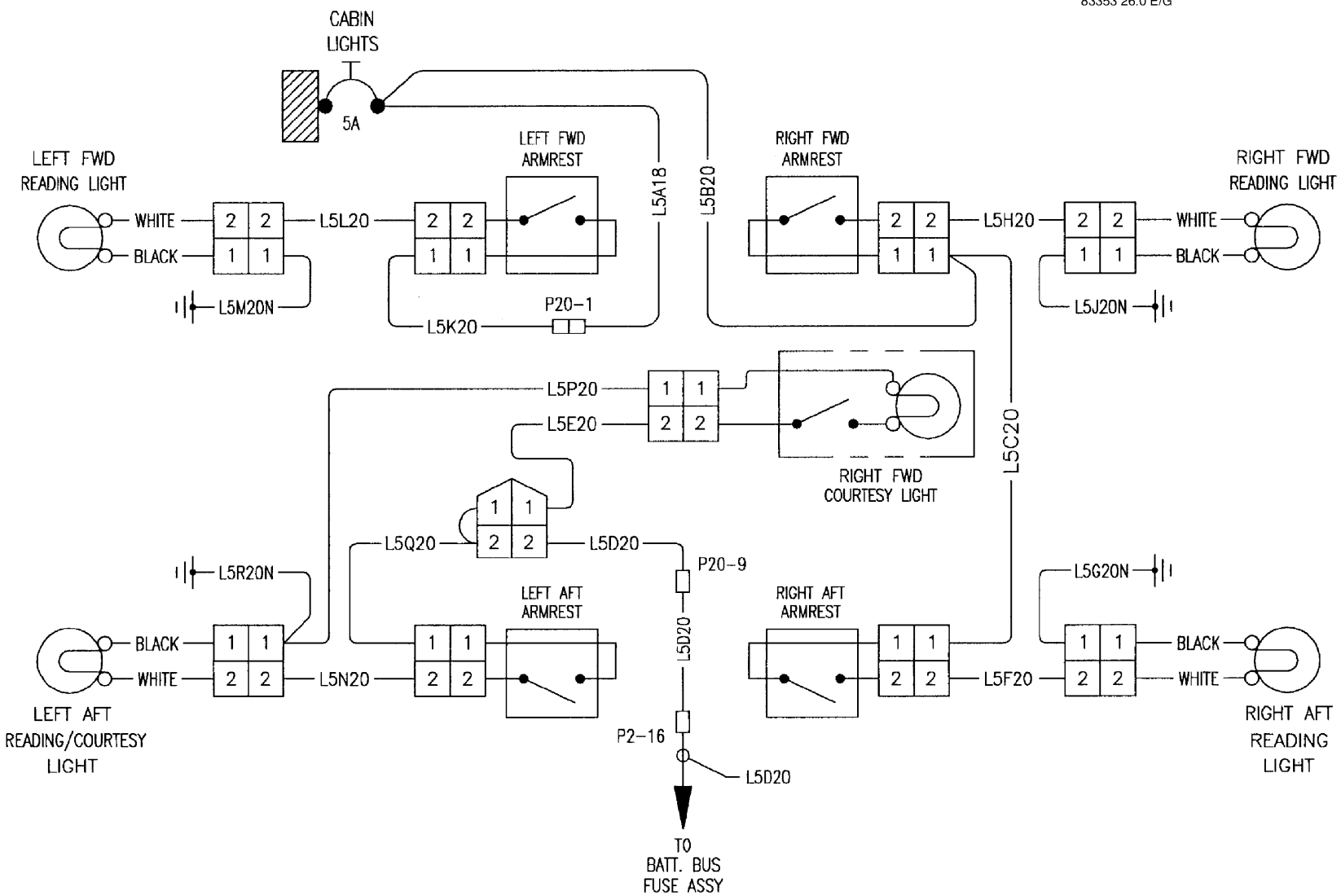
Switch Lights Dimming
Figure 4 (Sheet 3 of 3)

Effectivity
Seneca V
with Avidyne Option

THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL

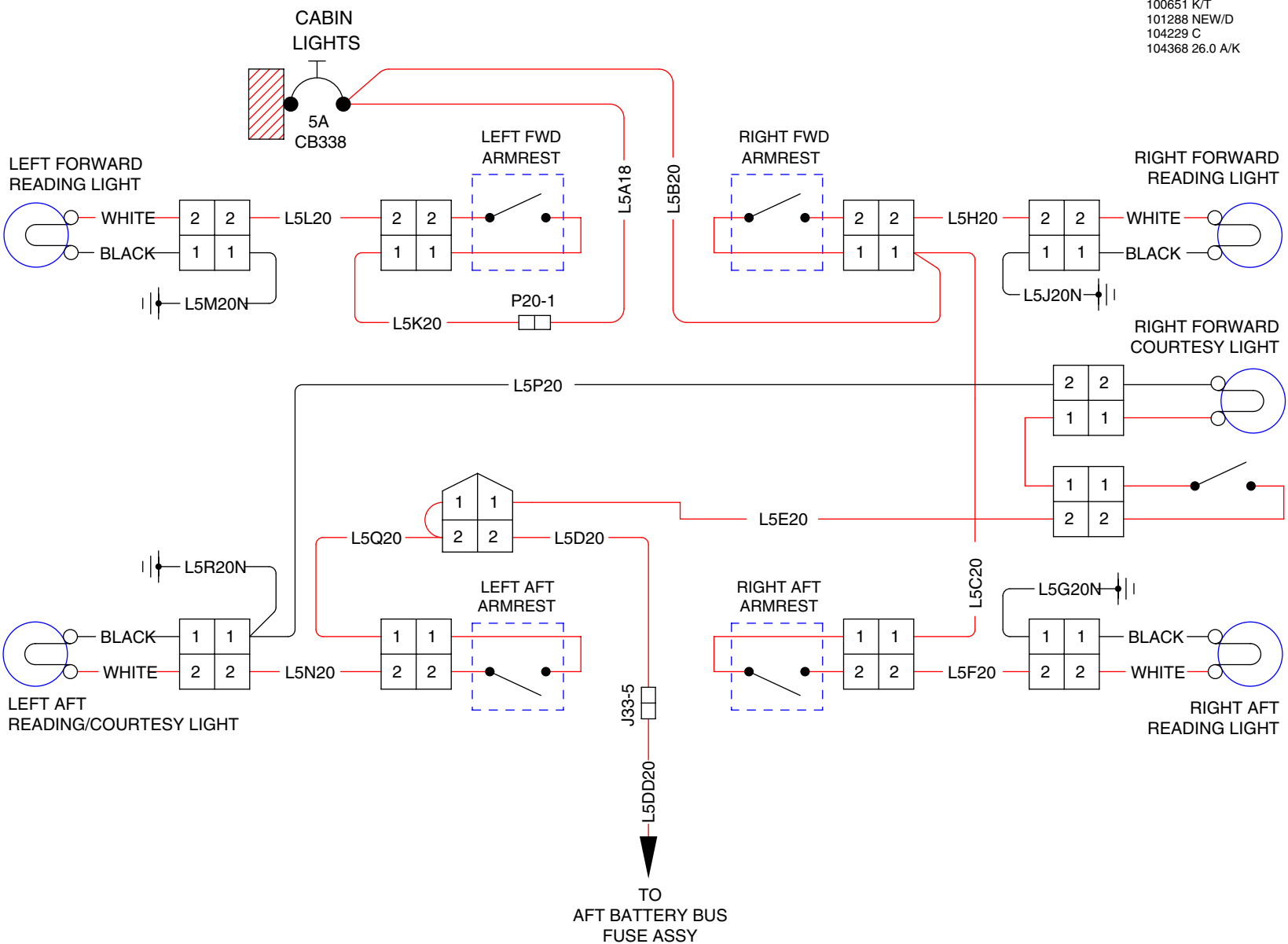
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83353 26.0 E/G



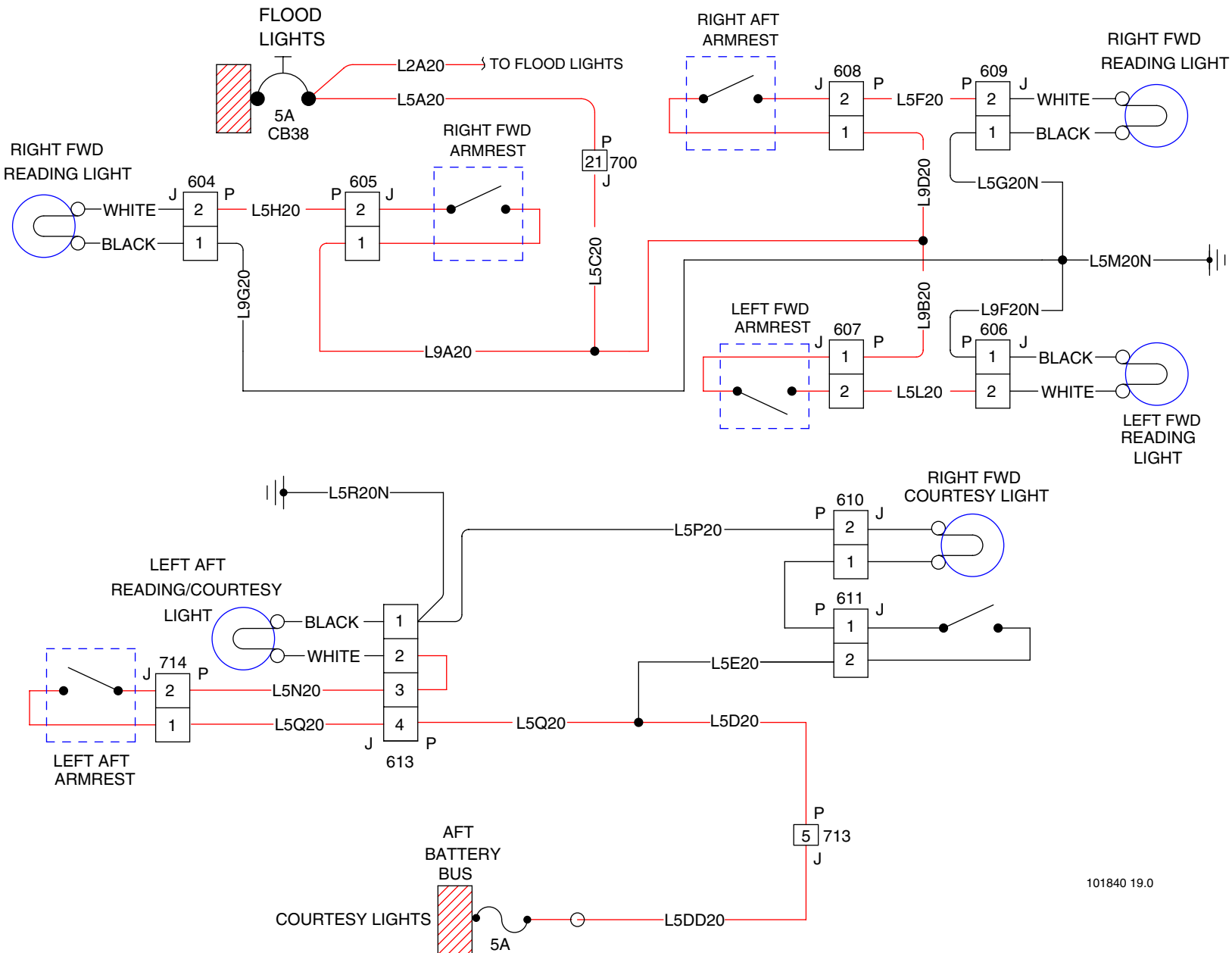
Courtesy / Reading Lights
Figure 1 (Sheet 1 of 3)

100651 K/T
101288 NEW/D
104229 C
104368 26.0 A/K



Effectivity
Seneca V

Courtesy / Reading Lights
Figure 1 (Sheet 2 of 3)



101840 19.0

Courtesy / Reading Lights
Figure 1 (Sheet 3 of 3)

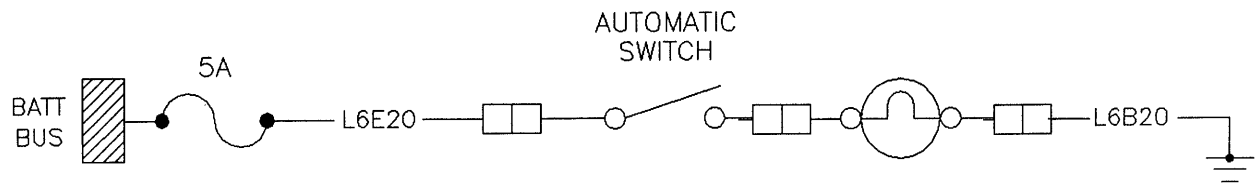
Effectivity
Seneca V
with Avidyne Option

**THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL**

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THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL

83353 18.0 NEW/G

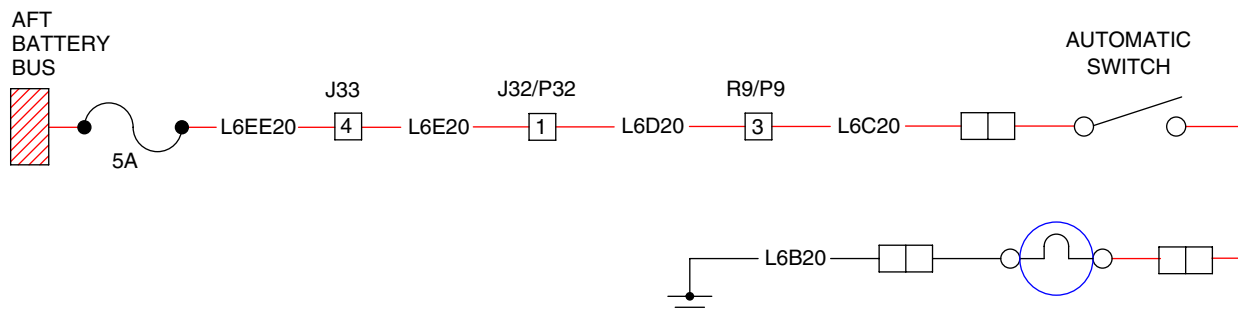


Baggage Compartment Light
Figure 1 (Sheet 1 of 2)

[Effectivity](#)
[Seneca IV](#)

**THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL**

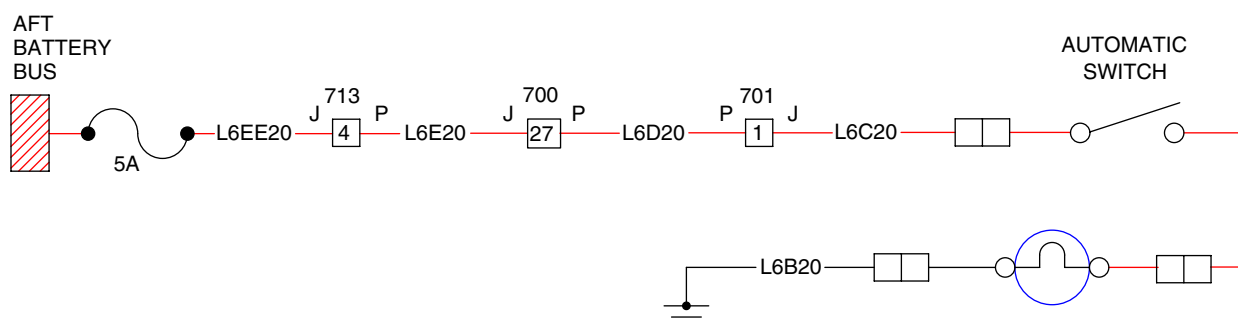
100651 K/T
101288 NEW/D
104229 NEW/C
104368 18.0 NEW/K



STANDARD

WITH AVIDYNE OPTION

101840 11.0

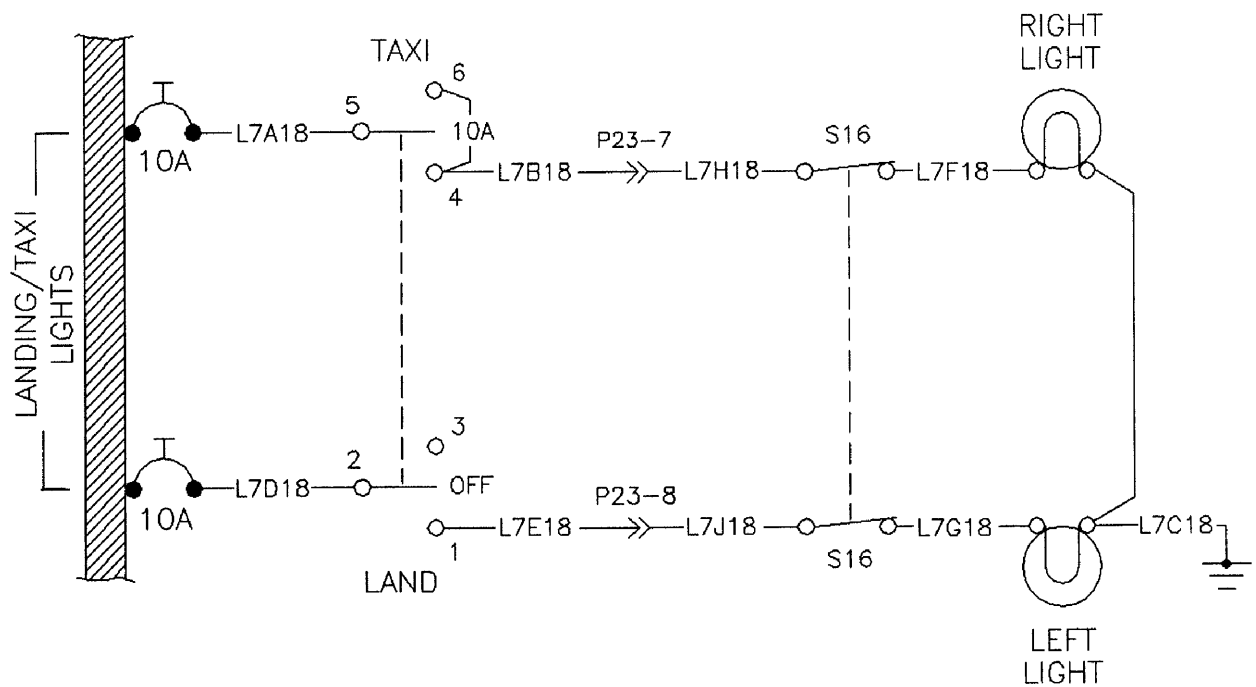


[Effectivity](#)
[Seneca V](#)

Baggage Compartment Light
Figure 1 (Sheet 2 of 2)

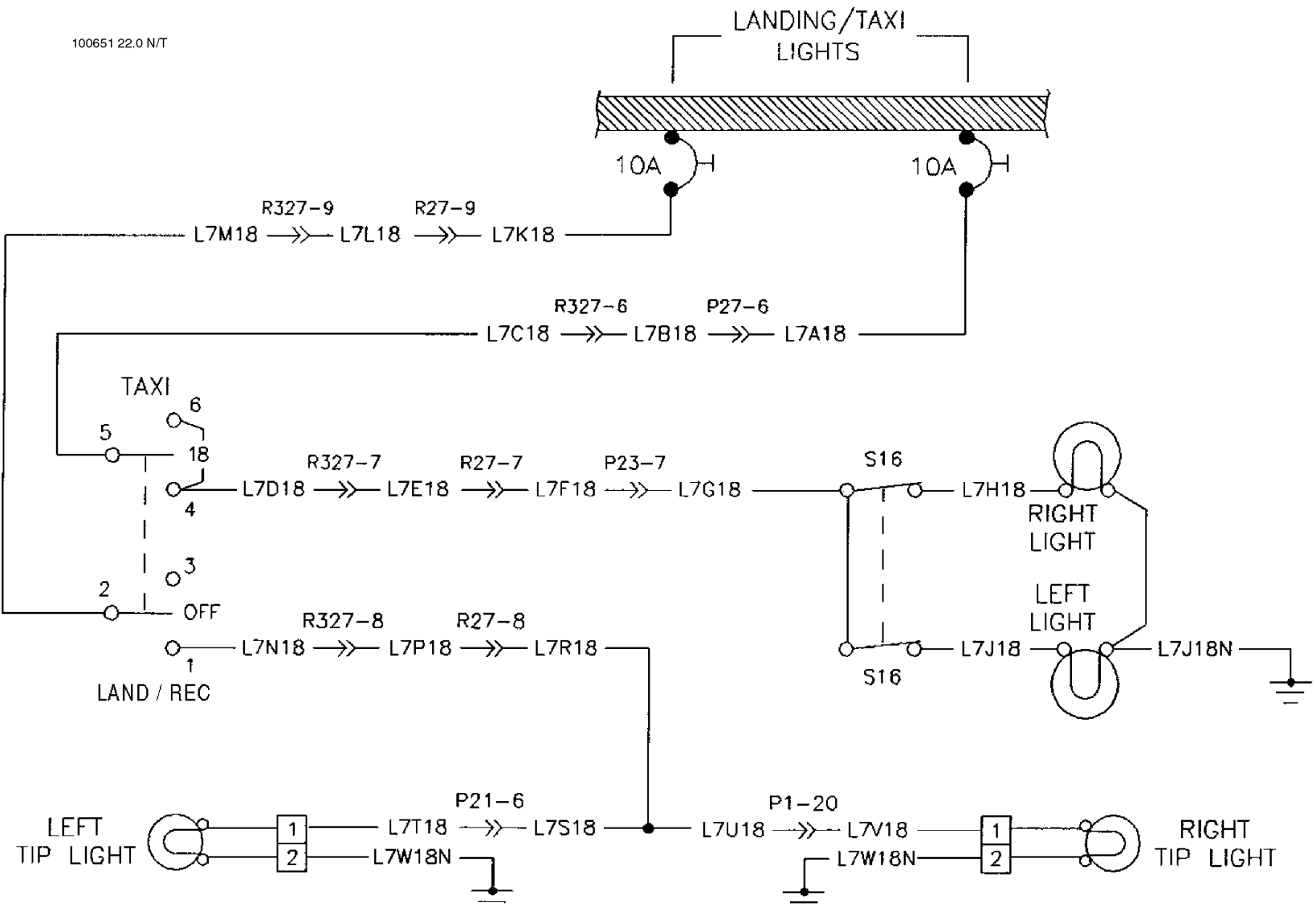
THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL

83353 22.0 B/G

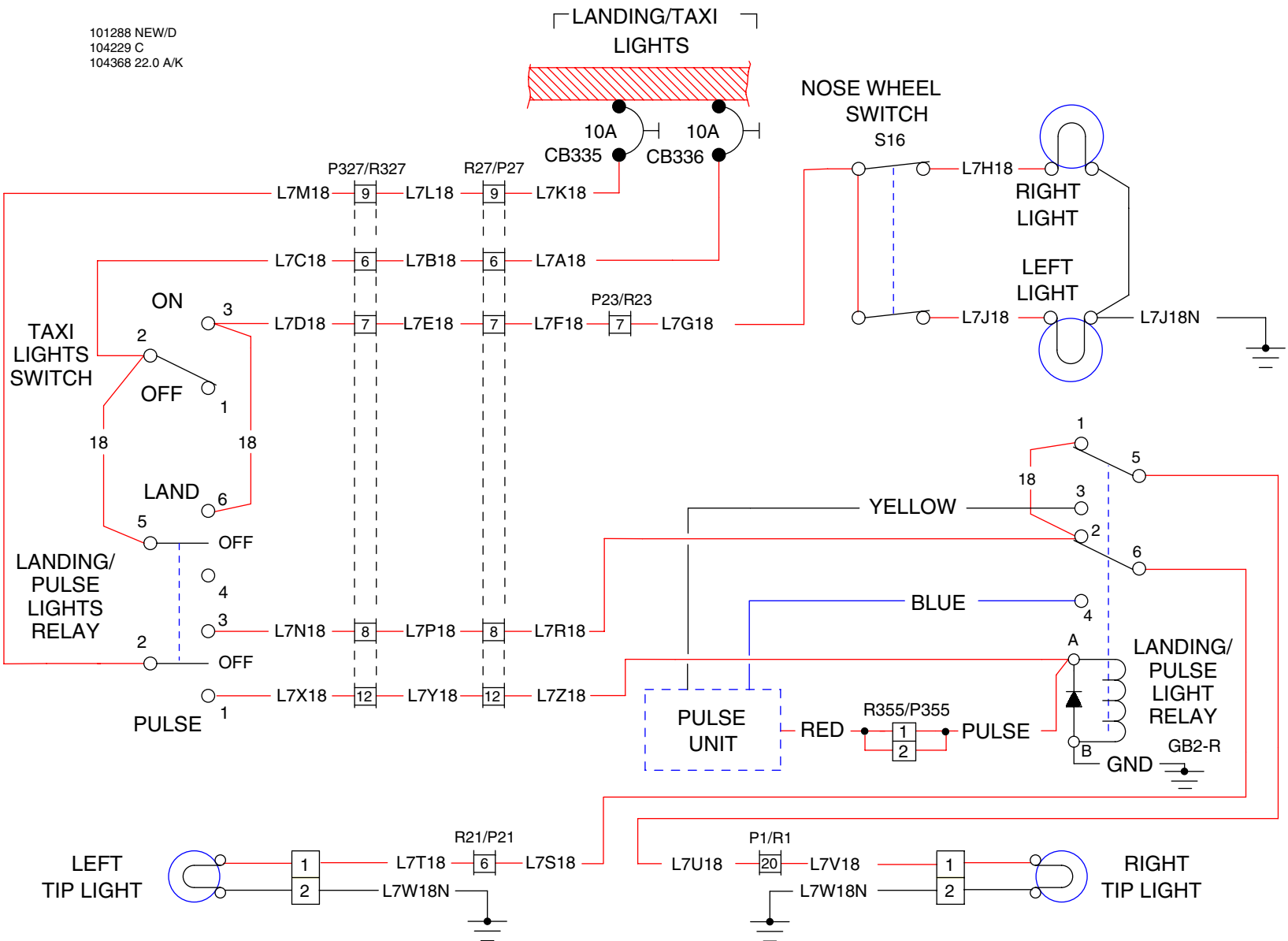


Landing / Taxi Lights
Figure 1 (Sheet 1 of 4)

[Effectivity](#)
[Seneca IV](#)

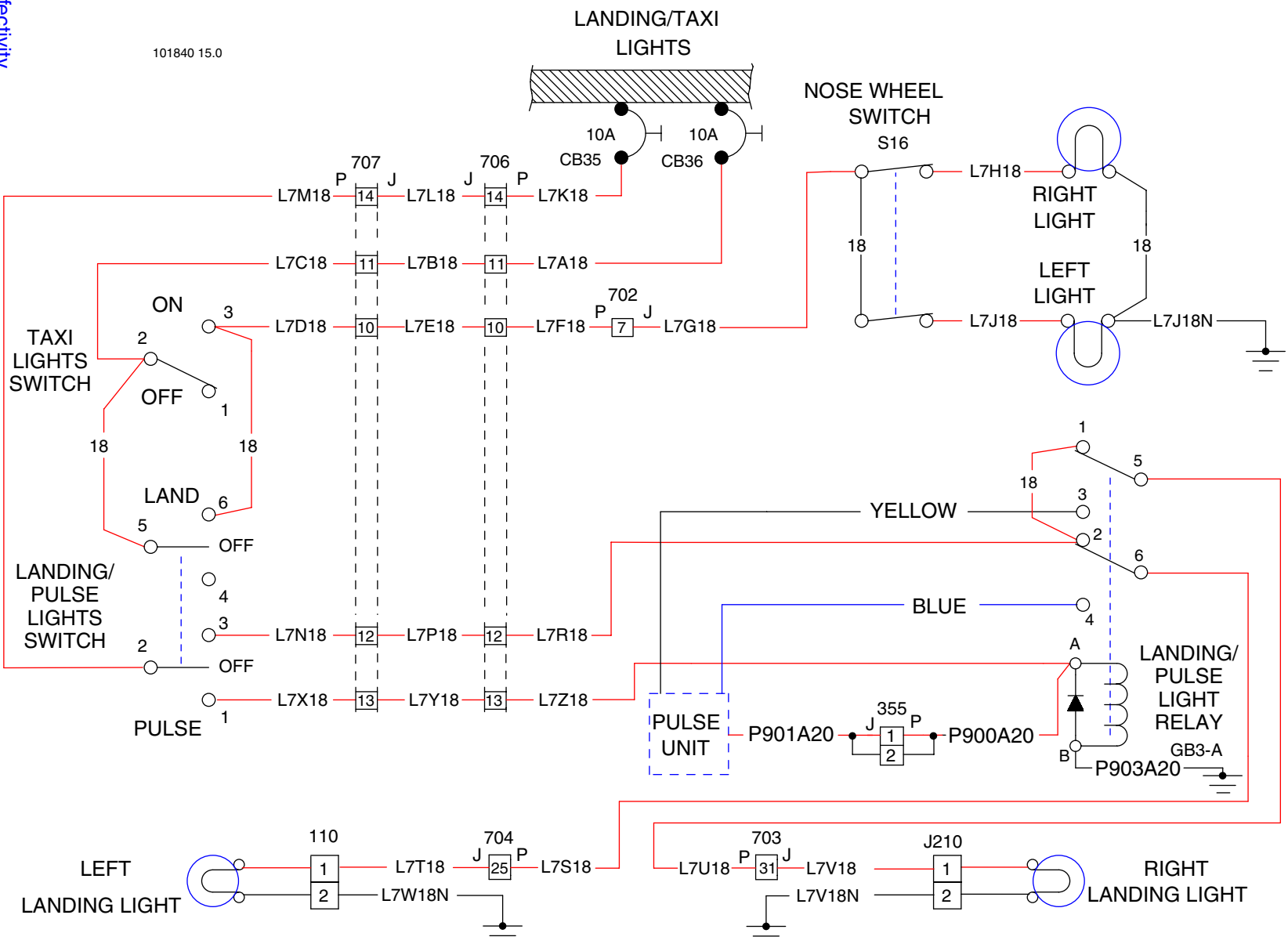


Effectivity
3449001 thru 3449096
Landing / Taxi Lights
Figure 1 (Sheet 2 of 4)



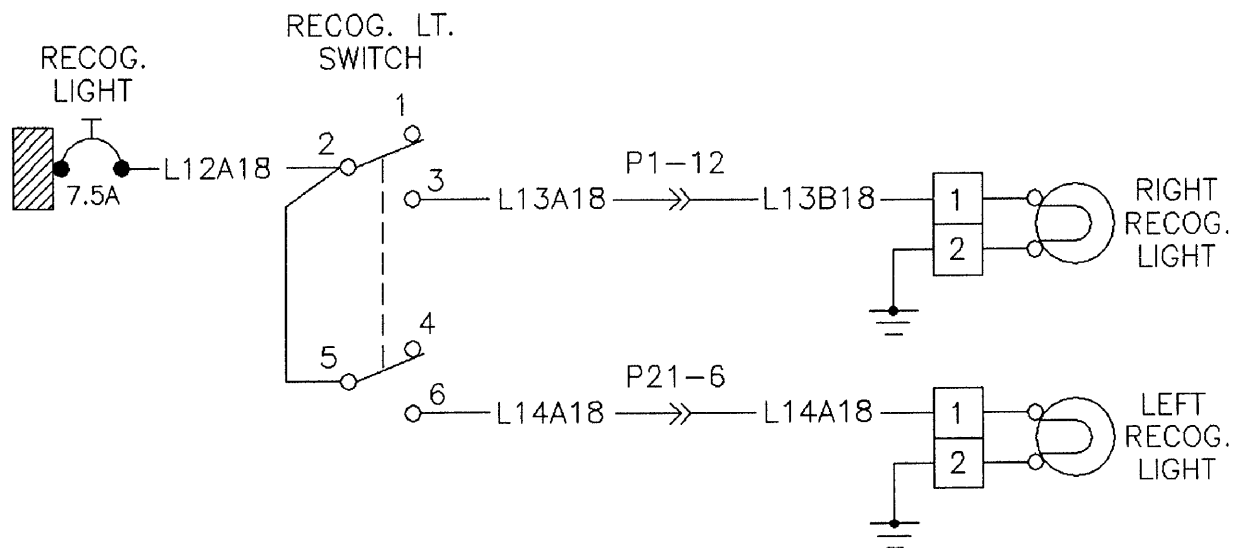
Landing / Taxi Lights
Figure 1 (Sheet 3 of 4)

Effectivity
3449097 & up



PA-34-220T, SENECA IV / V MAINTENANCE MANUAL

83353 12.0 NEW/G



Recognition Lights

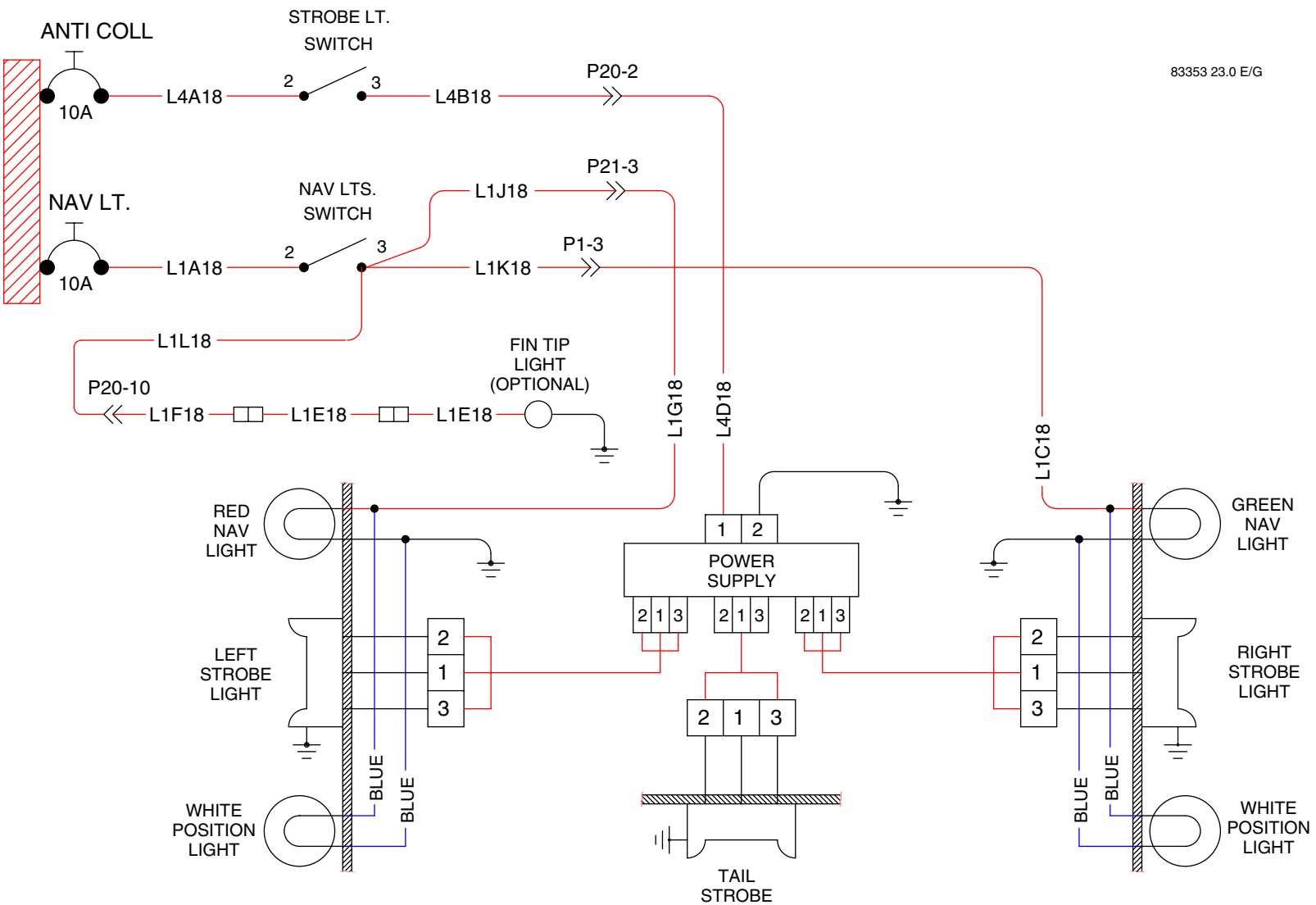
Figure 2

Effectivity

**THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL**

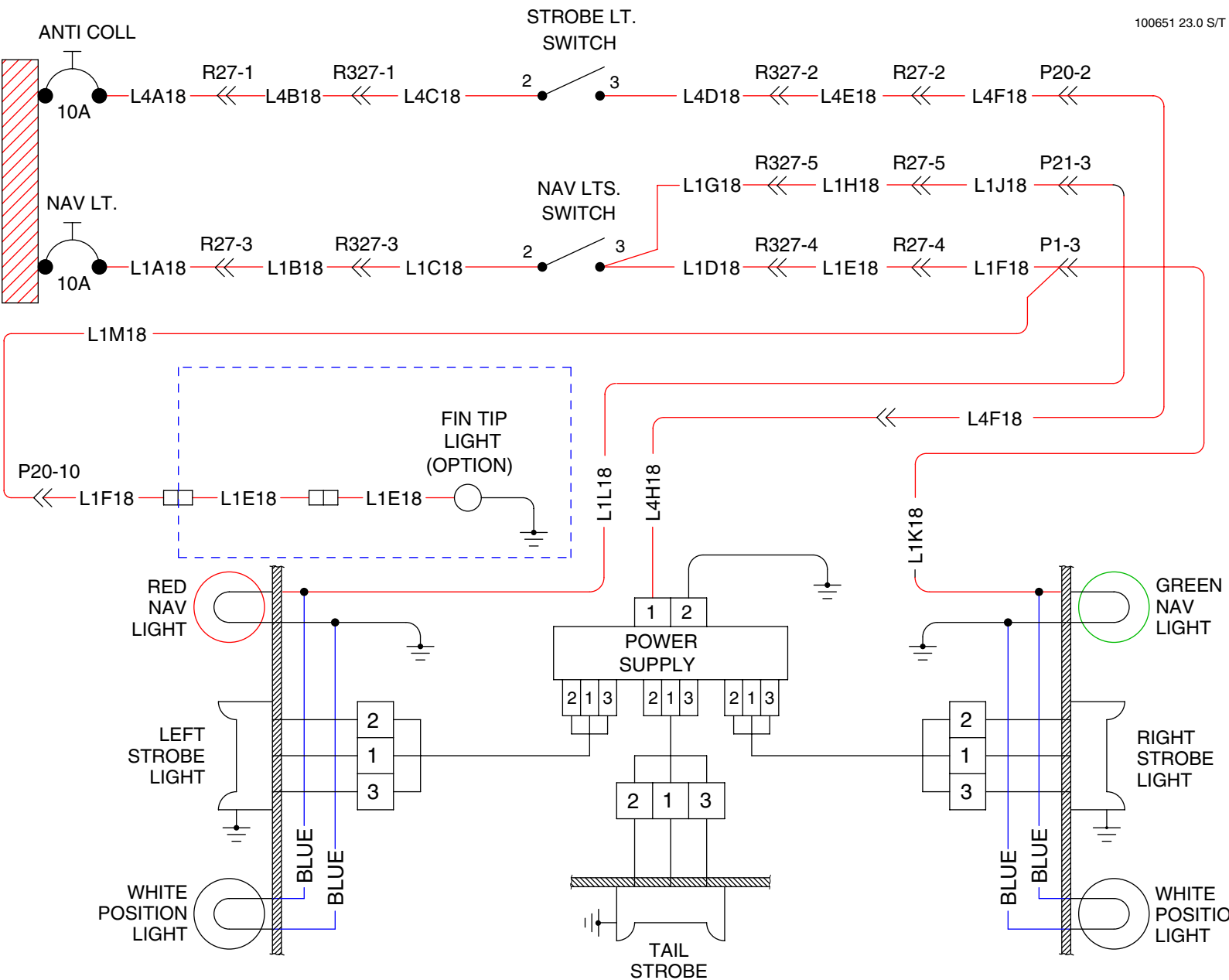
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83353 23.0 E/G



Navigation and Strobe Lights
Figure 3 (Sheet 1 of 4)

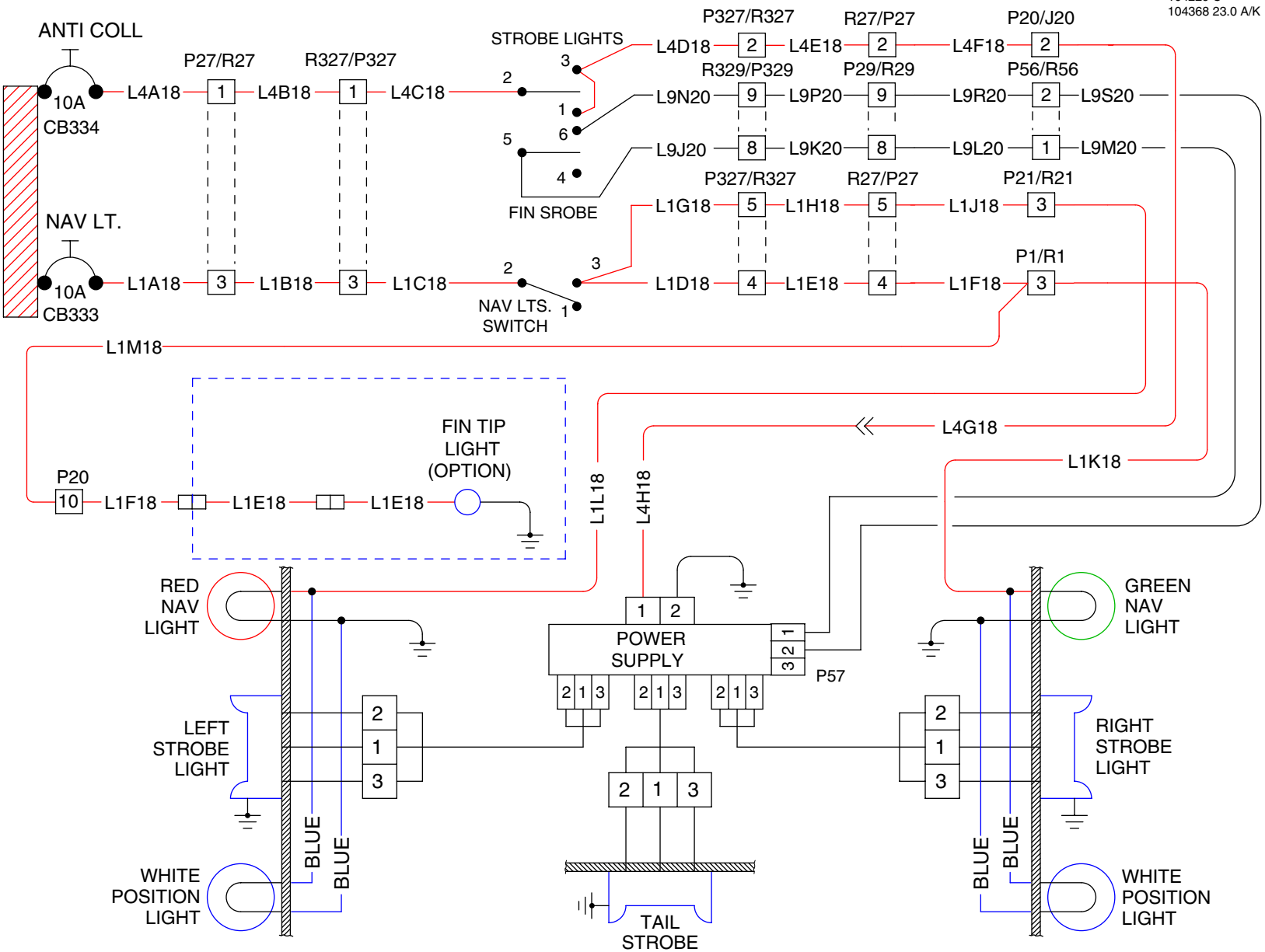
100651 23.0 S/T



Effectivity
3449001 thru 3449096

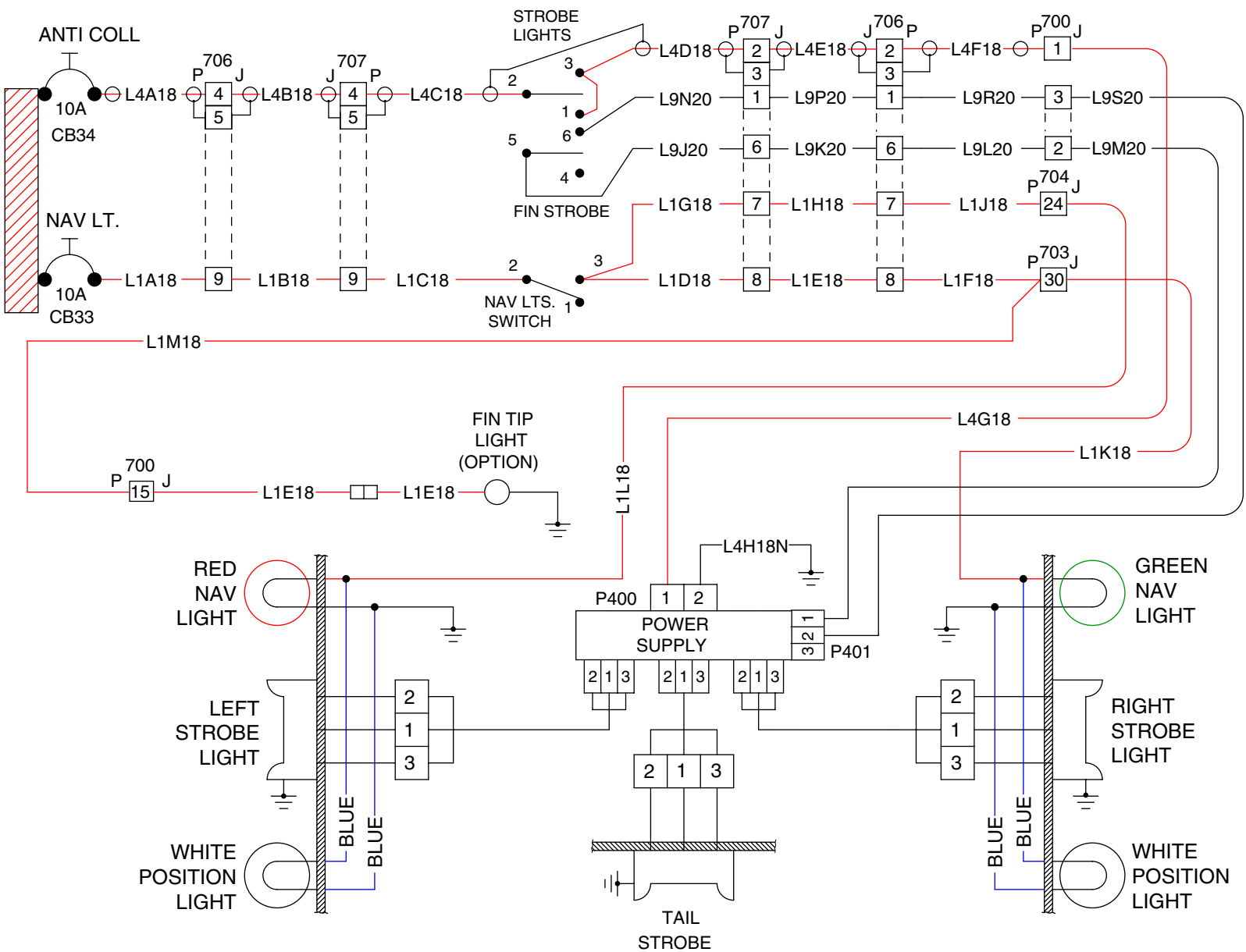
Navigation and Strobe Lights
Figure 3 (Sheet 2 of 4)

101288 C/D
104229 C
104368 23.0 A/K



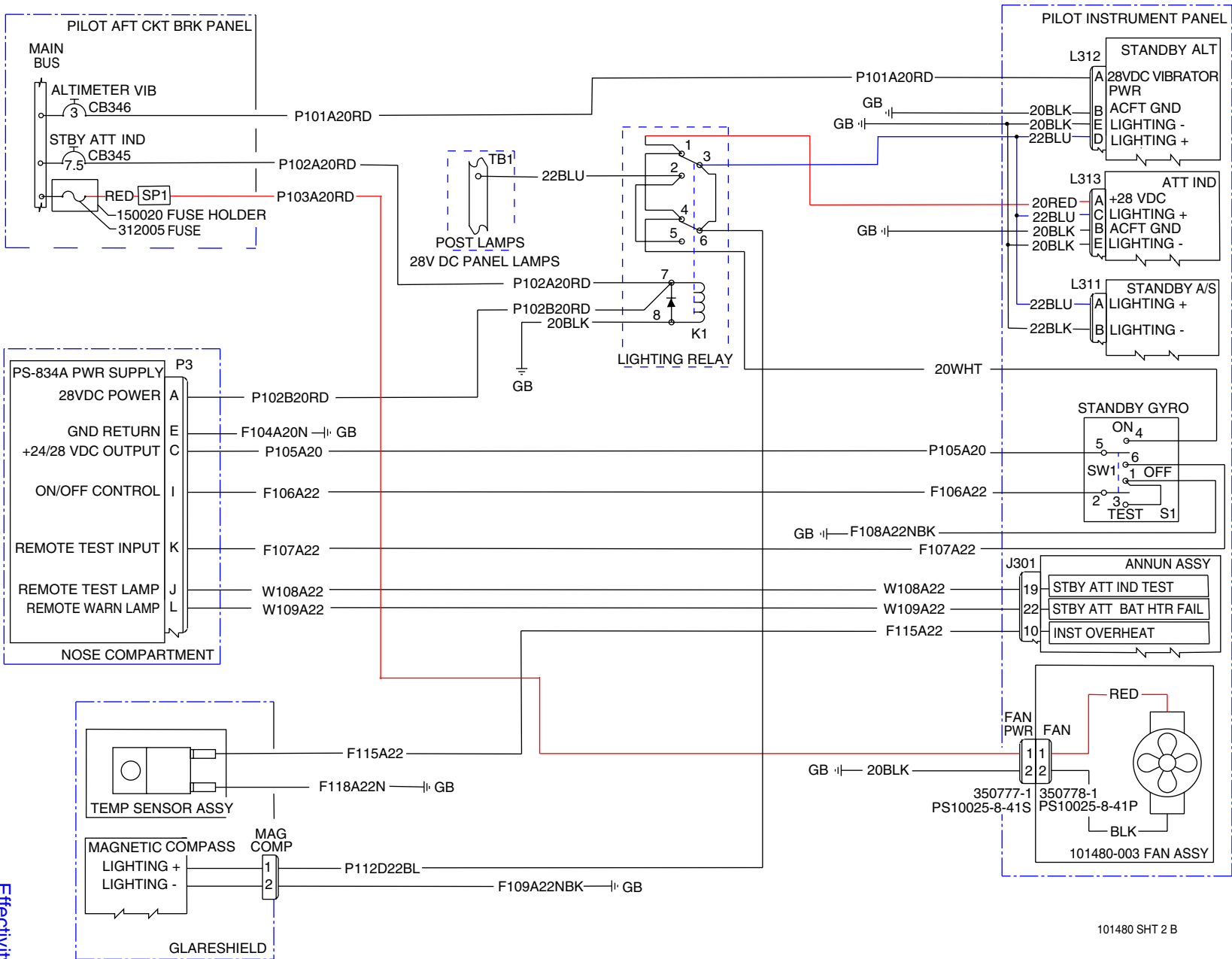
Navigation and Strobe Lights
Figure 3 (Sheet 3 of 4)

Effectivity
3449097 & up



Navigation and Strobe Lights
Figure 3 (Sheet 4 of 4)

Effectivity
Seneca V
with Avidyne Option



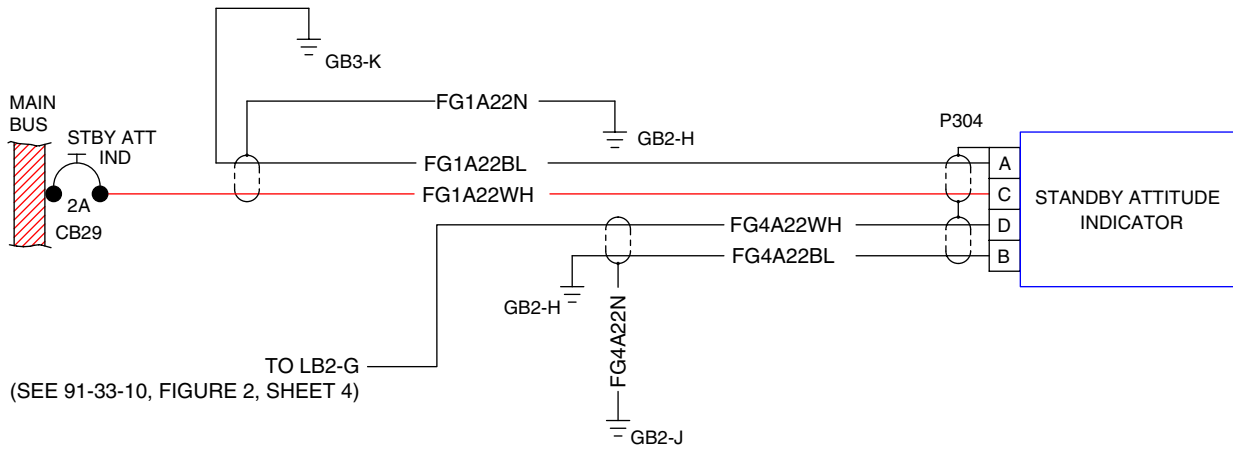
101480 SHT 2 B

Standby Instruments
Figure 1

Effectivity
3449269 & up
with Single-side EFIS Option

THE NEW PIPER AIRCRAFT, INC.
PA-34-220T, SENECA IV / V
MAINTENANCE MANUAL

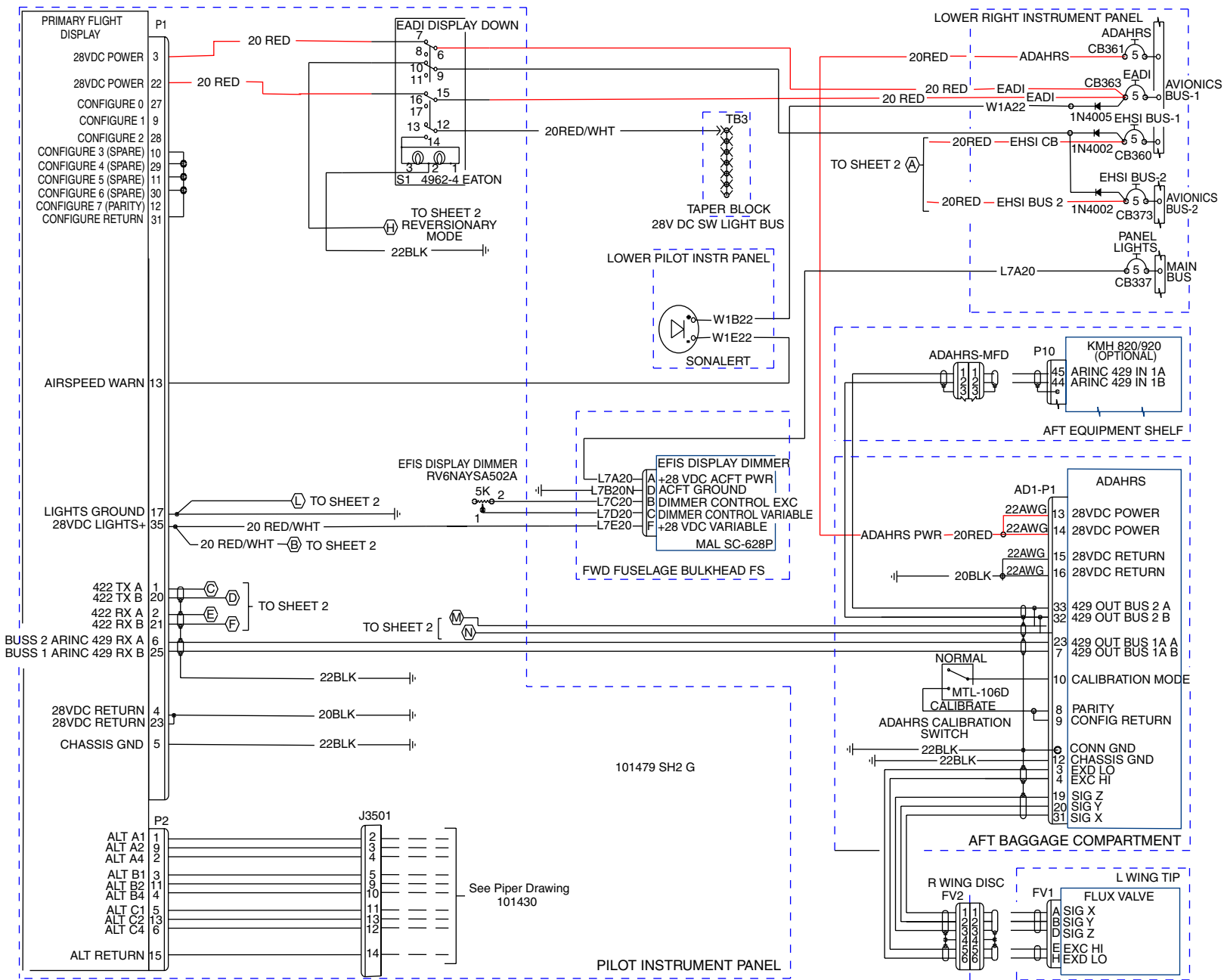
101840 33.0

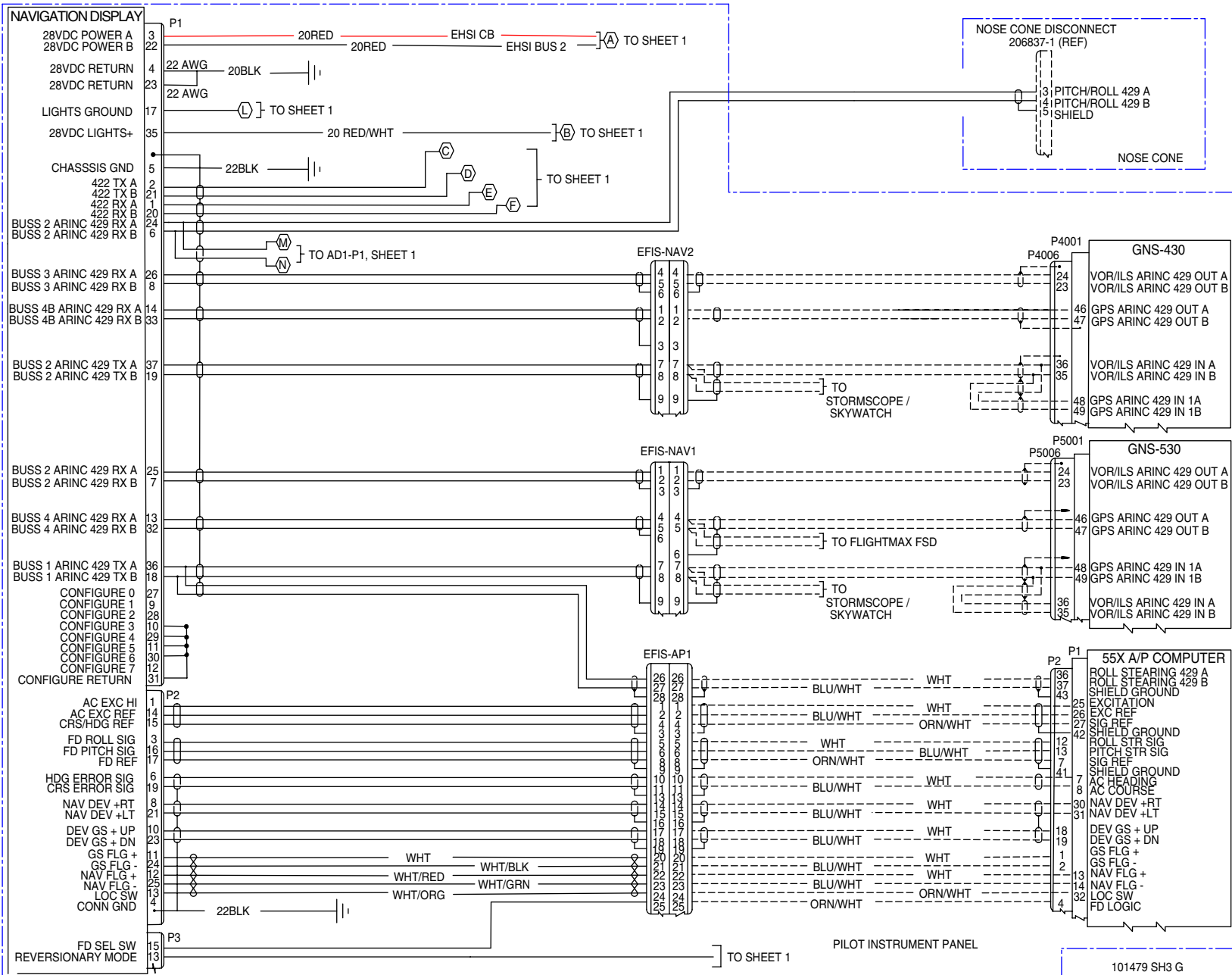


Effectivity
Seneca V
with Avidyne Option

Standby Attitude Indicator
Figure 2

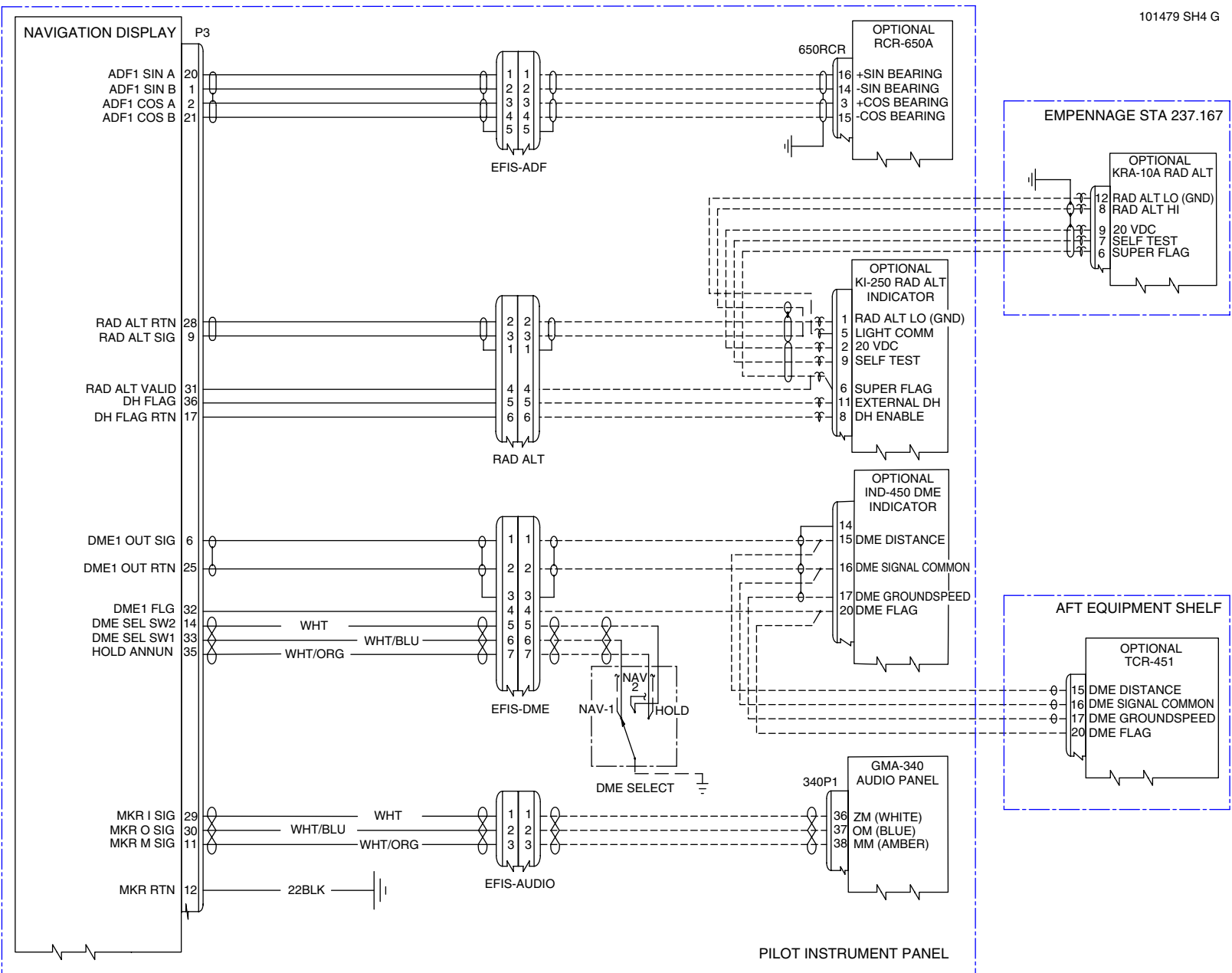
Effectivity
3449269 & up





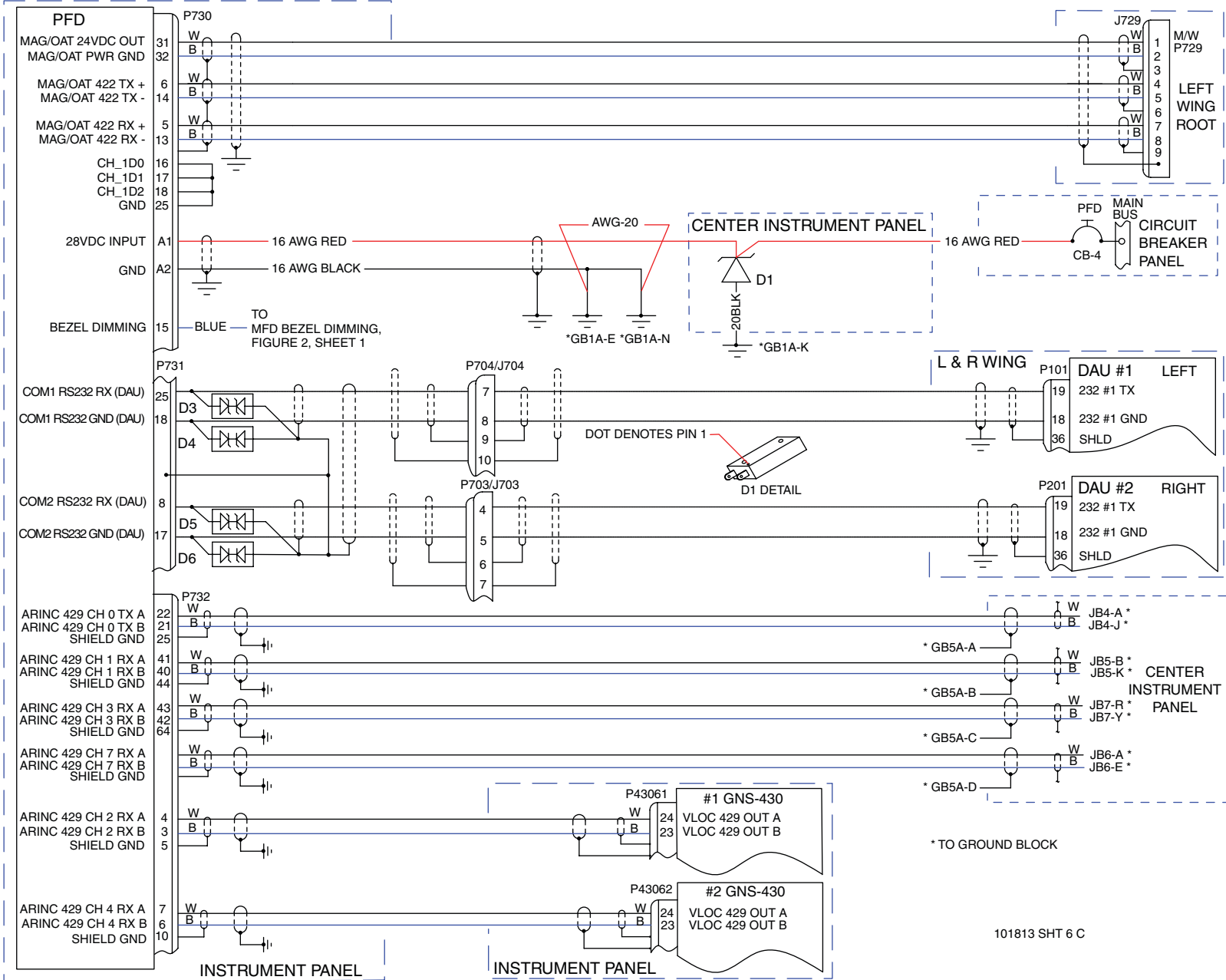
Effectivity
3449269 & up
Single-side EFIS Option (Meggit)
Figure 1 (Sheet 2 of 3)

101479 SH4 G



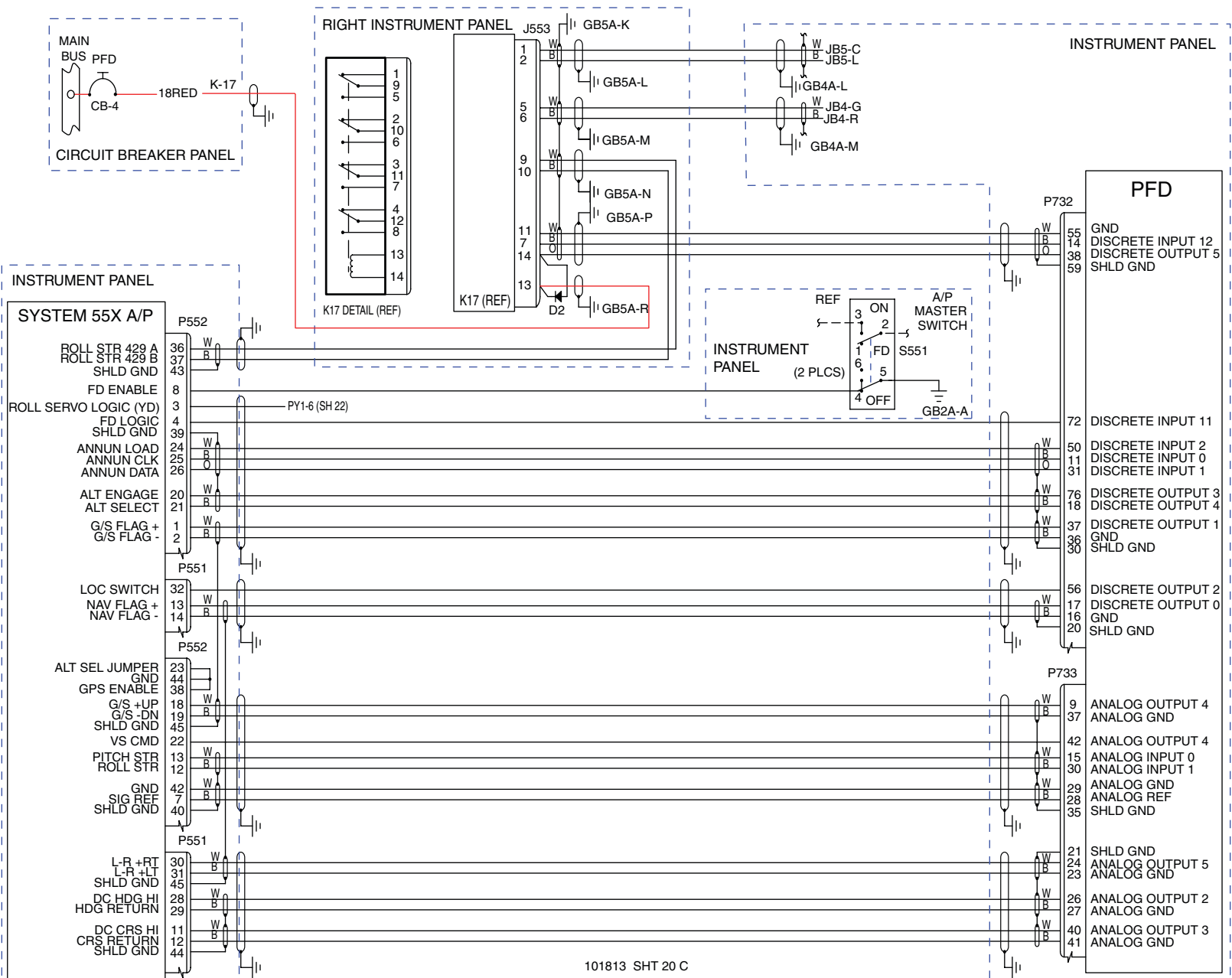
Single-side EFIS Option (Meggitt)
Figure 1 (Sheet 3 of 3)

Effectivity
3449269 & up



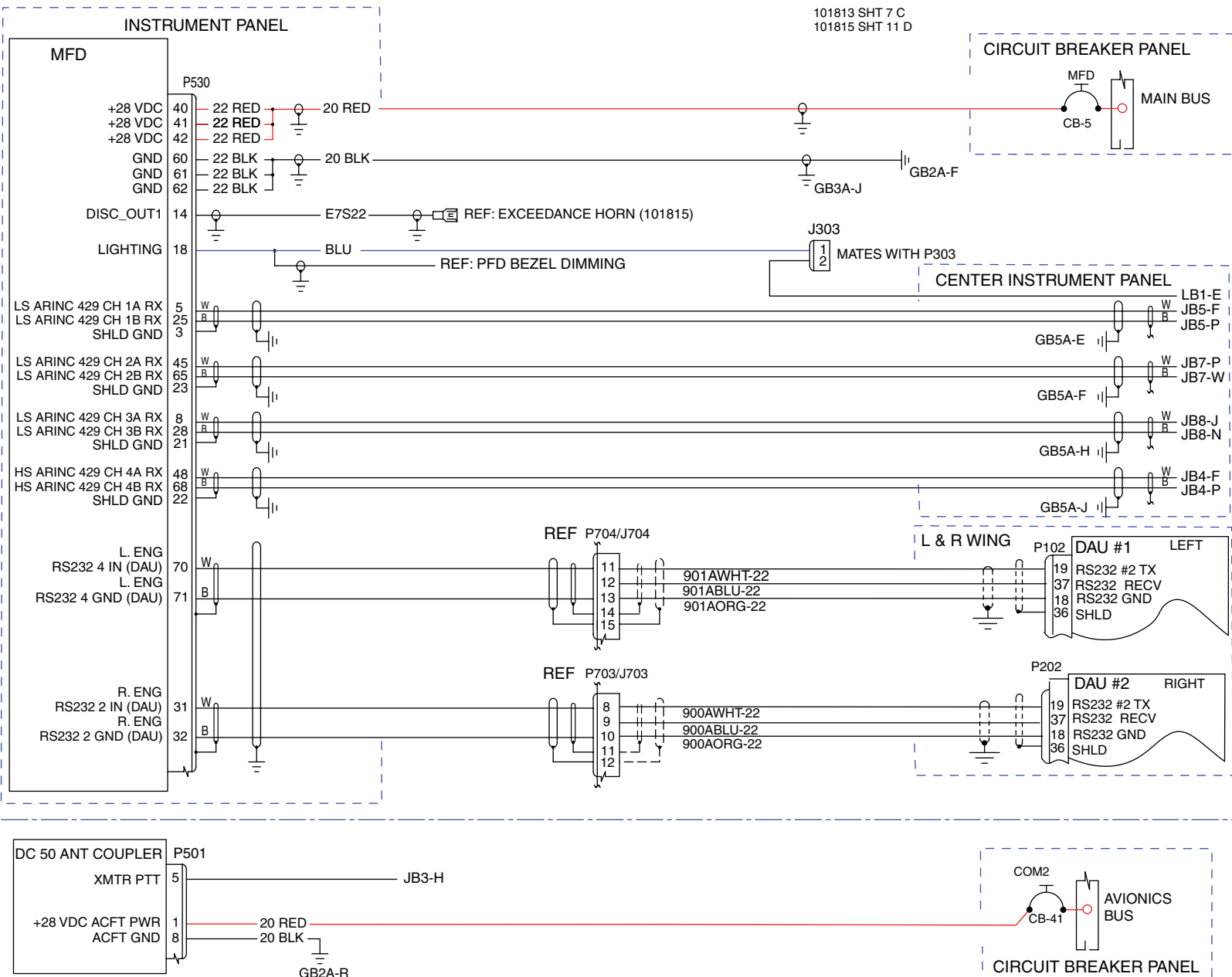
Effectivity
Seneca V
with Avidyne Option

Avidyne EFIS Option
Figure 2 (Sheet 1 of 5)



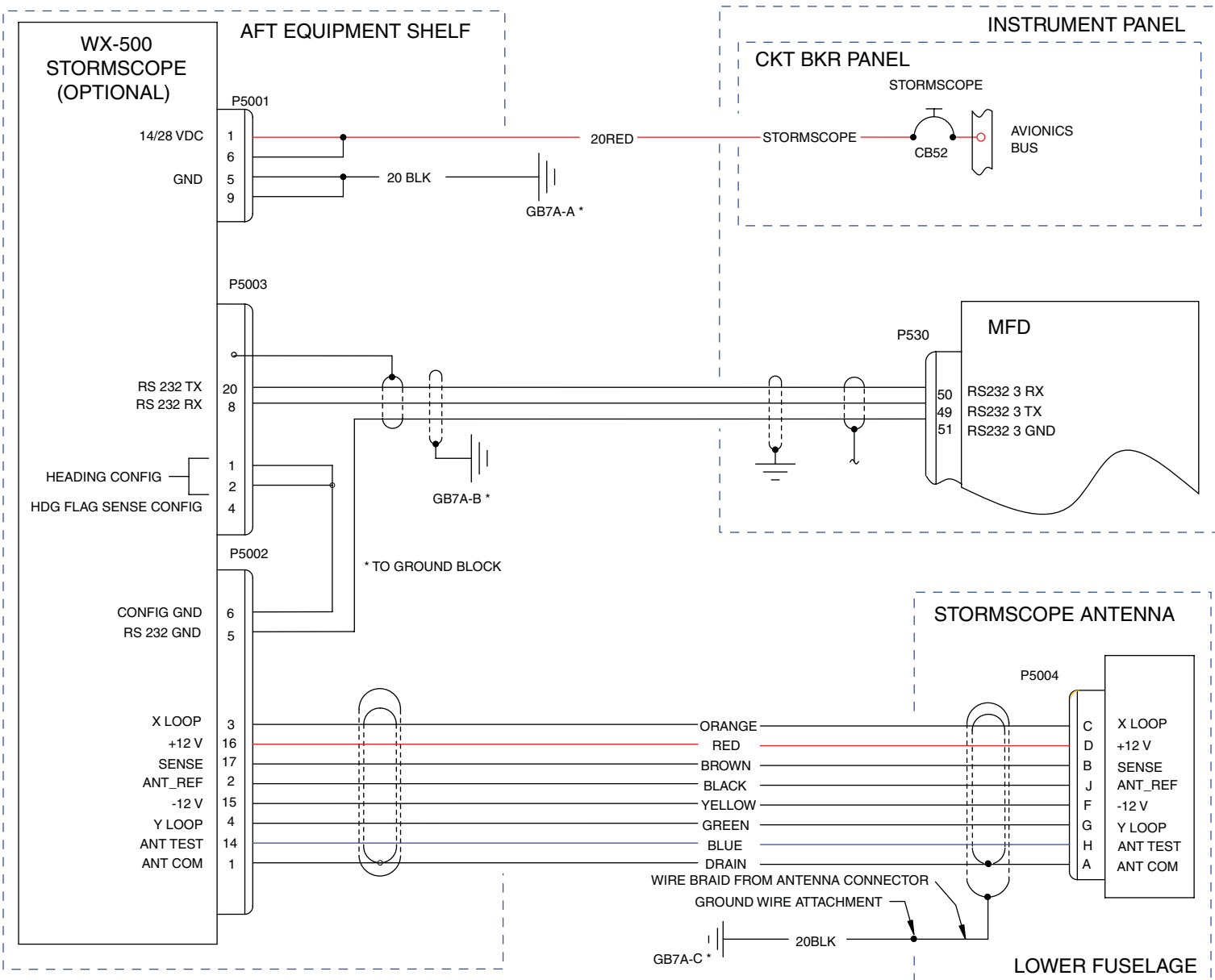
Avidyne EFIS Option
Figure 2 (Sheet 2 of 5)

Effectivity
Seneca V
with Avidyne Option



Effectivity
Seneca V
with Avidyne Option

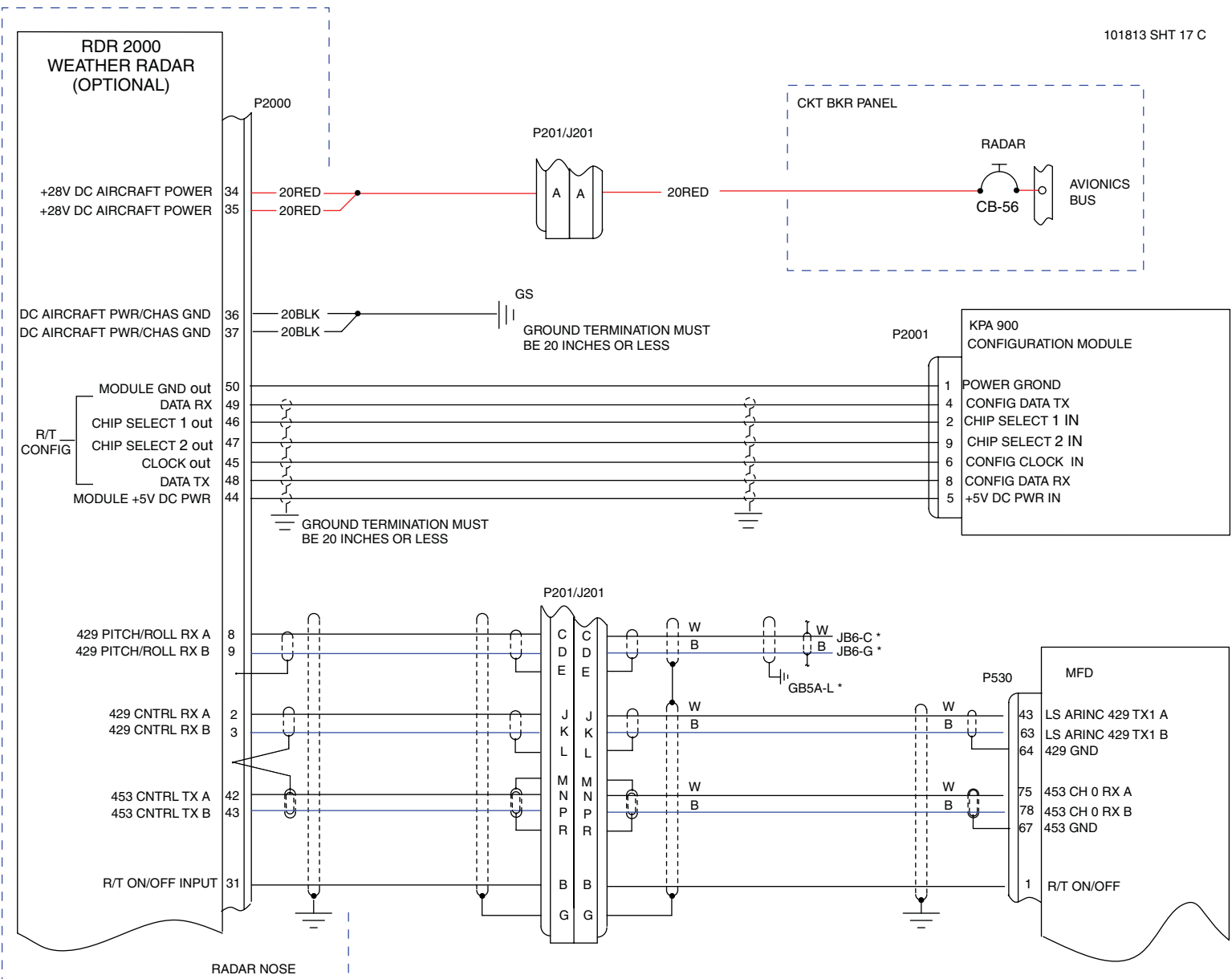
Avidyne EFIS Option
Figure 2 (Sheet 3 of 5)



101813 SHT 14 B

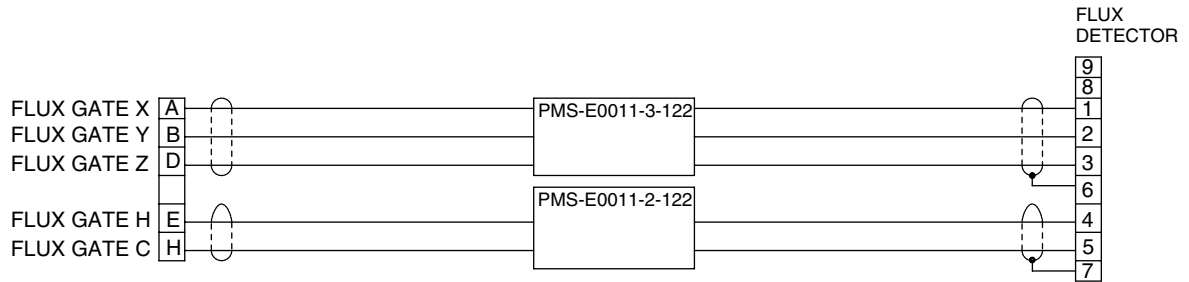
Avidyne EFIS Option
Figure 2 (Sheet 4 of 5)

Effectivity
Seneca V
with Avidyne Option



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MAINTENANCE MANUAL

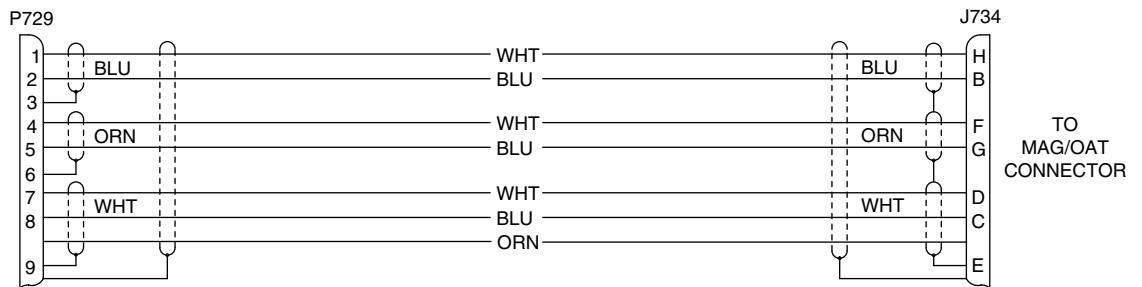
101261 J



STANDARD

WITH AVIDYNE OPTION

101753 C



ALL WIRE IS MINIMUM 22 AWG UNLESS OTHERWISE SPECIFIED.

Flux Detector
Figure 3

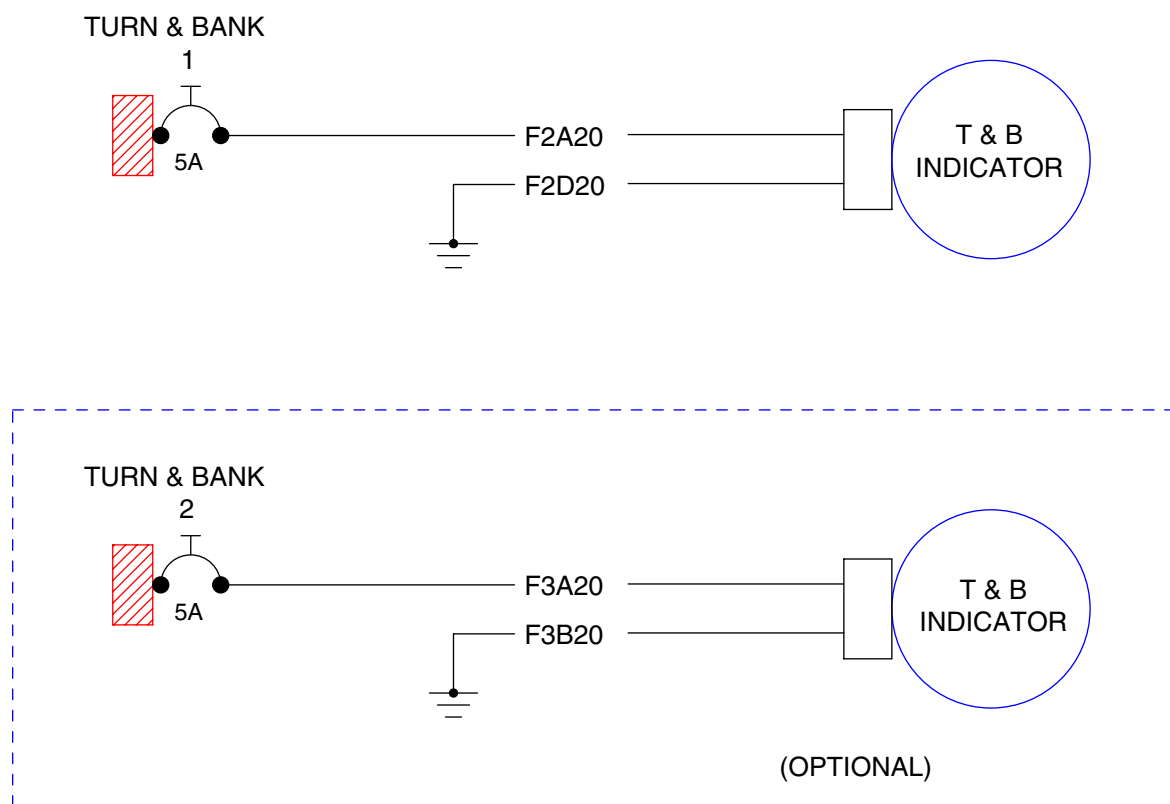
[Effectivity
3449152 & up](#)

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PA-34-220T, SENECA IV / V
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83353 NEW/G
100651 NEW/T
101288 9.0 NEW/D



Turn and Bank
Figure 4 (Sheet 1 of 2)

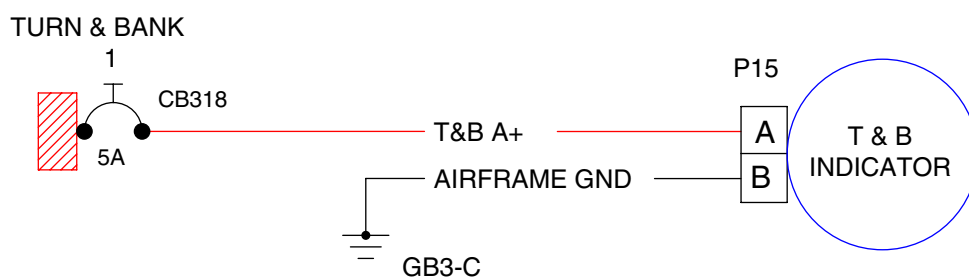
[Effectivity](#)
Seneca IV and,
3449001 thru 3449151

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MAINTENANCE MANUAL

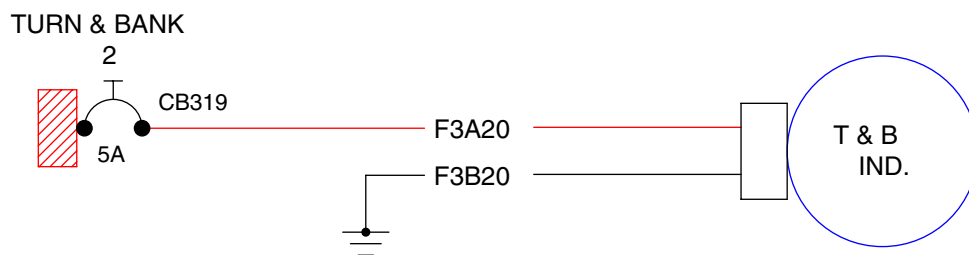
104229 C
104368 9.0 A/K
101810 6.0

PILOT

(PART OF AUTOPILOT INSTALLATION)



CO-PILOT

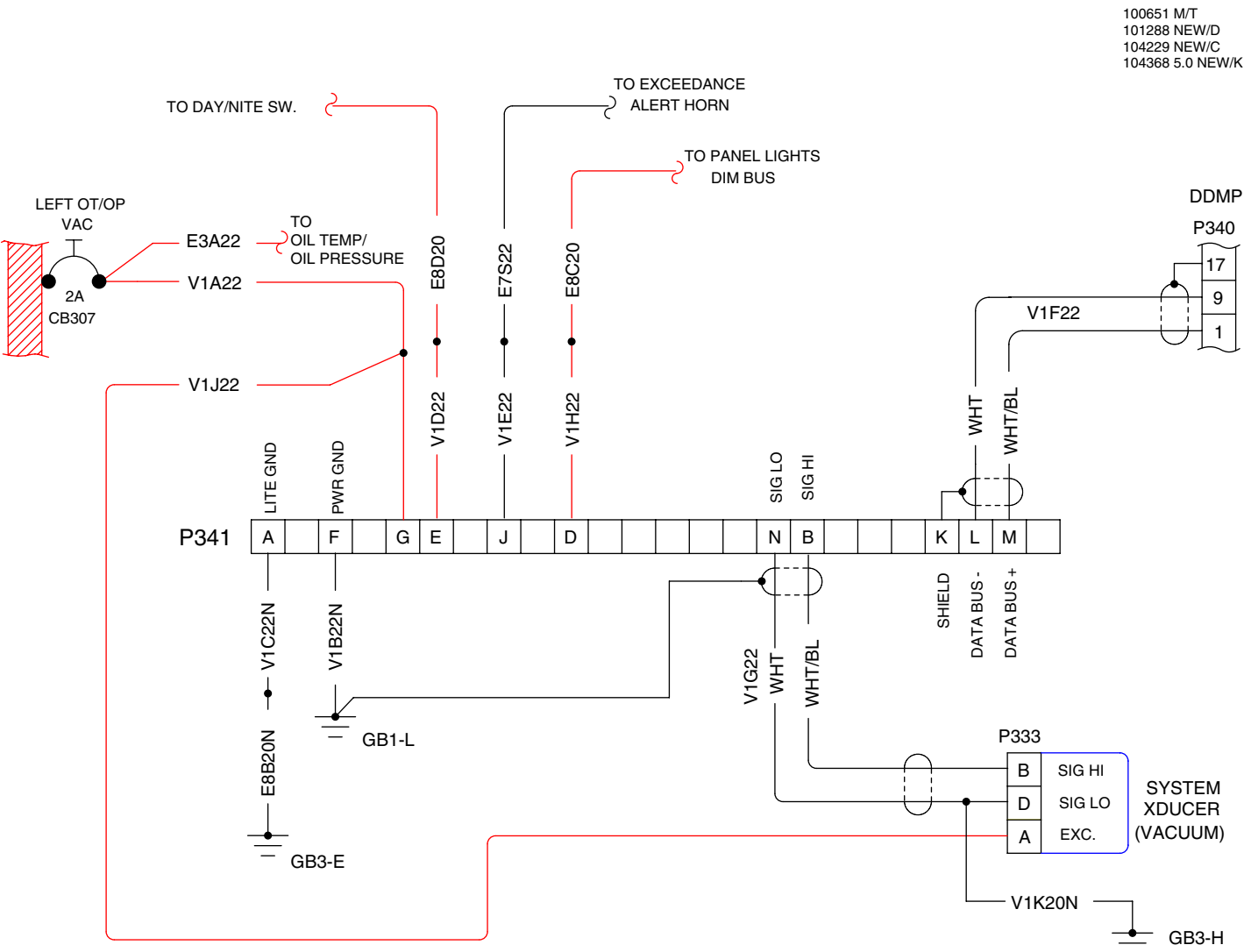


(OPTIONAL, but not available with Avidyne Option)

[Effectivity](#)
3449152 & up

Turn and Bank
Figure 4 (Sheet 2 of 2)

Vacuum Gauge
Figure 1



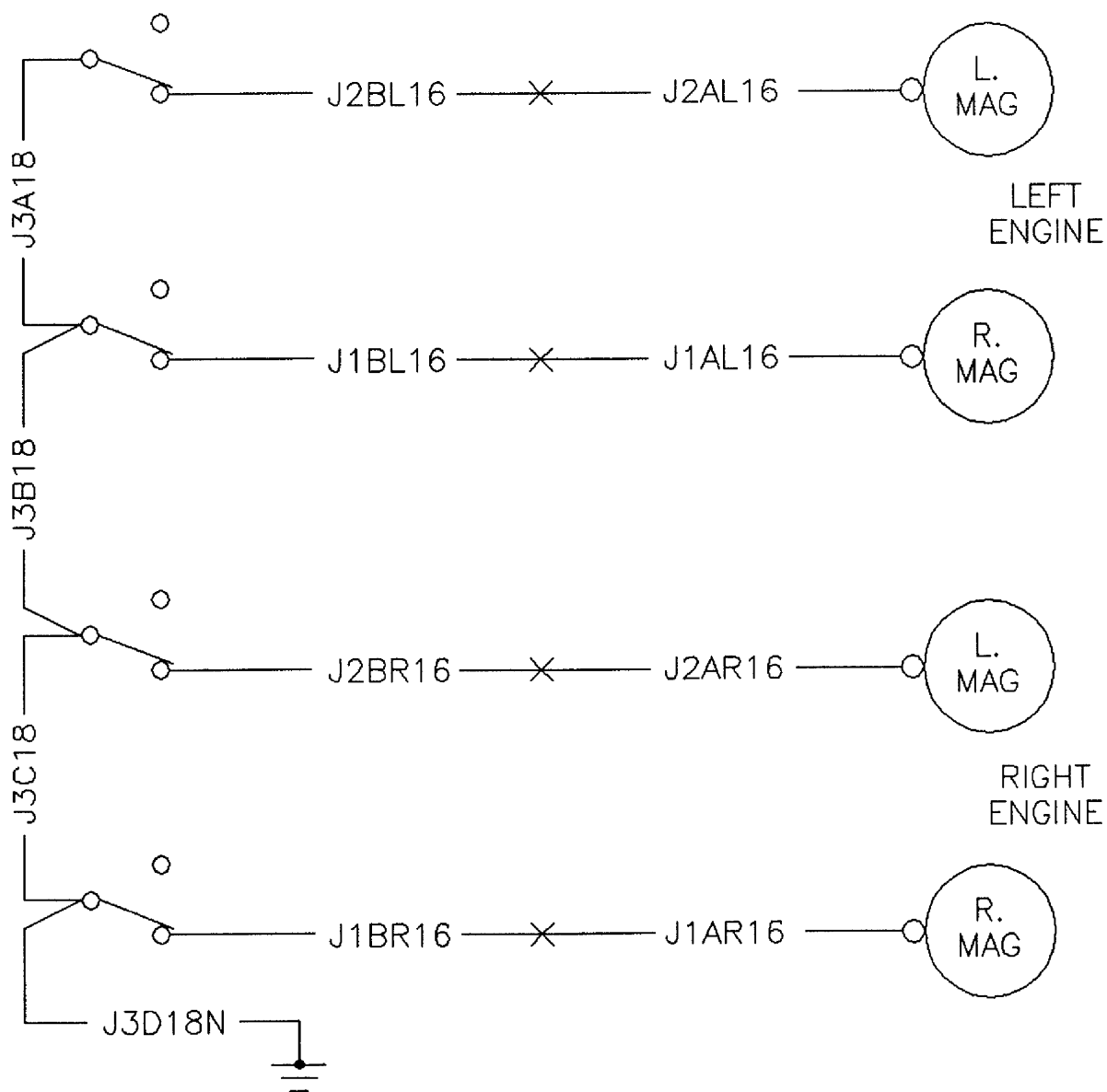
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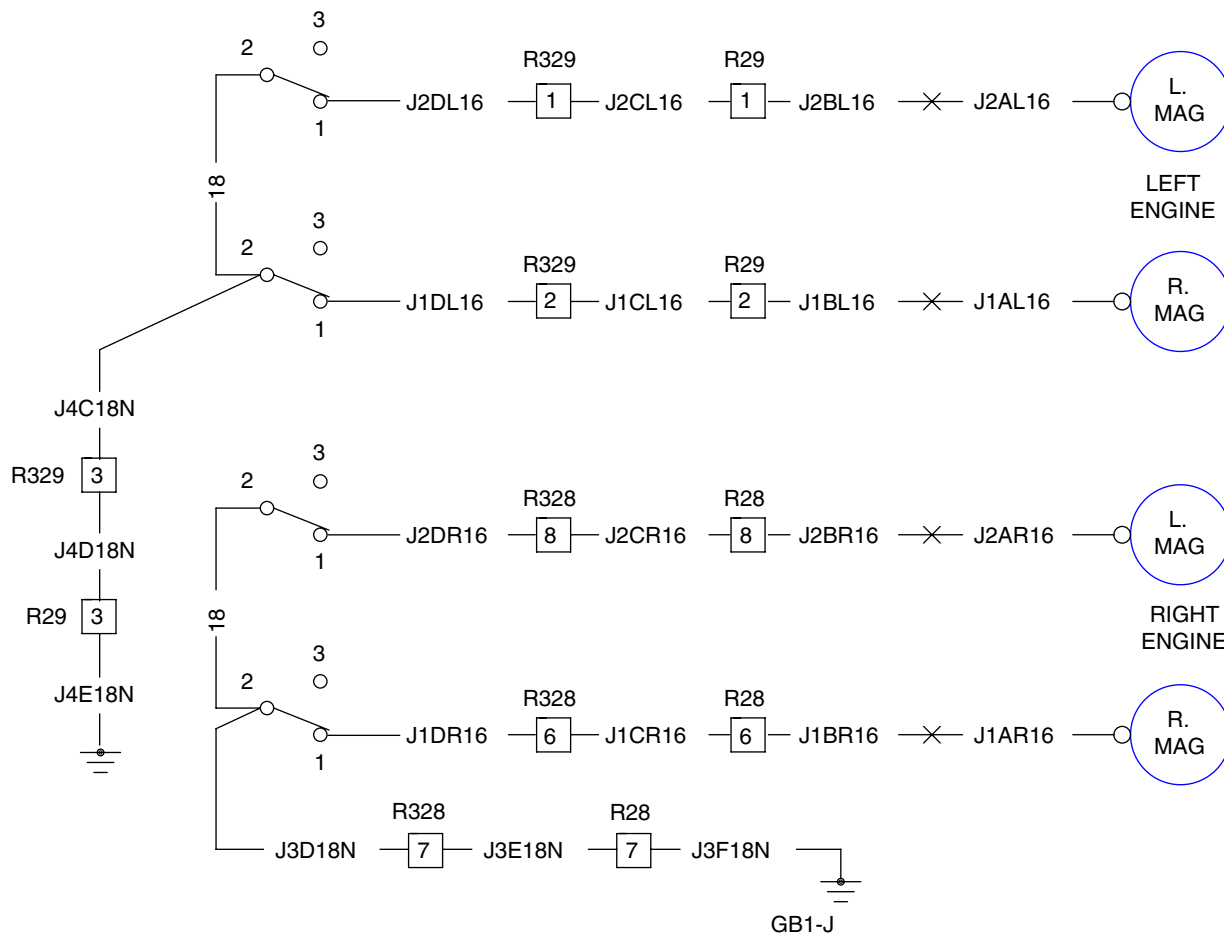


Magnetos
Figure 1 (Sheet 1 of 4)

[Effectivity](#)
[Seneca IV](#)

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MAINTENANCE MANUAL

100651 L/T
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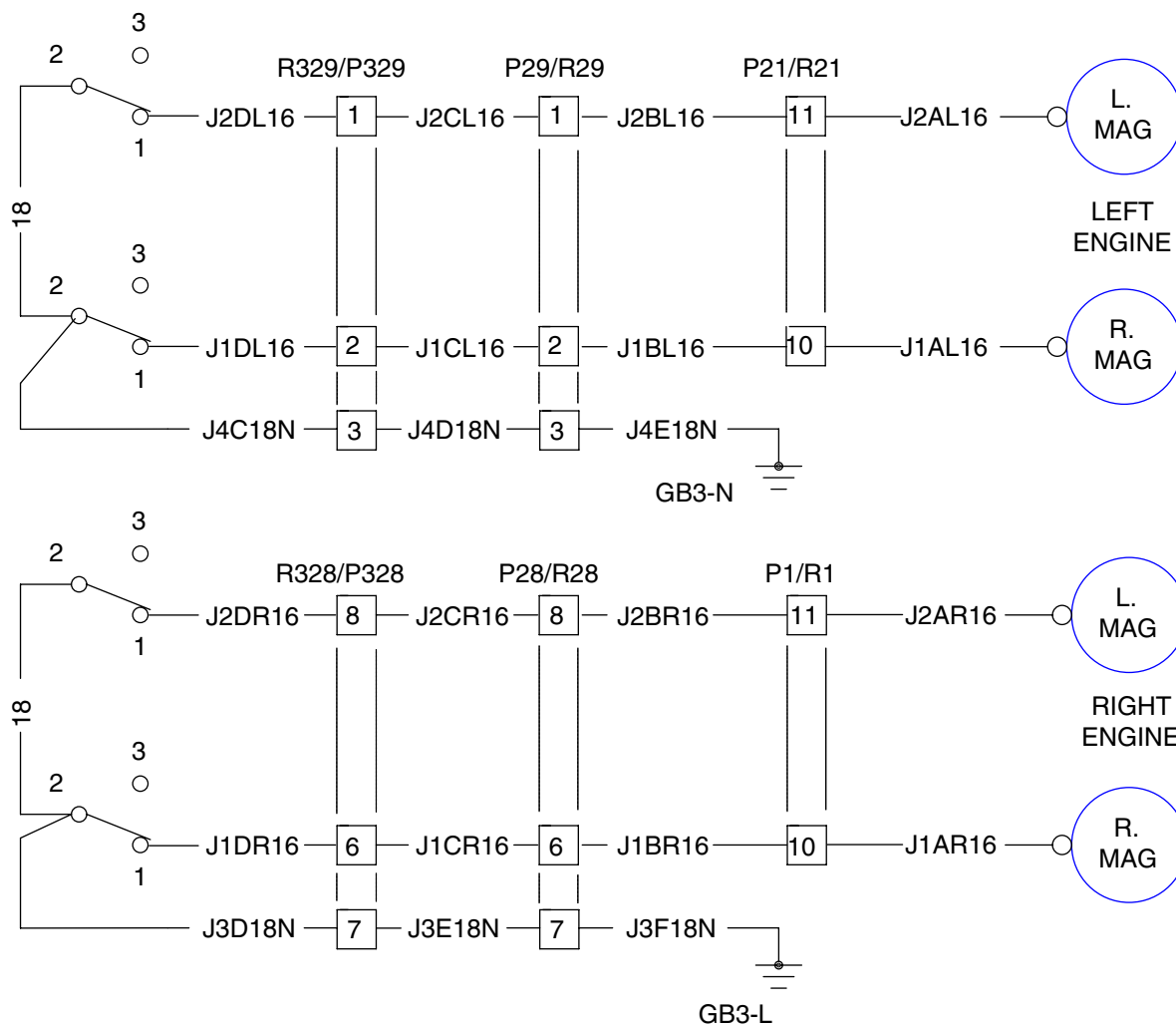


Effectivity
3449001 thru 3449151

Magnetos
Figure 1 (Sheet 2 of 4)

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MAINTENANCE MANUAL

104229 A/C
104368 10.0 NEW/K

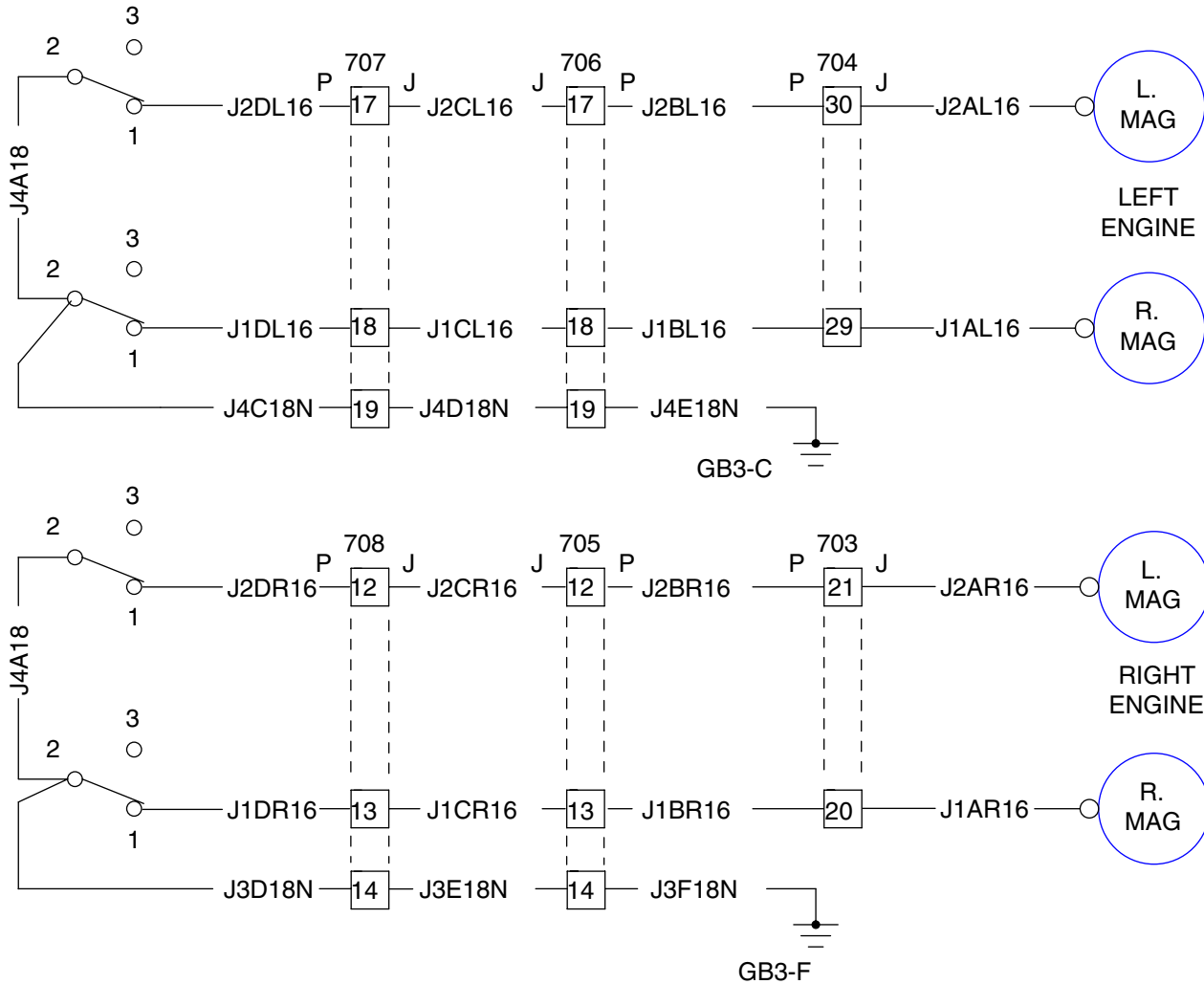


Magnetos
Figure 1 (Sheet 3 of 4)

Effectivity
3449152 & up

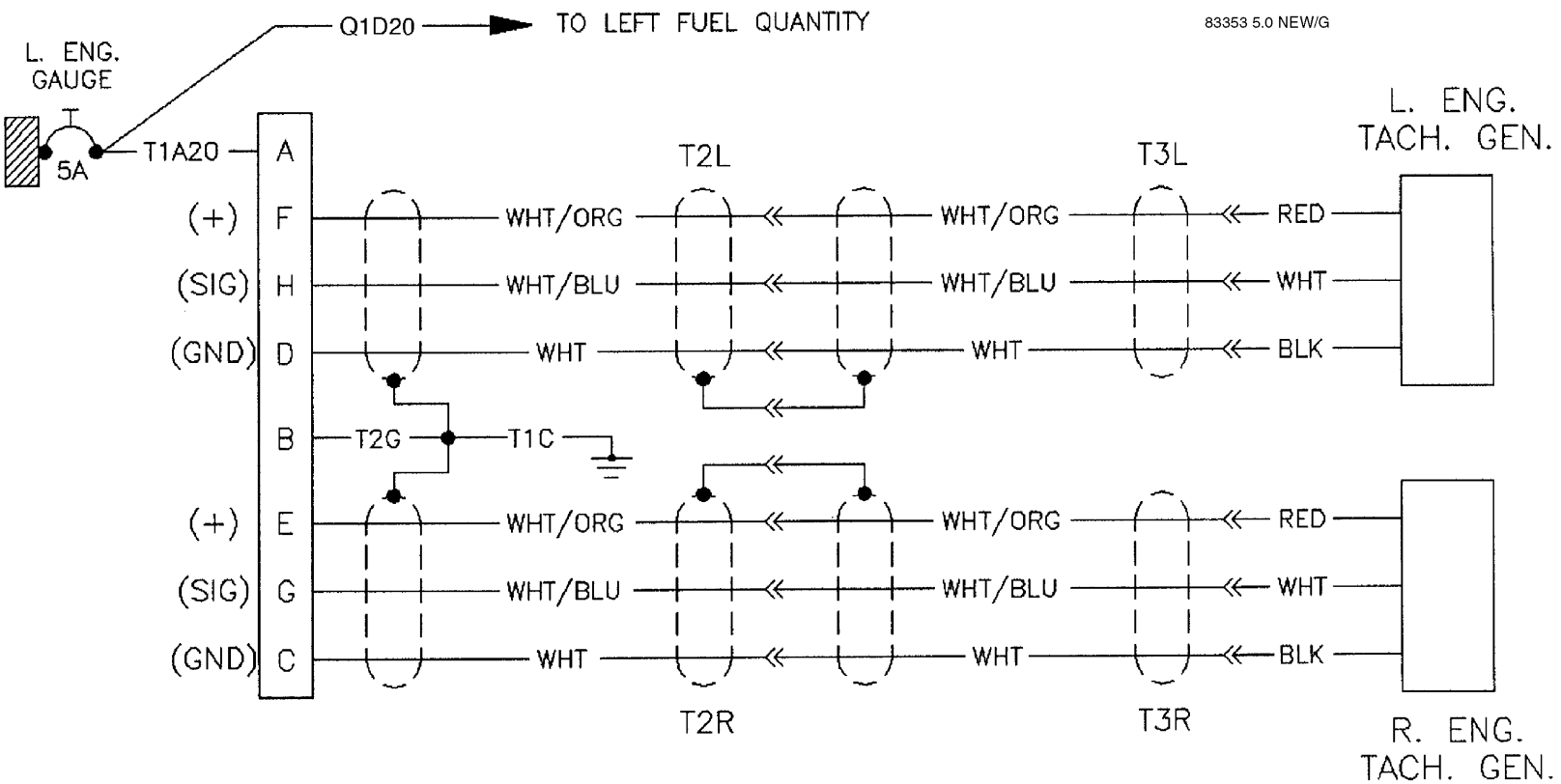
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MAINTENANCE MANUAL

101840 6.1



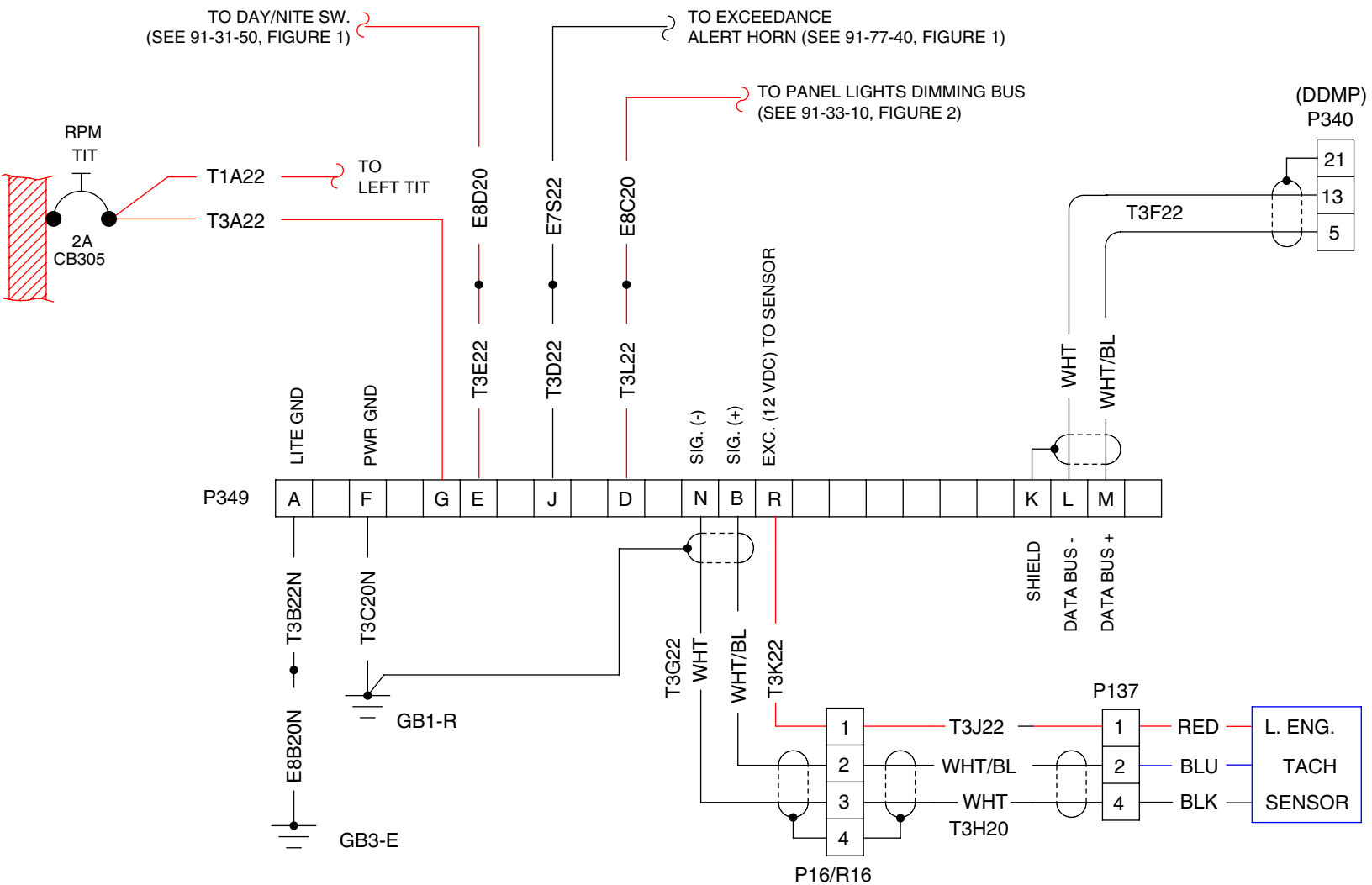
Effectivity
Seneca V
with Avidyne Option

Magnetos
Figure 1 (Sheet 4 of 4)



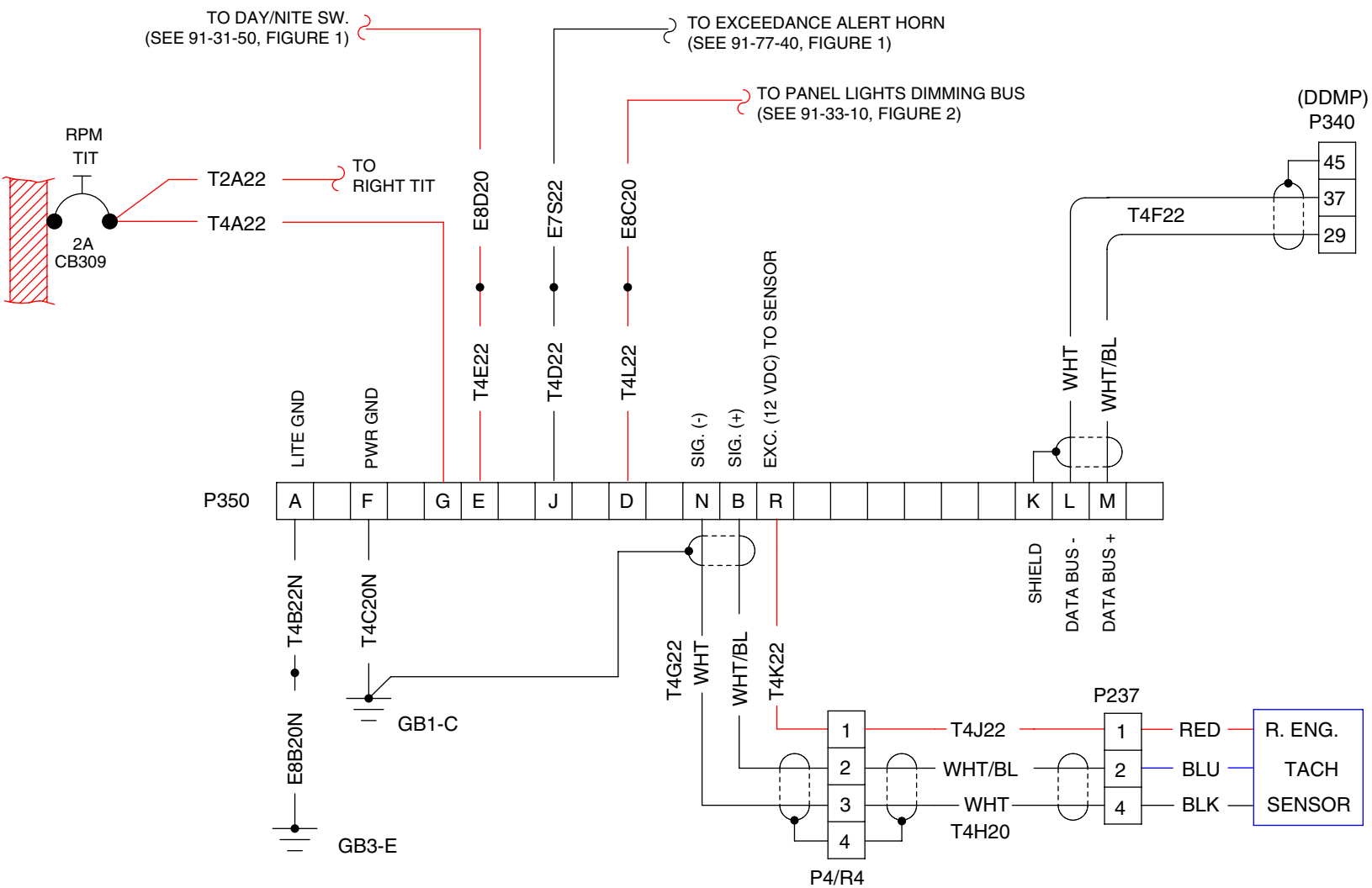
Engine Tachometer
Figure 1 (Sheet 1 of 3)

100651 D/T
101288 NEW/D
104229 NEW/C
104368 36.0 NEW/K



Effectivity
Seneca V - Left
Engine Tachometer
Figure 1 (Sheet 2 of 3)

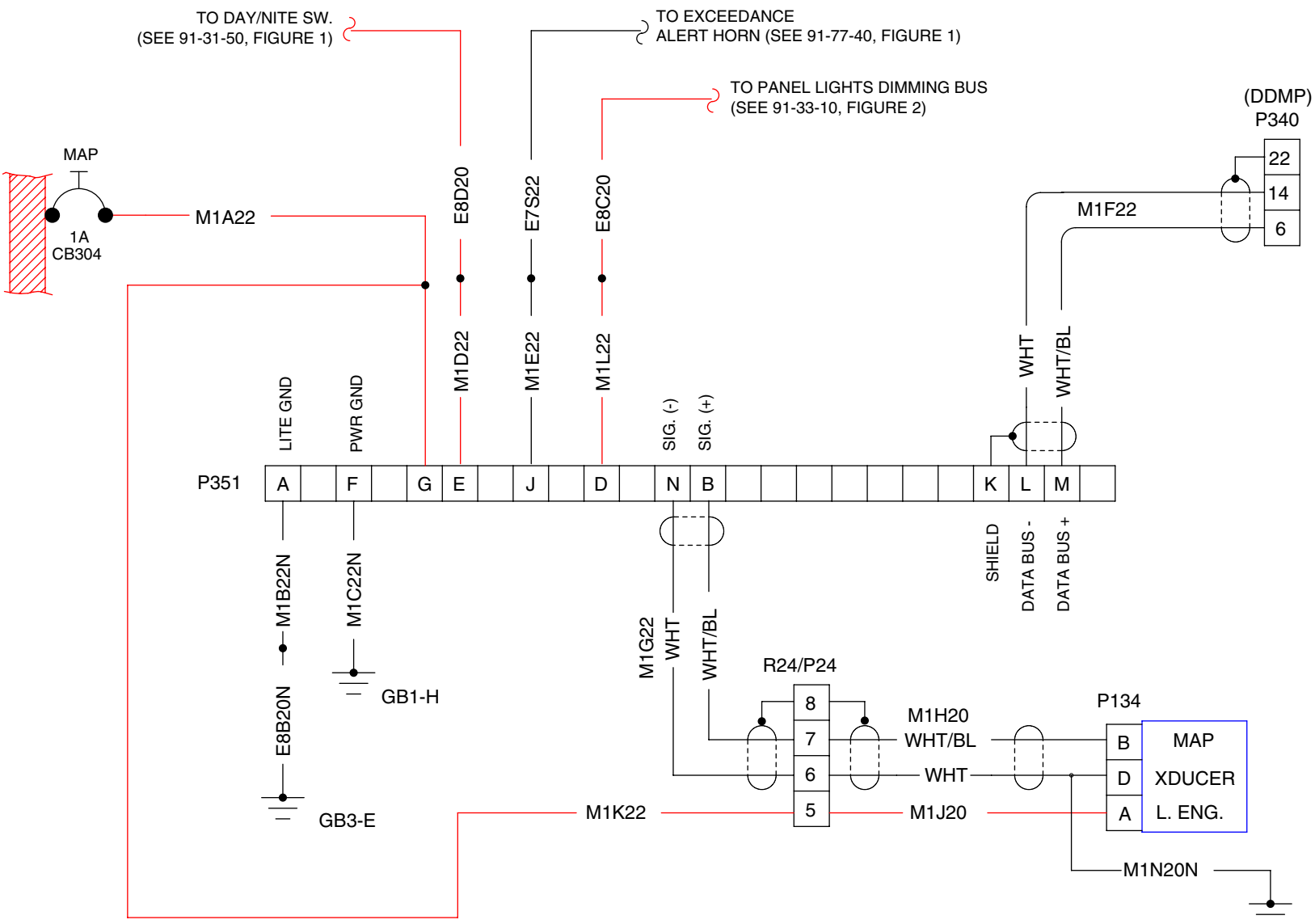
100651 D/T
101288 NEW/D
104229 NEW/C
104368 37.0 NEW/K



Engine Tachometer
Figure 1 (Sheet 3 of 3)

Effectivity
Right - Seneca V

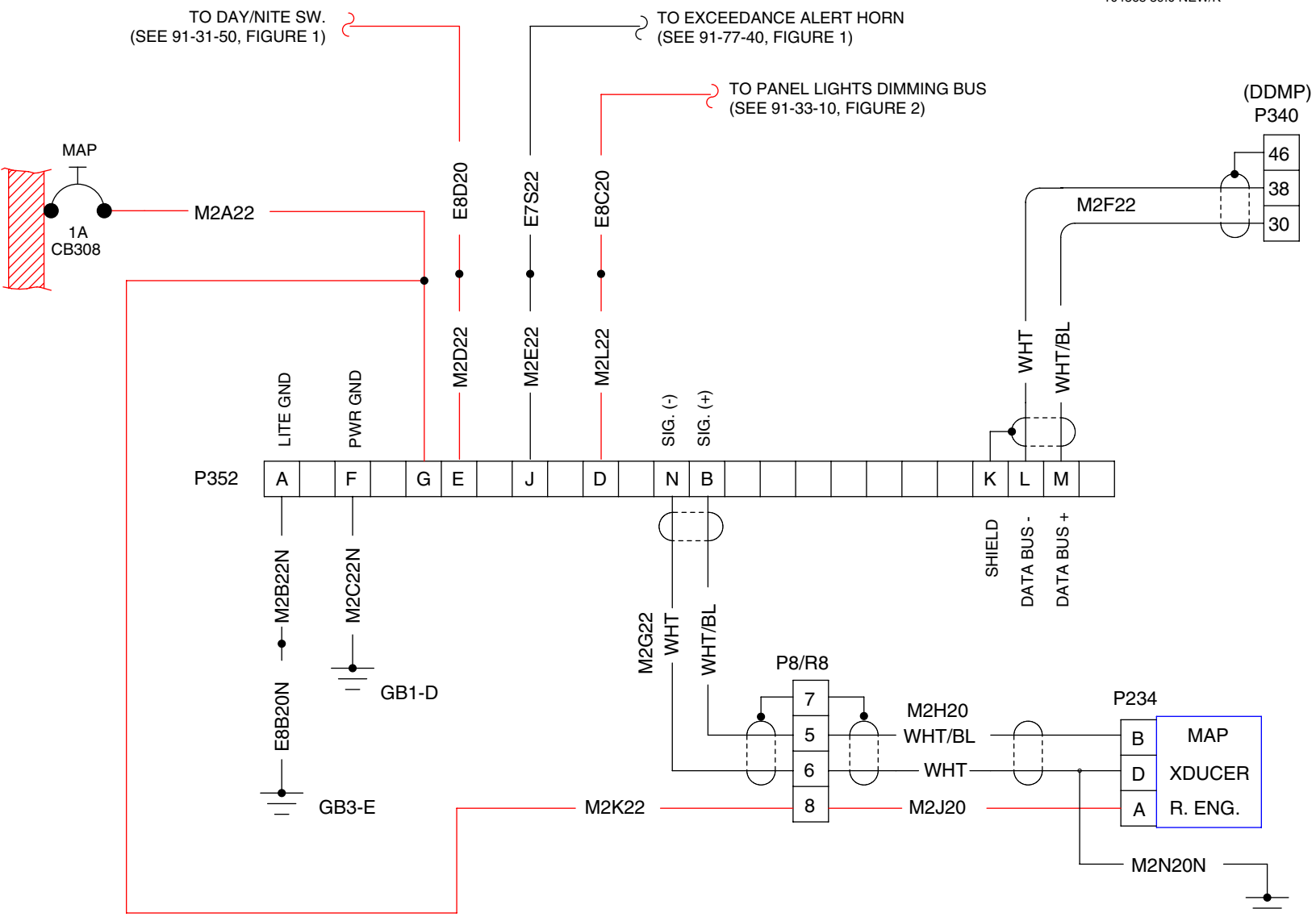
100651 M/T
101288 D
104229 B/C
104368 38.0 NEW/K



Effectivity
Seneca V - Left

Engine Manifold Pressure
Figure 2 (Sheet 1 of 2)

100651 M/T
101288 D
104229 B/C
104368 39.0 NEW/K



Engine Manifold Pressure
Figure 2 (Sheet 2 of 2)

Effectivity
Right - Seneca V

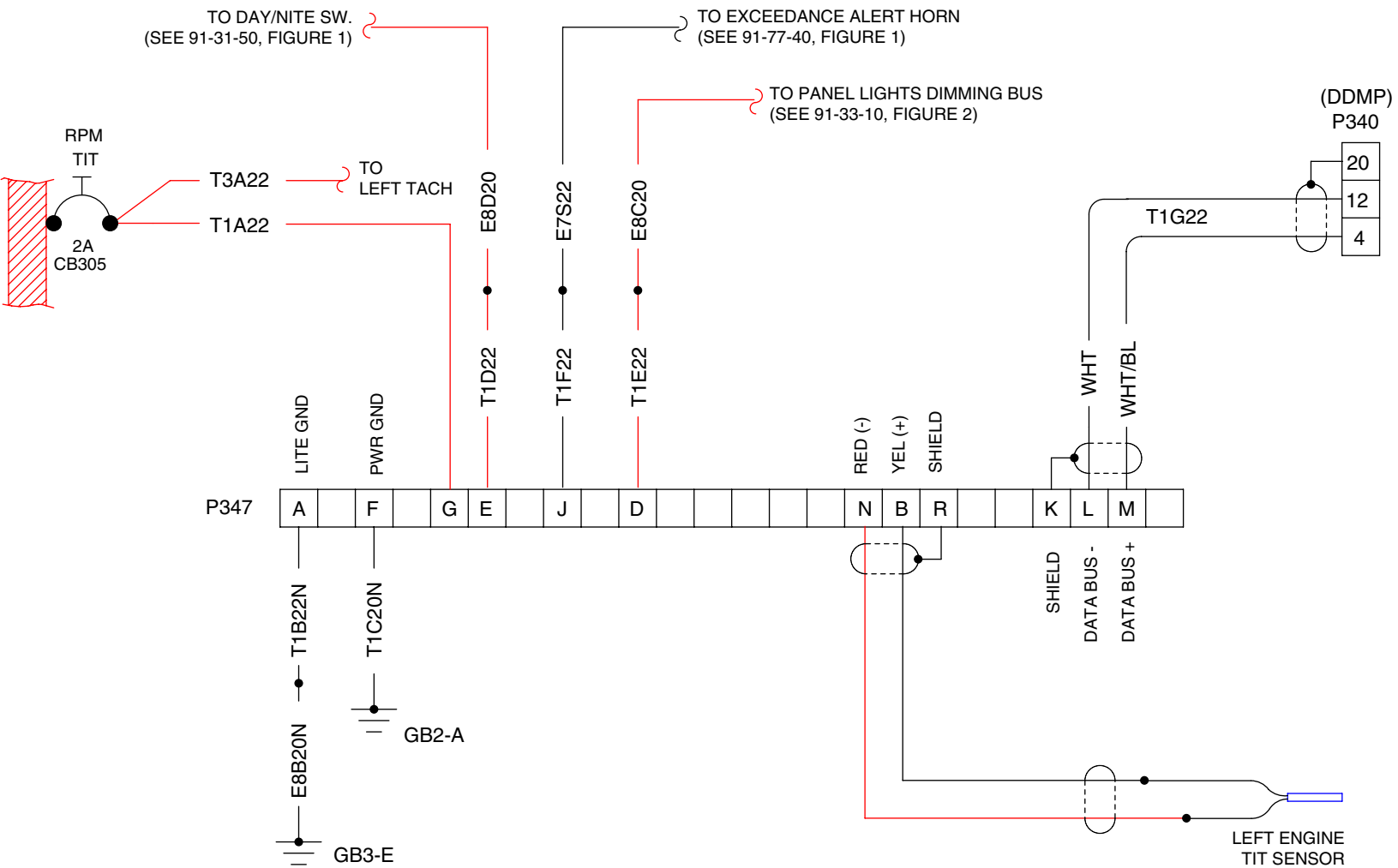
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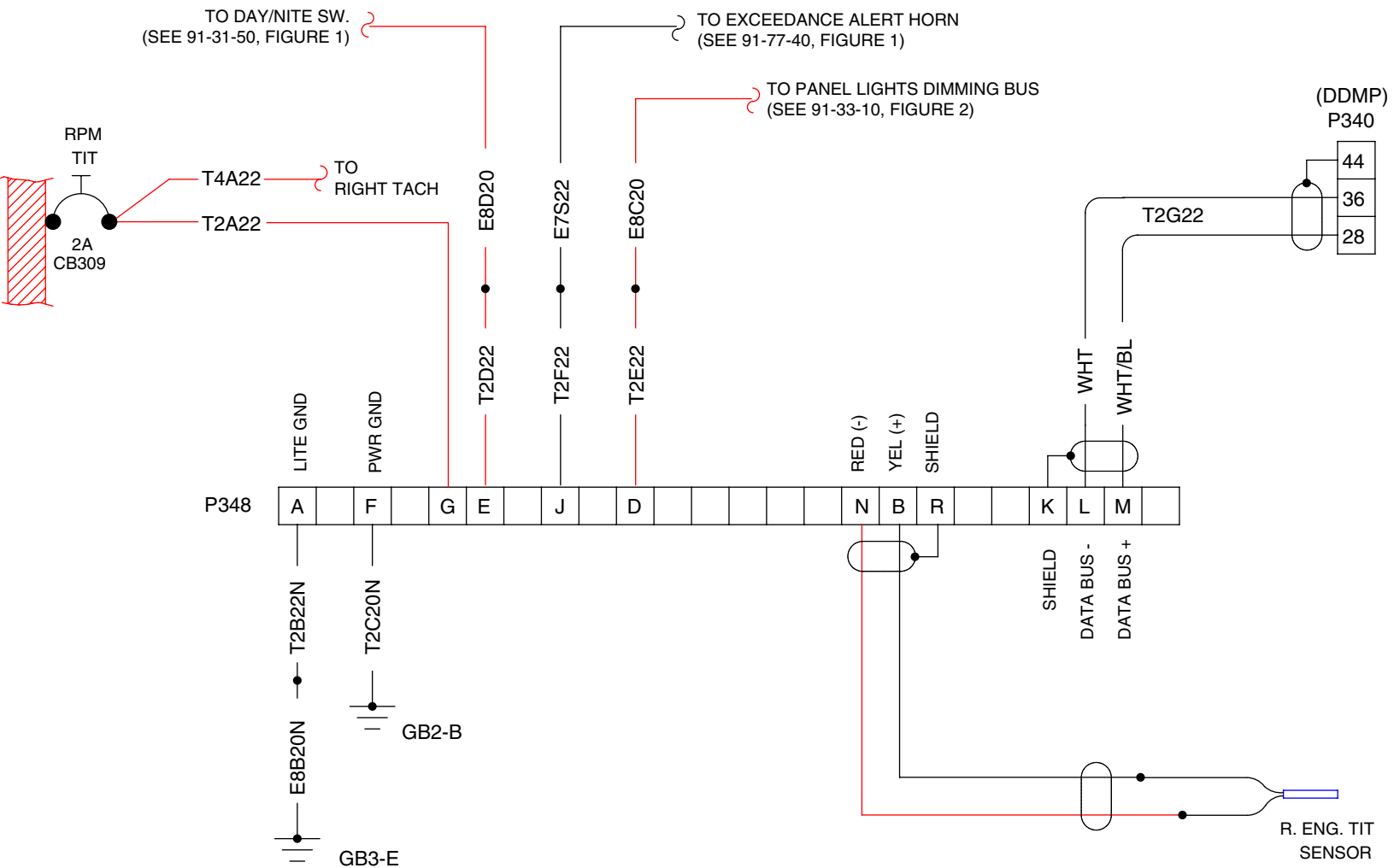
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100651 B/T
101288 NEW/D
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104368 34.0 NEW/K



Effectivity
Seneca V - Left
Turbine Inlet Temperature
Figure 1 (Sheet 1 of 2)

100651 B/T
101288 NEW/D
104229 NEW/C
104368 35.0 NEW/K



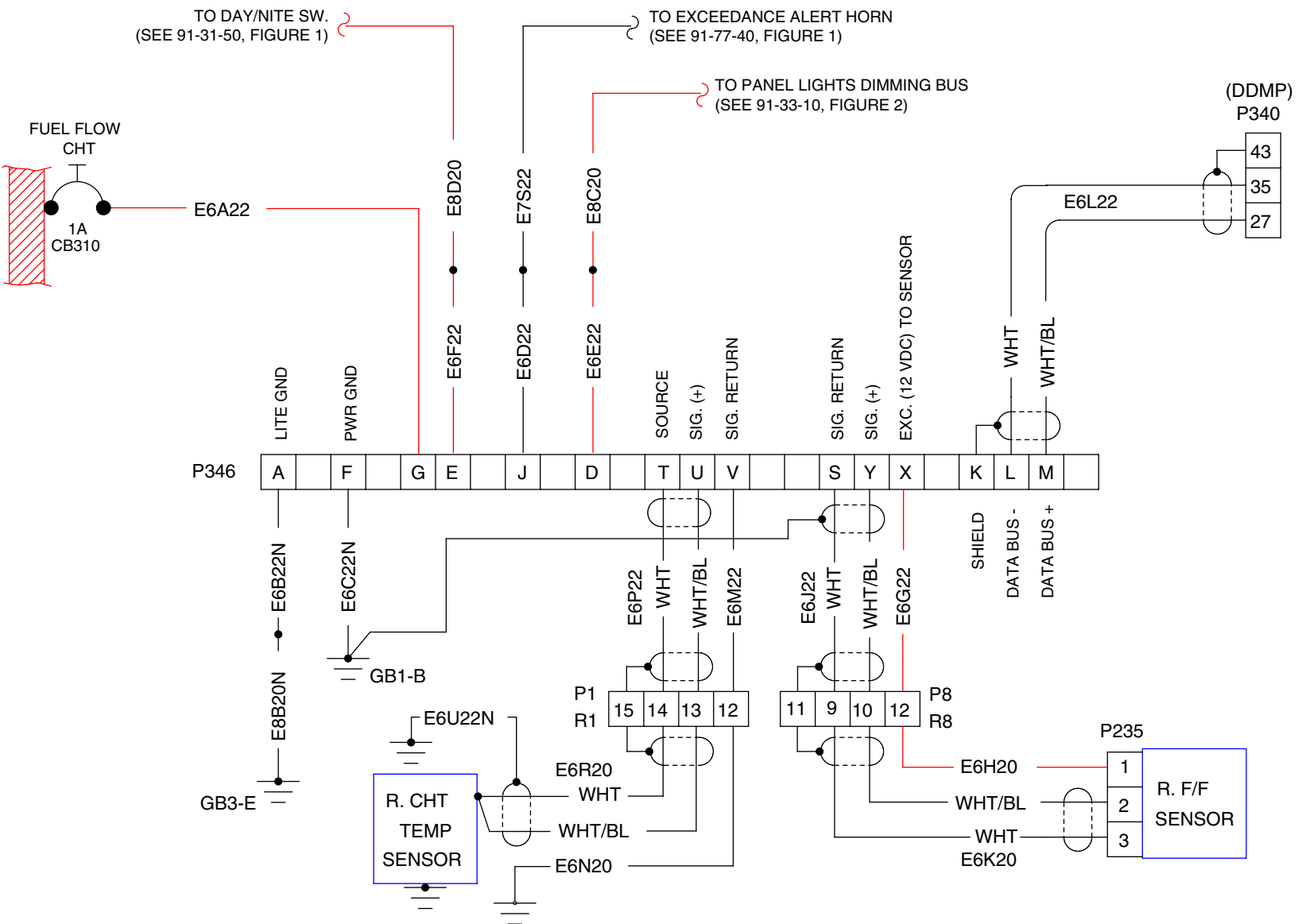
Turbine Inlet Temperature
Figure 1 (Sheet 2 of 2)

Effectivity
Right - Seneca V



Engine Fuel Flow / Cylinder Head Temperature
Figure 2 (Sheet 1 of 2)

100651 S/T
101288 C/D
104229 NEW/C
104368 41.0 NEW/K



Engine Fuel Flow / Cylinder Head Temperature
Figure 2 (Sheet 2 of 2)

Effectivity
Right - Seneca V

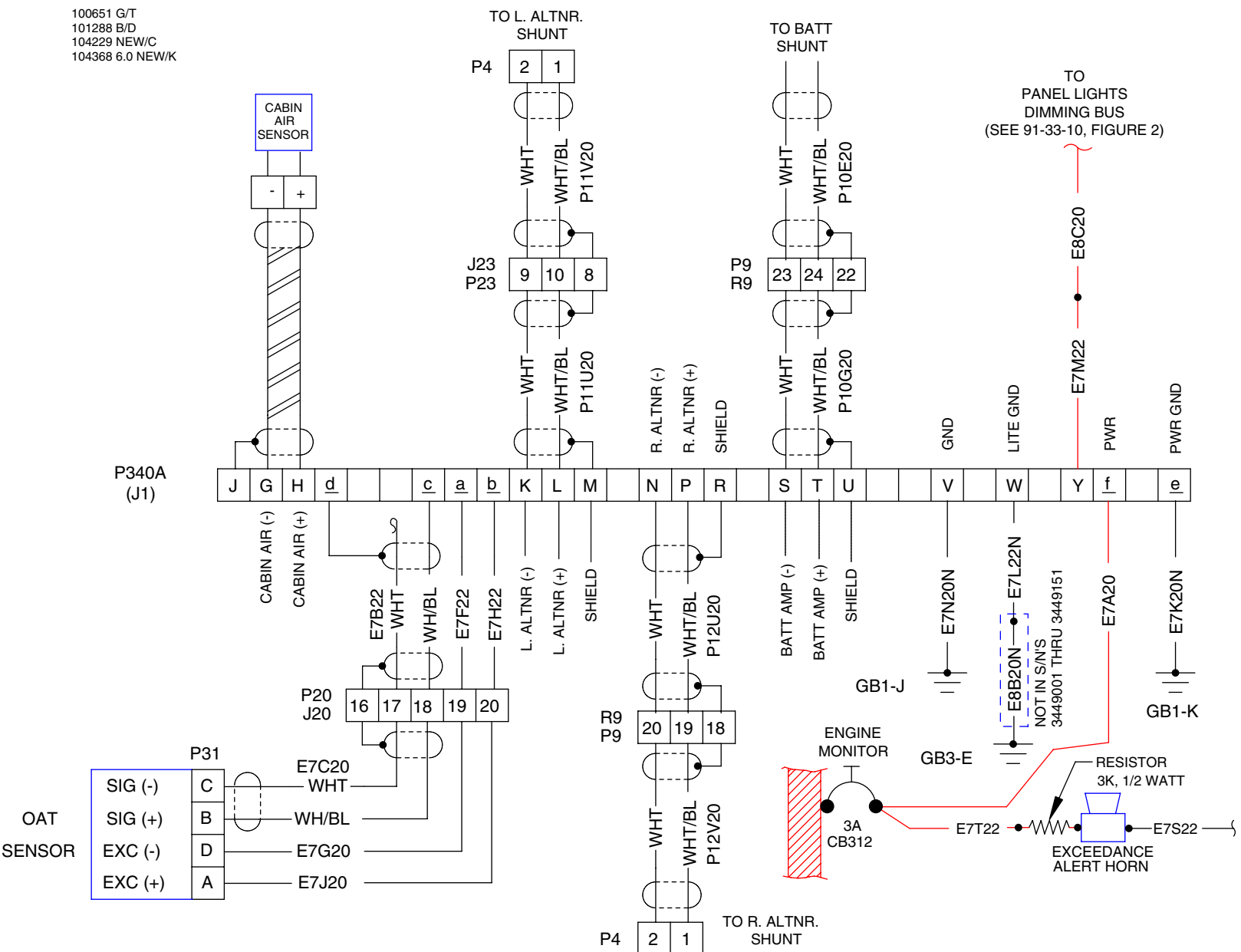
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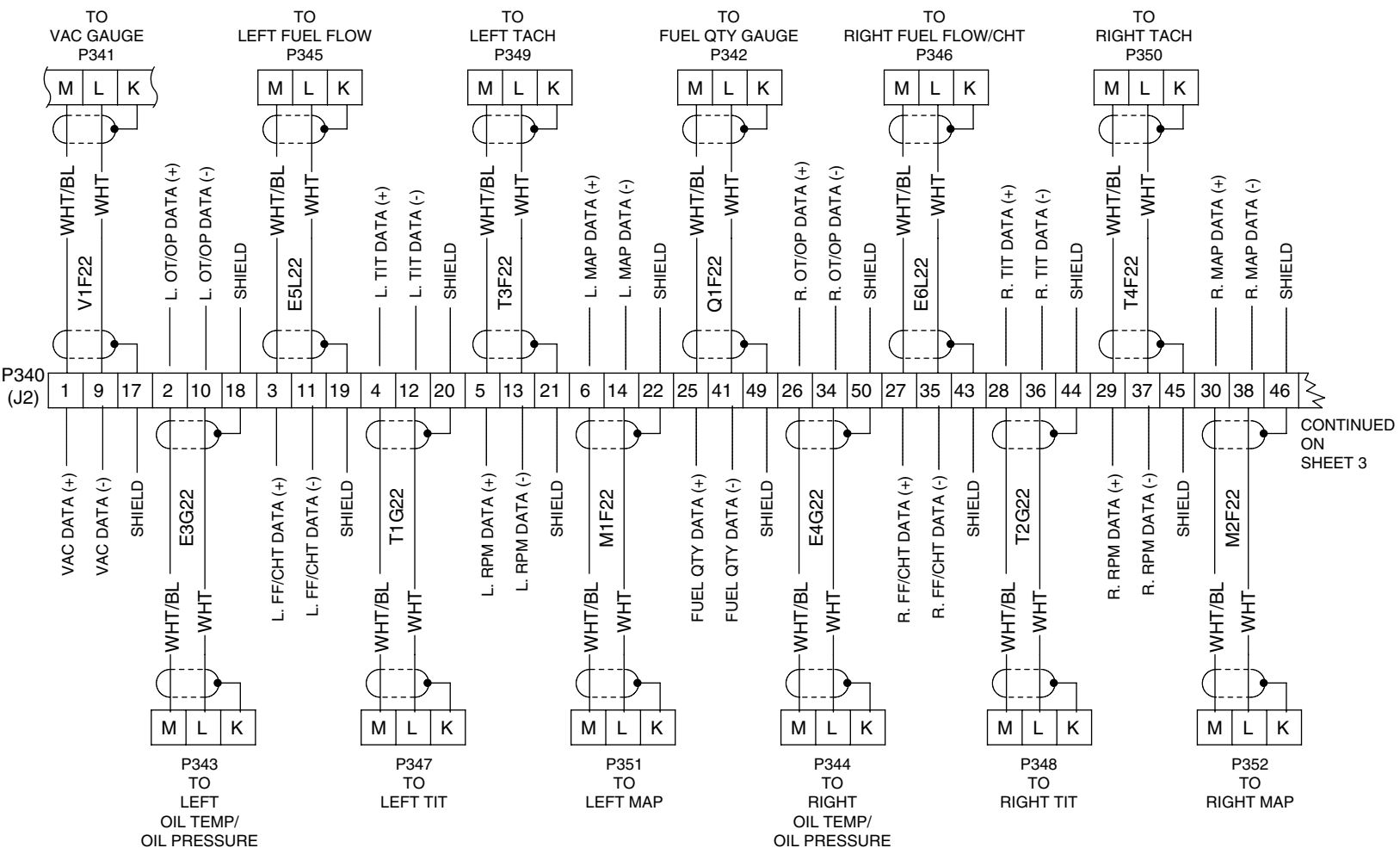
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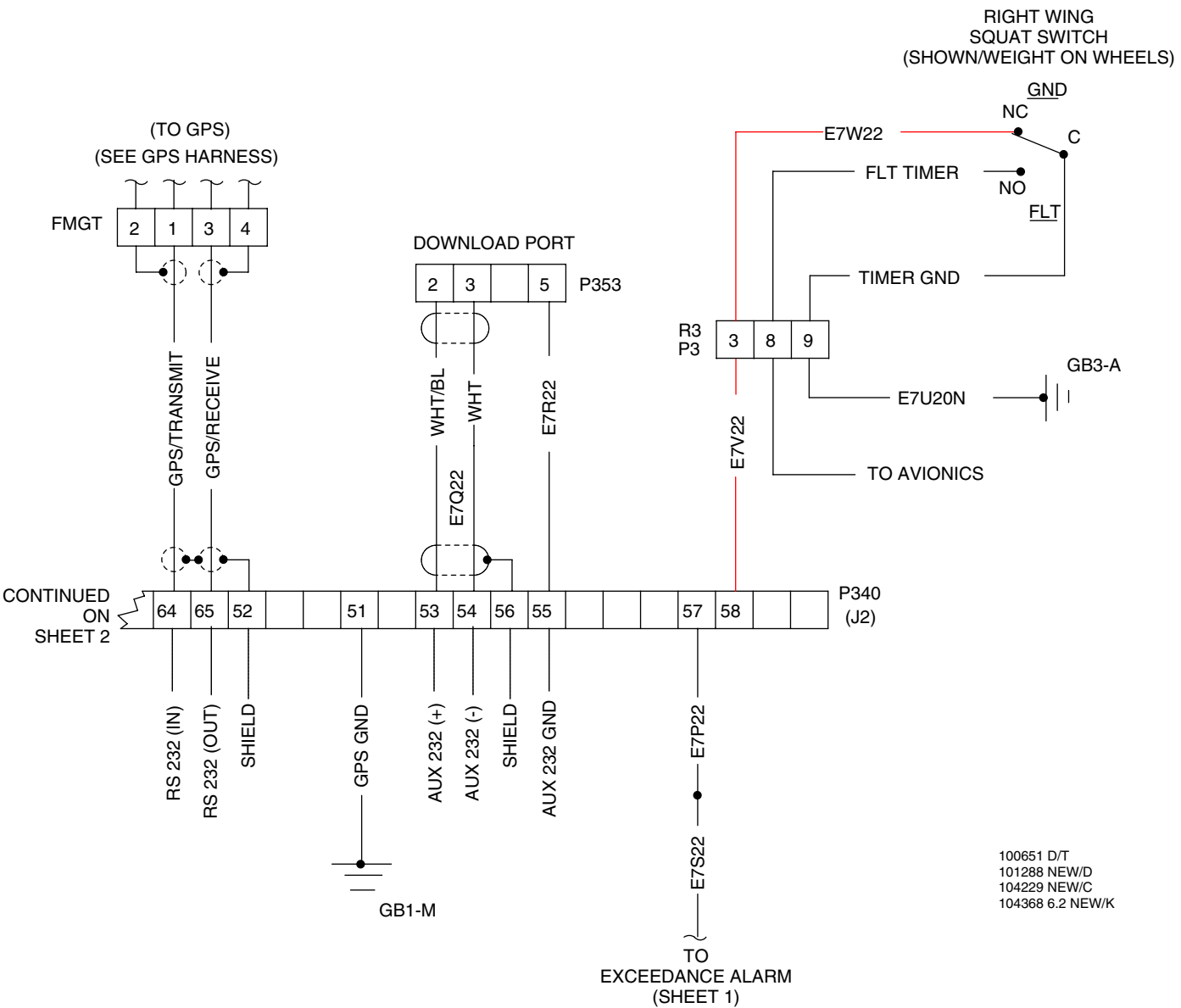
Engine Digital Display Monitoring Panel (DDMP)
Figure 1 (Sheet 1 of 3)



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101288 NEW/D
104229 NEW/C
104368 6.1 NEW/K

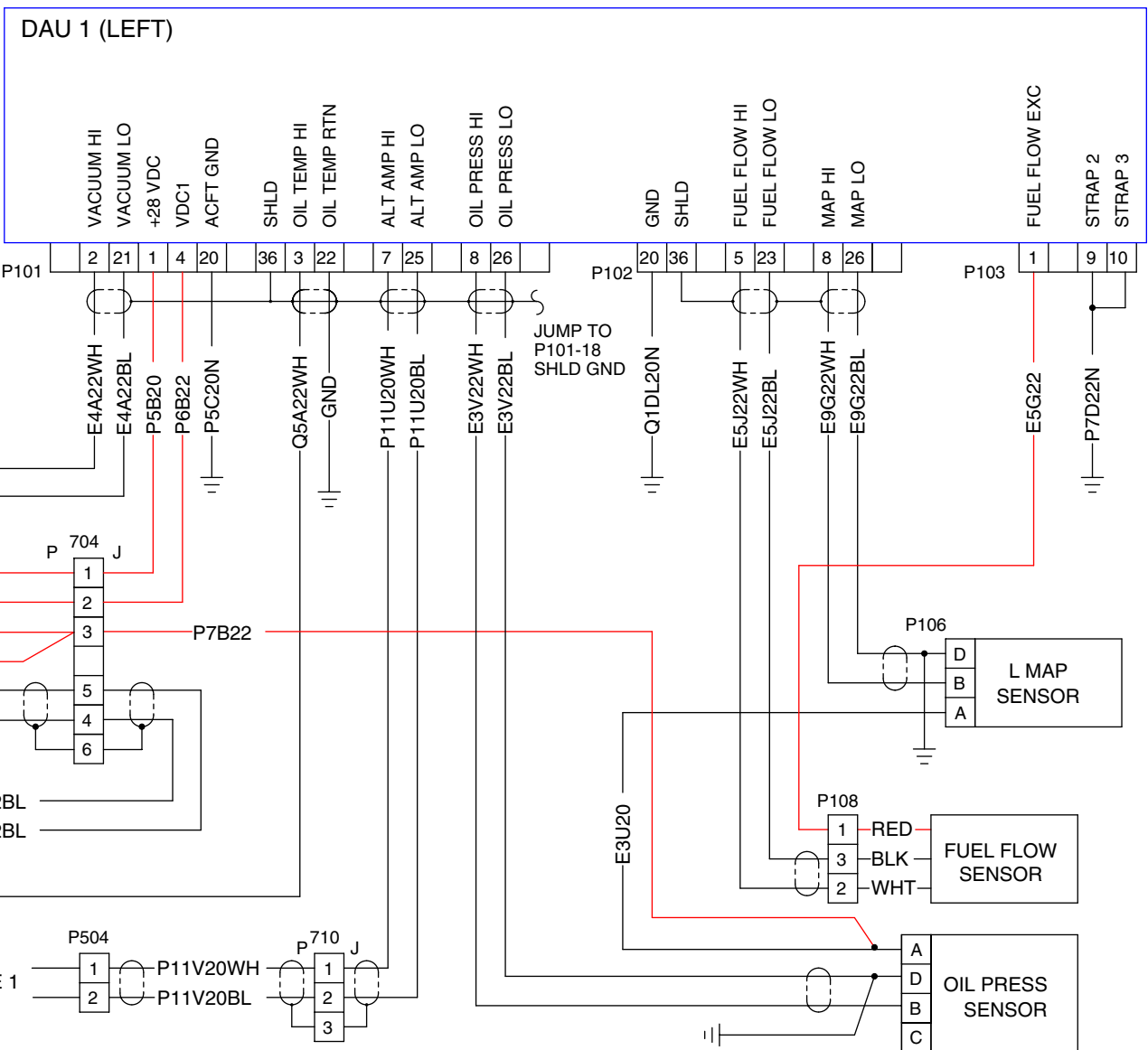


Engine Digital Display Monitoring Panel (DDMP)
Figure 1 (Sheet 2 of 3)



Effectivity
Seneca V

Engine Digital Display Monitoring Panel (DDMP)
Figure 1 (Sheet 3 of 3)

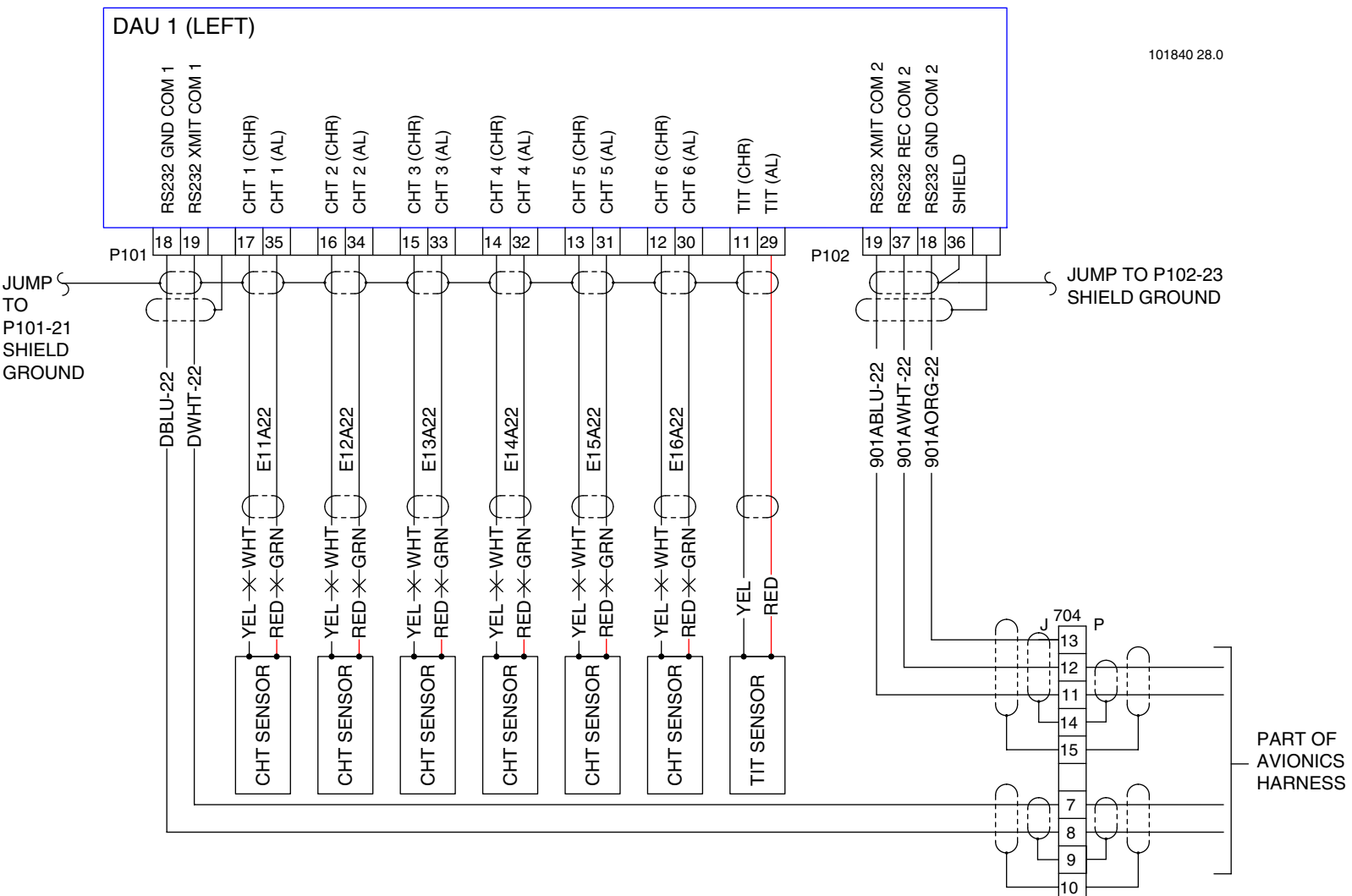


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Data Acquisition Units (DAU's)
Figure 2 (Sheet 1 of 6)

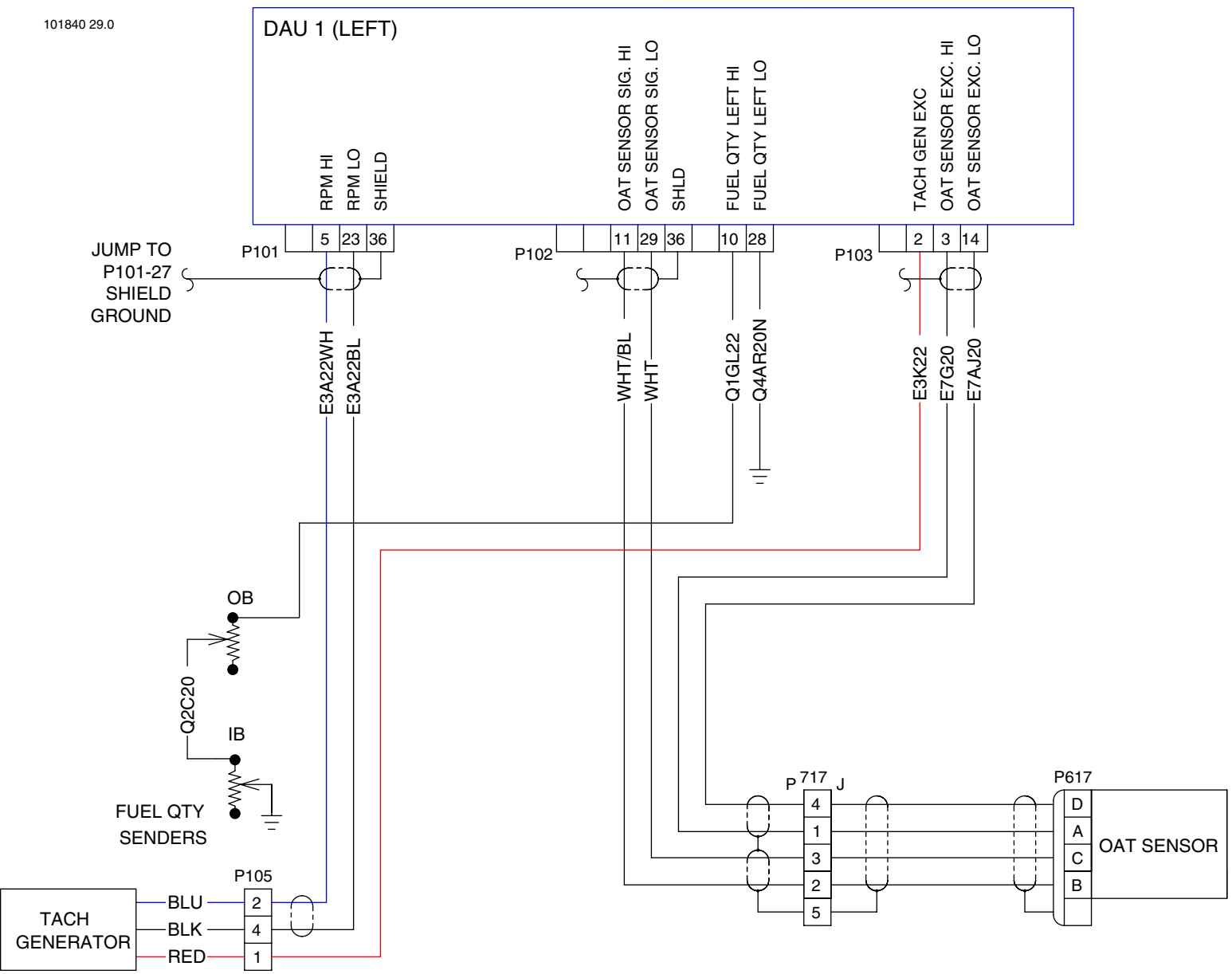
Effectivity
Seneca V
with Avidyne Option

101840 28.0



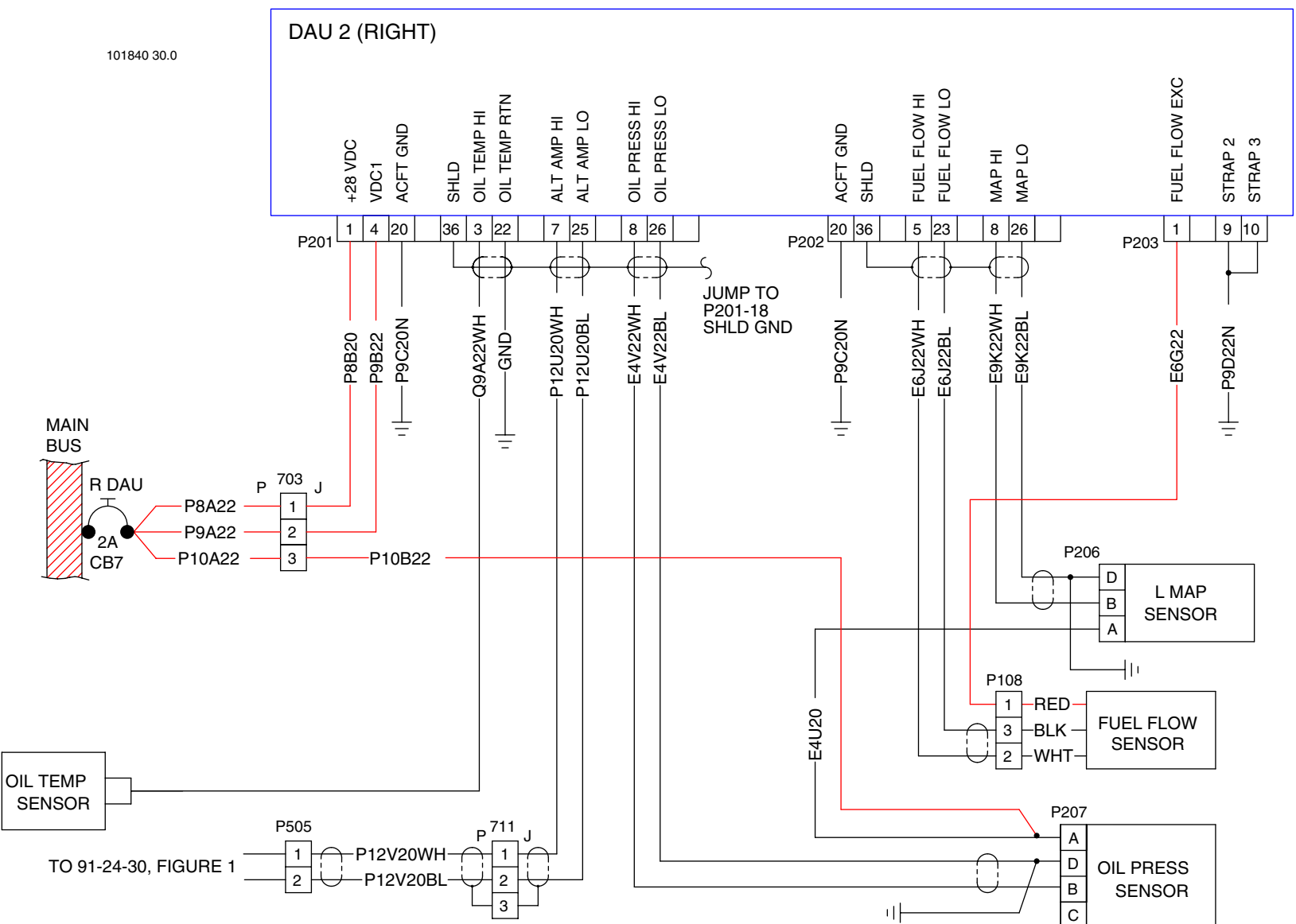
Effectivity
Seneca V
with Avidyne Option

Data Acquisition Units (DAU's)
Figure 2 (Sheet 2 of 6)



Data Acquisition Units (DAU's)
Figure 2 (Sheet 3 of 6)

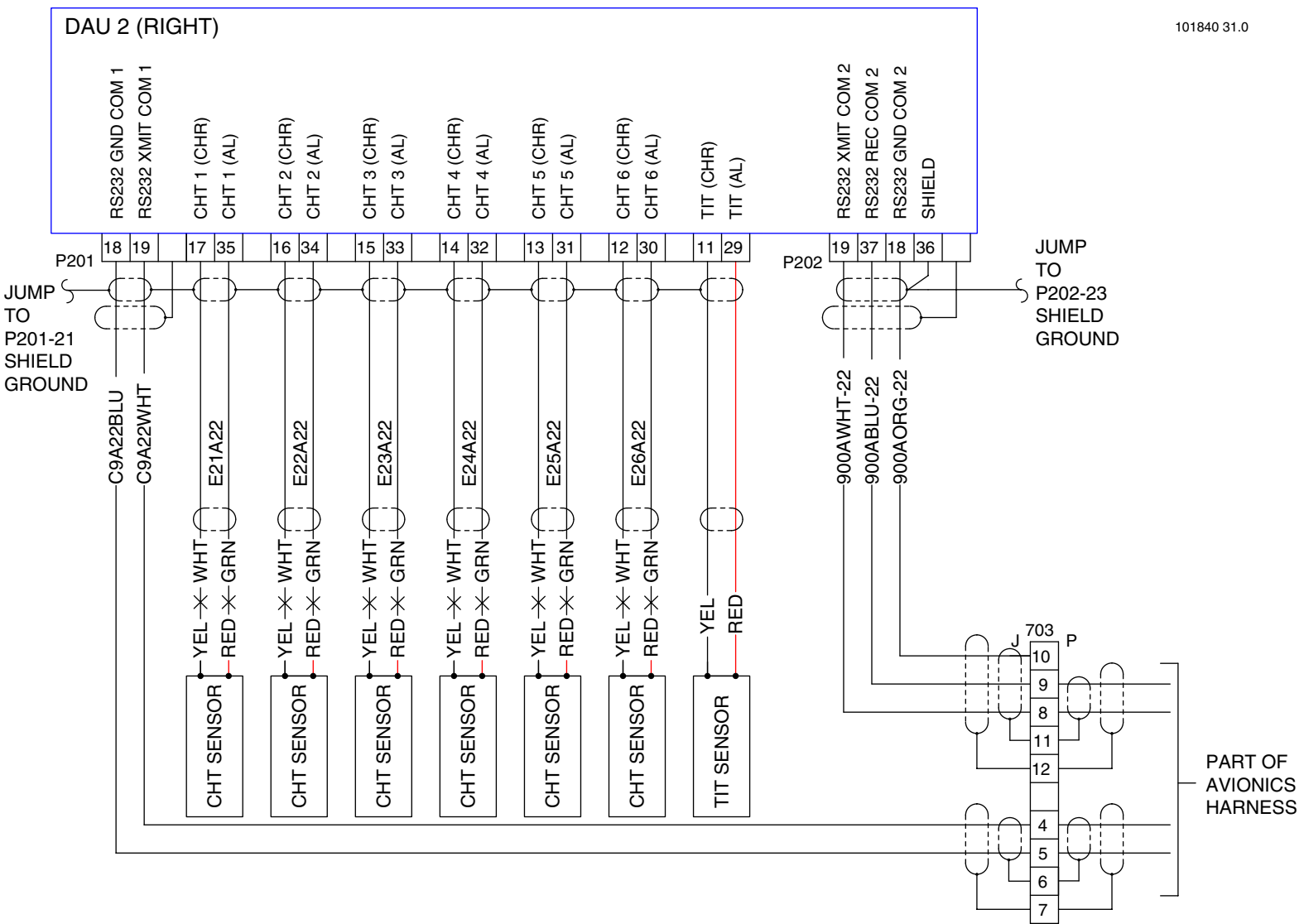
Effectivity
Seneca V
with Avidyne Option



Effectivity
Seneca V
with Avidyne Option

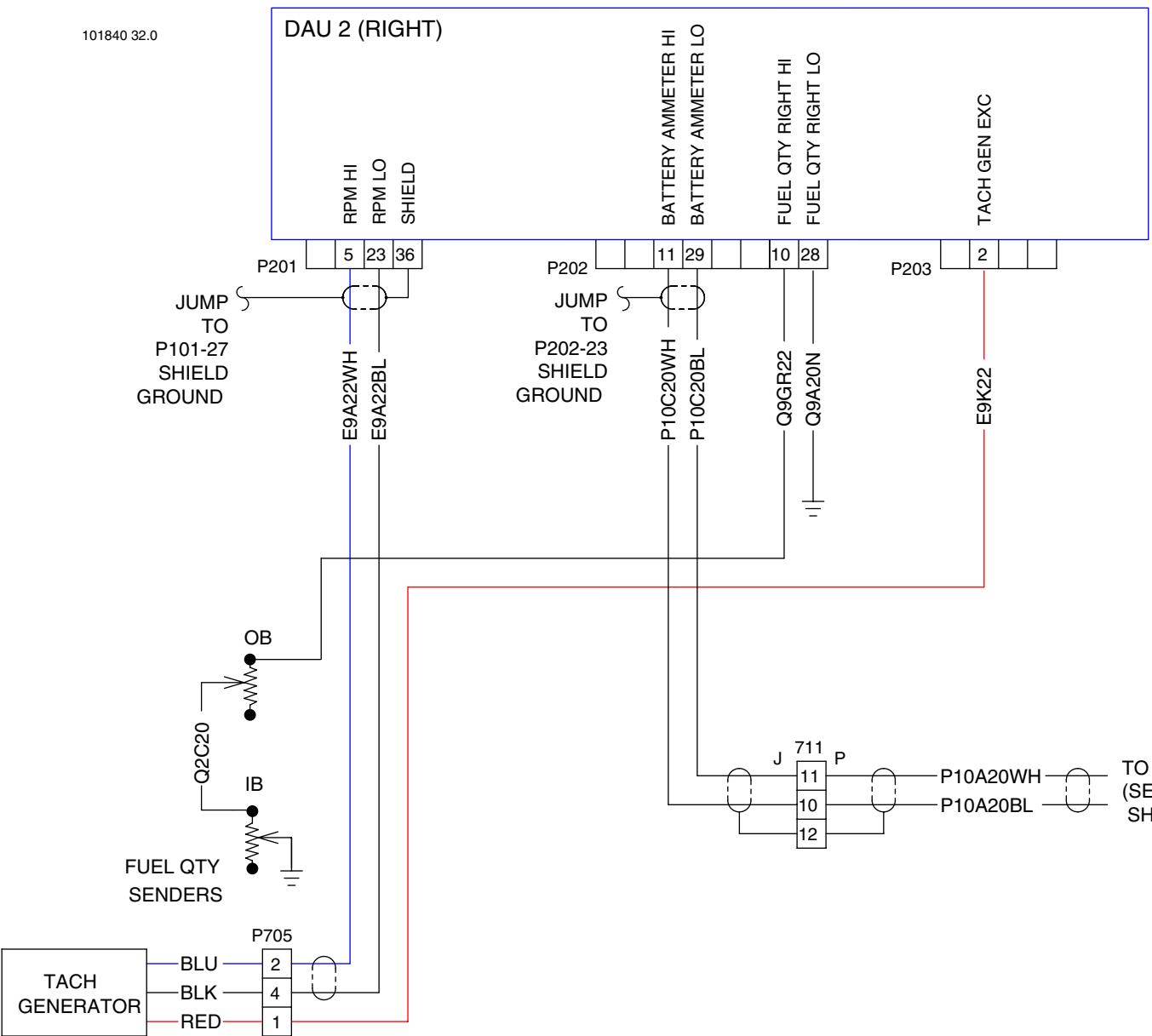
Data Acquisition Units (DAU's)
Figure 2 (Sheet 4 of 6)

101840 31.0



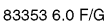
Data Acquisition Units (DAU's)
Figure 2 (Sheet 5 of 6)

Effectivity
Seneca V
with Avidyne Option



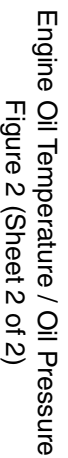
Effectivity
Seneca V
with Avidyne Option

Data Acquisition Units (DAU's)
Figure 2 (Sheet 6 of 6)



Effectivity

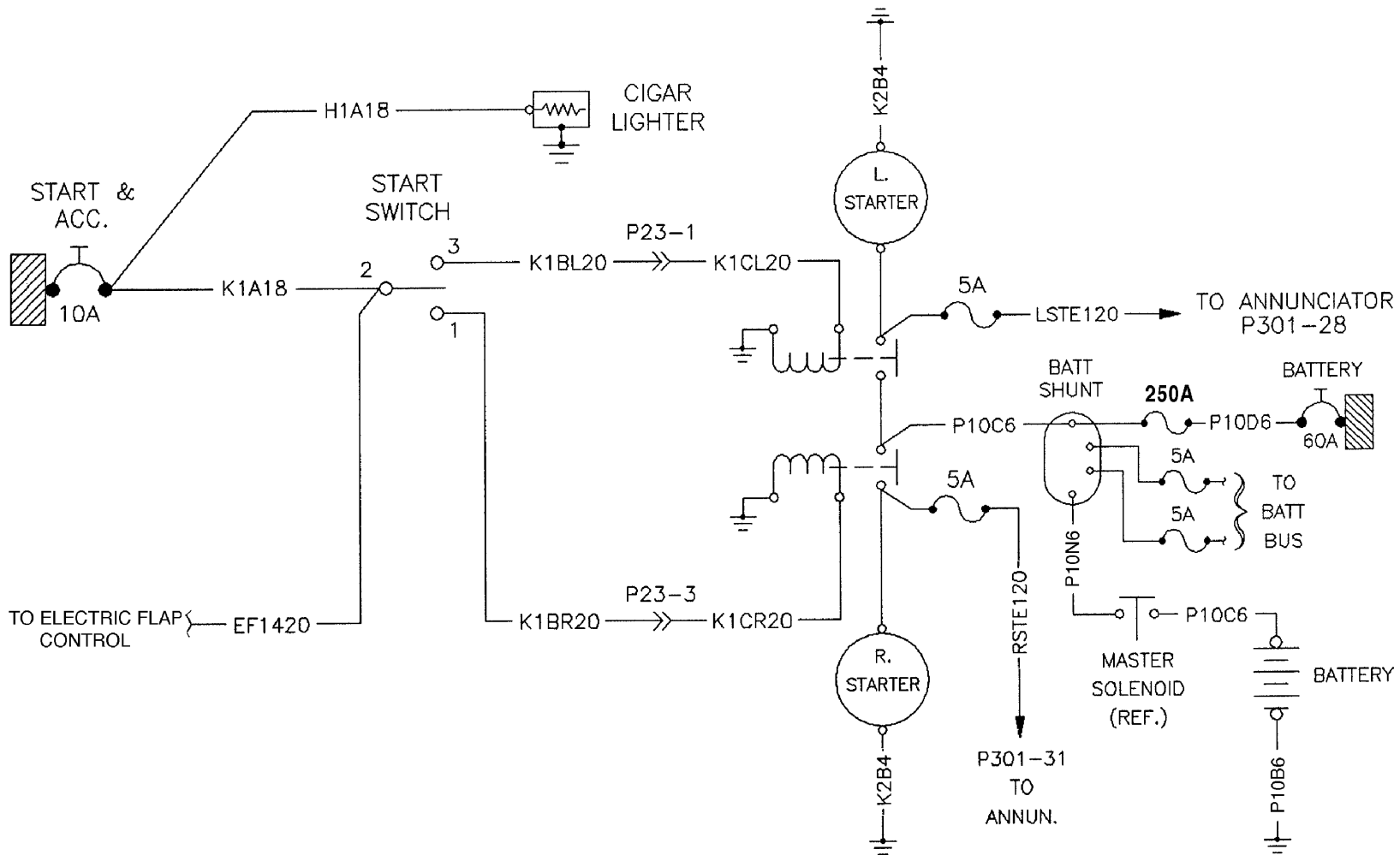




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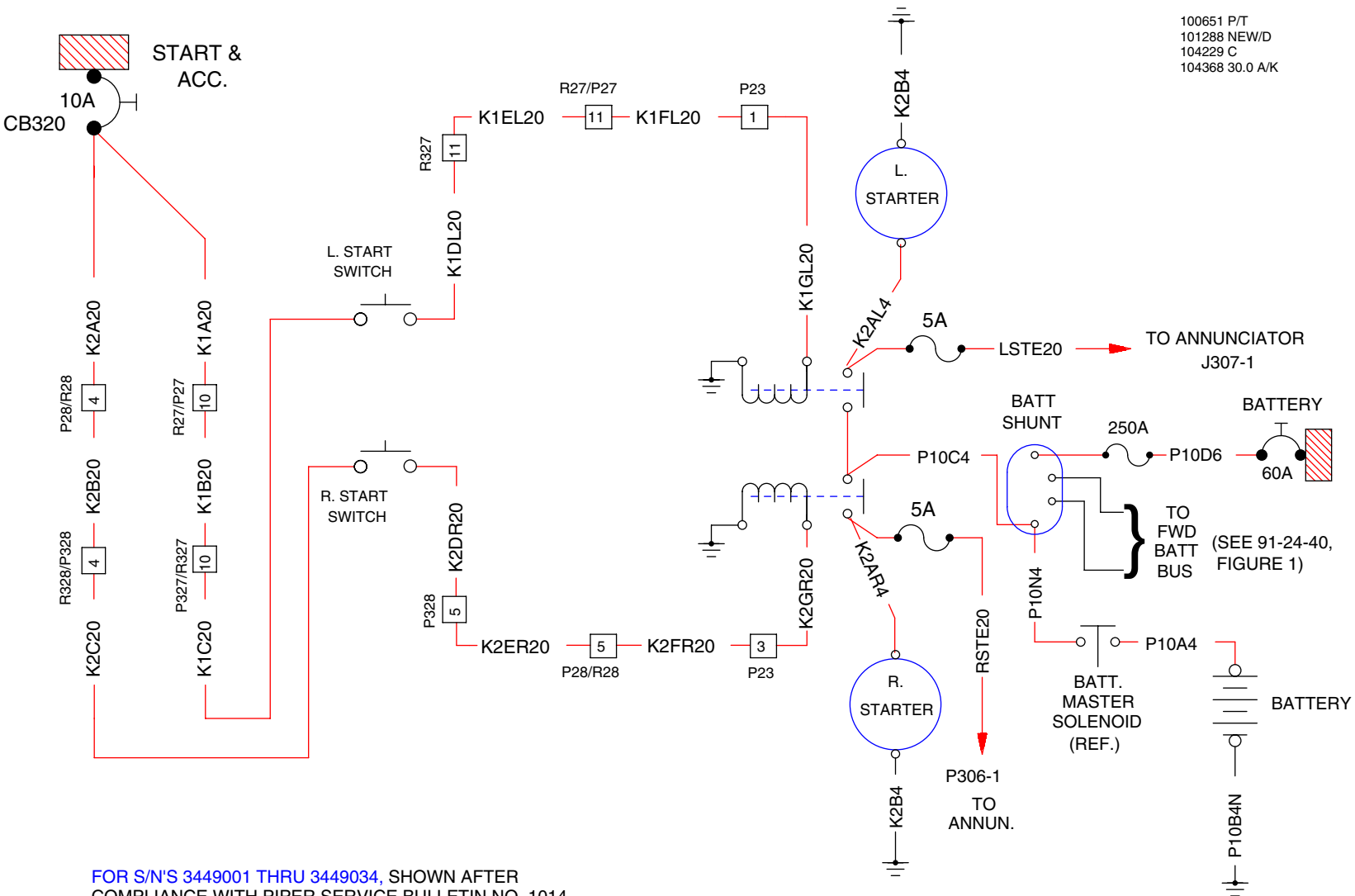
83353 30.0 F/G



SHOWN AFTER COMPLIANCE WITH PIPER SERVICE BULLETIN NO. 1014

Starter and Accessories
Figure 1 (Sheet 1 of 3)

100651 P/T
101288 NEW/D
104229 C
104368 30.0 A/K

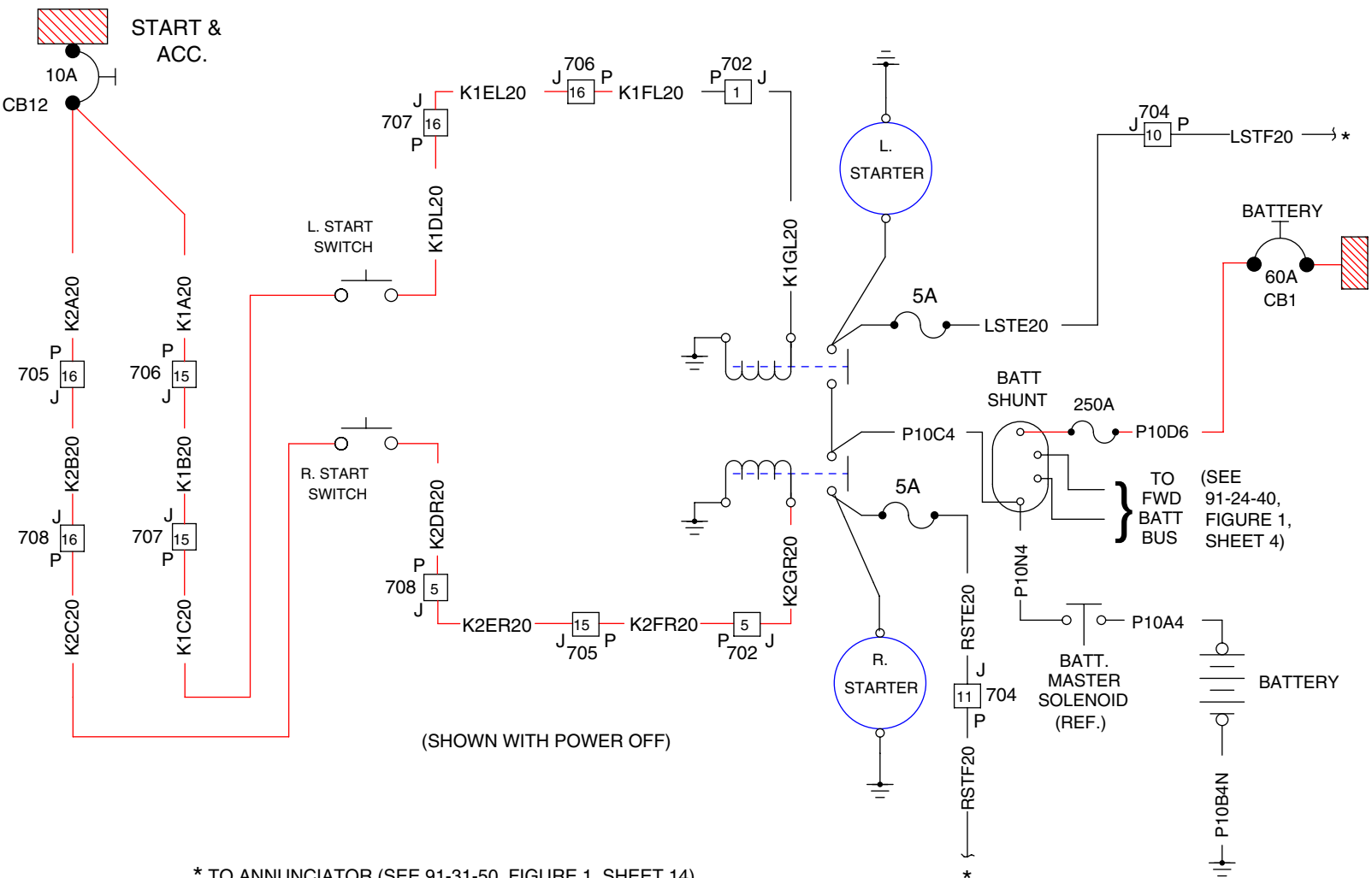


FOR S/N'S 3449001 THRU 3449034, SHOWN AFTER
COMPLIANCE WITH PIPER SERVICE BULLETIN NO. 1014.

Effectivity
Seneca V

Starter and Accessories
Figure 1 (Sheet 2 of 3)

101840 23.0



* TO ANNUNCIATOR (SEE 91-31-50, FIGURE 1, SHEET 14)

Starter and Accessories
Figure 1 (Sheet 3 of 3)

Effectivity
Seneca V
with Avidyne Option

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CHAPTER

95

SPECIAL PURPOSE EQUIPMENT

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CHAPTER 95

LIST OF EFFECTIVE PAGES

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Effective Pages	2	Aug 19/05			
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CHAPTER 95 - SPECIAL PURPOSE EQUIPMENT

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Control Surface Balancing Tool		2	7L4
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Aileron Bellcrank Rigging Tool		2	7L4
Rudder Rigging Tool		2	7L4
Flap Rigging Tool		2	7L4
Stabilator Rigging Tool		2	7L4
Heater Plug Gap Adjustment Tool		2	7L4

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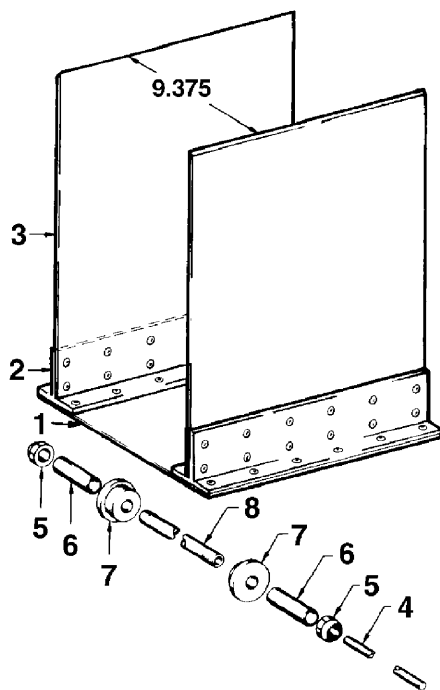
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GENERAL

1. Tire Balancer (See Figure 1.)

A useful tire balancing fixture can be built as follows: (Text keyed to Figure 1.)

- A. Chamfer top edges of -3 sides, leaving 1/16 inch flat on top of the inboard edge. Rivet -2 tee's to -3 sides using AN 470-AD5 rivets, with 2 inch spacing, and using AN 426-AD5 rivets (2 inch center to center) to secure -2 tee's to -1 base. If tee extrusion is unavailable, heavy angle extrusion could be used. -3 sides must be vertical.
- B. The -4 axle must slide through the -8 pipe, the -5 nuts are made by reaming the existing threads in the AN 365-624 nuts with an R drill, then tapping them with a 1/8-27 pipe tap.
- C. The -6 spacers were made from 1/2 inch aluminum tubing, the two lengths of spacers are suitable for balancing most any aircraft wheel.
- D. The -7 bushings may be made from one inch phenolic or aluminum using a 1-1/2 inch hole saw to cut out the smaller bushing and a 1-3/4 hole saw to cut out the larger. By inserting a 1/4 inch long threaded bolt through the pilot hole and securing with a washer and nut, a drill press and file may be used to make the off-set on the bushing. The turned-down part should just slide inside the bearing race and then ream the pilot hole to slide over the -8 pipe threads.
- E. The -8 pipe was made from a piece of 1/8 inch black pipe and threaded with a 1/8-27 pipe die, this will be thread 3 inches in from each end of the pipe.



USE THE FOLLOWING LIST OF MATERIALS TO MAKE THE BALANCER

- 1. 1 EA BASE	12 X 11	0.190 2024 T3 CLAD ALUMINUM ALLOY
- 2. 2 EA TEE	2.5 X 2 X 11	0.190 2024 T4 EXTRUDED ALUMINUM ALLOY
- 3. 2 EA SIDES	14 X 11	0128 2024 T3 CLAD ALUMINUM ALLOY
- 4. 2 EA AXLE	0.125 X 10.25	4130 STEEL, NOMALIZED
- 5. 2 EA NUTS	AN 365-624	
- 6. 2 EA SPACER	0.50 X 2.25	5052-0 ALUMINUM TUBING
2 EA SPACER	0.50 X 1.25	5052-0 ALUMINUM TUBING
- 7. 2 EA BUSHING	1.480 X 1.625 X 1.00	PHENOLIC OR ALUMINUM
2 EA BUSHING	2.240 X 1.37 X 1.00	PHENOLIC OR ALUMINUM
- 8. 1 EA PIPE	1/8 X 9.3	BLACK STEEL PIPE
* 2 EA BEARINGS	SAVE TWO OF EACH SIZE WORN WHEEL BEARINGS FROM PREVIOUS INSPECTIONS.	

Tire Balancing Fixture
Figure 1

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2. Control Surface Balancing Tool (See Figure 2.)

WARNING: ALL CONTROL SURFACES THAT HAVE BEEN REPLACED OR REPAINTED MUST BE BALANCED BEFORE INSTALLATION.

Balancing must be done using a suitable tool capable of measuring unbalance in inch-pounds from centerline of control surface hinge pin. A suggested tool configuration is shown in Figure 2. Other tool configurations may be used, provided accuracy is maintained and recalibration capability is provided.

The tool described in Figure 2 is used as follows:

- A. Ensure that the control surface is in its final flight configuration, static wicks, trim tabs, trim tab pushpull rod and control surface tip (as applicable) should be installed. The surface should be painted and trim/servo tabs should be in the neutral position.

NOTE: Paint is a considerable balance factor. Remove existing paint prior to repainting a control surface.

- B. Place hinge bolts through control surfaces and place control surface on a holding fixture.
- C. Avoiding rivets, place the balancing tool on the control surface with the tool's hinge centerline directly over the hinge line of the control surface.
- D. Adjust the movable trailing edge support to fit the width of the control surface, then tighten the set screw on the trailing edge support.
- E. Adjust the trailing edge support vertically until the beam is parallel with the control surface chordline.
- F. Remove the tool from the control surface and balance the tool itself by adding or removing nuts or washers from the beam balance bolt. When balancing the tool, the movable weight must be at the bar's hinge centerline.
- G. After balancing tool, reattach it to the control surface, but keep the beam positioned 90 degrees from the control surface hinge line.
- H. Determine balance control surface by sliding movable weight along the balance beam.
- I. Read the scale when the bubble in the level has been centered. Since the movable weight weighs three pounds, every inch it is moved from the center of the beam equals three inch-pounds of force.

3. Baggage Door Lock Tool

A suitable tool can be fabricated as shown in Figure 3.

4. Aileron Bellcrank Rigging Tool

A suitable tool can be fabricated as shown in Figure 4.

5. Rudder Rigging Tool

A suitable tool can be fabricated as shown in Figure 5.

6. Flap Rigging Tool

A suitable tool can be fabricated as shown in Figure 6.

7. Stabilator Rigging Tool

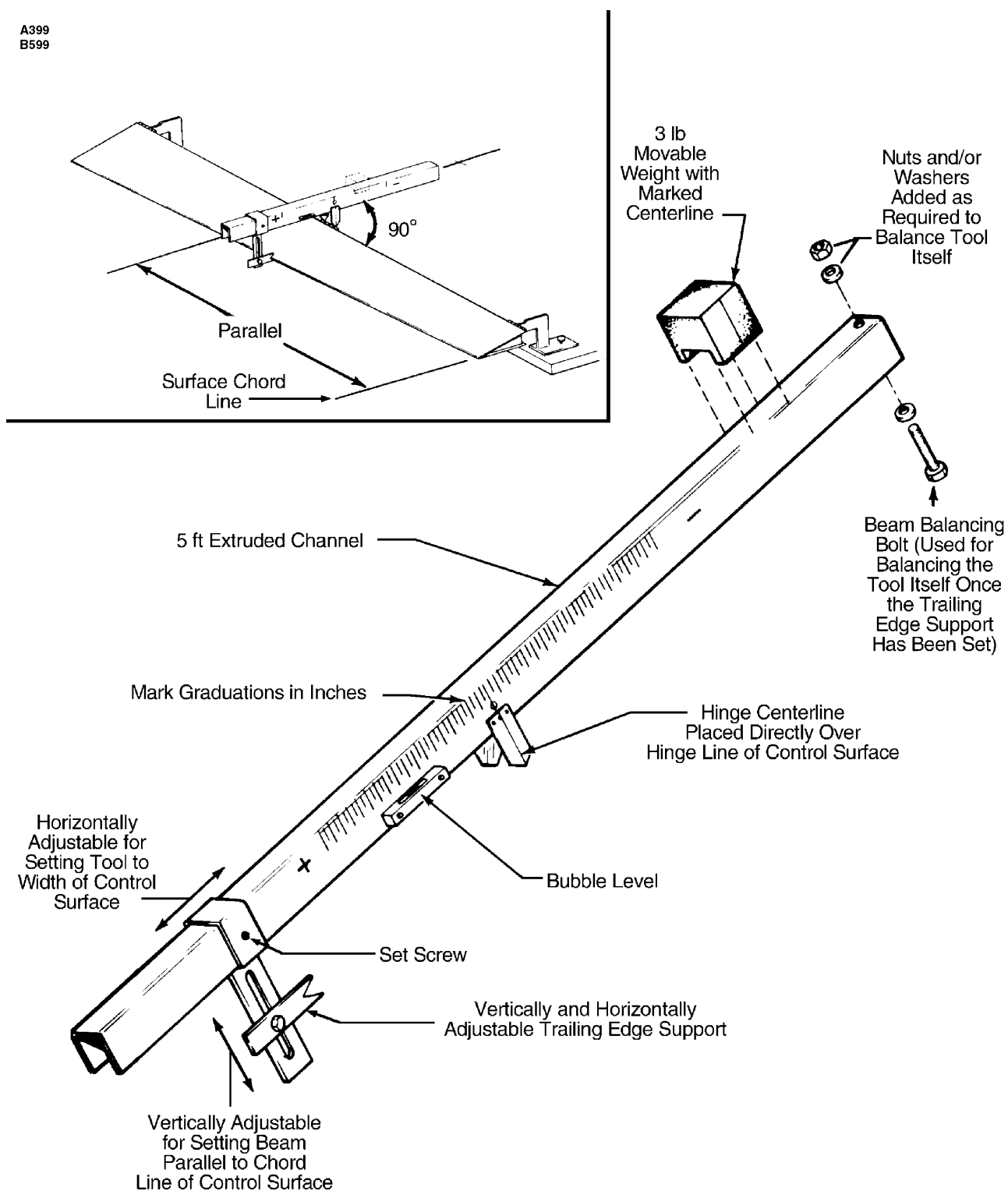
A suitable tool can be fabricated as shown in Figure 7.

8. Heater Plug Gap Adjustment Tool

See Figure 8.

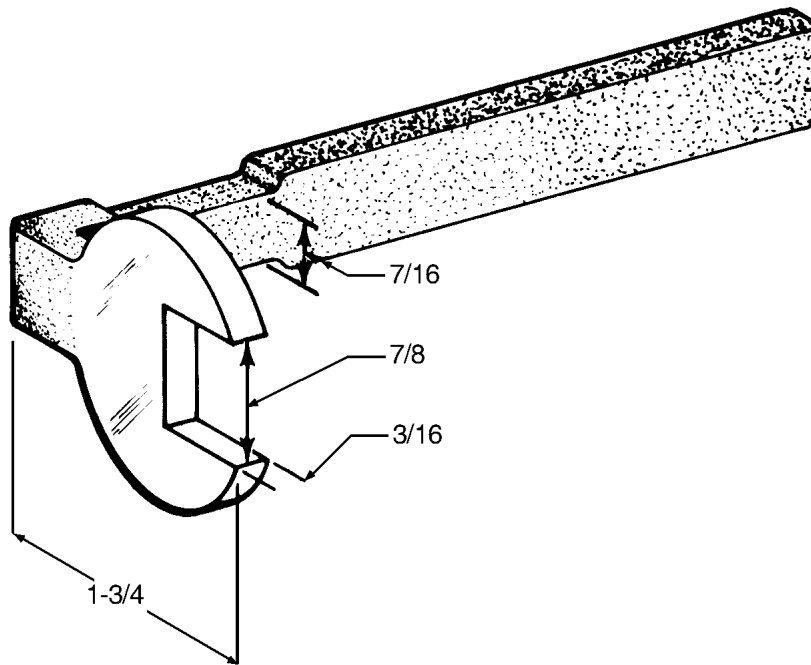
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A399
B599



Control Surface Balancing Tool
Figure 2

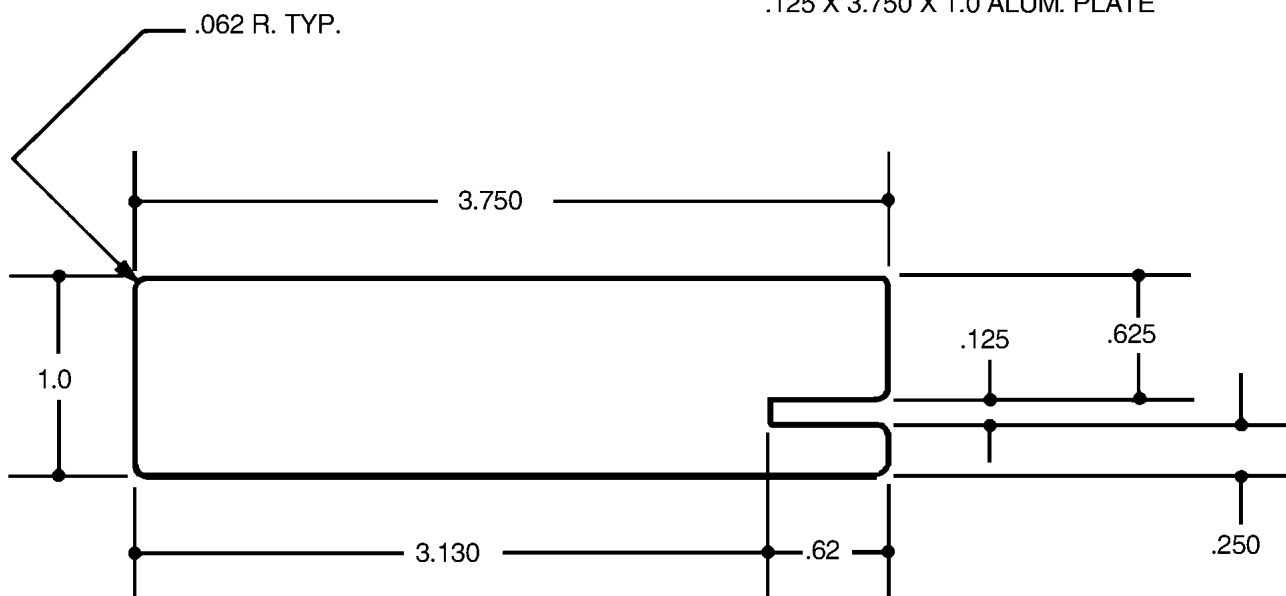
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Baggage Door Lock Tool
Figure 3

MATERIAL:

.125 X 3.750 X 1.0 ALUM. PLATE

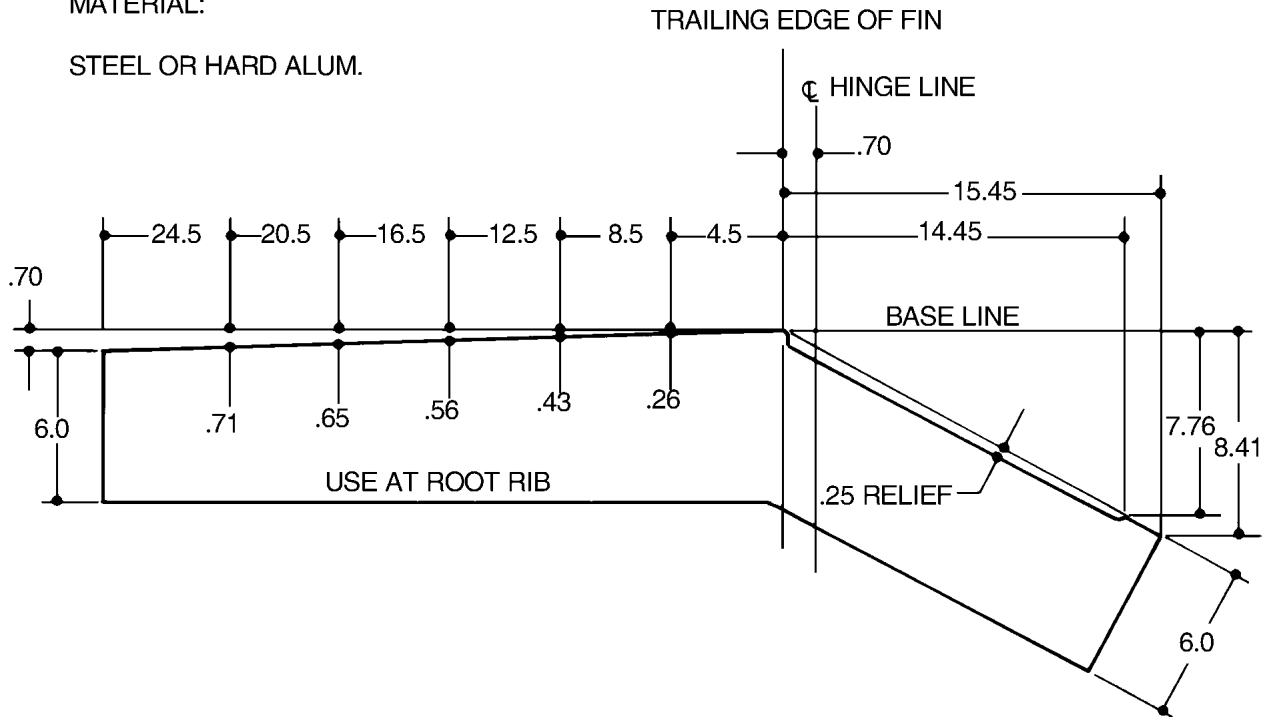


Aileron Bellcrank Rigging Tool
Figure 4

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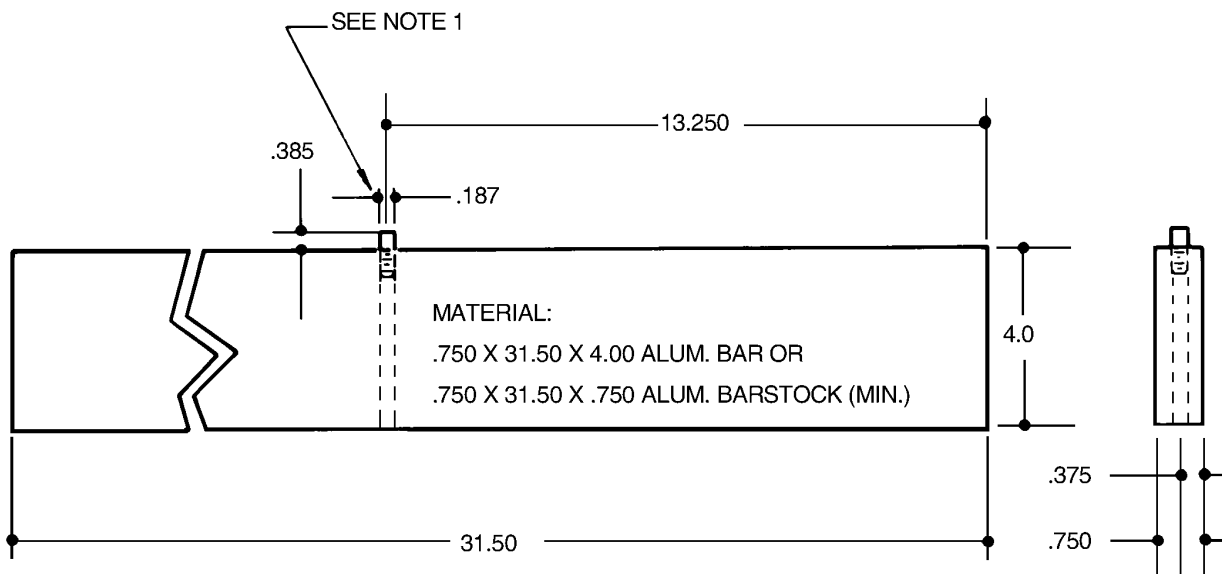
MATERIAL:

STEEL OR HARD ALUM.



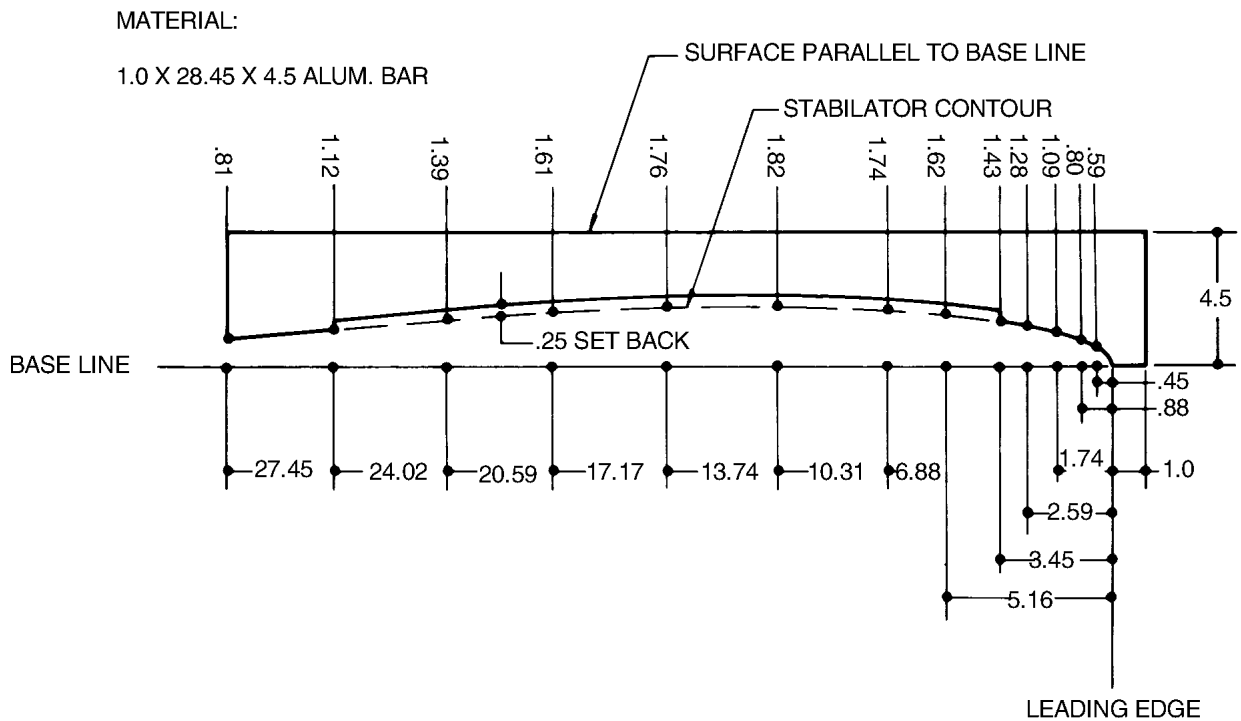
Rudder Rigging Tool
Figure 5

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Flap Rigging Tool
Figure 6

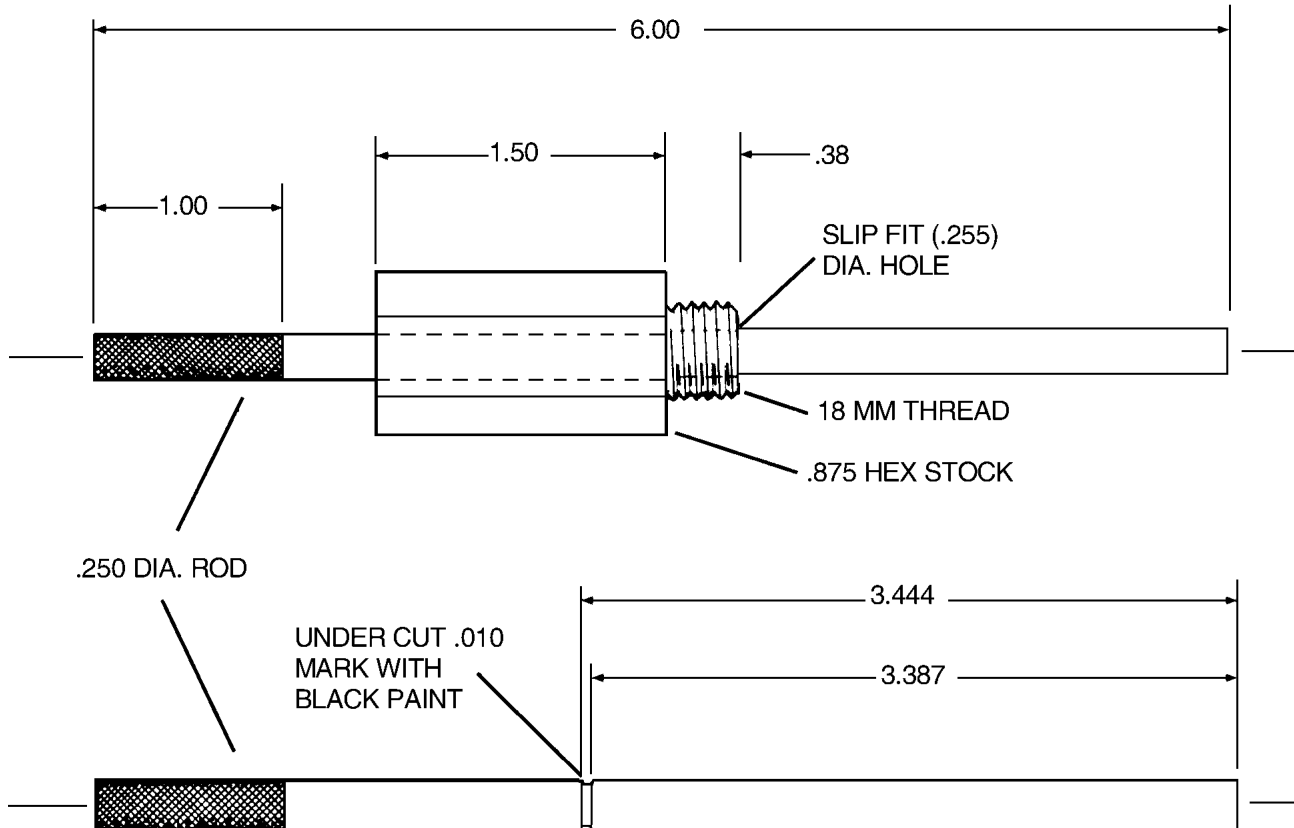
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Stabilator Rigging Tool
Figure 7

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MAINTENANCE MANUAL

GAUGE FOR LOCATING GROUND ELECTRODE IN JANITROL HEATERS



MATERIAL CAN BE SAE TYPE 303, 321 OR ST. OR ALUMINUM - CASE HARDENED

Heater Plug Gap Adjustment Tool
Figure 8

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**GRIDS 7L12 THRU 7L24
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