AIRPLANE MAINTENANCE MANUAL

CARD 1 OF 5

PA-34-220T

SENECA III

(ALL)

SENECA IV

(S/N's 3448038 THRU 3448079)

PIPER AIRCRAFT CORPORATION

PART NUMBER 761-751 APRIL 17, 2007

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GAMA

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Manufacturers Association

AEROFICHE REVISION STATUS

Revisions to this Maintenance Manual (P/N 761-751) originally issued December 19, 1980, and completely reissued November 29, 1993, are as follows:

Revision	Publication Date	Aerofiche Card Effectivity
ORG801219	December 19, 1980	1, 2 and 3
CR891220	December 20, 1989	1, 2, 3 and 4
CR931129	November 29, 1993	1, 2, 3, 4 and 5
IR970205	February 5, 1997	1 and 3
PR070417 *	April 17, 2007	1, 3, and 5

*** PARTIAL REVISION OF MAINTENANCE MANUAL 761-751**

Revisions appear only in Aerofiche Cards 1, 3, and 5. Accordingly, discard your existing Aerofiche Cards 1, 3, and 5, and replace them with these dated April 17, 2007.

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

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INTRODUCTION

TABLE OF CONTENTS / EFFECTIVITY

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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 III/IV Maintenance Manual constitutes the Instructions for Continued Airworthiness in accordance with 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 PARTS OR PIPER APPROVED PARTS OBTAINED FROM PIPER APPROVED SOURCES, IN CONNECTION WITH THE MAINTENANCE AND REPAIR OF PIPER AIRPLANES.

This manual 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 761-750 and FAR 43 for proper utilization.

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.

Reworked, salvaged or those parts obtained from non-PIPER approved sources, which the service history is unknown or cannot be authenticated, may have been subjected to unacceptable stresses or temperatures or have other hidden damage, not discernible through routine visual or usual nondestructive testing. This may render the part, component or structural assembly, even though originally manufactured by PIPER unsuitable and unsafe for airplane use.

Piper Aircraft, Inc. expressly disclaims any responsibility for malfunctions, failures, damage or injury caused by use of non-PIPER approved parts.

NOTE: 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.

Be sure to include the airplane serial number (see Effectivity, below) in any correspondence or communication concerning your airplane.

3. EFFECTIVITY

This maintenance manual is effective for PA-34-220T Seneca III airplanes, serial numbers 34-8133001 thru 3448035; and Seneca IV airplanes, serial numbers 3448038 thru 3448079.

This encompasses the following model years:

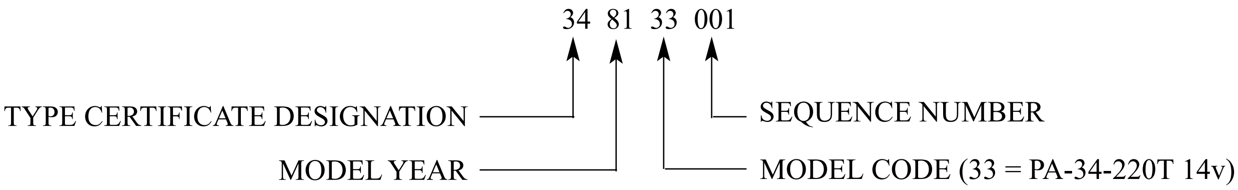
NOTE: The following is provided as a general reference only.

Model	Sub-Model	Serial Numbers	Model Year
Seneca III	14 V	34-8133001 (Prototype)	1981
		34-8133002 thru 34-8133277	
		34-8233001 thru 34-8233205	1982
		34-8333001 thru 34-8333120	1983
		34-8433001 thru 34-8433087	1984
		34-8533001 thru 34-8533063	1985
		34-8633001 thru 34-8633021	1986
		3433001 thru 3433020	
		3433037 thru 3433044, 3433021	1987
		3433089 thru 3433136	1988
		3433137 thru 3433168	1989
		3433171 thru 3433172	
		3433169 and 3433170	1990
Seneca III	28 V	3448001 thru 3448004	1989
		3448005 thru 3448007	1990
		3448009	
		3448011 thru 3448014	
		3448008 and 3448010	1992
		3448015 thru 3448022	
		3448023 thru 3448028	1993
		3448030 thru 3448033	
(036 & 037 renumbered		3448029	1994
as Seneca IV’s 051 & 060)		3448034 and 3448035	
Seneca IV		3448038 thru 3448061	1994
		3448062 thru 3448079	1995

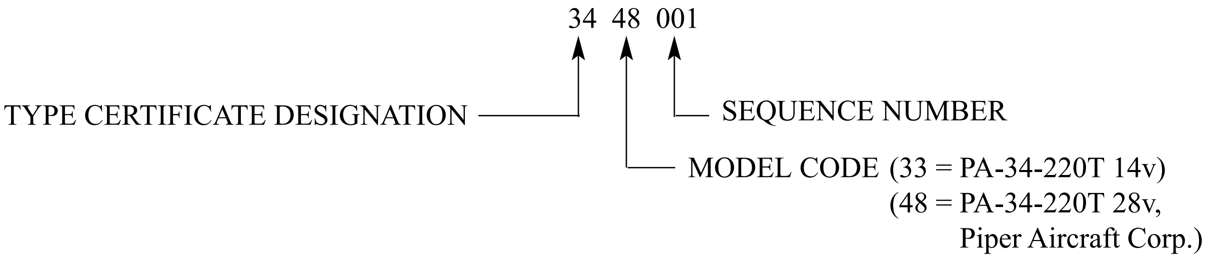
4. SERIAL NUMBER EXPLANATION

This manual encompasses airplanes manufactured under two different serial numbering systems.

A. The earlier system is comprised of four sets of numbers, as shown in the following example:



B. The later system is comprised of three sets of numbers, as shown in the following 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 28-40-00 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 28-40-00 concerns itself with the indicating section of the fuel system.

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 “00” of the number 28-40-00 is a subject designator. This element is assigned at the option of the manufacturer and is normally zeroed out by PIPER.

Refer to the Chapter/Section Index Guide, below, 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).

7. AEROFICHE EFFECTIVITY

A. The General Aviation Manufacturers Association (GAMA) have 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:

(1) At the beginning of the first aerofiche card:
  (a) A complete Chapter/Section Index Guide for all fiche in the set.
  (b) A complete List of Illustrations for all fiche in the set.
  (c) A complete List of Charts for all fiche in the set.

(2) At the beginning of the the second and subsequent aerofiche cards:
  (a) A complete Chapter/Section Index Guide for all fiche in the set.
  (b) A complete List of Illustrations for the individual aerofiche card.
  (c) A complete List of Charts for the individual aerofiche card.

8. IDENTIFYING REVISED MATERIAL

Revised text and illustrations are indicated by a vertical line along the left-hand margin of the page, opposite revised, added or deleted material. Revision lines indicate only current revisions with changes, additions to, or deletions of, existing text and illustrations. Changes in capitalization, spelling, punctuation, indexing, or the physical location of the material are not identified by revision lines, but are identified as revised by the revision date on each page.

Example.

A reference and record of the material revised is included in each chapter's Table of Contents/Effectivity. The codes used in the effectivity columns of each chapter are defined as follows:

TABLE OF CONTENTS/EFFECTIVITY CODES

Original Issue or Complete Reissue:	None
Revisions:	nRmmyy (i.e. - 2R0698)
Added Subject:	Ammyy (i.e. - A0698)
Deleted Subject:	Dmmyy (i.e. - D0698)

Where “nR” = revision number (since issue or reissue), “A” = added, “D” = deleted; and “mmyy” = month and year.

9. WARNINGS, CAUTIONS, AND NOTES

The Warnings, Cautions, and Notes used throughout this manual emphasize important information.

WARNING: OPERATING PROCEDURES, PRACTICES, ETC., WHICH MAY RESULT IN PERSONAL INJURY OR LOSS OF LIFE IF NOT CAREFULLY FOLLOWED.

CAUTION: OPERATING PROCEDURES, PRACTICES, ETC., WHICH IF NOT STRICTLY OBSERVED MAY RESULT IN DAMAGE TO EQUIPMENT.

NOTE: An operating procedure, condition, etc., which is essential to emphasize.

10. ACCIDENT/INCIDENT REPORTING

To improve our Service and Reliability system and aid in Piper's 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.

11. SUPPLEMENTARY PUBLICATIONS

A. PIPER PUBLICATIONS

		P/N
(1)	PA-34-220T Seneca III / IV Parts Catalog	761-750
(2)	PA-34-220T Seneca III / IV Progressive Inspection Manual (50 HR)	761-753
(3)	PA-34-220T Seneca III / IV Inspection Report	230-1061
(4)	AutoFlight II Service Manual	761-481
(5)	Pitch Trim Service Manual	753-771
(6)	AutoControl IIIB and Altimatic IIIB Service Manual	753-502
(7)	Altimatic IIIC Service Manual	761-602
(8)	Customer Service Information Aerofiche	1753-755
(9)	Service Bulletin / Service Letter Index	762-332

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. PH - 972-442-8400
601 South Sanden Blvd.
Wylie, TX 75098-4999
http://www.sanden.com

(2) AUTOFLIGHT:

Vendor(s): Honeywell
One Technology Center
23500 W. 105th St., M/D #45
Olathe, Kansas 66061-1950
http://www.bendixking.com/

System Flight Line
KFC 150
Installation Manual: P/N 006-0287-00

System Flight Line
KFC 200
Maintenance Manual: P/N 006-5134-01

(3) BRAKES:

Vendor: Parker Hannifin Corp. PH - 800-272-5464
Aircraft Wheel and Brake Division
1160 Center Road
Avon, Ohio 44011
http://www.parker.com/

(4) ENGINE:

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

Overhaul Manual: Form No. X-30596A
Parts Catalog: Form No. X-30597A
Operators Handbook: Form No. X-30583

(5) FIRE EXTINGUISHER (PORTABLE):

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

(6) FUEL CELLS:

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

(7) GEAR LOCKING ACTUATORS, HYDRAULIC PUMP, AND ALL HYDRAULIC COMPONENTS:

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

(8) 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

(9) 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 Instructions:
Teledyne Continental Motors (TCM)
Service Support Manual, P/N X42002
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/

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

(10) OXYGEN SYSTEM:

Vendor:
AVOX Systems PH - 716-686-1798
2225 Erie Street FAX - 716-686-1597
Lancaster, New York 14086
http://www.avoxsys.com/

(11) 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

Overhaul Instructions: Manual No. 117

or,

Vendor:
McCauley Propeller Systems
7751 East Pawnee
P.O. Box 7704
Wichita, KS 67277-7704

Service Manual: McCauley C500 Series Service Manual - P/N 810915

(12) VOLTAGE CONTROL:

Vendor:
Lamar Technologies Corp.
14900 - 40th Ave. N.E.
Marysville, WA 98271
http://www.lamartech.com/
PH - 360-651-6666
FAX - 360-651-6677

(13) WHEELS: (see Brakes, above)

12. CHAPTER/SECTION INDEX GUIDE

NOTE: The following GAMA Specification No. 2 standard chapters are not included in this Maintenance Manual: 31, 36, 38, 49, 53, 54, 60, 72, 78, 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.

CHAPTER	SECTION	TITLE	GRID NO.
4		AIRWORTHINESS LIMITATIONS	1B7
	00	Airworthiness Limitations	
5		TIME LIMITS/MAINTENANCE CHECKS	5I1
	00	General	
	10	Time Limits	
	20	Scheduled Maintenance	
	30	Special Inspections	
	50	Unscheduled Maintenance Checks	
6		DIMENSIONS AND AREAS	1C3
	10	Dimensions and Areas	
	20	Station References	
	30	Access and Inspection Provisions	
7		LIFTING AND SHORING	1C16
	00	General	
8		LEVELING AND WEIGHING	1C22
	10	Leveling	
	20	Weighing	
9		TOWING AND TAXIING	1D5
	10	Towing	
	20	Taxiing	
10		PARKING AND MOORING	1D12
	10	Parking	
	20	Mooring	
11		REQUIRED PLACARDS	1D18
	20	Exterior Placards/Markings	
	30	Interior Placards/Markings	

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LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (cont.)

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LIST OF ILLUSTRATIONS (cont.)

LIST OF ILLUSTRATIONS (cont.)

LIST OF ILLUSTRATIONS (cont.)

LIST OF ILLUSTRATIONS (cont.)

NOTE: Refer to Chapter 91 For Electrical Schematic Index

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LIST OF CHARTS

LIST OF CHARTS (cont.)

CHAPTER

4

AIRWORTHINESS LIMITATIONS

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CHAPTER 4 - AIRWORTHINESS LIMITATIONS

TABLE OF CONTENTS/EFFECTIVITY

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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. 17.)

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 III /IV 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:

(1) P/N 400-274 (AN7-35) bolt or P/N 693-215 (NAS6207-50D) bolt;
(2) P/N 407-591 (AN960-716L) washer, as applicable;
(3) P/N 407-568 (AN 960-716) washer, as applicable;
(4) P/N 404-396 (AN 320-7) nut; and
(5) 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

(MOVED TO GRID 5I1)

GRIDS 1B14 THRU 1C2
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CHAPTER

6

DIMENSIONS AND AREAS

CHAPTER 6 - DIMENSIONS AND AREAS

TABLE OF CONTENTS/EFFECTIVITY

DIMENSIONS

The principal airplane dimensions are shown in Figure 6-1 and are listed in Chart 601.

CHART 601. LEADING PARTICULARS AND PRINCIPAL DIMENSIONS

MODEL	PA-34-220T SENECA III and IV
ENGINE	
Manufacturer	Continental
Model - Left (12V)	TSIO-360-KB (CW)
Model - Right (12V)	LTSIO-360-KB (CCW)
	TSIO-360-KB-1A
	TSIO-360-KB2
	TSIO-360-KB2
Model - Left (24V)	TSIO-360-KB11 (CW)
Model - Right (24V)	LTSIO-360-KB7 (CCW)
Model - Left, with primer standard (24V)	TSIO-360-KB28 (CW)
Model - Right, with primer standard (24V)	LTSIO-360-KB14 (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. Scintilla	
Left (Left Engine)	10-79020-18L
Right (Right Engine)	10-79020-19R
Magnetos: (Bendix Pressurized)	79020-118
Left (Left Engine)	S6LN-25
Right (Right Engine)	S6RN-25
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 (12-volt):	
Left Engine	MCL-6501
Right Engine	MCL-6501

CHART 601. LEADING PARTICULARS AND PRINCIPAL DIMENSIONS (continued)

MODEL		**PA-34-220T SENECA III and IV**
ENGINE (continued)		
Starter - Prestolite (28-volt):		
Left Engine		646275
Right Engine		646275
Alternator - Prestolite (65 amp)		ALX-9402
Alternator - Teledyne Critten (60 amp)		
Left Engine		649280 or 653344
Right Engine		649280 or 653344
Alternator Voltage Regulator - Lamar (12V)		B-00288-1
Alternator Control Unit - Lamar (28V)		B-00382-1
Alternator Overvoltage Relay, (12V)		
WICO DIVISION, Prestolite		FOC-4002B
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:		
Left Engine	E-3-7	
Right Engine	E-3-7L (E-8-7L) [2]	
FUEL SYSTEM		
Fuel Tank	49 gal./wing 64 gal./wing [3]	
Total Capacity (Both Wings)	98 gal. 128 gal. [3]	
Total Usable Fuel	93 gal. 123 gal. [3]	

[1] Propellers To Be Mounted In Pairs Only. Do Not Mix With Other Propellers.

[2] With Synchrophaser Installation Only

[3] With Optional Fuel Tanks Installed on Seneca III; Standard on Seneca IV

CHART 601. LEADING PARTICULARS AND PRINCIPAL DIMENSIONS (continued)

MODEL	**PA-34-220T SENECA III and IV**
LANDING GEAR	
Thread (Width From Each Tire Center)	11.1 ft.
Turning Radius	60.4 ft.
Nose Gear Strut	Combination Air-Oil
Nose Tire Pressure	40 PSI @ Gross Weight, 34 PSI [4]
Nose Gear Travel	27 degrees LEFT or RIGHT
Main Gear Strut	Combination Air-Oil
Main Tire Pressure	55 PSI @ Gross Weight, 46 PSI [4]
Brakes	Cleveland 30-65 or 30-83 [4]
Tires:	
Main	6.00 x 6, 8 ply or Nylon TT [4]
Nose	6.00 x 6, 6 ply or Nylon TT [4]

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[4] With Heavy Duty Brakes, Wheels And Either B.F. Goodrich Nylon T. T. Type III Tires Or McCleary Air Hawk Type III.

C400
POH

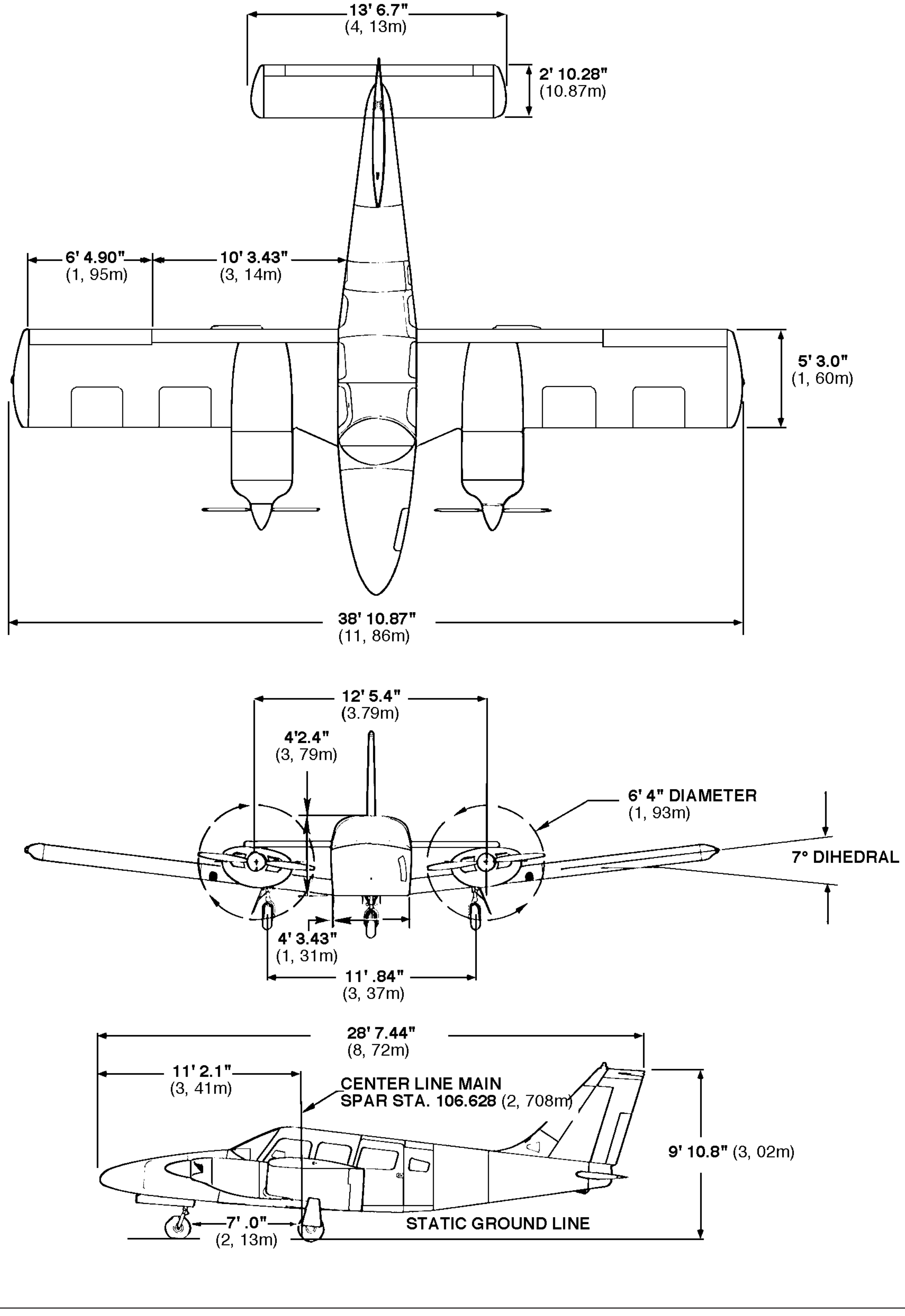


Figure 6-1. Seneca III and IV Three View

STATION REFERENCE LINES

In order to facilitate the location of various components of the airplane which require maintenance and servicing, a method utilizing fuselage station (Sta.) wing station of buttock line (BL), or waterline (WL) designations is frequently employed in this manual. (Refer to Figure 6-2). Fuselage stations, buttock lines, and waterlines are reference points measured by inches in the vertical or horizontal direction from a given reference line which indicates station locations of structural members of the airplane.

WEIGHT AND BALANCE DATA

When figuring various weight and balance computations, the empty weight, static and gross weight, and center of gravity of the airplane may be found in the Weight and Balance Form of the Airplane Flight Manual.

SERIAL NUMBER PLATE

The serial number plate is located on the fuselage near the leading edge of the stabilator. The serial number should always be used when referring to the airplane on service or warranty matters.

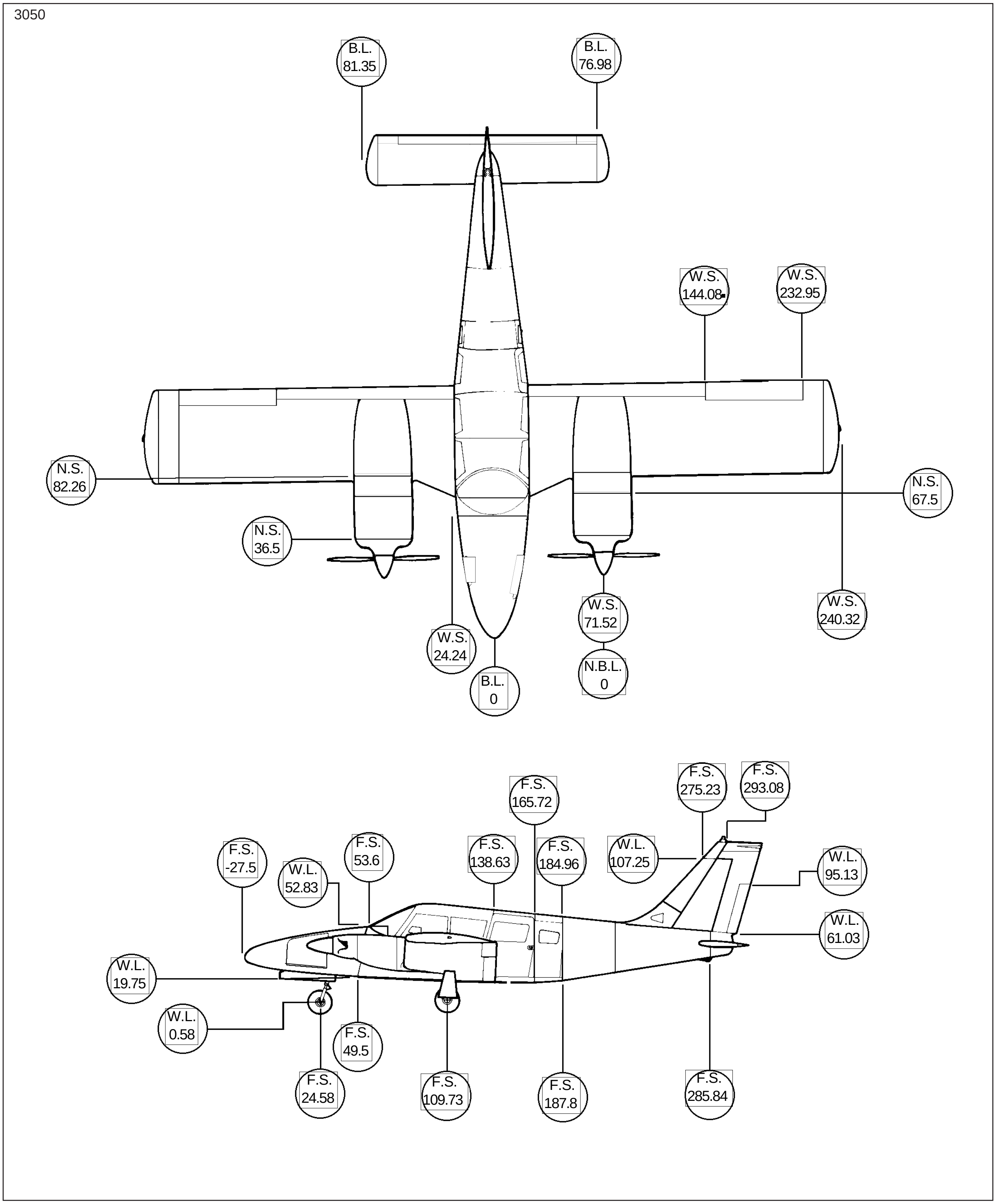
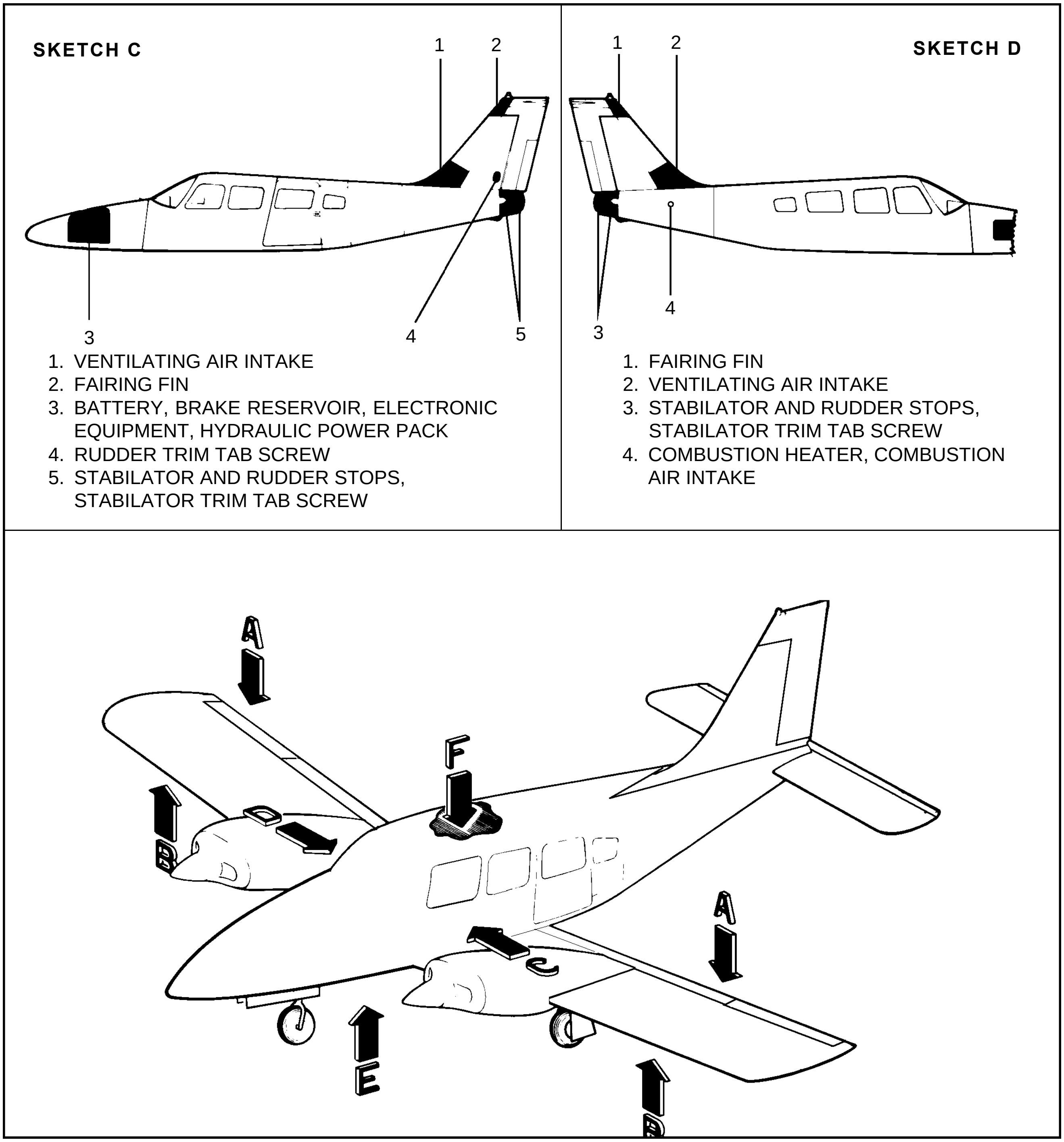


Figure 6-2 Station Reference Lines

ACCESS PLATES AND INSPECTION PROVISIONS

The access and inspection provisions for the airplane are shown in Figure 6-3. 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.



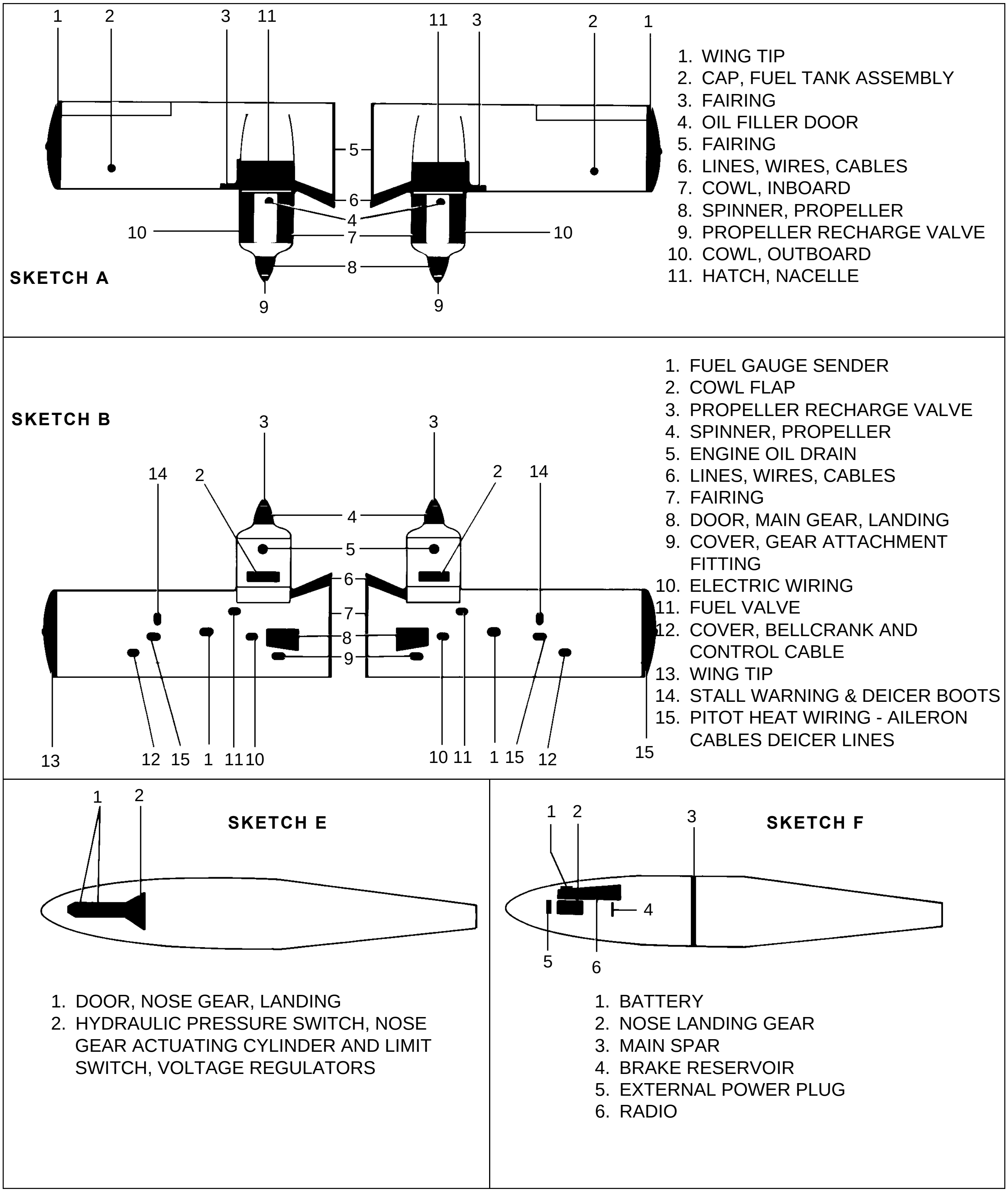
SKETCH C

1. VENTILATING AIR INTAKE
2. FAIRING FIN
3. BATTERY, BRAKE RESERVOIR, ELECTRONIC EQUIPMENT, HYDRAULIC POWER PACK
4. RUDDER TRIM TAB SCREW
5. STABILATOR AND RUDDER STOPS, STABILATOR TRIM TAB SCREW

SKETCH D

1. FAIRING FIN
2. VENTILATING AIR INTAKE
3. STABILATOR AND RUDDER STOPS, STABILATOR TRIM TAB SCREW
4. COMBUSTION HEATER, COMBUSTION AIR INTAKE

Figure 6-3 Access Plates and Panels



SKETCH A

1. WING TIP
2. CAP, FUEL TANK ASSEMBLY
3. FAIRING
4. OIL FILLER DOOR
5. FAIRING
6. LINES, WIRES, CABLES
7. COWL, INBOARD
8. SPINNER, PROPELLER
9. PROPELLER RECHARGE VALVE
10. COWL, OUTBOARD
11. HATCH, NACELLE

SKETCH B

1. FUEL GAUGE SENDER
2. COWL FLAP
3. PROPELLER RECHARGE VALVE
4. SPINNER, PROPELLER
5. ENGINE OIL DRAIN
6. LINES, WIRES, CABLES
7. FAIRING
8. DOOR, MAIN GEAR, LANDING
9. COVER, GEAR ATTACHMENT FITTING
10. ELECTRIC WIRING
11. FUEL VALVE
12. COVER, BELLCRANK AND CONTROL CABLE
13. WING TIP
14. STALL WARNING & DEICER BOOTS
15. PITOT HEAT WIRING - AILERON CABLES DEICER LINES

SKETCH E

1. DOOR, NOSE GEAR, LANDING
2. HYDRAULIC PRESSURE SWITCH, NOSE GEAR ACTUATING CYLINDER AND LIMIT SWITCH, VOLTAGE REGULATORS

SKETCH F

1. BATTERY
2. NOSE LANDING GEAR
3. MAIN SPAR
4. BRAKE RESERVOIR
5. EXTERNAL POWER PLUG
6. RADIO

Figure 6-3 Access Plates and Panels (continued)

GRIDS 1C13 THRU 1C15
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CHAPTER

7

LIFTING AND SHORING

CHAPTER 7 - LIFTING AND SHORING

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

Jacking the airplane is necessary to perform servicing of the landing gear and the operations. The jacking operation can be performed through the use of conventional tripod jacks, or in other situations, (emergency, post-accident lifting), slings or air bags should be used.

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

JACKING (Refer to Figure 7-1.)

1. Align the jacks under the wings with their respective pads on the wing front spar.
2. Attach a tail stand with approximately 600 pounds ballast, to the tail skid.

— CAUTION —

ENOUGH SUPPORT BALLAST MUST BE ADDED TO THE TAILSTAND TO PREVENT THE AIRPLANE FROM TIPPING FORWARD ON ITS NOSE SECTION. MAKE SURE TO ACCOUNT FOR SOMEONE IN THE FUSELAGE IF APPLICABLE.

3. 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.

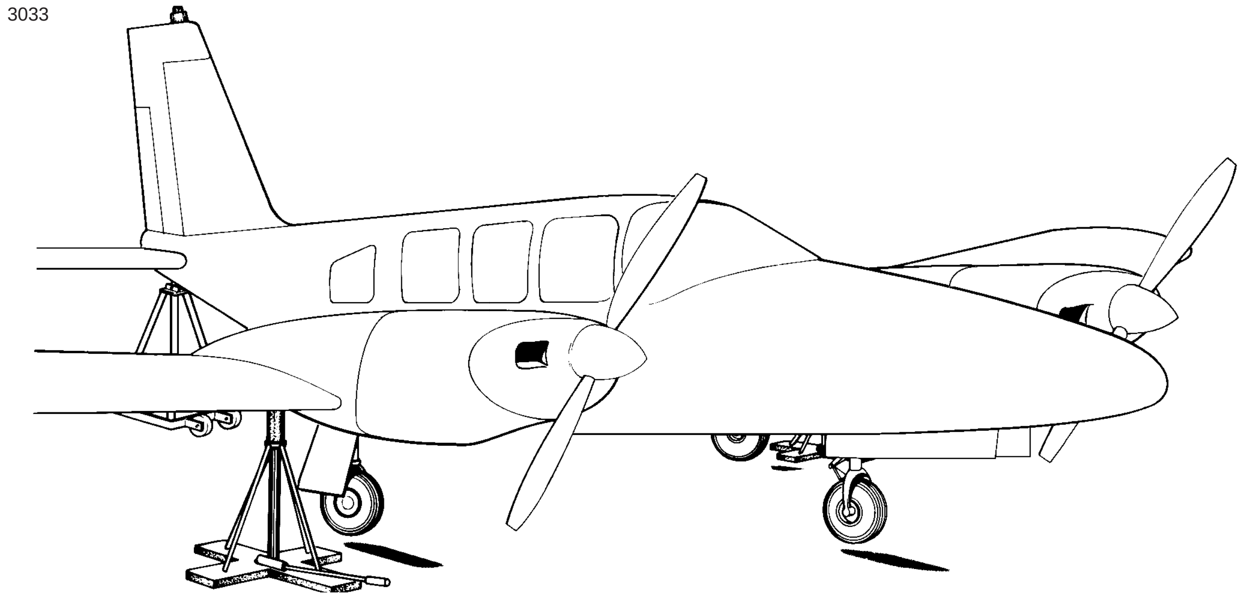

Figure 7-1. Jacking Arrangement

**GRIDS 1C19 THRU 1C21
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CHAPTER

8

LEVELING AND WEIGHING

CHAPTER 8 - LEVELING AND WEIGHING

TABLE OF CONTENTS/EFFECTIVITY

LEVELING (Refer to Figure 8-1.)

The airplanes are provided with a means for longitudinal and lateral leveling. The airplanes may be leveled while on jacks, during the weighing procedure while the wheels are on the 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:

1. To longitudinally level the airplane, partially withdraw the two leveling screws located immediately below the left front side window. Place a level on these screw heads and adjust the jacks until the level is centered. Should the airplane be either on scales or on the floor, first block the main gear oleos to full extension; then deflate the nose wheel until the proper position is reached.
2. To laterally level the airplane, place a level across the baggage compartment floor along the rear bulkhead. Raise or lower one wing tip by deflating the appropriate tire on the high side of the airplane or adjust either jack until the bubble of the level is centered.

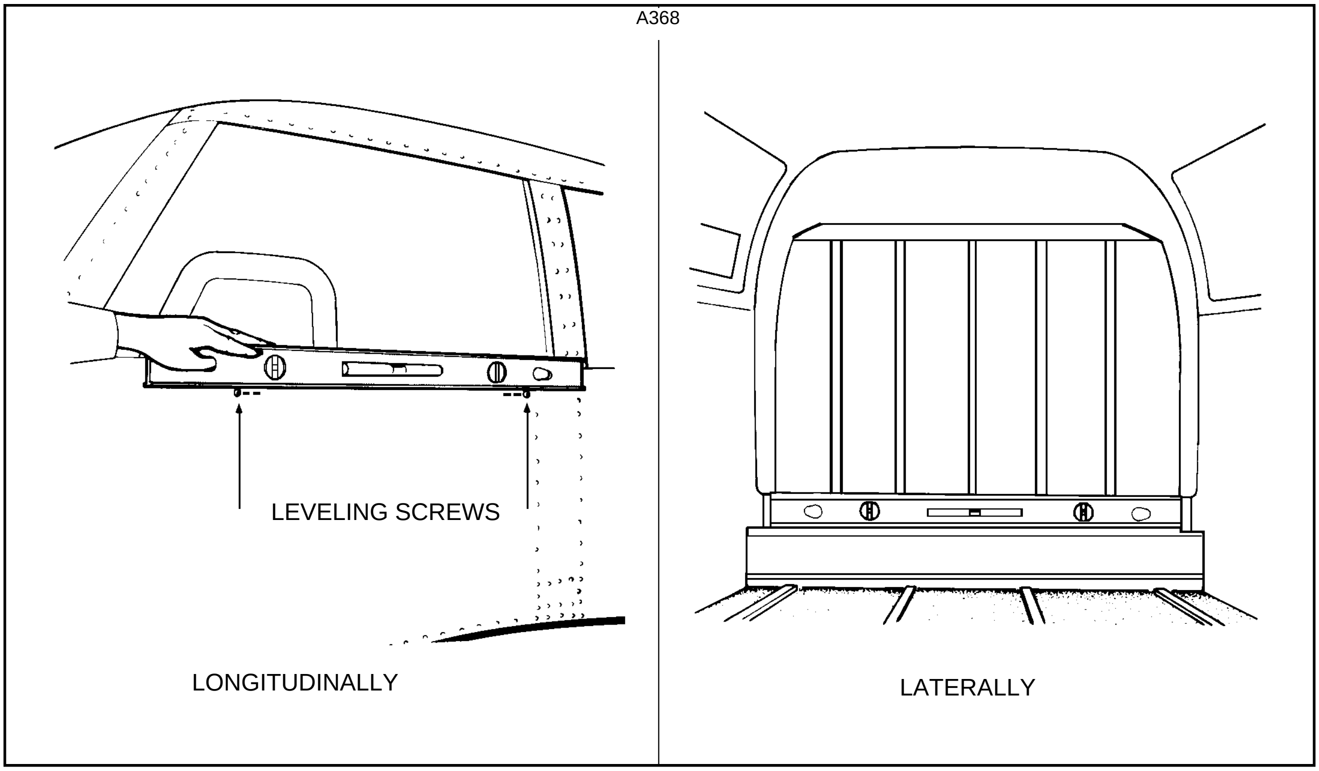

Figure 8-1. Leveling Airplane

WEIGHING (Refer to Figure 8-2.)

The airplane may be weighed by the following procedure:

1. Position a scale and ramp in front of each of the three wheels.
2. Secure the scales from rolling forward and tow the airplane onto the scales.
3. Remove the ramp so as not to interfere with the scales.
4. If the airplane is to be weighed for weight and balance computations, level the airplane.

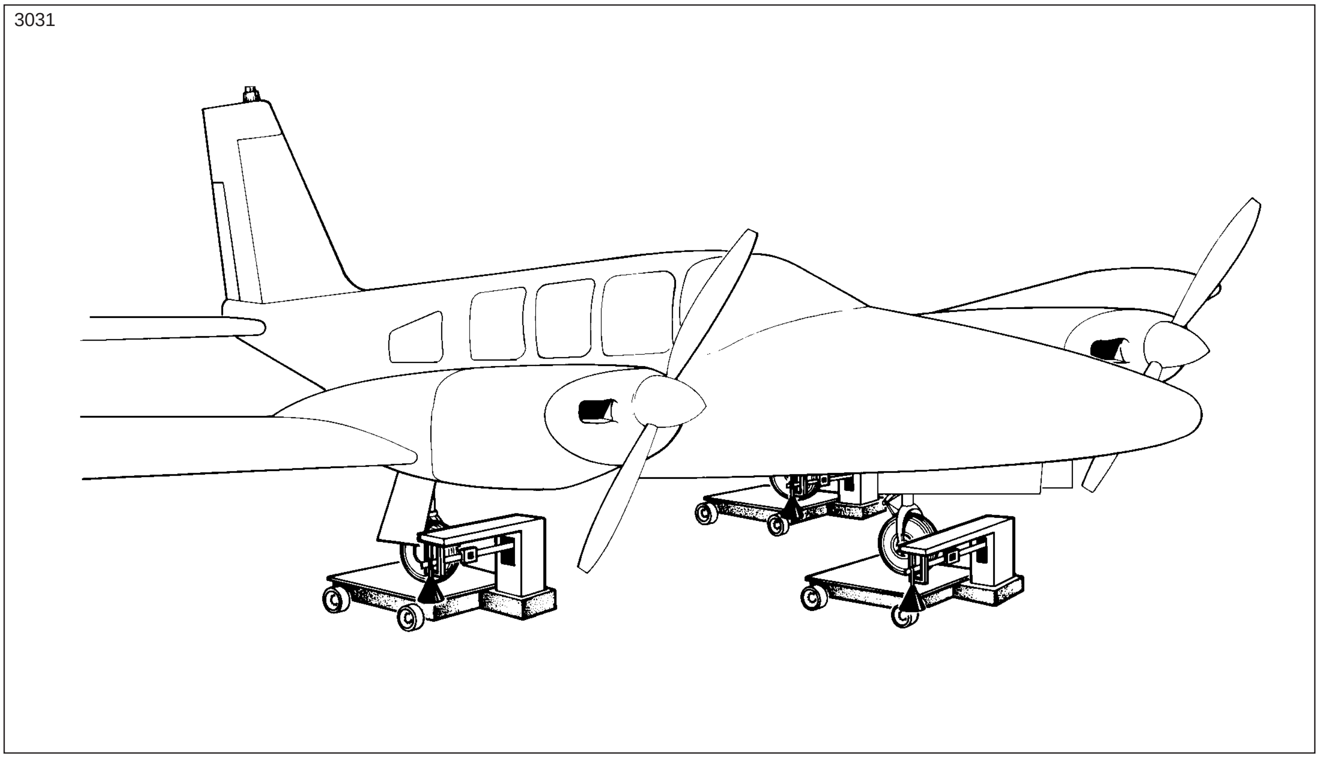

Figure 8-2. Weighing Airplane

GRIDS 1D2 THRU 1D4
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CHAPTER

9

TOWING AND TAXIING

CHAPTER 9 - TOWING AND TAXIING

TABLE OF CONTENTS/EFFECTIVITY

TOWING

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

— CAUTION —

WHEN TOWING WITH POWER EQUIPMENT, DO NOT TURN THE NOSE GEAR IN EITHER DIRECTION BEYOND ITS STEERING RADIUS LIMITS AS THIS WILL RESULT IN DAMAGE TO THE NOSE AND STEERING MECHANISM.

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

In the event towing lines (rope) are necessary, they 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 than15 feet, and a qualified person must ride in the pilot's seat to maintain control by use of the brakes.

TAXIING

Before attempting to taxi the airplane, ground personnel must be checked out by a qualified pilot or other responsible person. Each 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:

1. Taxi forward a few feet and apply brakes to determine their effectiveness.
2. Taxi with propellers set in low pitch, high rpm setting.
3. While taxiing, make slight turns to ascertain the effectiveness of steering.
4. Observe wing clearances when taxiing near buildings or other stationary objects. If possible, station a guide outside the airplane to observe.
5. When taxiing on uneven ground, look for and avoid holes and ruts.
6. 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 —

Refer to Figure 9-1 for aircraft turning distance.

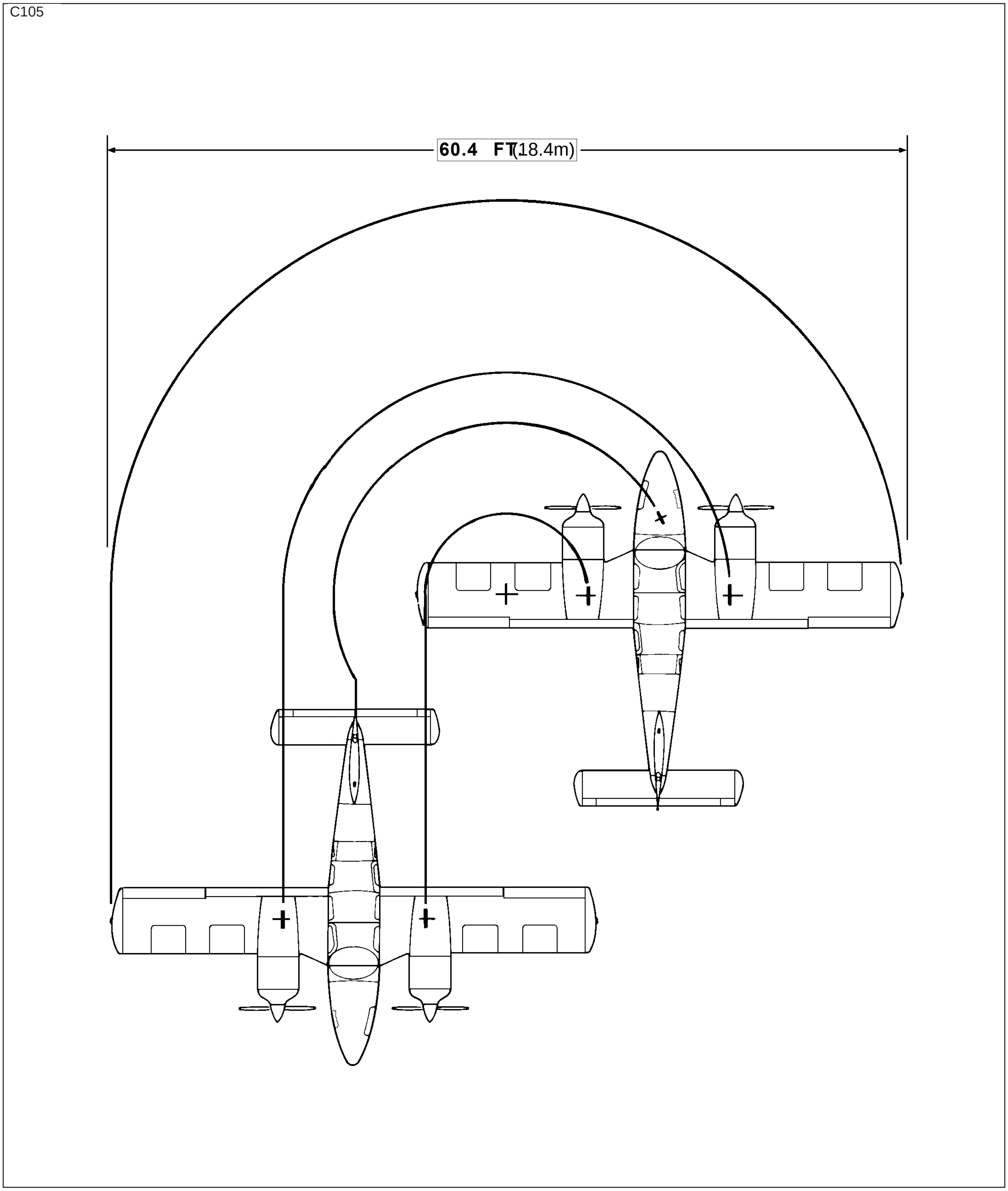

Figure 9-1 Airplane Turning Radius (Distance)

GRIDS 1D9 THRU 1D11
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CHAPTER

10

PARKING AND MOORING

CHAPTER 10 - PARKING AND MOORING

TABLE OF CONTENTS/EFFECTIVITY

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.

1. To park the airplane, head it into the wind, if possible.
2. Set the parking brake by pulling back the brake lever and depressing the knob attached to the left side of the handle; then release the handle. To release the parking brake, pull back on the brake lever to disengage the catch mechanism, and allow the handle to swing forward.

— NOTE —

Care should be taken when setting brakes that are overheated. During cold weather, accumulated moisture may freeze the discs and lining together if the aircraft is parked with the brakes set.

MOORING

The airplane is moored to ensure its immovability, protection, and security under various weather conditions. The following procedure gives the instructions for proper mooring of the airplane.

1. Head the airplane into the wind, if possible.
2. Block all wheels.
3. Lock the aileron and elevator controls using the seat belt or control surface blocks.
4. Secure the-down ropes to the wing tie-down rings and the tail skid at approximately 45 degree angle to the ground.

— NOTE —

Use square or bowline knots. Do not use slip knots. Additional preparations for high winds include using tie-down ropes from the landing gear legs, and securing the rudder.

GRIDS 1D15 THRU 1D17
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CHAPTER

11

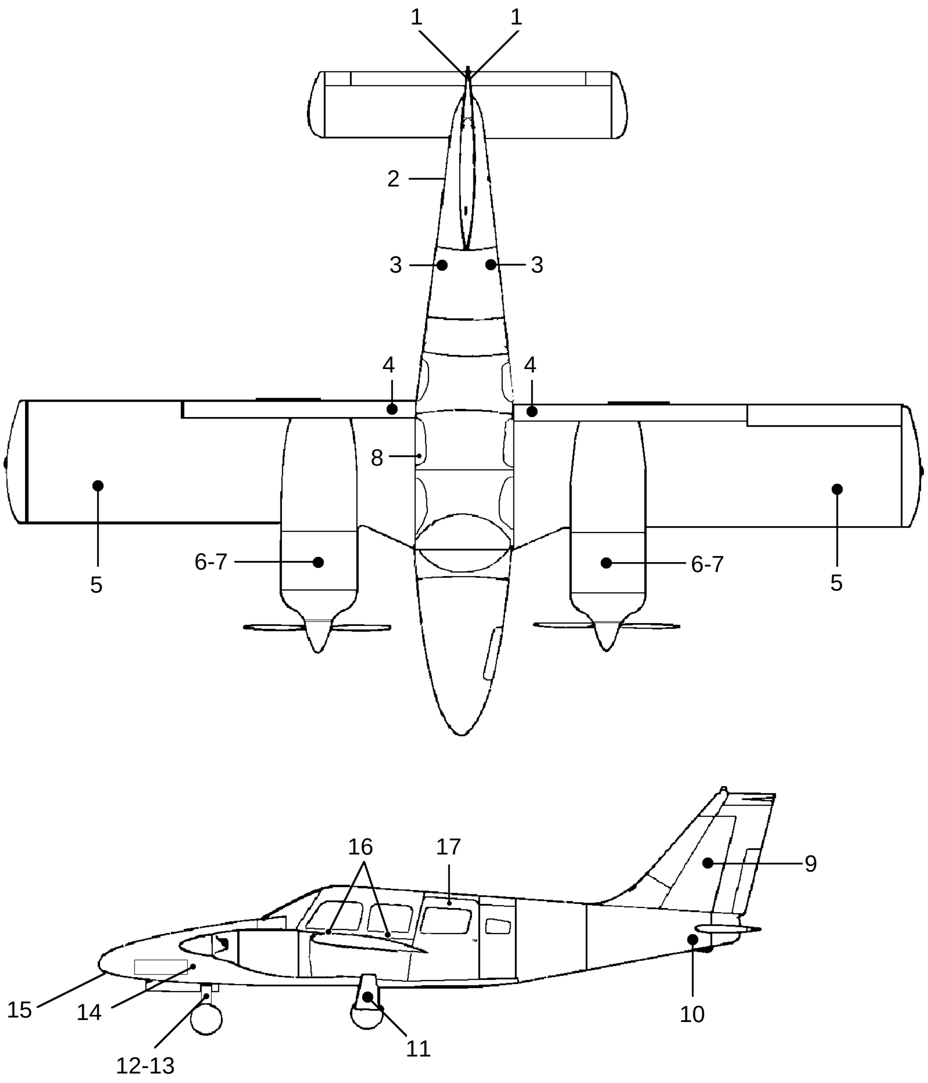
REQUIRED PLACARDS

CHAPTER 11 - REQUIRED PLACARDS

TABLE OF CONTENTS/EFFECTIVITY

PLACARDS AND MARKINGS

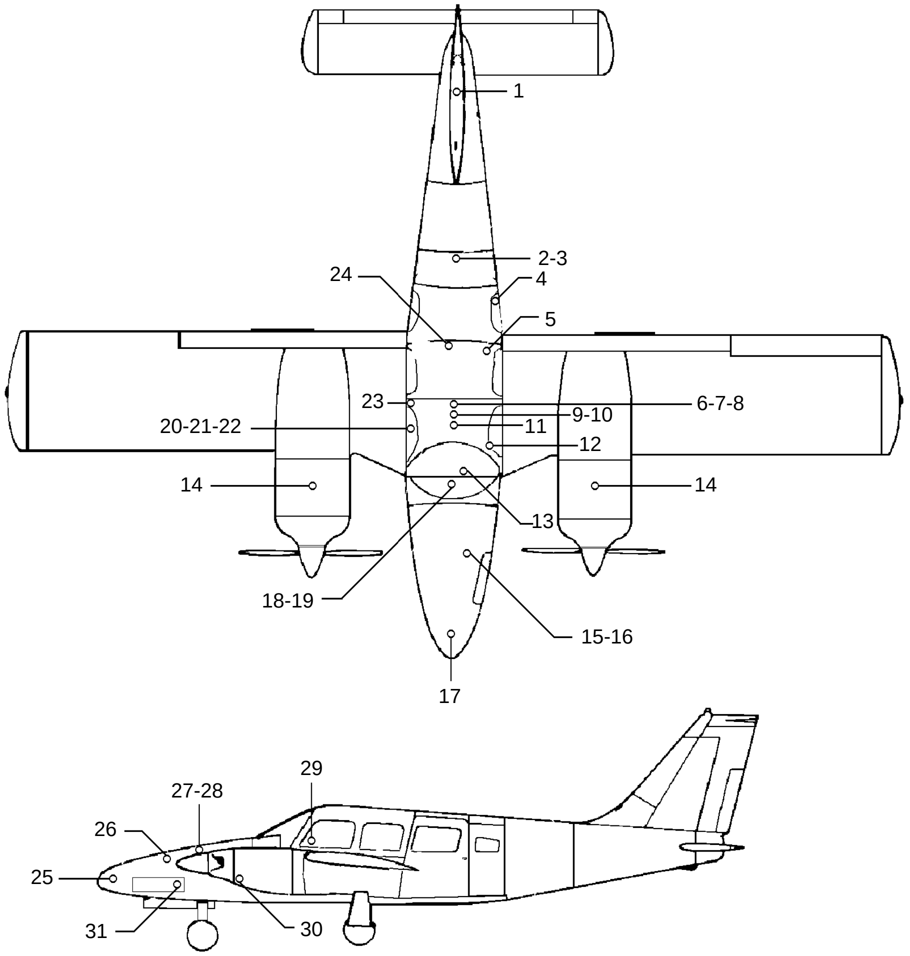
EXTERIOR PLACRDS



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

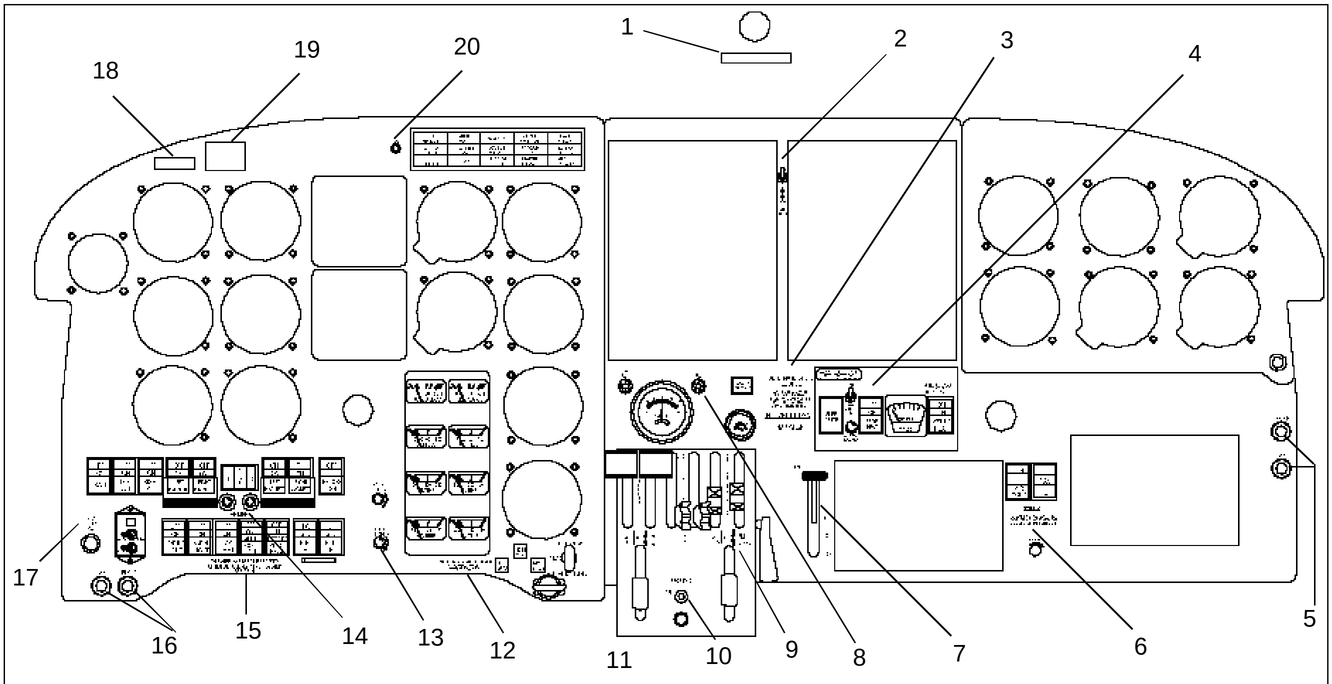
Figure 11-1. Exterior Placards and Decals

INTERIOR PLACARDS



1. PLACARD - Stabilator Balance Weight
2. PLACARD - Baggage Limitations
3. PLACARD - Cabin Bulkhead
4. PLACARD - Aft Cabin Door Release
5. PLACARD - Table Stowage
6. PLACARD - Fuel Selector (46.5 Gallons Per Side)
   PLACARD - Fuel Selector (61.5 Gallons Per Side)
7. PLACARD - Heater Control
8. PLACARD - Heater, Flight and Ground Operation
9. PLACARD - Cabin Air, Pull Off
10. PLACARD - Vent Fan (3 Position)
11. PLACARD - Flap Lever
12. PLACARD - Pitot Drain
13. PLACARD - Control Wheel (Transponder Ident)
14. PLACARD - Oil Drain Probe Location
15. PLACARD - Brake Reservoir
16. PLACARD - Fuel Level Line, Reservoir
17. PLACARD - Hydraulic Fluid Specification
18. PLACARD - Propeller Synchrophaser
19. PLACARD - Takeoff and Landing Operation
20. PLACARD - Door, Open
21. PLACARD - Door, Latch
22. PLACARD - Forward Cabin Door Release
23. PLACARD - Sump Drain
24. PLACARD - Oxygen Bottle Installation
25. PLACARD - External Power
26. PLACARD - Baggage Limitations
27. PLACARD - Light Switch, Baggage Door
28. PLACARD - Unlatch
29. PLACARD - Storm Window
30. PLACARD - Oil Drain Probe
31. PLACARD - Press Ball To Unlatch

Figure 11-2. Interior Placards and Decals (Sheert 1 of 4)



SENECA III INSTRUMENT PANEL. SEE SHEET 4 OF 4 FOR SENECA IV PANEL.

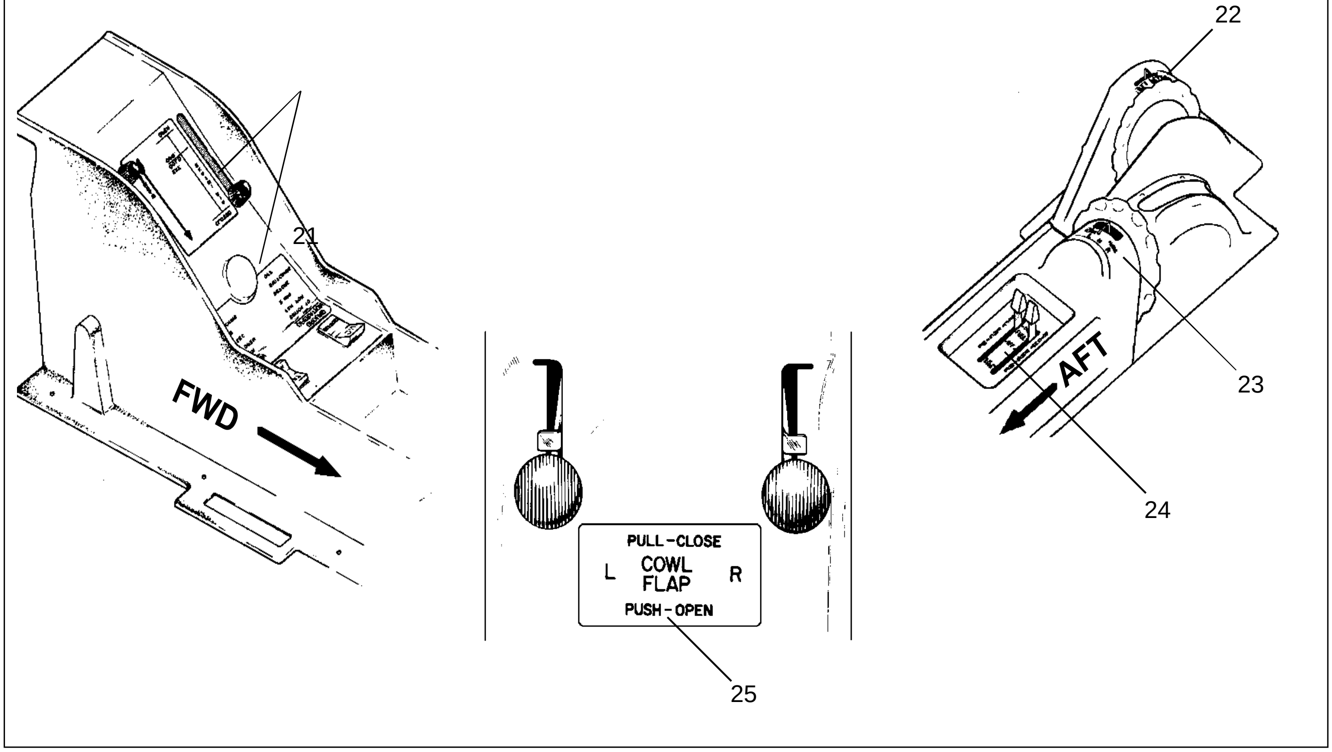


Figure 11-2. Interior Placards and Decals (Sheert 2 of 4)

1. PLACARD - Compass Erratic
2. PLACARD - Radio Master
3. PLACARD - Alternate Static Source
4. PLACARD - Surface/Propeller Deice
5. PLACARD - Phone/Mike
6. PLACARD - Air Conditioner
7. PLACARD - Optional Electric Flap Position
8. PLACARD - Right and Left Alternator
9. PLACARD - Alternate Air
10. PLACARD - Propeller Synchrophaser
11. PLACARD - Throttle, Propeller, Mixture Control
12. PLACARD - Emergency Gear Extender
13. PLACARD - Lights Dimmer
14. PLACARD - Primer L & R
15. PLACARD - Optional Fuel Primer System
16. PLACARD - Phone/Mike
17. PLACARD - Park Brake Pull
18. PLACARD - Registration Number
19. PLACARD - Airspeed Limits
20. PLACARD - Annunciator Press-To-Test
21. PLACARD - Heater/Fan Operation
22. PLACARD - Elevator Trim
23. PLACARD - Rudder Trim
24. PLACARD - Fuel Controls
25. PLACARD - Cowl Flaps

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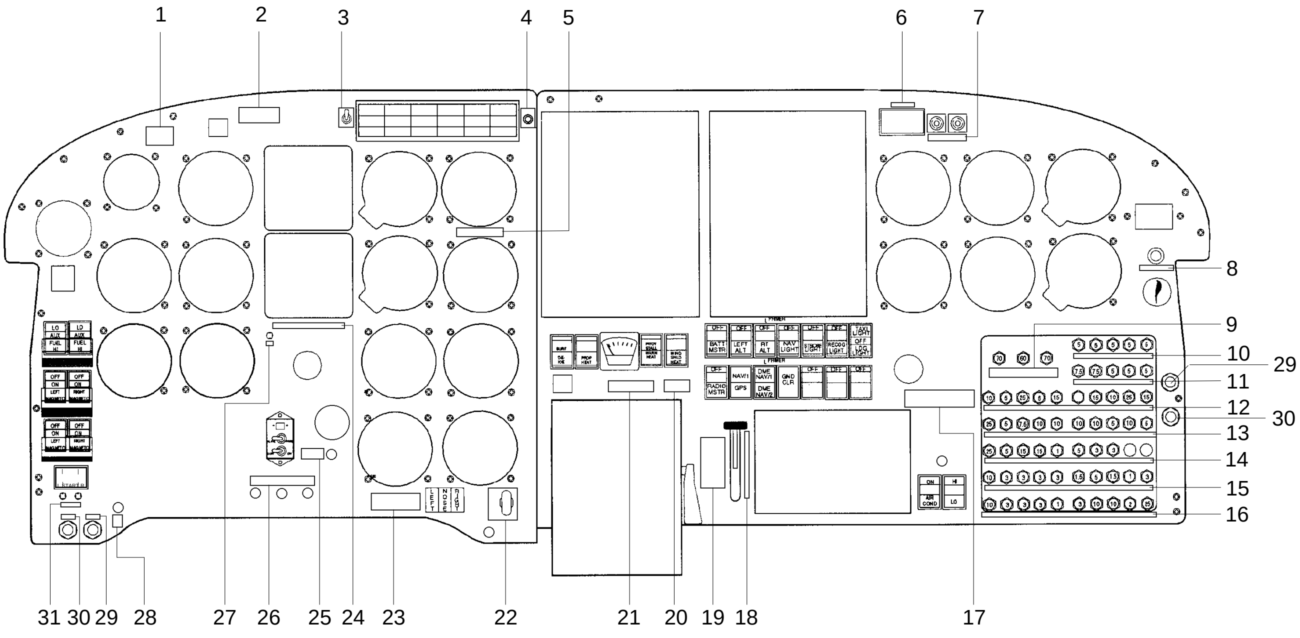
Figure 11-2. Interior Placards and Decals (Sheert 3 of 4)



SENECA IV INSTRUMENT PANEL (SERIAL NUMBERS 3448038 AND UP)

1. PLACARD – Speed Limitations
2. PLACARD – Airplane Registration
3. PLACARD – Day - Night
4. PLACARD – Press To Test
5. PLACARD – Avoid Continuous Ground operation ....
6. PLACARD – Ammeter
7. PLACARD – L Alt. Amps - R.Alt Amps
8. PLACARD – KLN-90 Dataloader
9. PLACARD – Circuit Breaker
10. PLACARD – Circuit Breaker
11. PLACARD – Circuit Breaker
12. PLACARD – Circuit Breaker
13. PLACARD – Circuit Breaker
14. PLACARD – Circuit Breaker
15. PLACARD – Circuit Breaker
16. PLACARD – Circuit Breaker
17. PLACARD – Warning - Air Conditioner Must Be Off...........
18. PLACARD – Flap Travel
19. PLACARD – Alternate Static Source.
20. PLACARD – Windshield Panel Heat
21. PLACARD – Warning - This Aircraft is not
22. PLACARD – Gear Up-Down Maximum Speeds
23. PLACARD – Emergency Gear Extension
24. PLACARD – GPS Limited To VFR Use Only
25. PLACARD – Oxygen - Pull ON
26. PLACARD – Dimming – Switch - Panel - Avionics
27. PLACARD – GPS
28. PLACARD – Park Brake Pull
29. PLACARD – Phone
30. PLACARD – Mike
31. PLACARD – L Primer R

Figure 11-2. Interior Placards and Decals (Sheert 4 of 4)

MEYERCORD DECALS

GENERAL

Decals installed on the instrument panel of the Seneca IV are Meyercord type manufacturered 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.

REMOVAL OF MEYERCORD DECALS

CAUTION

Do not use lacquer thinner on any panel that has been painted with enamel or lacquer. Seneca IV panels are painted at the factory with polyurethane paints.

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

CAUTION

Mark-it J-70 solvent will remove enamel, lacquer, and polyutherane based paint products if liquid is dropped onto painted and not removed immediately.

   a. 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.

INSTALLATION OF MEYERCORD DECALS

1. Brush or wipe a fluid coat of Mark-It C-175 solution on surface to receive decal.
2. Mix a solution consisting of 2 parts water and 1 part J-70 solvent.
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 rubber squeegee, squeegee0.00 from center to edges to remove excess solution.
6. Wait approximately 1 to 1 1/2 minutes, then remove backing paper.
7. Using a damp sponge, remove excess solution from face of decal and surrounding area.

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CHAPTER

12

SERVICING

CHAPTER 12 - SERVICING

TABLE OF CONTENTS/EFFECTIVITY

CHAPTER 12 - SERVICING

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

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

AIRCRAFT FINISH CARE

CLEANING

— WARNING —

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

CLEANING EXTERIOR SURFACES

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

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

CLEANING WINDSHIELD AND WINDOWS

— CAUTION —

USE ONLY WATER AND MILD SOAP WHEN CLEANING THE HEATED WINDSHIELD. USE OF ANY OTHER CLEANING AGENT OR MATERIAL MAY CAUSE DISTORTION OR DAMAGE TO WINDSHIELD COATINGS.

1. Remove dirt, mud and other loose particles from exterior surfaces with clean water.
2. Wash interior and exterior window surfaces with mild soap and warm water. Use a soft cloth or sponge in a straight back and forth motion. Do not rub harshly.
3. Remove oil and grease with a cloth dampened with Plexiglas Polish and Cleaner, P/N 403D or similar substance conforming to Federal Specification (P-P-560) or kerosene.
4. Rinse windows thoroughly and dry with soft lint-free cloth.

— 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.

5. A superficial scratch or mar in plastic can be removed by polishing out the scratch with jeweler's rouge.
6. When windows are clean, apply a thin coat of polishing wax. Rub lightly with a soft cloth. Do not apply wax to heated windshields with electrical heating elements.
7. Apply REPCON repellent or equivalent to windows and windshield to improve visibility during flights through rain. Apply only according to manufacturer’s instructions. (Refer to Chapter 91, Consumable Materials.)

CLEANING INTERIOR

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.

4. Wood laminated surfaces should be maintained using only a high grade furniture wax.
5. All upholstery fabrics are Scotchguard treated and may be cleaned as follows:
   Spilled oily and watery liquids will generally bead up on the fabric and can be blotted away leaving little or no stain. Blot spills up as quickly as possible with an absorbent cloth, tissue or sponge. If the material is a solid or semi-solid, such as butter, remove the excess by 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:

   Water-based stains such s ketchup, milk, ice cream, coffee:

   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.

   Oil based stains such as salad dressing, butter or mayonnaise may be removed by either of the following procedures:

   Apply “Texize K-2R Spot Remover” by spraying or rubbing into the fabric and let dry. Vacuum off the residual powder. Repeat if necessary or 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.

   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 —

It is best to test the cleaner on an inconspicuous portion of the fabric to test for discoloration. Also avoid soaking or harsh rubbing.

CLEANING 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.

ENGINE WASHING

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, 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. (Refer to Chapter 12.)

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.

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.

— CAUTION —

PETROLEUM PRODUCTS SUCH AS THESE ARE INJURIOUS TO RUBBER AND THEREFORE SHOULD BE USED SPARINGLY IF AT ALL.

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

CLEANING LANDING GEAR

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

1. Place can under gear to catch waste.
2. Spray or brush gear area, as required, with solvent or mixture of solvent and degreaser.
3. Allow solvent to remain on gear for 5 to 10 minutes. Rinse gear with additional solvent and allow to dry.
4. Remove cover from wheel and remove catch can.
5. Lubricate gear per lubrication chart in Chapter 12.

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REPLENISHING

SERVICING FUEL SYSTEM

The fuel filter, mounted to the wing station 82.92 rib, should be cleaned at intervals of 50 hours or every 90 days, whichever comes first. Servicing of the filter is as follows:

1. Move the system's fuel selector valve to its off position.
2. Just outboard of the nacelle (refer to Figures 12-1 and 12-2), 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.

DRAINING FUEL SYSTEM

The bulk of the fuel may be drained from the system by removing the flush type drain valve at the inboard end of each fuel tank. The remaining fuel in the system may be drained through the fuel filters and the two drains located on the lower right side of the fuselage inboard to the flaps.

FILLING FUEL TANKS

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 comprising a total of 49 gallons per side. With the optional system, an additional bladder cell of 15 gallons is added per side giving 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.

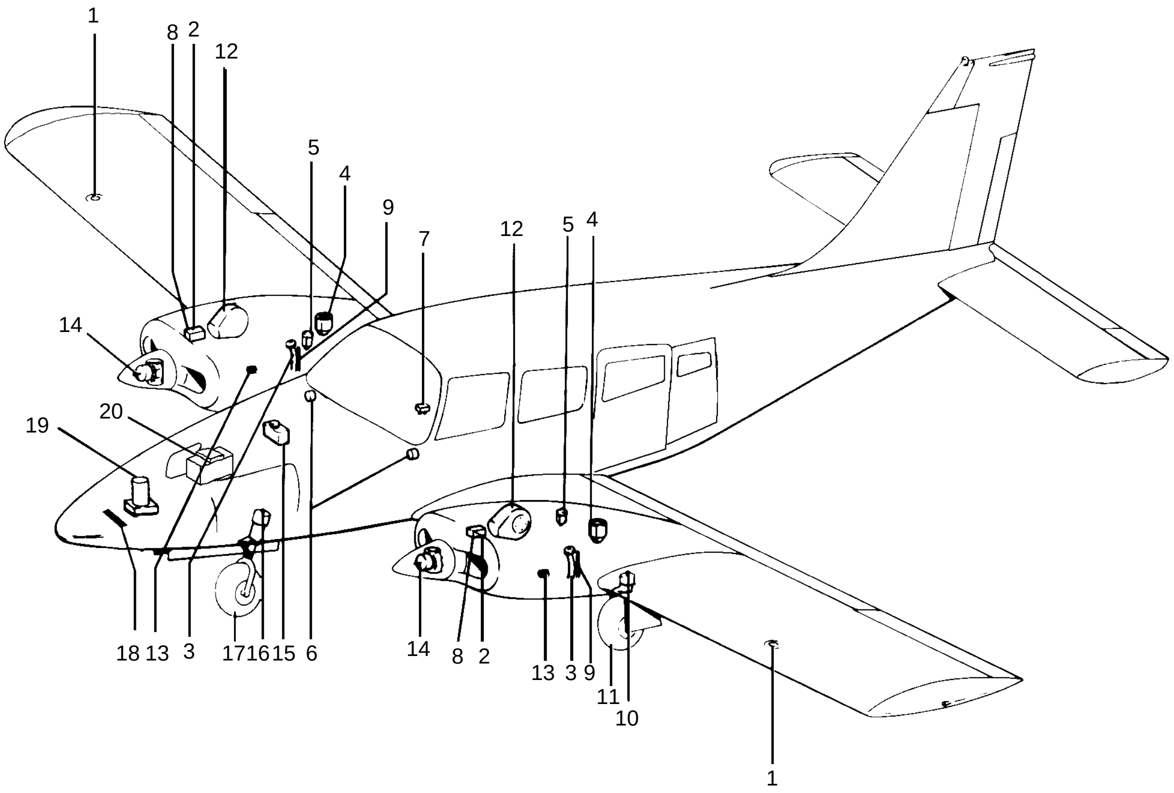
HANDLING OF DIRT AND MOISTURE IN FUEL SYSTEM

— 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.



1. FUEL FILLERS
2. FUEL INJECTORS
3. ENGINE OIL FILL
4. ENGINE OIL FILTERS
5. FUEL FILTERS
6. INSTRUMENT AIR FILTERS
7. FUEL SYSTEM DRAINS
8. FUEL METERING CONTROL UNIT
9. OIL DIPSTICK
10. MAIN GEAR STRUT
11. MAIN GEAR TIRES
12. INDUCTION AIR FILTERS
13. ENGINE OIL SUCTION SCREEN
14. PROPELLER AIR CHARGE
15. BRAKE RESERVOIR
16. NOSE GEAR STRUT
17. NOSE GEAR TIRE
18. EXTERNAL POWER RECEPTACLE
19. BATTERY
20. HYDRAULIC RESERVOIR

Figure 12-1. Service Points

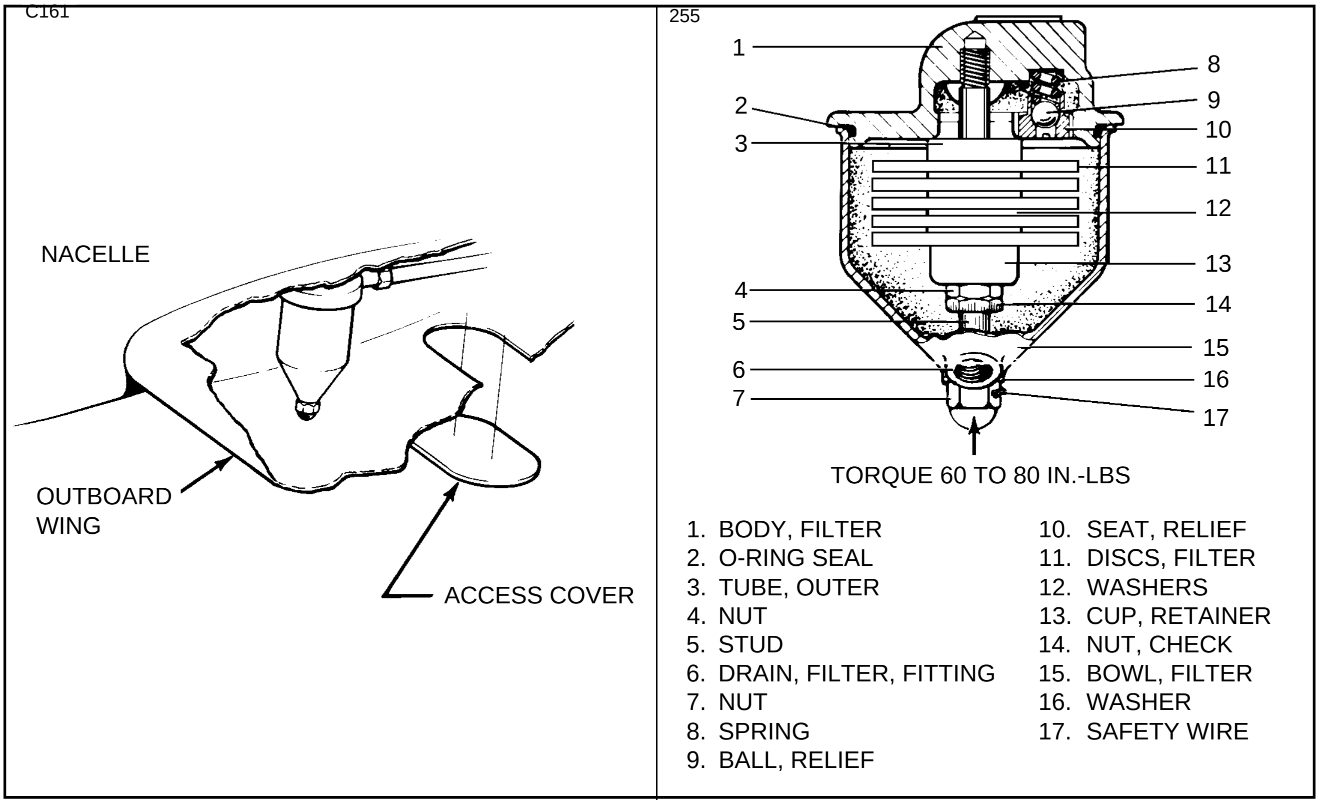


Figure 12-2. Fuel Filter Installation

HANDLING OF DIRT AND MOISTURE IN FUEL SYSTEM (continued)

— CAUTION —

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

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.

SERVICING OIL SYSTEM

The engine oil level should be checked before each flight and changed after each 100 hours of engine operation. During oil change the oil screen(s) should be removed and cleaned, and the oil filter cartridge replaced. Replace oil filter at 50 hour intervals.

— CAUTION —

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

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

DRAINING OIL SUMP

— NOTE —

It is recommended that the engine be warmed to operating temperature before draining to ensure drainage.

Obtain a suitable container to hold the appropriate amount of oil and place under engine. If the optional quick drain is used, remove from baggage compartment. Remove the access panel in the lower cowl and insert quick drain or remove drain plug as applicable.

RECOMMENDATIONS FOR CHANGING OIL.

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.

FILLING OIL SUMP

The oil sump should normally be filled with oil to the mark on the engine dipstick. The specified grade of oil may be found in the Lubrication Chart, or on the cowl panel access door of each engine. To service the engine with oil, open the access door of the cowl and remove the oil filler cap.

OIL SCREEN (SUCTION)

The oil suction screen is located on the bottom aft end of the engine sump, 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. After cleaning and inspection, place the screen inside the recess in the hex head plug to eliminate possible damage to the screen. Insert the screen into the housing and when certain that the screen is properly seated, tighten and safety the plug with MS-20995-C41 safety wire.

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 Champion cutter tool CT-470, available from Champion Spark Plug Co., Toledo, Ohio 43601. It will cut open any spin-on type 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 attaching bolt within 15 to 18 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.

SCHEDULED SERVICING

SERVICING OLEO STRUTS

The air-oil type oleo strut should be maintained at proper strut piston tube exposures for best oleo action. The nose gear strut must have approximately 1.2 ± .25 inches of piston tube exposed, while the main gear strut requires approximately 3.2 ± .50 inches of tube exposure.

— CAUTION —

DO NOT EXCEED THESE TUBE EXPOSURES.

These measurements are taken with the airplane sitting on a level surface under normal static load.

— NOTE —

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

— WARNING —

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

— CAUTION —

CLEAN ALL DIRT AND FOREIGN PARTICLES FROM AROUND THE FILLER PLUGS WITH COMPRESSED AIR AND/OR WITH A QUICK DRYING SOLVENT.

If the strut has less tube exposure than prescribed, determine whether it needs air or oil by rocking the airplane. If the oleo strut oscillated with short strokes (approximately one inch) and the airplane settles to its normal position within one or two cycles after the rocking force is removed, the oleo strut requires inflating. Check the valve core and filler plug for air leaks, correct if required, and add air. If the oleo strut oscillates with long strokes (approximately three inches) and the airplane continues to oscillate after the rocking force is removed, the oleo struts require fluid. Check the oleo for indications of oil leaks, correct if required, and add fluid. For repair procedures of the landing gear and/or oleo struts, refer to Chapter 32 of this manual.

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 require a large amount, it should be filled as follows:

1. Raise the airplane on jacks. (Refer to Chapter 7.)
2. Place a pan under the gear to catch spillage.
3. Relieve air pressure 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 and these are as follows:
   a. Method I:
      (1) Remove the valve core from the filler plug at the top of the nose gear strut housing. Allow the filler plug to remain installed.
      (2) With the piston tube extended, fill the strut with approved type fluid.
      (3) Attach one end of a clean plastic hose to the valve stem of the filler plug and submerge the other end of the hose in a container of clean hydraulic fluid; make sure the end of the hose is below the surface of the 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.

(4) Fully compress and extend the piston tube, thus expelling any air trapped within the strut chamber. By watching the fluid pass through the plastic hose, it can be determined when the strut is full and no air is present in the chamber.

(5) When air bubbles cease to flow through the hose, compress the piston fully and remove the hose from the valve stem. Remove the filler plug to determine that fluid level is visible up to the bottom of the filler plug hole.

(6) Reinstall the core in the filler plug and the plug in the strut housing and torque the plug to 350 to 400 inch-pounds.

b. Method II: Filling completely empty struts.

(1) Proceed with Steps 1 through 3 of Method I.

(2) Remove the filler plug at the top inboard side of the main gear housing.

(3) Disconnect the torque links by removing any one of the three torque link bolts.

— CAUTION —

WITH THE TORQUE LINK DISCONNECTED, THE STRUT TUBE IS FREE; SLIDE OUT OF THE TRUNNION.

(4) Extend the piston to a visible strut extension of 10 inches minimum, 12 inches maximum.

(5) Add one-half pint minimum of hydraulic fluid through the air valve hole and allow it to drain and fill the chamber below the top bearing hole.

(6) Reconnect the torque links.

(7) Add hydraulic fluid through the air valve hole until the fluid level reaches the bottom (or lower side) of the air valve hole with the piston fully compressed and no air trapped in the assembly below the valve hole.

— NOTE —

Gear assemblies with the air valve hole on the side of the cylinder may be serviced in the horizontal position with the air valve hole vertical.

(8) Install the air valve and torque it from 350 to 400 inch-pounds.

FILLING MAIN GEAR OLEO STRUTS

To fill the main gear oleo struts with hydraulic fluid (MIL-H-5606) one of the following methods should be used, depending on the type of service performed on the strut assembly.

1. Method I: Addition of small amount of fluid.
   a. Raise the airplane on jacks.
   b. Place a pan under the gear to catch any spillage.
   c. Relieve the air pressure from the strut housing chamber by removing the cap from the air valve and depressing the valve core.

d. Remove the valve core from the filler plug and allow the filler plug to remain installed.
e. With the piston tube extended, fill the strut with the approved type of hydraulic fluid.
f. Attach one end of a clear plastic hose to the valve stem of the filler plug and submerge the other end of the hose in a container of clean hydraulic fluid; make sure the end of the hose is below the surface of the 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.

g. Fully compress and extend the piston tube, thus expelling any air trapped within the strut chamber. By watching the fluid pass through the plastic hose, it can be determined when the strut is full and no air is present in the chamber.
h. When air bubbles cease to flow through the hose, fully compress the piston and remove the hose from the valve stem. Remove the filler plug to determine that fluid is visible up to the bottom of the filler plug hole.
i. Reinstall the air valve core in the filler plug and the plug in the strut housing and torque the plug from 350 to 400 inch-pounds.
j. With the airplane still on jacks, compress and extend the gear piston tube several times to ascertain that the strut will operate freely. The weight of the gear, wheel and fork should allow the piston tube to extend.
k. Clean off any overflow of fluid and inflate the strut with air to 250 psi.
l. Remove the airplane from jacks and check strut exposure as described earlier in this section.

2. Method II: Filling completely empty struts.
   a. Proceed with Steps A through C of Method I.
   b. Remove the filler plug at the top inboard side of the main gear housing.
   c. Disconnect the torque links by removing any one of the three torque link bolts.

— CAUTION —

WITH THE TORQUE LINK DISCONNECTED, THE STRUT TUBE IS FREE TO SLIDE OUT OF THE TRUNNION.

d. Extend the piston to a visible strut extension of 10 inches minimum, 12 inches maximum.
e. Add one-half pint minimum of hydraulic fluid through the air valve hole and allow it to drain and fill the chamber below the top bearing hole.
f. Reconnect the torque links.
g. Add hydraulic fluid though the air valve hole until the fluid level reaches the bottom (or lower side of the air valve hole with the piston fully compressed and no air trapped in the assembly below the valve hole.

— NOTE —

Gear assemblies with the air valve hole on the side of the cylinder may be serviced in the horizontal position with the air valve hole vertical.

h. Install the air valve and torque it from 350 to 400 inch-pounds.

INFLATING OLEO STRUTS

1. Make sure enough fluid is in the strut and attach a strut pump to the air valve. If a strut pump is unavailable line pressure may be used.
2. With the airplane at empty weight (full fuel and oil only) fill the main strut to 250 ± 25 psi and the nose gear to 120 ± 12 psi. After attaining pressure, rock airplane to ensure proper strut extension.
3. Before capping valve, check valve core for leakage.

SERVICING STEERING BUNGEES

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

1. Remove the access panels located in the forward baggage compartment.
2. Clamp the rudder pedals in the neutral position as shown in Chapter 27.
3. Remove the nut, washers, and bolt that secures the steering bungee and the steering arm.
4. Remove the clamp that secures the boot, on the frame at station 49.50, to the bungee.
5. Within the fuselage, disconnect the bungee from the rudder pedal arm by removing the nut, washer and bolt.
6. Remove the steering bungee from the aircraft.
7. Cut the safety wire from the bungee retainer.
8. Carefully remove the retainer and release the spring.
9. Apply Aero Lubriplate to the spring and mounting hardware as specified in the Lubrication Chart.
10. Compress the spring into the bungee tube and install the retainer securing with MIL-W-6713 Type 316 safety wire.
11. Ascertain that the measurement taken between the facing sides of the washers at the rod end is 13.71 inches.
12. With the nose gear in the neutral position, install the steering bungee into position. The web must be in the vertical position. (Refer to Chapter 32.)
13. Install the bolt, washers, and nut that secures the bungee to the steering arm.
14. Install the bolt, washer, and nut that secures the bungee to the rudder pedal arm.
15. Install the boot clamp.
16. Repeat this procedure for the other steering bungee.
17. Align the nose gear. Refer to Chapter 32.
18. Remove the rudder pedal clamps and check the operation of the steering bungees.
19. Install the access panels in the forward baggage compartment with the attachment hardware.

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 to accomplish repairs to any of the brake system components, or to bleed the system may be found in Chapter 32.

FILLING BRAKE CYLINDER RESERVOIR

The brake cylinder reservoir should be filled to the level marked on reservoir with the fluid specified in Lubrication Chart. The reservoir, located on the upper right hand side of the bulkhead in the nose compartment, should be checked at every 50 hour inspection and replenished as necessary. No adjustment of the brakes is necessary, though they should be checked periodically per instructions given in Chapter 32.

DRAINING BRAKE SYSTEM

To drain the brake system, connect a hose to the bleeder fitting on the bottom of the cylinder and place the other end of the line in a suitable container. Open the bleeder and slowly pump the hand brake lever and the desired brake pedal until fluid ceases to flow. To drain the wheel brake unit, disconnect the line at the bottom of the unit and allow fluid to flow into a suitable container. To clean the brake system, flush with denatured alcohol.

TIRES

The tires should be maintained at the pressure specified in Chart 601. When checking tire pressure, examine the tires for wear, cuts, bruises and slippage. The tire, tube, and wheel should be balanced when installed. Align the index mark on the tire with the index mark on the tube.

TIRE BALANCING

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, and an inexpensive balancer can be made that will balance almost any tire for light aircraft. Refer to Chapter 91 for balancer fabrication details. Balance the tire as follows:

1. Mount the tire and tube (if one is used) on the wheel, but do not install the securing bolts. Install the wheel bearings in the wheel; then, using the -7 bushings, -6 spacers, and -5 nuts, install the wheel-tire assembly on the -8 pipe. Secure the -5 nuts finger-tight so that the wheel halves touch each other. Be sure the bolt holes are aligned. Insert the -4 axle through the -8 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.
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 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 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.
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 inflate the tire and recheck the balance. The wheel should not be more than 1/2 ounce out of balance.

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.

BATTERY

Servicing of the battery which is located under the floor panel of the forward baggage compartment, involves adding distilled water to maintain electrolyte even with the horizontal baffles, checking cable connections, and checking for any spilled electrolyte that would lead to corrosion. A check for proper fluid level and presence of corrosion should be conducted at intervals of 50 hours or 30 days, whichever comes first. When corrosion is found, at each 100 hour inspection or every 90 days, the battery should be removed from the box and the battery and box should be cleaned. Removal, cleaning, and charging instructions may be found in Chapter 24 of this manual.

INDUCTION AIR FILTER

REMOVAL OF AIR FILTER

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

1. Remove the upper cowling.
2. Release the three stud fasteners, remove filter cover.
3. Remove the filter.

SERVICE INSTRUCTIONS (INSPECTION AND REPLACEMENT)

1. The air filter must be inspected at least once every 50 hours. Under extremely adverse operating conditions, it must be inspected more frequently. Replace as required.
2. When returning existing filter to service, rap gently on a hard flat surface to remove embedded debris. Be careful not to damage sealing ends.
3. Inspect filter housing for damage.
4. The filter housing may be cleaned by wiping with a clean cloth soaked in a suitable quick drying type solvent.

INSTALLATION OF AIR FILTER

1. Properly position the filter in the box assembly and secure the cover assembly with the stud fasteners.

FUEL SYSTEM

1. To flush the fuel tanks and selector valve, disconnect the fuel line at the carburetor.
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.

LUBRICATION INSTRUCTIONS

Proper lubrication procedures are of immeasurable value both as a means of 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, as detailed in the following paragraphs, together with the observance of cleanliness will ensure the maximum efficiency and utmost service of all moving parts. Lubrication instruction regarding the locations, time intervals, and type of lubricants used may be found in the Lubrication Chart. To ensure the best possible results from the application of lubricants, the following precautions should be observed:

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

— NOTE —

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

APPLICATION OF OIL

Whenever specific instructions for lubrication of mechanisms requiring lubrication are not available, observe the following precautions:

1. Apply oil sparingly, never more than enough to coat the bearing surfaces.
2. Since the control cables are sufficiently coated by the manufacturer, additional protection for the prevention of corrosion is unnecessary.
3. 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.

— 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.

APPLICATION OF GREASE

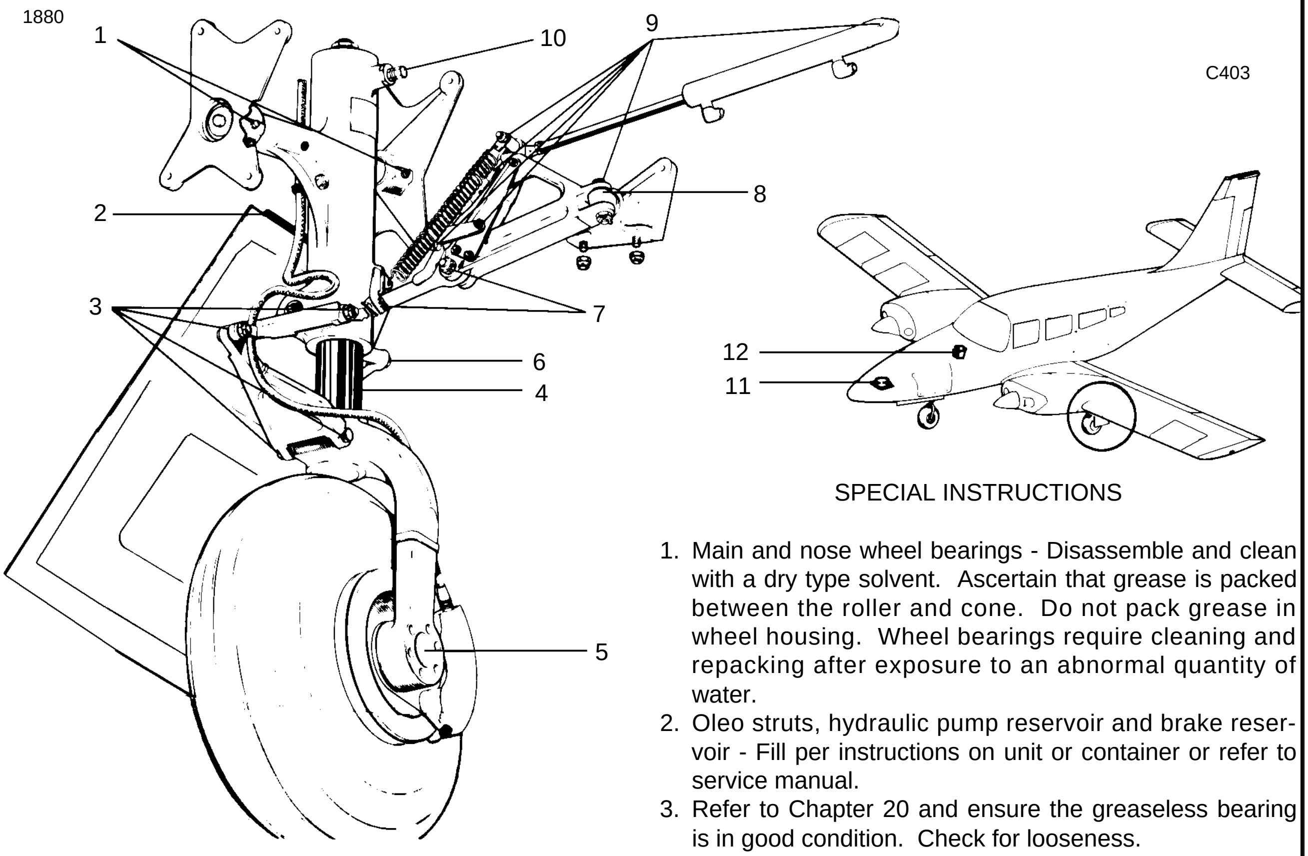
Care must be taken when lubricating bearings and bearing surfaces with a grease gun to ensure that the gun is filled with new clean grease of the grade specified for the particular application before applying lubricant to the grease fittings.

1. Where a reservoir is not provided around a bearing, apply the lubricant sparingly and wipe off any excess.
2. Remove wheel bearings from the wheel hub and clean thoroughly with a suitable solvent. When repacking 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 the constant speed propeller hub to avoid blowing the clamp gaskets. Remove one grease fitting and apply grease to the other fitting until fresh grease appears at the hole of the removed fitting.

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. Refer to Chapter 91 for a List of Consumable Materials and suggested vendors.

COMPONENT	LUBRICANT	FREQUENCY
1. MAIN GEAR PIVOT POINTS (SEE NOTE 3)	MIL-G-23827	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	TEXACO MARFAX ALL PURPOSE GREASE OR MOBIL GREASE 77 (OR MOBIL EP2 GREASE)	100 HRS
6. MAIN GEAR DOOR CONTROL ROD ENDS	MIL-L-7870	100 HRS
7. MAIN GEAR SIDE BRACE LINK ASSEMBLY	MIL-G-23827	100 HRS
8. UPPER SIDE BRACE SWIVEL FITTING	MIL-G-23827	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

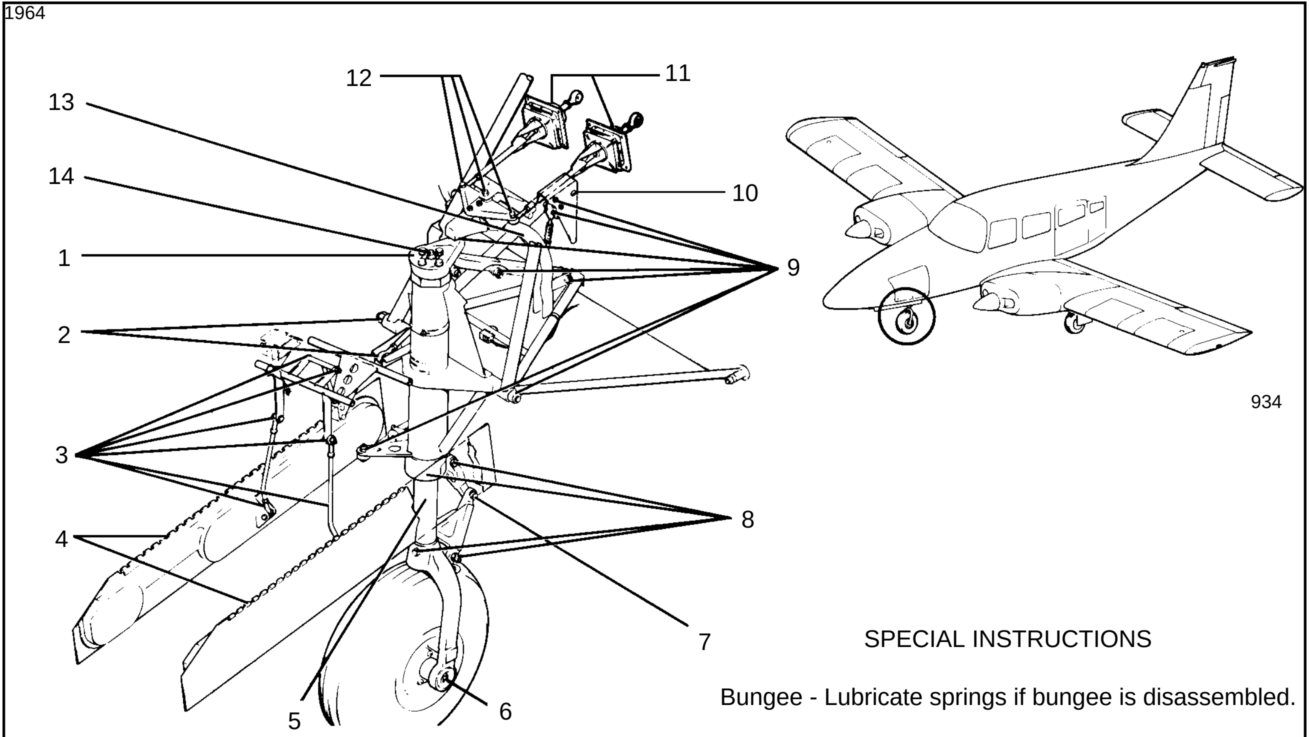


SPECIAL INSTRUCTIONS

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.

Figure 12-3. Lubrication Chart (Main Landing Gear)

COMPONENT	LUBRICANT	FREQUENCY
1. NOSE GEAR STRUT HOUSING	MIL-G-23827	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	TEXACO MARFAC ALL PURPOSE GREASE OR MOBIL GREASE 77 (OR MOBIL EP2 GREASE)	100 HRS
7. NOSE GEAR TORQUE LINK ASSEMBLY	MIL-L-7870	100 HRS
8. NOSE GEAR TORQUE LINK ASSEMBLY AND STRUT HOUSING	MIL-G-23827	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. BUNGEES	LUBRIPLATE #907, FISKE BROS. REFINING CO.	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



SPECIAL INSTRUCTIONS

Bungee - Lubricate springs if bungee is disassembled.

Figure 12-4. Lubrication Chart (Nose Landing Gear)

— 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	LUBRIPLATE #907, FISKE BROS. REFINING CO	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. FLAP RETURN AND TENSION CHAIN	MIL-L-7870	100 HRS
11. FLAP HANDLE PIVOT POINT LOCK MECHANISM AND CABLE PULLEY	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

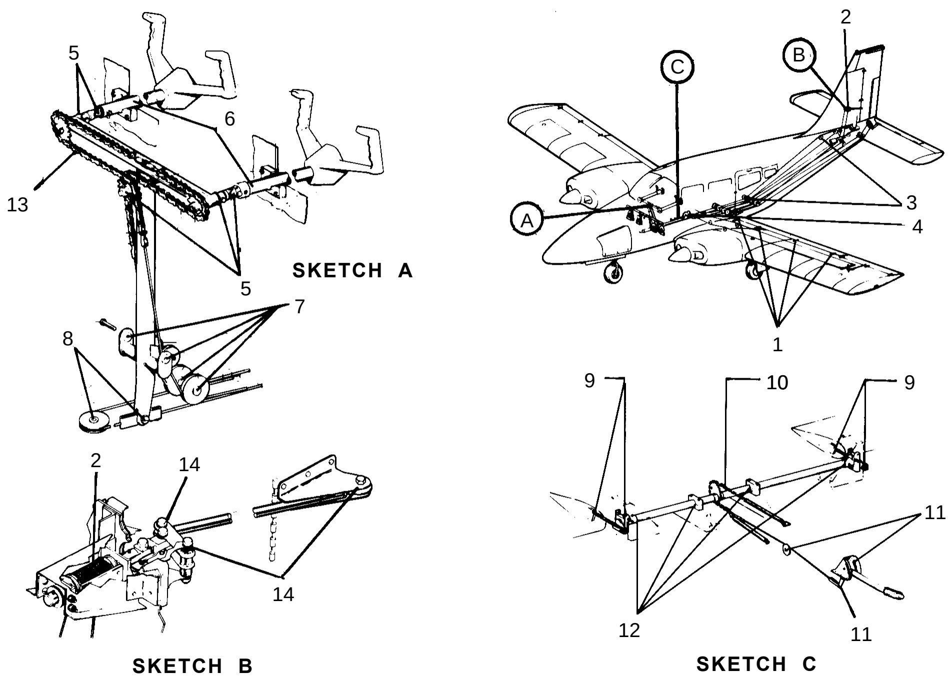


Figure 12-5. Lubrication Chart (Control System)

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	LUBRIPLATE #907, FISKE BROS. REFINING CO.	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

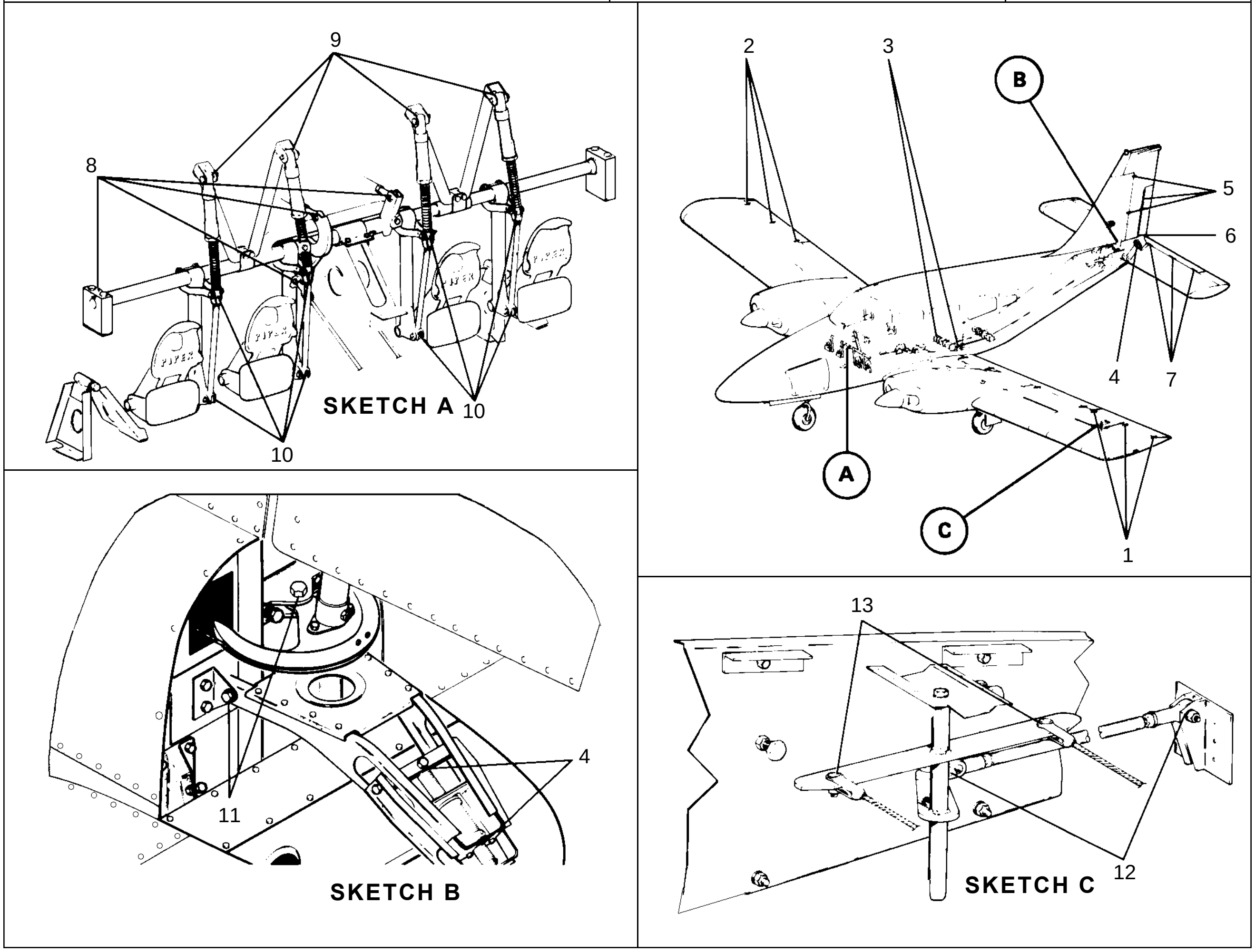
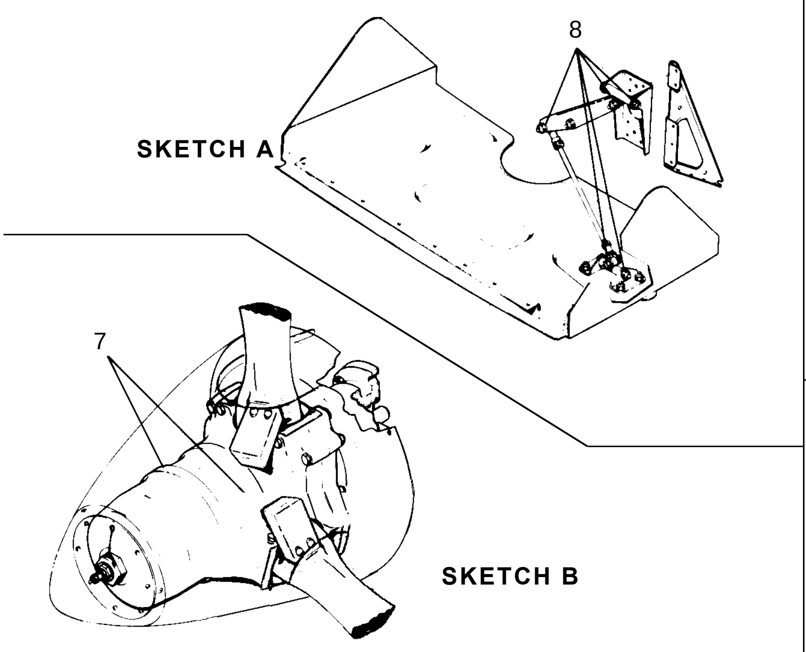
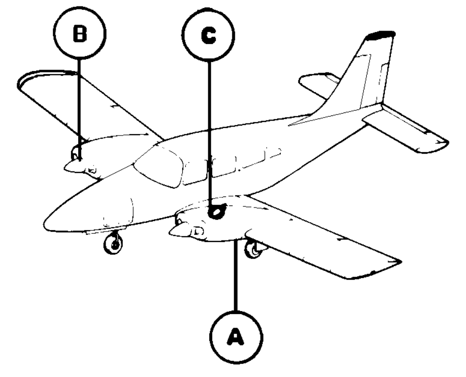
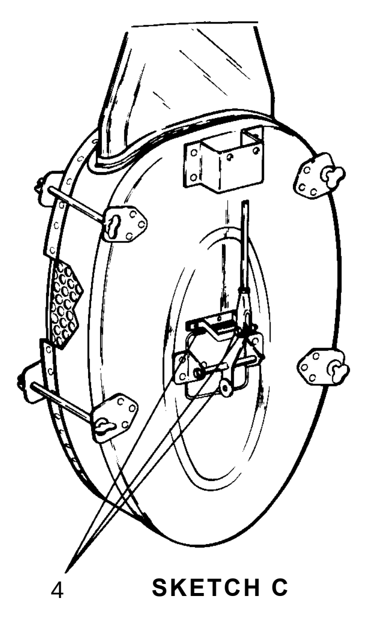


Figure 12-5. Lubrication Chart (Control System)

COMPONENT	LUBRICANT	FREQUENCY
1. ENGINE OIL SUMPS	CONTINENTAL SPECIFICATION MHS-24A AND THE 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 CONDITION	
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	MIL-G-23827	100 HRS
8. COWL FLAP ACTUATING MECHANISM	LUBRIPLATE #907, FISKE BROS. REFINING CO.	500 HRS







SPECIAL INSTRUCTIONS

1. AIR FILTER - TO CLEAN FILTER, TAP GENTLY TO REMOVE DIRT PARTICLES. DO NOT BLOW OUT WITH COMPRESSED AIR OR USE OIL, REPLACE FILTER IF PUNCTURED OR DAMAGED.
2. SEE THE LATEST REVISION OF TCM SERVICE BULLETIN FOR RECOMMENDED OIL AND FILTER CHANGE PERIOD. THE ENGINE LUBRICATING OIL SYSTEM IS SERVICED WITH MIL-C-6529. TYPE II FOR THE INITIAL FILL AND FOR THE FIRST 25 HOURS ENGINE TIME PER TCM OPERATOR'S MANUAL AND MHS-184. SERVICE ENGINE THEREAFTER WITH OIL PER MHS-24A AND THE LATEST REVISION OF TCM SERVICE BULLETIN M75-2.
3. ASCERTAIN THAT OIL FILTER COMPLIES WITH SPECIFICATIONS OF THE LATEST REVISION OF TCM SERVICE BULLETIN M75-7.
4. PROPELLER - REMOVE ONE OF TWO GREASE FITTINGS FOR EACH BLADE. APPLY GREASE THROUGH FITTING UNTIL FRESH GREASE APPEARS AT HOLE OF REMOVED FITTING.
5. LUBRICATE OUTER SURFACE OF INNER SPACER ON COWL FLAP LINKAGE.

Figure 12-6. Lubrication Chart (Power Plant and Propeller)

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

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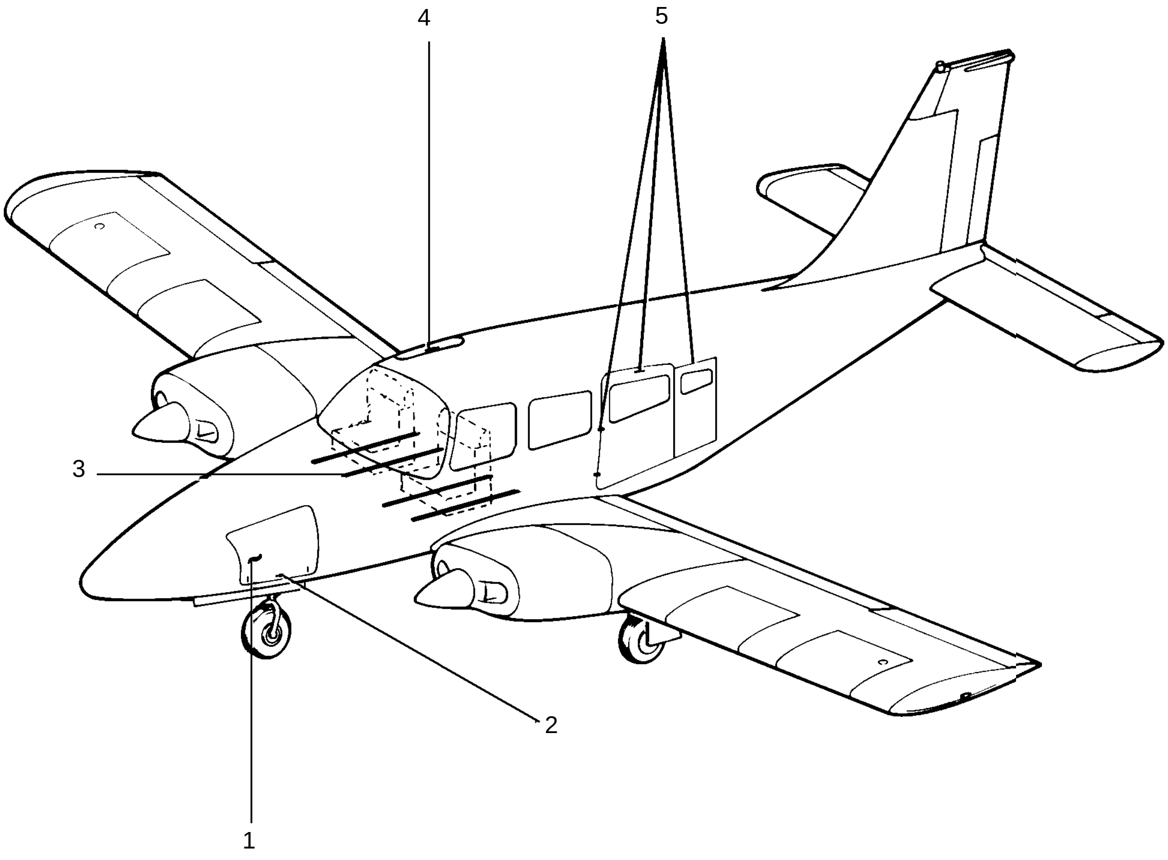

SPECIAL INSTRUCTIONS

Pilot and passengers seats - Lubricate track rollers and stop pins as required.

Figure 12-7. Lubrication Chart (Cabin Door, Baggage Door and Seats)

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CHAPTER

20

STANDARD PRACTICES/ AIRFRAME

CHAPTER 20 - STANDARD PRACTICES/AIRFRAME

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

This chapter contains general information pertaining to standard aircraft hardware installation and removal practices. The information included will be very helpful if it is referred to on a regular basis.

For standard repair practices of a minor nature, refer to AC43-13.

If repairs dictate Non-Destructive Testing (NDT) after repair such as welding, magnaflux should be used on materials made from 4130 steel such as engine mounts and seat frames.

Testing and inspecting of aluminum castings and machines aluminum parts may be accomplished by the dye penetrant method.

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

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STANDARD PRACTICES - AIRFRAME

CHERRYLOCK RIVET, REMOVAL (Refer to Figure 20-1.)

Should it be necessary to remove an installed cherrylock rivet, the following procedures are recommended:

1. In thick material, remove the lock by driving out the rivet stem, using a tapered steel drift pin (see View 1).

— NOTE —

Do not drill completely through the rivet sleeve to remove a rivet as this will tend to enlarge the hole.

2. If the rivets have been installed in thin sheets, driving out the locked stem may damage the sheets. It is recommended that a small center drill be used to provide a guide for a larger drill on top of the rivet stem, and the tapered portion of the stem be drilled away to destroy the lock (see Views 2 and 3).
3. Pry the remainder of the locking collar out of the rivet head with the drift pin (see View 3).
4. Drill nearly through the head of the rivet using a drill the same size as the rivet shank (see View 4).
5. Break off rivet head using a drift pin as a pry (see View 5).
6. Drive out the remaining rivet shank with a pin having a diameter equal to the rivet shank (see View 6).

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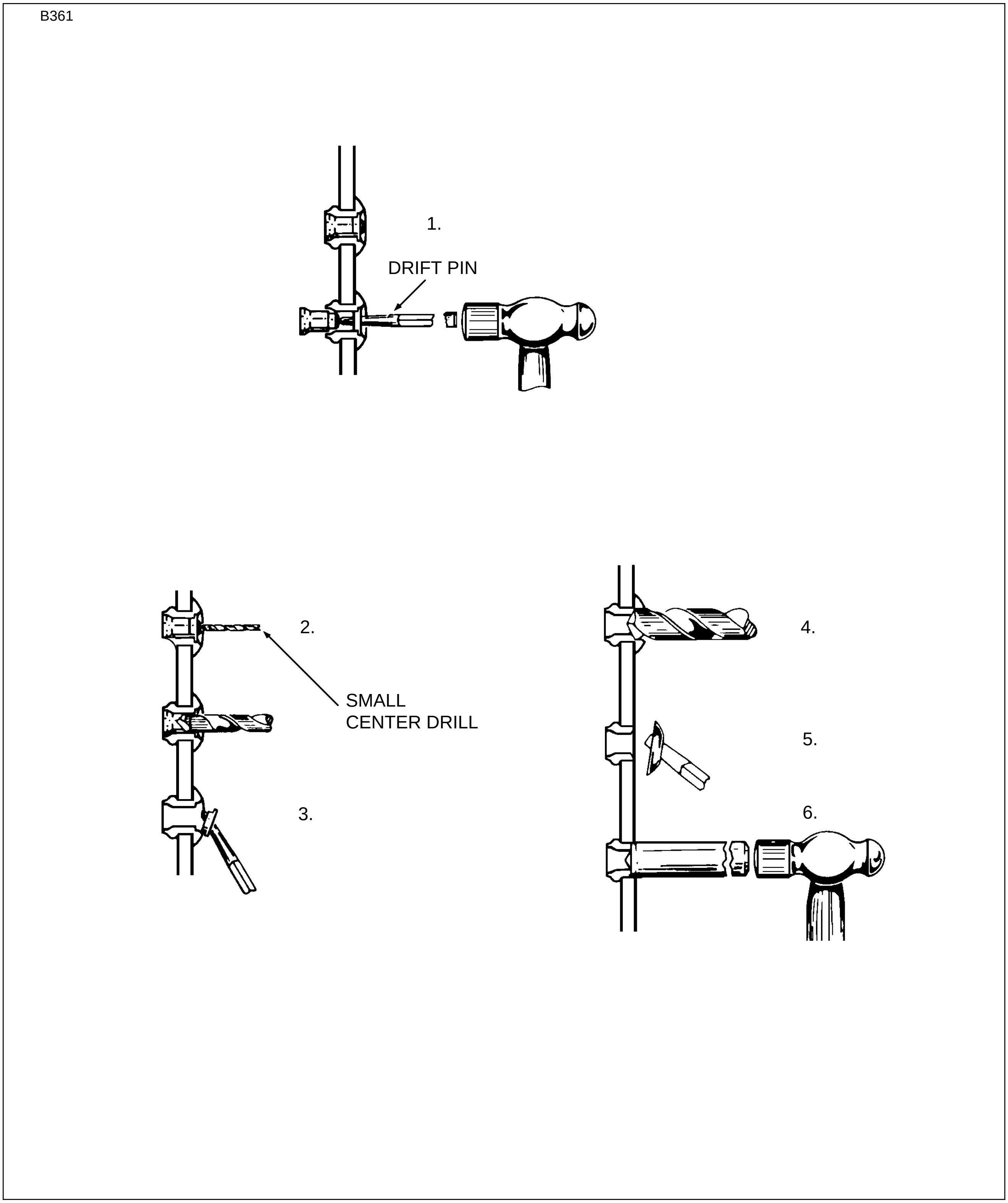


Figure 20-1. Cherrylock Rivet Removal

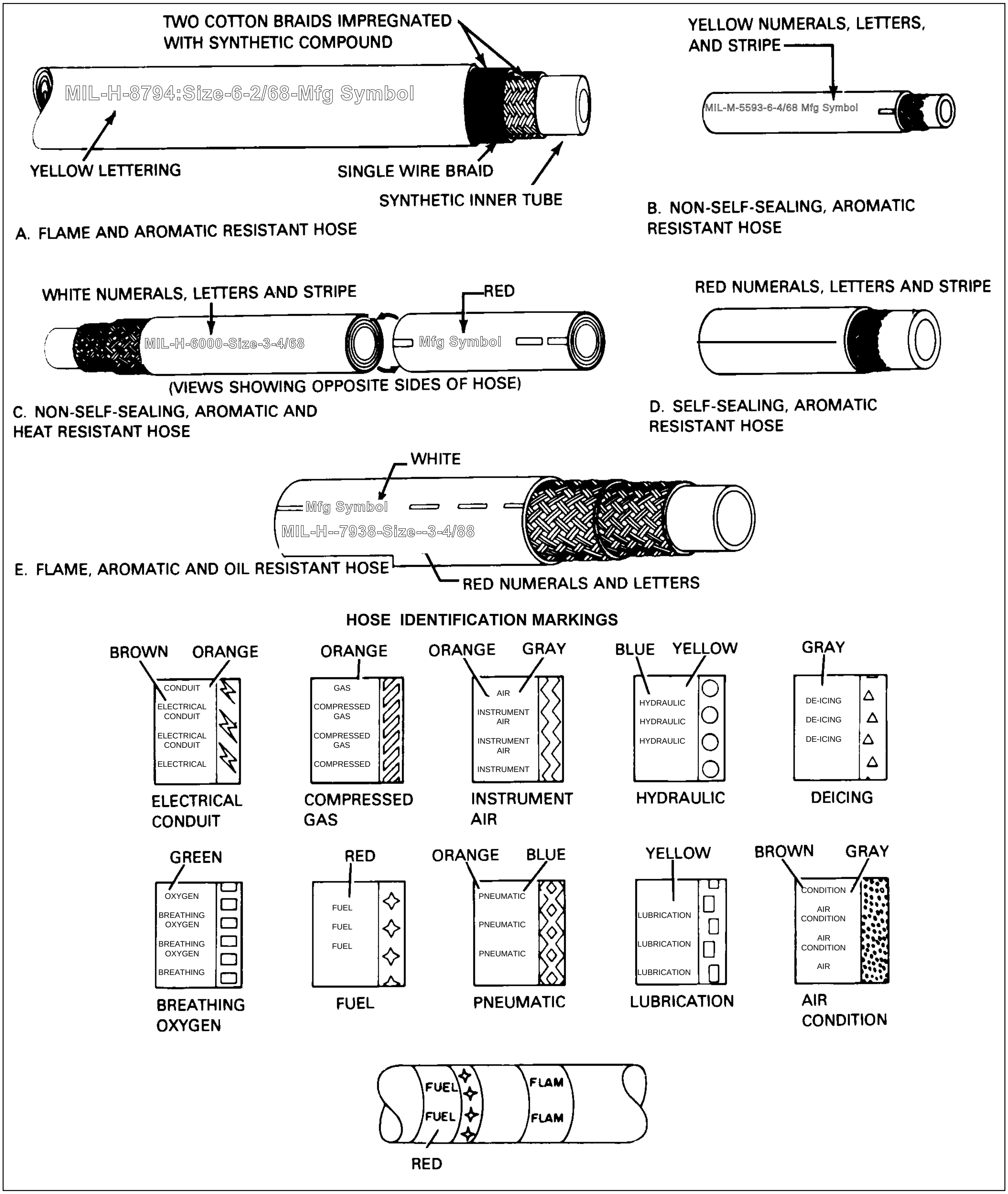


Figure 20-2. Hose/Line Markings

IDENTIFICATION OF FLUID LINES (Refer to Figure 20-2.)

Fluid lines in aircraft are often identified by markers made up of color codes, words, and geometric symbols. These markers identify each line's function, content, and primary hazard, as well as the direction of fluid flow.

In most instances, fluid lines are marked with 1-inch tape or decals. Paint is used on lines in engine compartments where there is the possibility of tapes, decals or tags being drawn into the engine induction system.

In addition to the above-mentioned markings, certain lines may be further identified as to specific function within a system; for example, DRAIN, VENT, PRESSURE or RETURN.

Lines conveying fuel may be marked FLAM; lines containing toxic materials marked TOXIC in place of FLAM. Lines containing physically dangerous materials, such as oxygen, nitrogen, or freon, are marked PHDAN.

The aircraft and engine manufacturers are responsible for the original installation of identification markers, but the aviation mechanic is responsible for their replacement when it becomes necessary.

Generally, tapes and decals are placed on both ends of a line and at least once in each compartment through which the line runs. In addition, identification markers are placed immediately adjacent to each valve, regulator, filter or other accessory within a line. Where paint or tags are used, location requirements are the same as for tapes and decals.

FLARELESS-TUBE ASSEMBLIES (Refer to Figure 20-3.)

Although the use of the flareless-tube fittings eliminates all tube flaring, another operation, referred to as presetting, is necessary prior to installation of a new flareless-tube assembly which is performed as follows:

1. Cut the tube to the correct length with the ends perfectly square. Deburr the inside and outside of the tube. Slip the nut, then the sleeve, over the tube (Step 1).
2. Lubricate the threads of the fitting and nut. See Figure 20-3 for proper lubricant to use, depending on the type system the tubing assemblies are to be used on. Place the fitting in the vise (Step 2) and hold the tubing firmly and squarely on the seat in the fitting. (Tube must bottom firmly in the fitting.) Tighten the nut until the cutting edge of the sleeve grips the tube. This point is determined by slowly turning the tube back and forth while tightening the nut. When the tube no longer turns, the nut is ready for final tightening.
3. Final tightening depends upon the tubing. For aluminum alloy tubing up to and including 1/2-inch outside diameter, tighten the nut from one to one and one-sixth turns. For steel tubing and aluminum alloy tubing over 1/2-outside diameter, tighten from one and one-sixth to one and one-half turns.

After presetting the sleeve, disconnect the tubing from the fitting and check the following points (illustrated in Step 3):

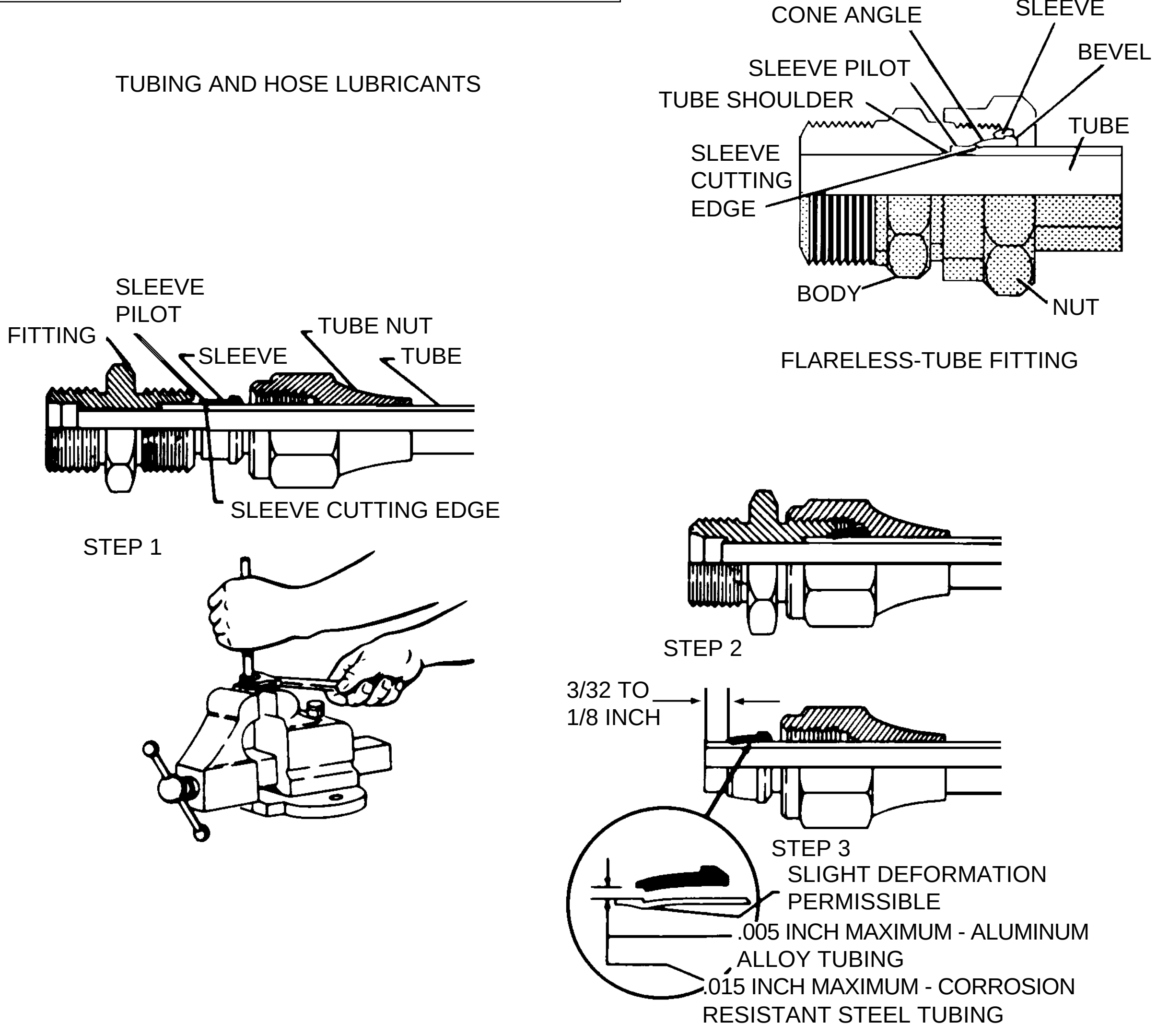
1. The tube should extend 3/32 to 1/8 inch beyond the sleeve pilot; otherwise blowoff may occur.
2. The sleeve pilot should contact the tube or have a maximum clearance of 0.005 inch for aluminum alloy tubing or 0.015 inch for steel tubing.
3. A slight collapse of the tube at the sleeve cut is permissible. No movement of the sleeve pilot, except rotation is permissible.

B363

TUBING SYSTEM	LUBRICANT
HYDRAULIC	MIL-H-5606
FUEL	MIL-H-5656
OIL	SYSTEM LIL
PNEUMATIC	MIL-L-4343
OXYGEN *	MIL-L-5542

* CAUTION - DO NOT USE OIL OR GREASE

TUBING AND HOSE LUBRICANTS



FLARELESS-TUBE FITTING

PRESETTING FLARELESS-TUBE ASSEMBLY

Figure 20-3. Flareless-Tube Fittings

SUPPORT CLAMPS

Support clamps are used to secure the various lines to the airframe or power plant assemblies. Several types 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 effect of hydraulic fluid (MIL-H-5606A) or fuel is expected. 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. 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.

All plumbing lines must be secured at specified intervals. The maximum distance between supports for rigid fluid tubing is shown in Chart 2001.

ELECTRICAL BONDING

Aircraft electrical bonding should be accomplished or verified to establish a maximum allowable resistance value. See Chart 2002 for values.

All electrical, electronic equipment and components shall be installed in such a manner as to provide a continuous low-resistance path from the equipment enclosure to the airplane structure.

Parts shall be bonded directly to the primary structure rather than to other bonded parts.

All parts shall be bonded with as short a lead as possible.

All bonding surfaces shall be cleaned prior to the installation of the bonded joint.

All nuts used in bonding shall be of the self-locking type. (Do Not use fiber-locking type).

All electrical bonding shall be accomplished without affecting the structural integrity of the airframe.

Bond connections shall be secure and free from corrosion.

Selt-Tapping Screws will not be used for bonding purposes.

CHART 2001. MAXIMUM DISTANCE BETWEEN FLUID TUBING SUPPORTS

TUBE OD (IN.)	MAXIMUM DISTANCE BETWEEN SUPPORTS (IN.) ALUMINUM ALLOW	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

"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. (Refer to the latest revision of Piper Service Bulletin #884.)

SELF-LUBRICATING IMPREGNATED BEARING/BUSHINGS (Refer to Figure 20-4.)

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.

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 20-4 , 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:

1. Apply a smear of oil to the outside surface of the bearing.
2. With an arbor press, obtain an arbor 0.010 to 0.015 of an inch smaller than the housing aperture.
3. 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.

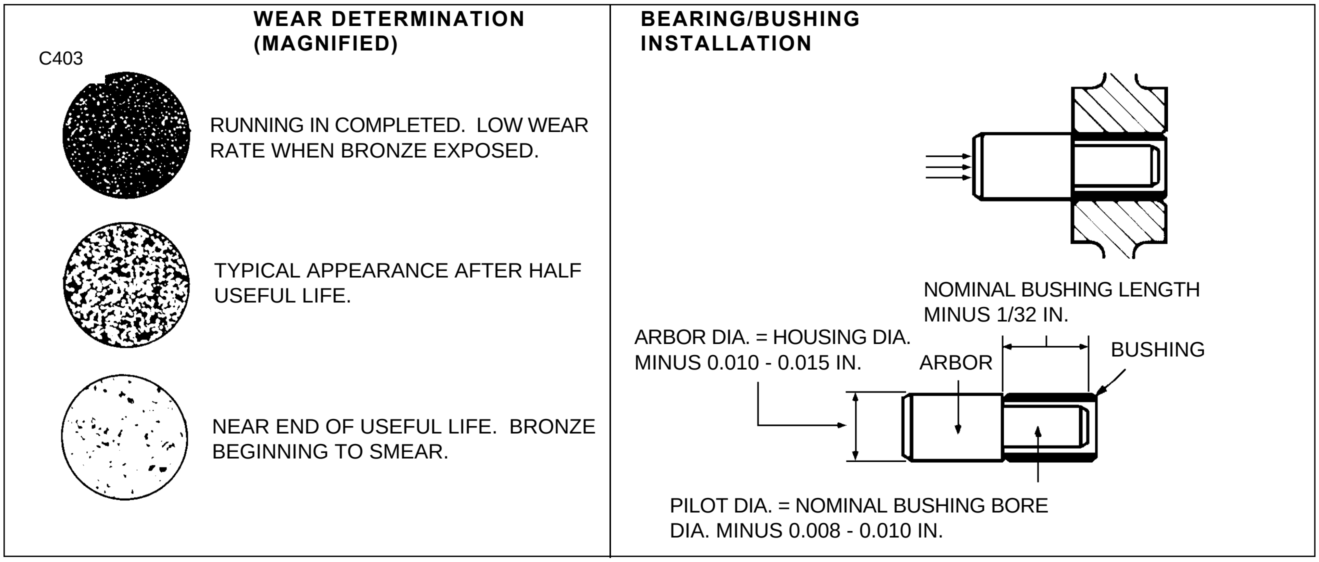


Figure 20-4. Self-Lubricating Bearing/Bushing

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: (Refer to Figure 20-5.)

T = Torque desired at the part.

A = Basic lever length from center of wrench shank to center of handle. This may be stamped on the wrench itself or it may be listed elsewhere.

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

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

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

EXAMPLE

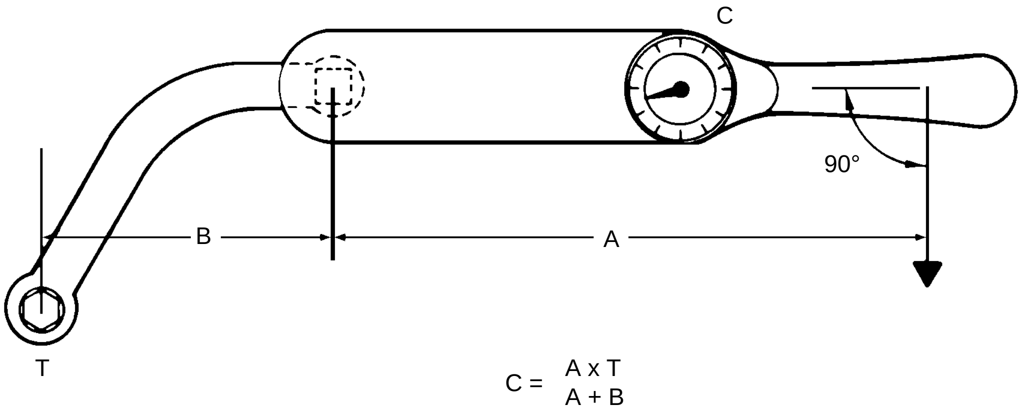
A bolt requires 30 foot-pounds and a 3 inch adapter (one-quarter of a foot or .25') is needed to get at it. You want to know what scale reading it will take on a one-foot lever arm wrench to obtain the 30 foot-pounds at the bolt.

$$C = \frac{1 \times 30}{1 + 25} \text{ or } C = \frac{30}{1.25} = 24 \text{ ft.-lbs.}$$

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.

CHART 2002. MAXIMUM ALLOWABLE RESISTANCE VALUES

ITEM TO BE ELECTRICALLY BONDED	MAXIMUM ALLOWABLE RESISTANCE VALUE IN OHMS
Engine Mount	.003
Generators	.003
Ailerons	.003
Elevators	.003
Rudder	.003
Motor(s)	.003
Flaps	.003
Trim Tabs	
Conventional Hinge	.003
Piano Wire Hinge	.01
Instrument Panel Inserts	.01
Interior Lights	.01
Exterior Lights Mounted on Non-Conductive Material	.003
Heaters	.003
Electrical Equipment	.003
Avionics "Black Boxes"	.003
Battery Ground Point to Generator Ground Point	.01
Refueling Ground Attachment to .032 Aluminum Plate under Tire (A/C on Ground)	10 Megohms



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

Figure 20-5. Torque Wrench Formula

DYE PENETRANT INSPECTIONS

NOTE

Thje following procedure is general in nature. See manufacture's instructions, included with dye penetrant kit, for specifics.

1. Using a volatile cleaner, thoroughly remove dirt, loose scale, oil and grease from surface to be inspected.
2. Heat surface to at least 70°F (21°c), but not exceeding 130°F. (54°c)
3. Apply penetrant by brushing, spraying, or dipping. Let stand 2 to 15 minutes, depending on temperature.
4. Remove surplus penetrant by applying special cleaner recommended by penetrant manufacturer, or by rinsing with water. Allow housing to dry.
5. 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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CHAPTER

21

ENVIRONMENTAL SYSTEM

CHAPTER 21 - ENVIRONMENTAL SYSTEM

TABLE OF CONTENTS/EFFECTIVITY

CHAPTER 21 - ENVIRONMENTAL SYSTEM

TABLE OF CONTENTS/EFFECTIVITY

CHAPTER 21 - ENVIRONMENTAL SYSTEM

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

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

DESCRIPTION

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.

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.

TROUBLESHOOTING

Chart 2101 provides information for troubleshooting heating system.

CHART 2101. 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.

— 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.

Trouble	Cause	Remedy
	Restriction in fuel nozzle orifice.	Remove the 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.
	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.

CHART 2101. TROUBLESHOOTING HEATER (continued)

Trouble	Cause	Remedy
Heater fails to light. (cont)	Cycling switch open.	Replace if defective.
	Duct switch open.	Operate control to see if switch will come on. Replace switch if defective.
Ventilating air blower fails to run.	Heater switch "OFF". Broken or loose wiring to motor.	Energize the heater switch. Check and repair wiring.
	Circuit breaker open.	Close circuit breaker.
	Worn motor brushes.	Replace motor brushes.
	Blower wheel jammed.	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.

CHART 2101. TROUBLESHOOTING HEATER (continued)

Trouble	Cause	Remedy
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.
	High voltage leak in lead between ignition assembly and spark plug.	Replace ignition assembly.
	Inoperative ignition assembly.	If vibrator is in good condition, replace ignition assembly only.
	Restriction in fuel nozzle orifice.	Remove nozzle for cleaning or replacement.
	Nozzle loose in retainer or improper spray angle.	Tighten or replace the nozzle as required.

CHART 2101. TROUBLESHOOTING HEATER (continued)

Trouble	Cause	Remedy
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.

DISTRIBUTION

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.)

REMOVAL OF BLOWER ASSEMBLY

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.

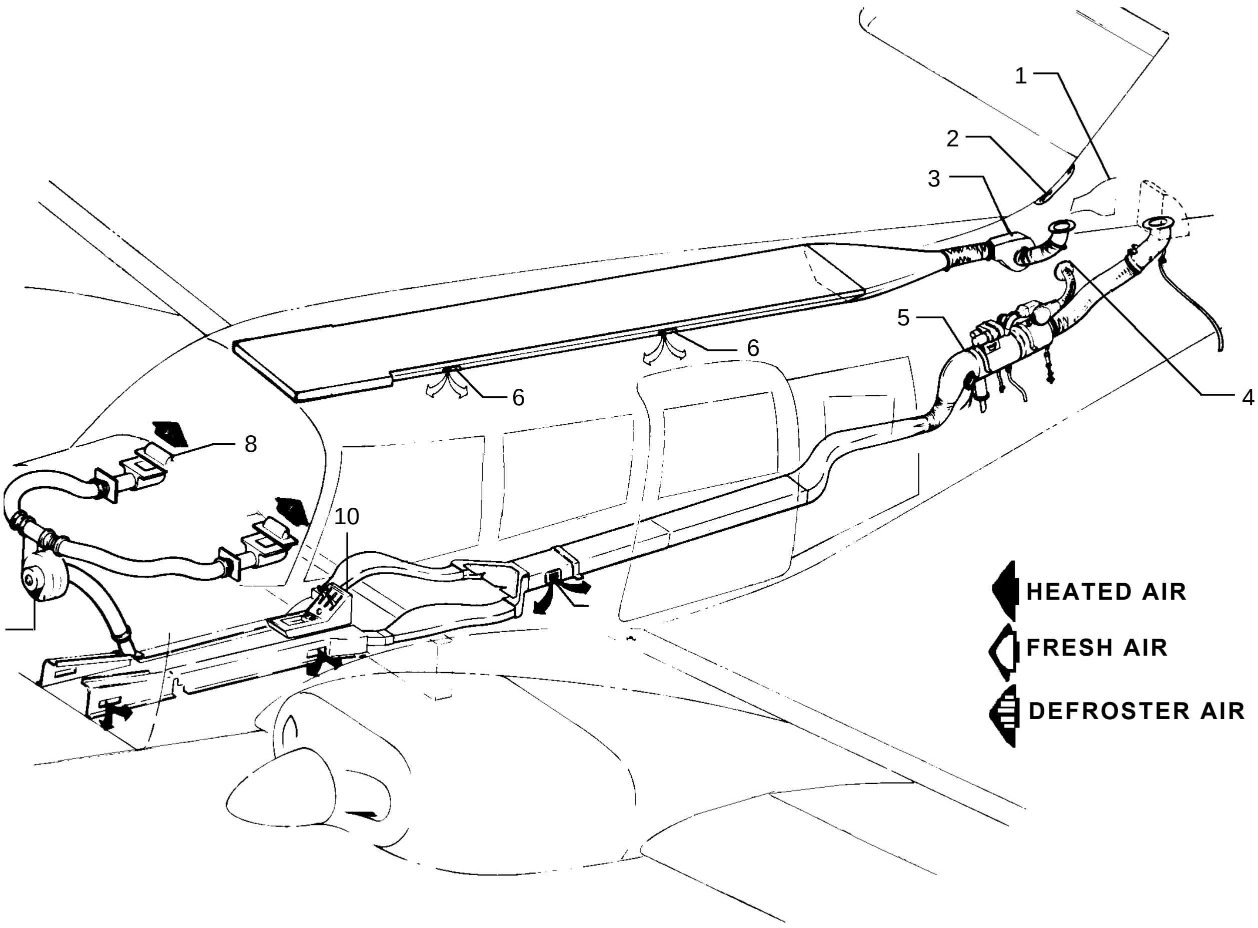
DISMANTLING BLOWER ASSEMBLY

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.

REBUILDING BLOWER ASSEMBLY

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.
3. With the holes in the cover matching the holes in the motor plate, secure the two parts together with rivets.

C404
37069 78629 78630



1. HEATER INLET
2. FRESH AIR INLET
3. OVERHEAD VENT BLOWER - OPTIONAL
4. COMBUSTION AIR BLOWER INLET
5. COMBUSTION HEATER ASSEMBLY
6. FRESH AIR OUTLETS
7. HEATER OUTLETS
8. DEFROSTER OUTLETS
9. DEFROSTER BLOWER
10. HEATER AND DEFROSTER CONTROL ASSEMBLY

Figure 21-1. Cabin Heat, Vent and Defrost Systems

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.

INSTALLATION OF BLOWER ASSEMBLY

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 Arno Co. C-520 wrap 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.

CHART 2102. BLOWER SYSTEM WIRE COLOR CODES

MOTOR WIRES				AIRCRAFT WIRES		
		Pin Nos.	YY1S062 ESB - Universal Elect. Company	Aircraft Harness	Pin Nos.	
Ground	Plug	2	Brown	AC26A	2	Receptacle
Low Speed	Plug	1	Yellow	Black	1	Receptacle
High Speed	Receptacle	1	Orange	Red	1	Plug

— NOTE —

Pin number 1 is at the pointed side of the plug and receptacle.

HEATING

HEATER SYSTEM - OPERATIONAL TEST

1. Check all fittings and connections for condition and security of mounting, and all ducts for freedom of obstructions.
2. 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.
3. 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.
4. Momentarily insert a wedge under the leaf of the main gear squat switch. The ventilation blower should stop operating.
5. Turn off heater switch and remove wedge at squat switch.
6. 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.
7. Reconnect the wire (H 10A) to the heater terminal No. 2.
8. Place the air intake lever in the "OPEN" position and the temperature control lever in the center of its travel.
9. 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.
10. Turn on the master switch; then press the press-to-test in the annunciator panel — red overheat light should illuminate with other warning lights.
11. 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.
12. 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.
13. 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.

14. 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.
15. Remove the pressure gauge and "T" fitting from the regulator.

DESCRIPTION OF HEATER AND BASIC COMPONENTS

SPARK-SPRAY IGNITION (Refer to Figure 21-3.)

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 14 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.

FUEL REGULATOR AND SHUTOFF VALVE (Refer to Figure 21-4.)

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 ± .5 psi. The shutoff valve is operated by a solenoid.

DUCT SWITCH (Refer to Figure 21-5.)

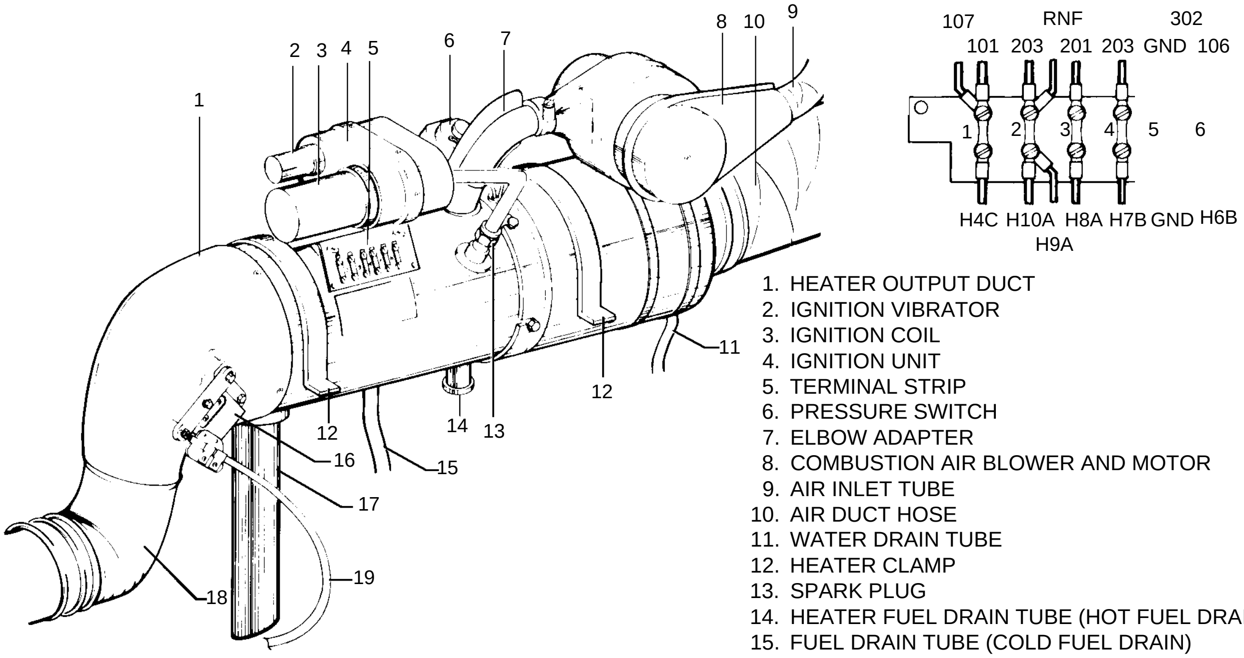
This switch is installed in the ventilating manifold upstream from the heater to sense the ventilating air outlet temperature. To select the desired cabin temperature, the switch may be adjusted manually from a high of 250°F + 10° downward through a range of 146°F ± 6°. The switch has a differential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

COMBUSTION AIR BLOWER

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

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.



1. HEATER OUTPUT DUCT
2. IGNITION VIBRATOR
3. IGNITION COIL
4. IGNITION UNIT
5. TERMINAL STRIP
6. PRESSURE SWITCH
7. ELBOW ADAPTER
8. COMBUSTION AIR BLOWER AND MOTOR
9. AIR INLET TUBE
10. AIR DUCT HOSE
11. WATER DRAIN TUBE
12. HEATER CLAMP
13. SPARK PLUG
14. HEATER FUEL DRAIN TUBE (HOT FUEL DRAIN)
15. FUEL DRAIN TUBE (COLD FUEL DRAIN)
16. ADJUSTABLE DUCT SWITCH
17. EXHAUST SHROUD
18. HEAT OUTLET DUCT
19. DUCT SWITCH CONTROL CABLE

Figure 21-2. Heater and Combustion Air Blower Assembly

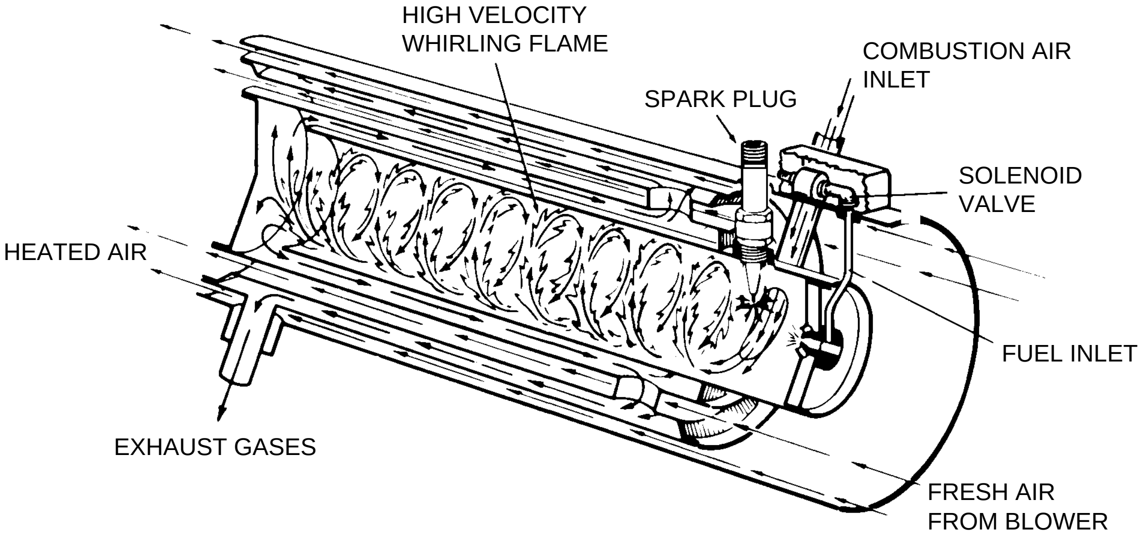


Figure 21-3. Diagramatic Cutaway of Heater to Show Whirling Flame Action

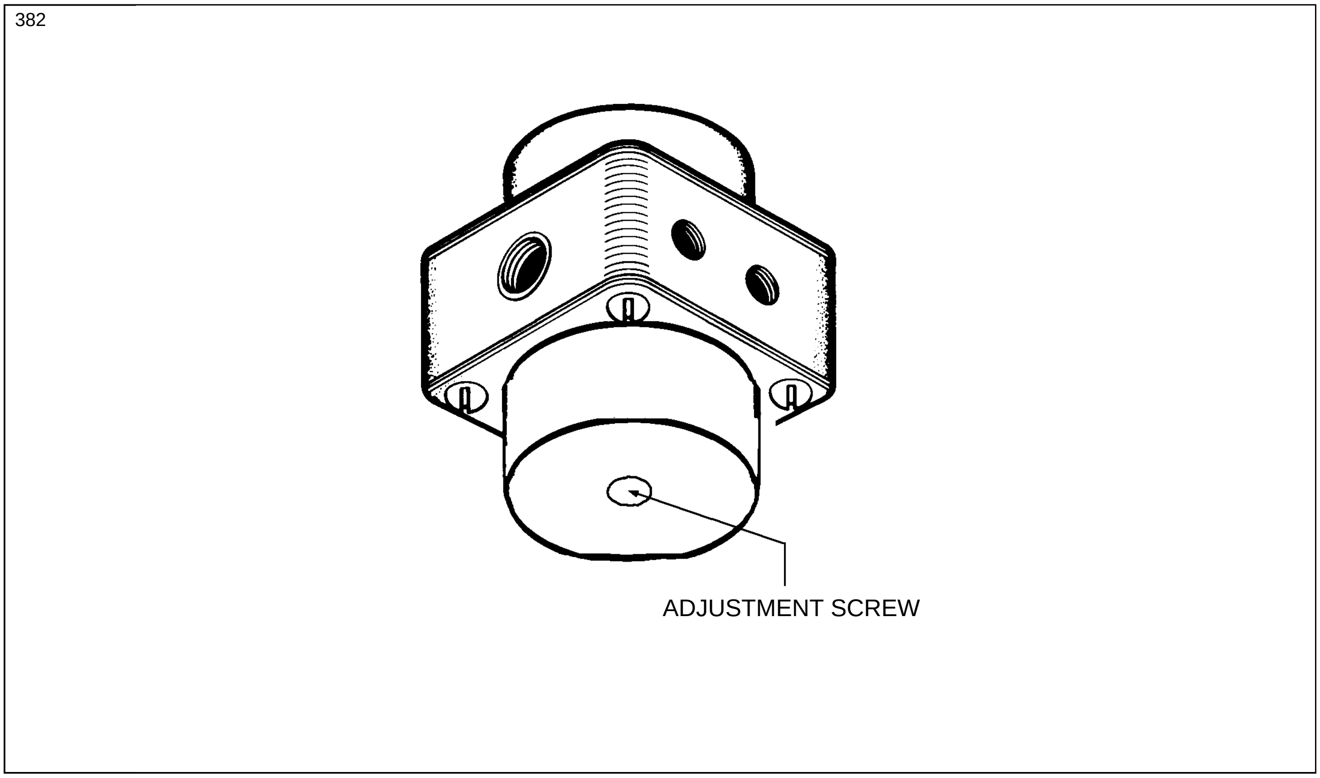


Figure 21-4. Fuel Regulator and Shutoff Valve

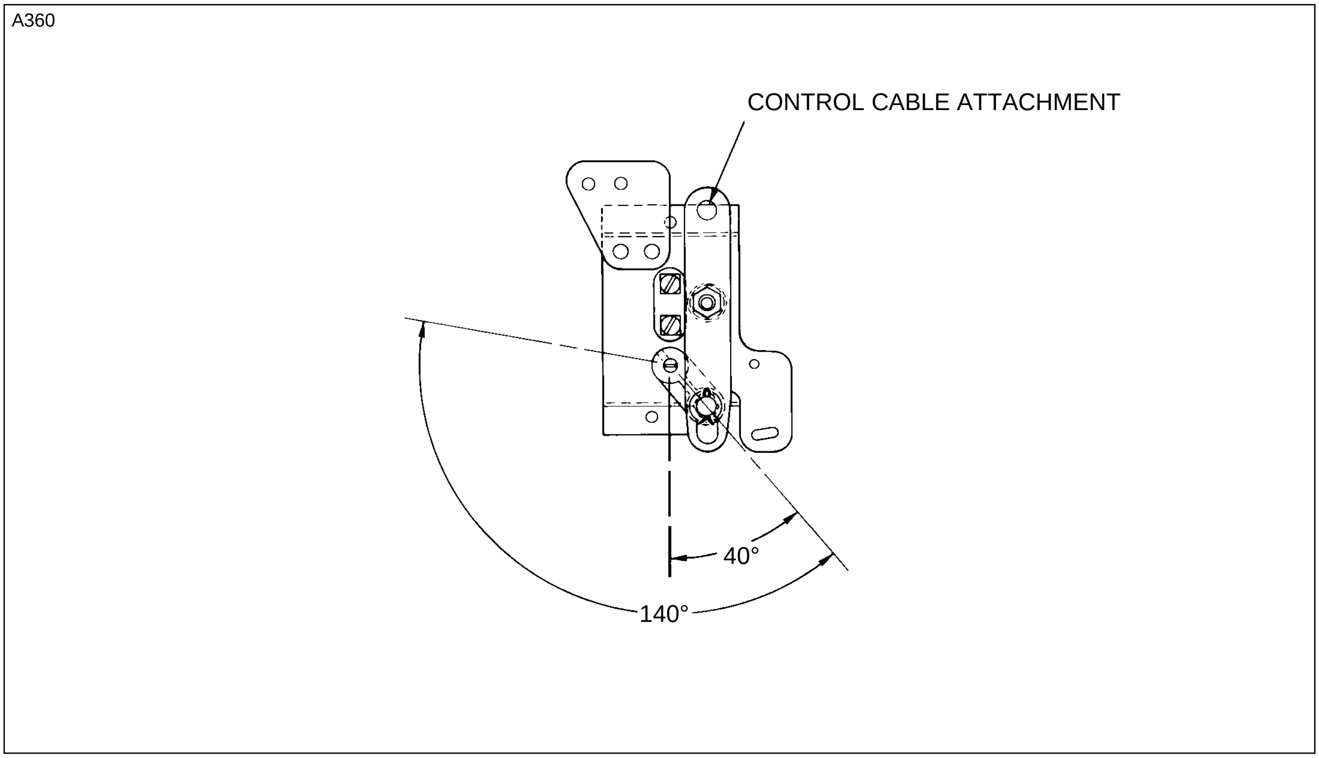


Figure 21-5. Top View - Duct Switch

OPERATING CONTROLS (Refer to Figure 21-1)

— NOTE —

The schematic diagram (Figure 21-6 and 21-7) shows the heater circuit including the electrical wiring in the airplane.

The HEATER SWITCH is connected in the line that supplied 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.

OPERATING PROCEDURE

1. Place the master and heater switches in their 0N 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.

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.

INSPECTION OF HEATER AND HEATER COMPONENTS

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:
   a. 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.

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.

REMOVAL OF HEATER (Refer to Figure 21-2.)

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.

INSTALLATION OF HEATER (Refer to Figure 21-2.)

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 21-2.
10. Check the operation of the heater per previous instructions.
11. Install the access panel to the aft section of the fuselage.

HEATER ELECTRICAL SYSTEM CHECKS

ELECTRICAL CHECKS

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

— NOTE —

The schematic wiring diagram (Figures 21-6 and 21-7) shows, in addition to the heater circuitry, the aircraft control circuit, for both 14 and 28 volt systems. 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.

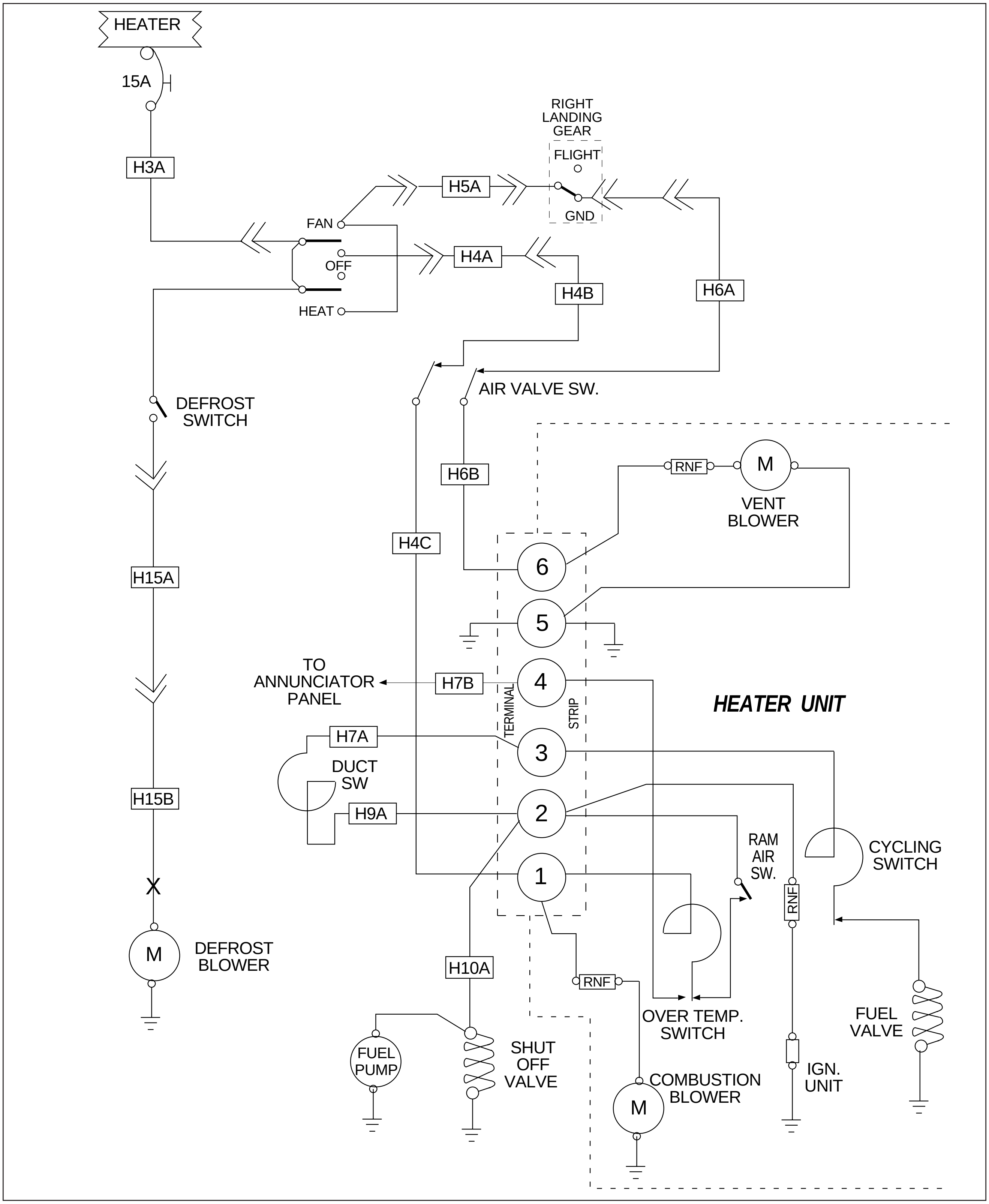


Figure 21-6. Seneca III (14 Volt System) Heater and Defroster Wiring Diagram

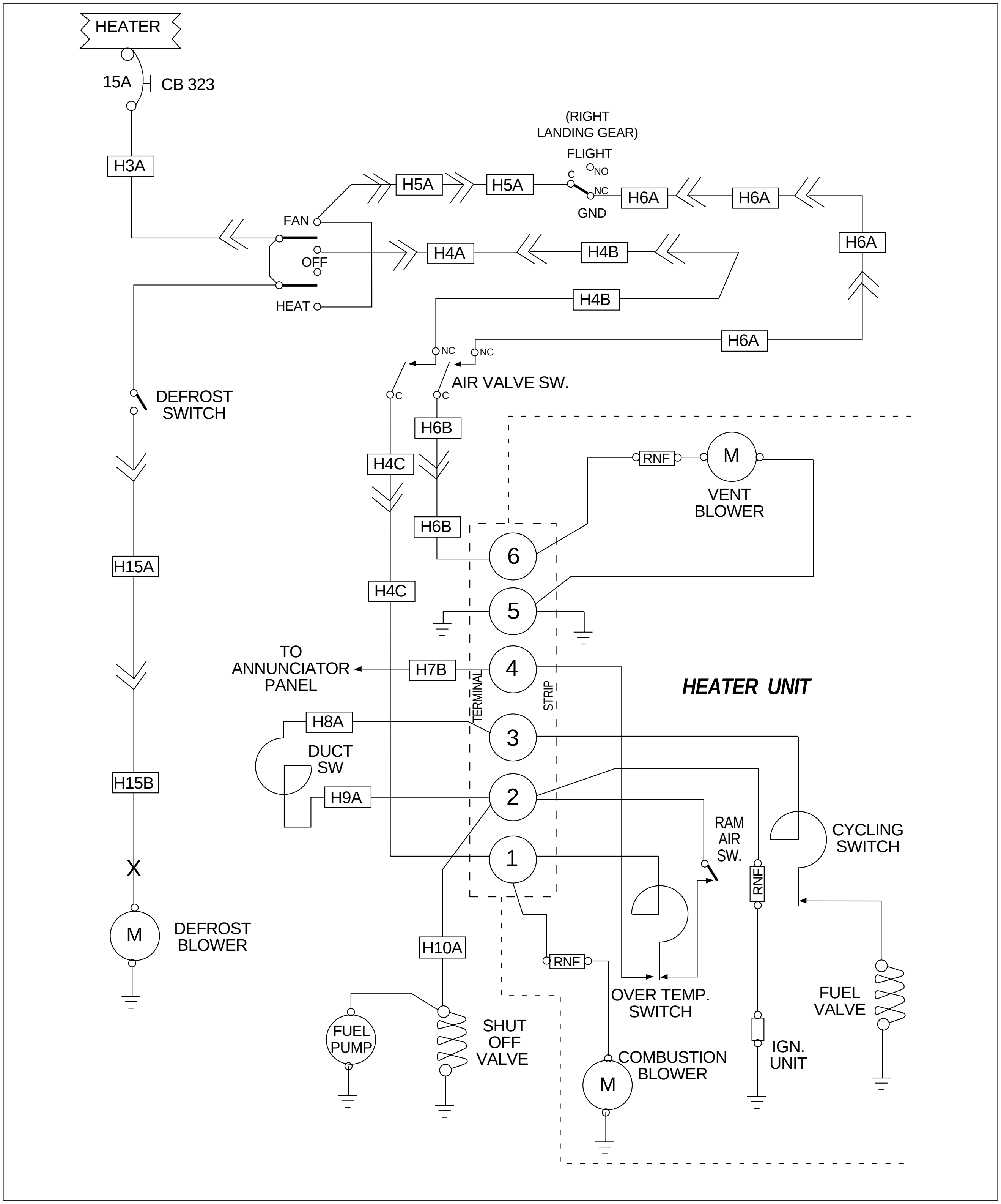


Figure 21-7. Seneca III (28 Volt System) and Seneca IV Heater and Defroster Wiring Diagram

VENT BLOWER POWER CIRCUIT CHECK

1. With the HEATER SWITCH in the FAN position, voltage (14-volts nominal) should be present at the following locations: (Refer to Figures 21-7 and 21-7.)
   a. Terminal No. 6 on the heater terminal strip if the air valve is open.
   b. From terminal No. 6 of the heater terminal strip through the radio noise filter to the ventilating air motor.
   c. 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.

HEATER POWER CIRCUIT CHECK

1. With the HEATER SWITCH in the HEAT position, voltage should be present at the following locations: (Refer to Figures 21-6 and 21-7.)

— 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.

   a. Terminal No. 1 of the heater terminal strip if the air valve is open.
   b. 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.
   c. From terminal No. 3 of the overheat switch through the combustion air pressure switch to terminal No. 2 of the heater terminal strip.
   d. 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.
   e. From terminal No. 3 of the heater terminal strip through the cycling switch to the fuel solenoid valve.

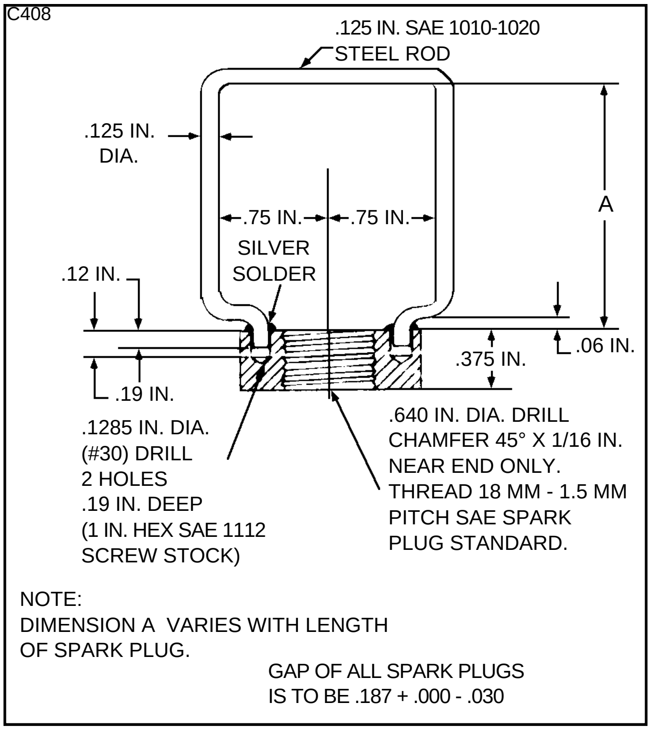
In the event that voltage is not present at one or more of the above listed points, the wiring must be traced back to the power source. If components are still inoperative after the wiring inspection, check the individual inoperative components for voltage and, if necessary, replace them.

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 —

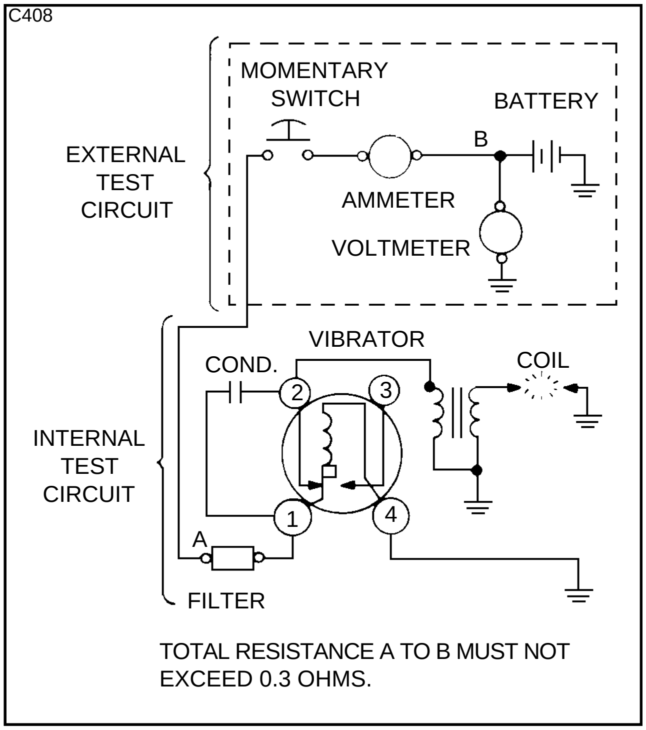
No special service tools are required for normal periodic maintenance.



NOTE:
DIMENSION A VARIES WITH LENGTH
OF SPARK PLUG.

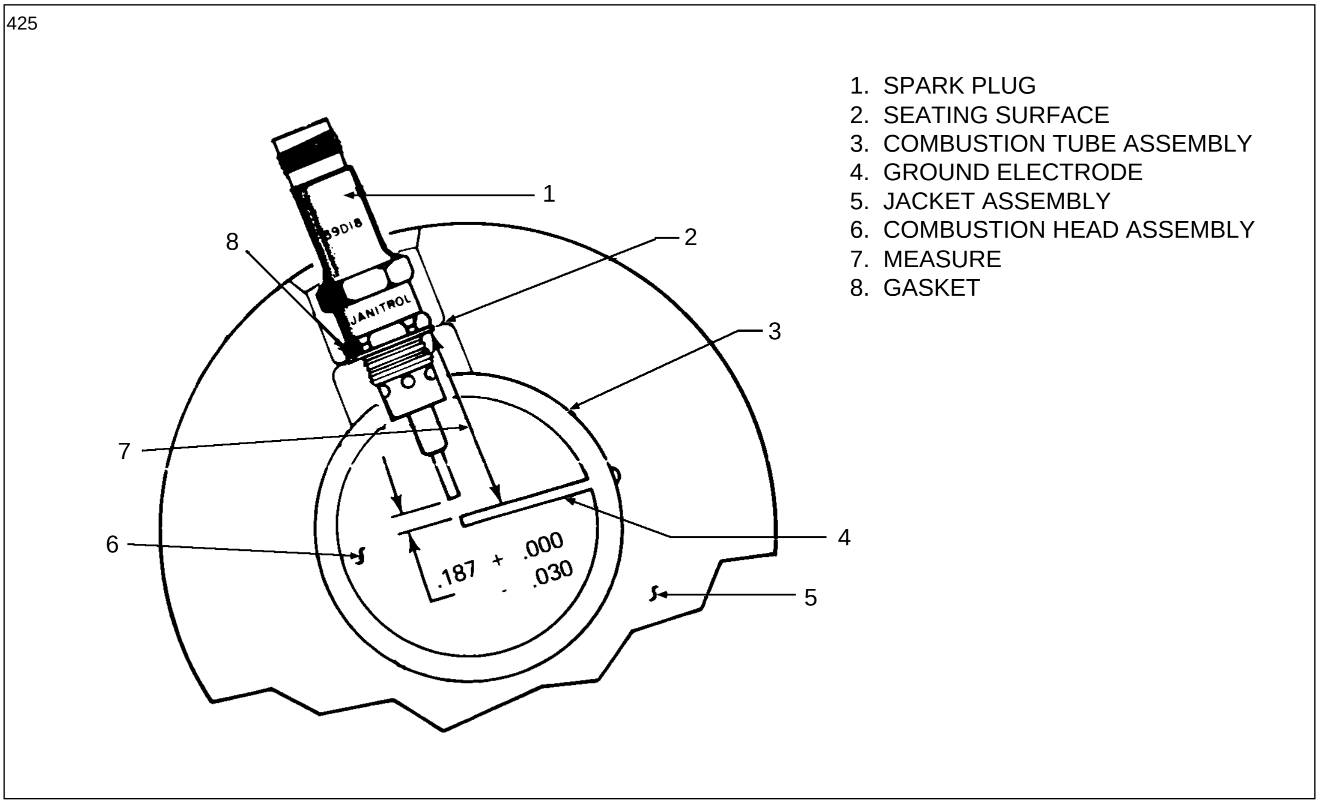
GAP OF ALL SPARK PLUGS
IS TO BE .187 + .000 - .030

Figure 21-8. Spark Plug Fixture



TOTAL RESISTANCE A TO B MUST NOT
EXCEED 0.3 OHMS.

Figure 21-9. Wiring Test Setup



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

Figure 21-10. Spark Plug Gap Adjustment

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: (Refer to Figure 21-17.)
    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.
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.

SPARK PLUG

1. Removal: (Refer to Figure 21-16.)
   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):
   a. 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.

3. Spark Gap Check and Adjustment: (See Figure 21-10.) 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 Chapter 95 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:

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

4. Installation: (Refer to Figure 21-10.)
   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 (39, Figure 21-16) 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.

IGNITION UNIT

This unit converts 14-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.

IGNITION UNIT REMOVAL AND INSTALLATION

1. Removal: (Refer to Figure 21-16.)

— NOTE —

Make sure heater electrical circuits are de-energized.

   a. Disconnect the primary wire from the primary terminal of the ignition assembly.
   b. Carefully unscrew and disconnect the high voltage ignition cable at the spark plug. Exercise care to avoid fouling or damaging the connector.
   c. Remove the four attaching screws and lift the ignition assembly off the heater jacket.
2. Installation: (Refer to Figure 21-16.)
   a. Place the ignition assembly in position on the heater jacket with the high voltage cable facing the spark plug end of the heater.
   b. Install the four screws. Tighten the screws securely.
   c. Carefully connect the high voltage lead to the spark plug.
   d. Connect the primary lead to the primary terminal on the ignition unit and tighten the nut securely.
   e. Check for proper heater operation.

TESTING IGNITION UNIT

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:

1. A battery that will supply power at approximately 14 or 28 volts DC.
2. A voltmeter with a range of 0-30-volts.
3. 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.

— CAUTION —

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

4. 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. (Refer to Figure 21-8 for information on fabricating this fixture.)

— NOTE —

Any one of several spark plugs may be used with the spark plug fixture detailed in Figure 21-8. 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.

5. The high tension shielded ignition lead between the ignition unit and the spark plug is a part of the cover assembly.
6. Arrange the test equipment as shown in Figure 21-9.

OPERATIONAL TEST OF IGNITION UNIT

1. Close the momentary switch and read the voltmeter and ammeter. Release the momentary switch immediately.
2. The amperage reading at 14-volts DC must be 1.50 + 0.25 amperes.
3. The amperage reading at 28-volts DC must not be more than 1.5 amperes.

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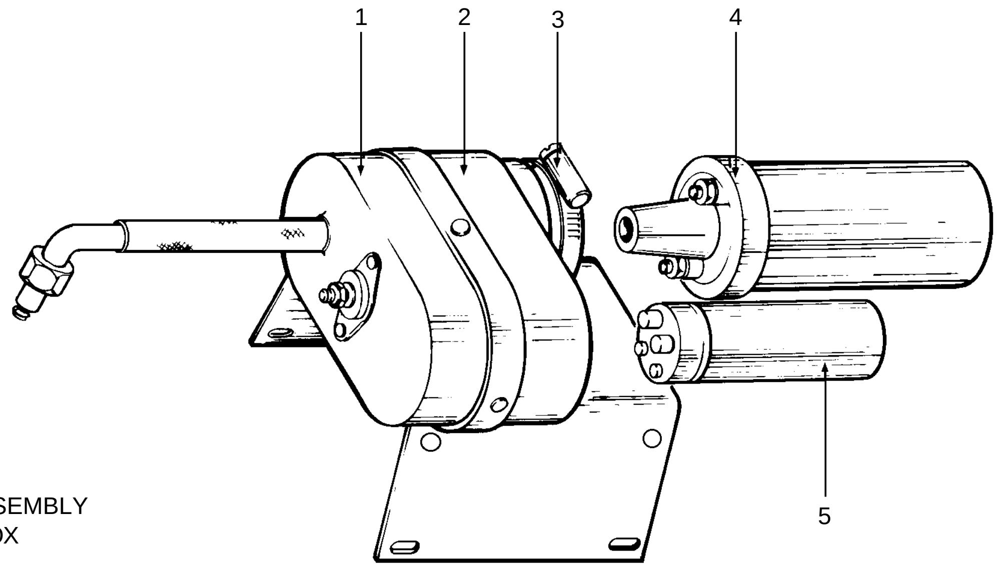


1. COVER ASSEMBLY
2. IGNITION BOX
3. CLAMP
4. IGNITION COIL
5. VIBRATOR

Figure 21-11. Ignition Unit Assembly

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.

VIBRATOR REMOVAL AND INSTALLATION (Refer to Figure 21-11.)

1. Remove the clamp.
2. 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.
3. 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.

CHART 2103. 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.

INSPECTION OF IGNITION UNIT

Inspect components as directed in Chart 2103 and Figure 21-11.

— NOTE —

Replace any component that fails to meet checks listed in Chart 2103.

CYCLING SWITCH AND LIMIT (OVERHEAT) SWITCH (Refer to Figure 21-16.)

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: (Refer to Figure 21-16.)
   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 21-6 and 21-7.)
   c. Install the cycling switch (refer to Figure 21-16) 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. (Refer to wiring diagram, Figure 21-6 and 21-7.)

COMBUSTION AIR PRESSURE SWITCH (Refer to Figure 21-16.)

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 21-6 and 21-7. Connect the tube to the switch cap.
   c. Check for proper heater operation.

FUEL REGULATOR AND SHUTOFF VALVE (Refer to Figure 21-4.)

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.

REMOVAL OF FUEL REGULATOR

1. Ascertain that the left fuel tanks are empty and the fuel selector controls are in the OFF position.
2. Gain access to the regulator and disconnect the electrical leads from regulator and shutoff valve.
3. 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.

ADJUSTMENT OF FUEL REGULATOR

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:

1. Install the regulator in a test stand similar to that shown in Figure 21-12.
2. Install a 2.0 gph nozzle (Janitrol Part No. C08D09). Gasoline or Stoddard solvent can be used for testing.
3. Apply fluid pressure from fuel pump and energize the solenoid. Outlet pressure should be 7.0 ± .5 psi, if not, correct accordingly.

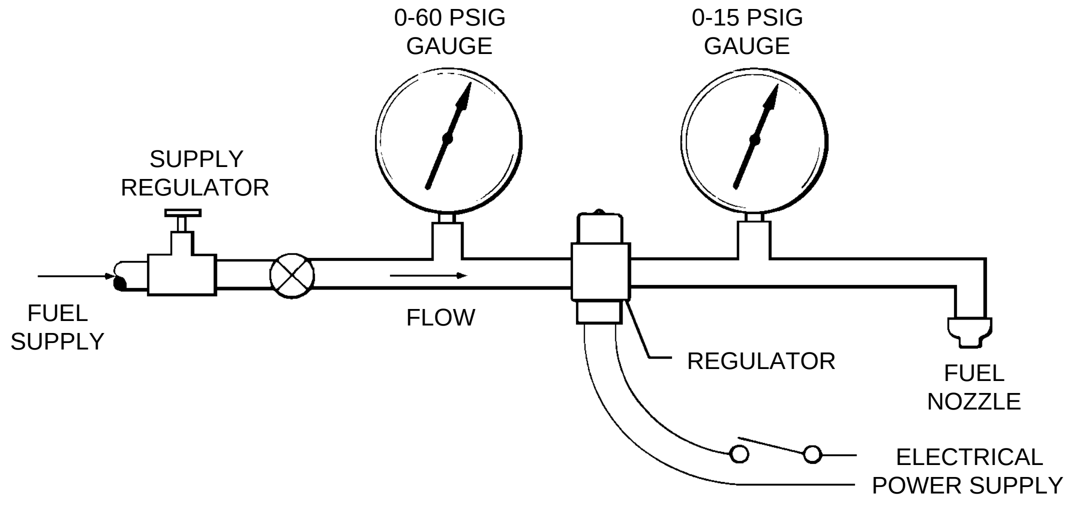


Figure 21-12. Test Setup for Fuel Regulator and Shutoff Valve

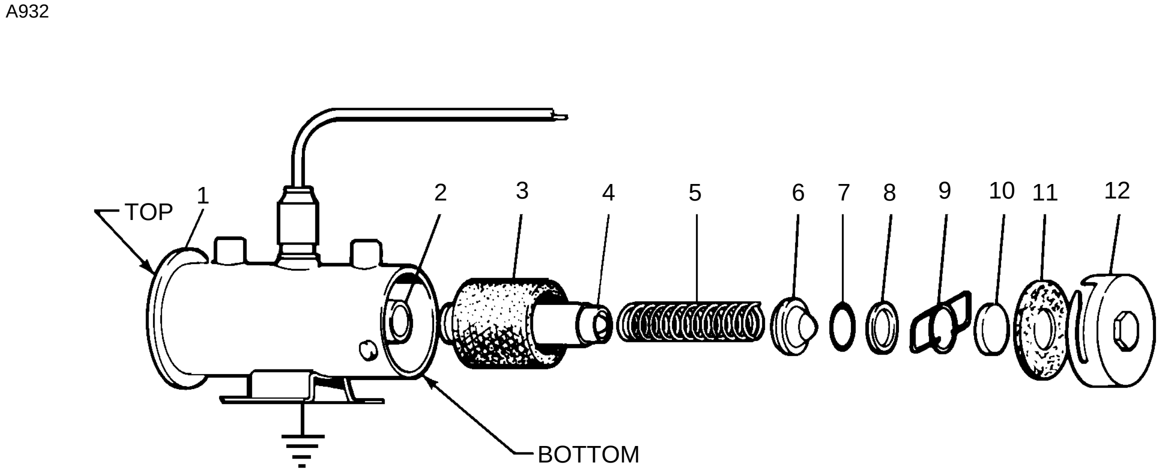
4. Using a screwdriver, break the seal over the adjustment screw and adjust the regulated outlet pressure to 7.0 ± .5 psi. (Turn clockwise to increase pressure or counterclockwise to decrease pressure.)
5. De-energize and energize the solenoid at least twice. The outlet pressure should be 6.5 to 7.5 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.
6. 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.

INSTALLATION OF FUEL REGULATOR

1. Position the regulator between the fuel line and fuel pump. Ascertain that the inlet side of the regulator is towards the fuel pump.
2. Connect the regulator to the pump and the heater fuel line to the regulator outlet port.
3. Connect the electrical leads from the regulator.
4. Operate the heater to make sure the unit is functioning properly.

HEATER FUEL PUMP MAINTENANCE (Refer to Figure 21-13.)

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



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

Figure 21-13. Heater Fuel Pump

REMOVAL OF HEATER FUEL PUMP

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.

1. Ascertain that the left fuel tanks are empty and the fuel selector controls are in the OFF position.
2. Disconnect the electrical lead from the pump.
3. 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.
4. Remove the bolts which secure the pump to its mounting bracket.

DISASSEMBLY OF PUMP (Refer to Figure 21-13.)

1. Remove the safety wire that secures the bottom cover to the pump.
2. 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.
3. Remove the filter, magnet and cover gasket.
4. Remove the retainer spring from the plunger tube using thin nose pliers to spread and remove ends of retainer from tube.
5. Remove washers, O-ring seal, cup valve, plunger spring and plunger from the tube.

CLEANING OF PUMP

1. Wash all parts in cleaning solvent and blow out with air pressure.
2. If plunger does not wash clean or if there are any rough spots, gently clean the surface with crocus cloth.
3. Slosh the pump assembly in cleaning solvent and blow out with air pressure.
4. Swab the inside of the tube with a cloth wrapped around a stick.

INSPECTION AND REPAIR OF PUMP

1. Disassemble the pump.
2. The filter usually comes off with the cover; it may stick inside the fuel pump. Carefully remove the filter and replace it, if distorted.
3. Check cover gasket and replace if deteriorated.
4. Check the O-ring seal and plunger spring. Replace if worn.

ASSEMBLING PUMP (Refer to Figure 21-13.)

1. 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.
2. Install the plunger spring, cup valve, O-ring seal and washer.
3. Compress spring and assembly retainer with ends of retainer in side holes of tube.
4. Place the cover gasket and magnet in the bottom cover and assemble the filter and cover assembly.
5. 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.

INSTALLATION OF HEATER FUEL PUMP

1. Position the fuel pump on the forward bulkhead assembly and secure in place with bolts.
2. Connect the regulator to the pump outlet and the fuel line to the pump inlet.
3. Connect the electrical lead from the pump.
4. Operate the heater to make sure the unit is functioning properly.
5. Replace nose cone and secure.

DUCT SWITCH (Refer to Figure 21-17.)

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:
   a. 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.

OVERHAUL INSTRUCTIONS

The heater assembly shall be overhauled after 1000 hours of heater time or when the "Pressure Decay Test" requirements cannot be met. Refer to this chapter and latest Janitrol Maintenance and Overhaul Manual, P/N 24E25-1.

— NOTE —

For disassembly and reassembly operations, refer to the exploded view drawings and the parts list.

DISASSEMBLY OF HEATER (Refer to Figure 21-16.)

1. Remove the screw and slide the elbow adapter off the combustion air inlet tube.
2. Disconnect and remove electrical wiring and individual wires from the various components on the heater. If wires appear to be in good condition, it may be desirable to remove wire harness assembly intact. First disconnect wires at terminal strip and components.

— NOTE —

It is advisable to label all wires, prior to removal, to ensure correct connections during reassembly. Cable straps and clips must be replaced if removed, as they cannot be reused.

3. Carefully disconnect the high voltage ignition lead at the spark plug. Handle the spring connector on the end of this lead with care to prevent fouling or damage.
4. Remove the four screws and cable straps to free the ignition assembly from the heater jacket and remove the ignition assembly. The vibrator may be removed by releasing the clamp and exerting a firm pull straightaway from the ignition assembly case.
5. Remove the grommet from the jacket and remove the spark plug with a 7/8 inch deep socket. Make sure the spark plug gasket is removed.
6. Remove the two screws and lift out the overheat (limit) switch and spacer gaskets.
7. Remove the two screws and lift out the cycling switch.
8. Remove the four screws to release the terminal strip and insulator from the jacket.
9. Disconnect the tube fitting at the cover of the combustion air pressure switch. Take precaution when bending tube. Unscrew and remove the combustion air pressure switch from the combustion air inlet tube.
10. Remove vent air inlet adapter from the blower housing by removing the three screws.
11. Loosen the four screws and rotate the blower and motor housing to disengage the notched end from the four screws in the end of the heater jacket. Disconnect the motor wiring quick-disconnect.
12. Remove the upper fuel shroud box cover by removing the screws.
13. Remove the grommet from the fuel shroud and carefully pull the fuel solenoid wires through the hole in the shroud.
14. With an open end wrench, remove the fuel solenoid assembly being careful not to damage the wires on the solenoid.
15. Reach inside the inlet end of the jacket assembly with a 3/4 inch open end wrench, and while holding the fuel tube-tube fitting at the jacket, use a 3/4 inch deep socket to remove the elbow, nut, washer, gasket and fuel shroud.

16. Remove the two screws and carefully withdraw the nozzle holder from the combustion head assembly; remove gasket.
17. Remove the six screws and withdraw the combustion head assembly from the combustion tube assembly. Remove gasket.
18. Remove the screws and remaining cable straps, if not previously removed, from the seam of the jacket assembly. Note the position of the cable straps as they are removed. Spread the jacket at the seam and remove it from the combustion tube assembly. This will free the asbestos gasket which can be removed from the particular part to which it remains attached.
19. Carefully unscrew and remove the spray nozzle from the nozzle holder. Remove the gasket.

— CAUTION —

HANDLE THE NOZZLE WITH CARE TO AVOID DAMAGE TO THE TIP. THE MATERIAL AROUND THE ORIFICE IS VERY THIN AND ANY SHARP BLOW ON THE FACE OF THE NOZZLE CAN DISTORT THE SPRAY PATTERN AND CAUSE MALIGNITION OR IMPROPER COMBUSTION.

20. Remove the three screws and rubber grommets from the blower housing.
21. Slide the ventilating air blower motor out of the blower housing with the motor bracket assembly and blower wheel attached. Loosen the set screw in the blower wheel and slide it off the end of the motor shaft. Then remove the motor bracket assembly, fasteners and ground bracket.
22. Remove the screw and lock washer to free the capacitor assembly (18) with attached leads.

BREAKDOWN OF COMBUSTION AIR BLOWER ASSEMBLY (Refer to Figure 21-17.**)**

1. Remove the combustion air blower inlet adapter by removing the screw.
2. Remove screws; then separate the outer housing from the inner housing and free the motor leads and capacitor from the inner housing.
3. Loosen the set screw in the blower wheel and slide it off the motor shaft.
4. Remove the two hex nuts, lockwashers and flat washers and slide the inner housing off the motor through bolts. The spacer will drop out.
5. Install new motor brushes. If the motor commutator is badly worn or if the motor is defective in any respect, it must be replaced.

CLEANING (Refer to Figure 21-16.)

— CAUTION —

DO NOT ATTEMPT TO BUFF OR SCRAPE OFF ANY DEPOSITS ON FACE OF SPRAY NOZZLE. THE FACE OF THE NOZZLE IS VERY SUSCEPTIBLE TO DAMAGE FROM MISHANDLING. CAREFULLY REPEAT CLEANING PROCESS USING ONLY A BRISTLE BRUSH AND REPEATED APPLICATIONS OF SOLVENT TO LOOSEN ANY STUBBORN DEPOSITS.

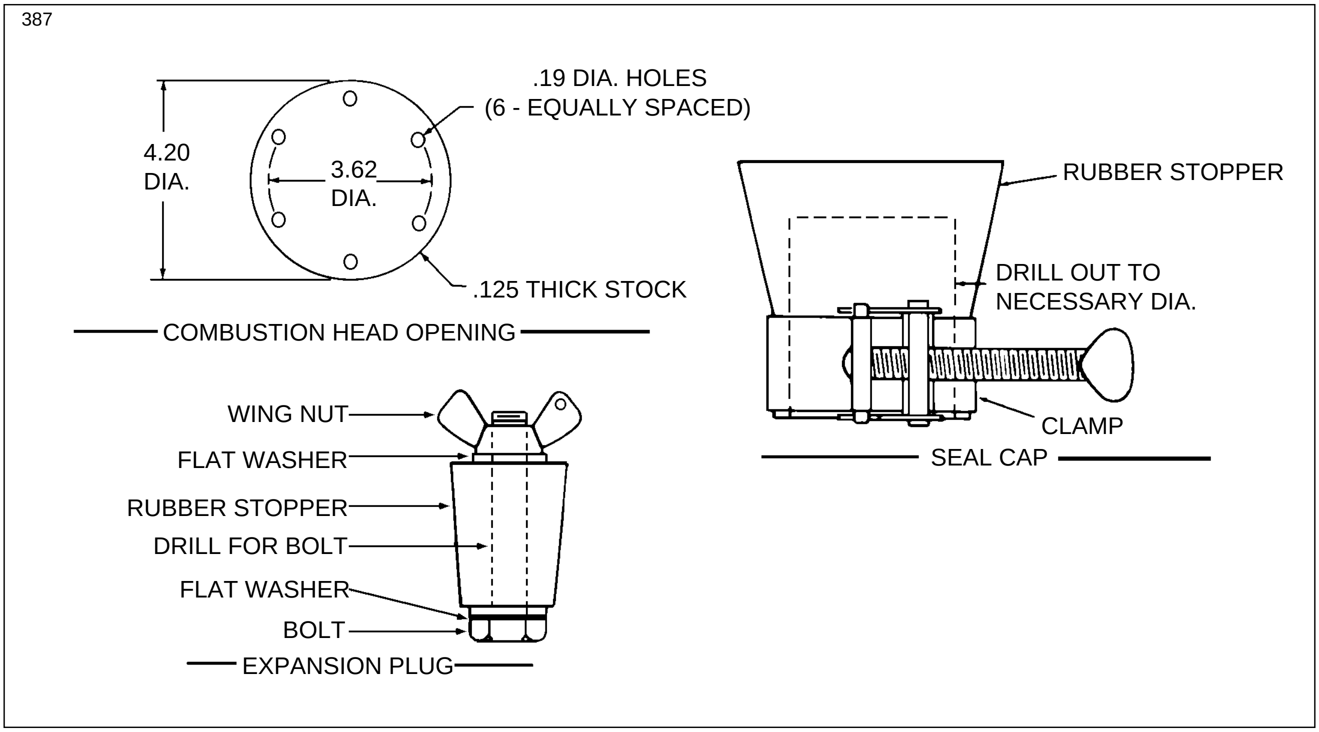
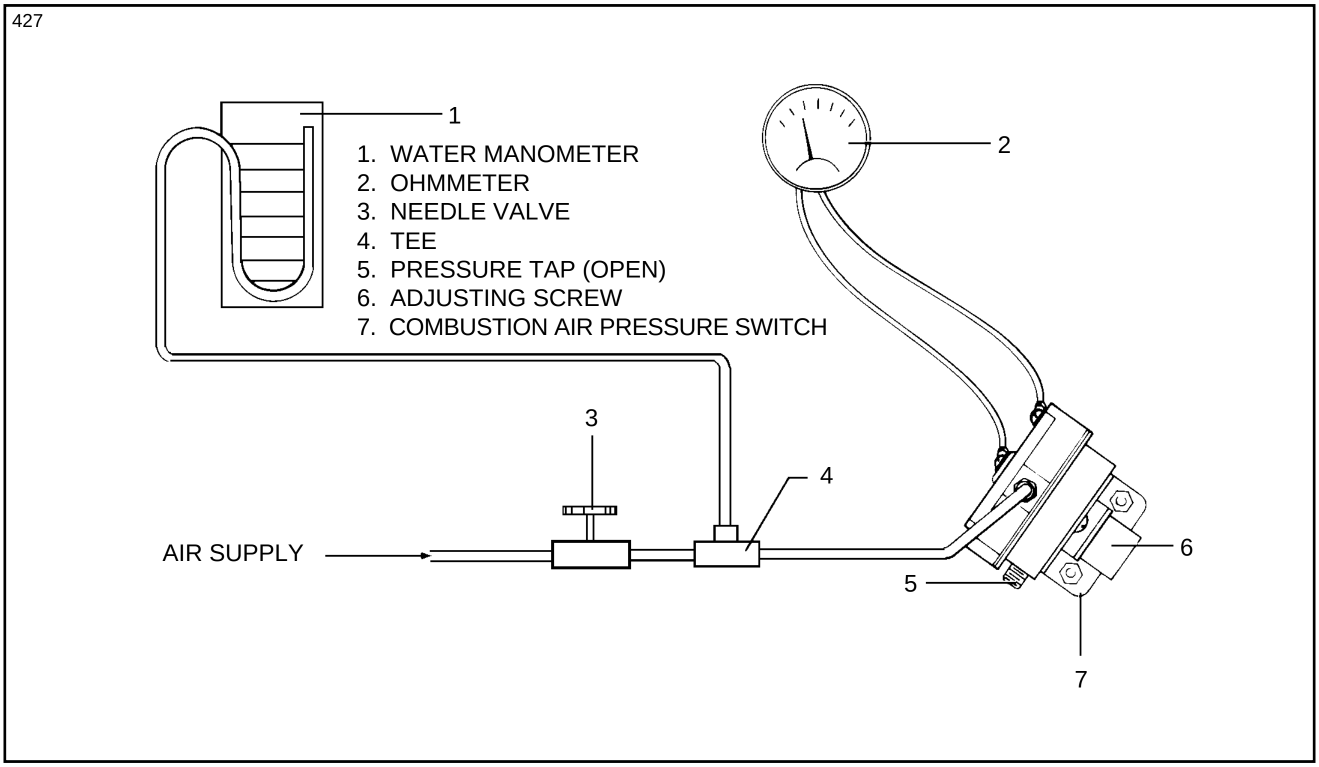


Figure 21-14. Suggested Design for Seal Plates, Plugs and Caps for Combustion Tube Leakage Test



1. WATER MANOMETER
2. OHMMETER
3. NEEDLE VALVE
4. TEE
5. PRESSURE TAP (OPEN)
6. ADJUSTING SCREW
7. COMBUSTION AIR PRESSURE SWITCH

Figure 21-15. Test Setup for Combustion Air Pressure Switch

1. Clean individual metal parts (except those parts containing switches and electrical wiring) and the combustion tube assembly by immersing them in dry cleaning solvent, such as Stoddard solvent (Federal Specification P-D-680). A bristle brush should be used to assist the cleaning process if foreign accumulations are stubborn to remove.
2. Use compressed air or lintless cloth to dry the parts, unless sufficient time is available for them to air dry.
3. Wipe electrical components with a clean, dry cloth. If foreign material is difficult to remove, moisten the cloth in carbon tetrachloride or electrical contact cleaner and clean all exterior surfaces thoroughly.

CLEANING AND INSPECTION THE COMBUSTION TUBE ASSEMBLY (Refer to Figure 21-16.)

1. Slight scaling and discoloration of the combustion tube assembly is a normal condition for units that have been in service up to 1000 airplane hours. The slight scaling condition will appear to be mottled and a small accumulation of blue-gray powder may be present on the surface in certain areas. This condition does not require replacement of the combustion tube assembly unless severe overheating has produced soft spots in the metal.

— NOTE —

This assembly should be inspected prior to cleaning in order to prevent the removal of visible evidences of damage.

2. Look inside the exhaust outlet to determine if the combustion tube appears to be heavily scaled or mottled. Deformation is more difficult to detect visually but can usually be observed by looking straight through the combustion tube assembly and sighting along the outer surface of the inner combustion tube. An assembly that has been obviously deformed should be replaced. Slight deformation will not affect heater operation unless it is extensive and localized enough to reduce the flow of ventilating air through the heater more than 10 percent.
3. The combustion tube assembly may be cleaned by either of two methods:
   a. One method is to soak the combustion tube assembly overnight in an Oakite M-S Stripper solution made by mixing one pound of Oakite salts with each gallon of water used. The solution should be maintained at a temperature of between 190°F and 210°F. After soaking overnight, rinse the combustion tube assembly thoroughly in water to remove all traces of the Oakite solution. In order to reach all areas of the combustion tube assembly, it is advisable to let it stand in the rinsing water for as long as 1/2 hour while occasionally agitating it to circulate the water. All openings should be left open during this operation. Be sure to dry the combustion tube assembly thoroughly after cleaning.
   b. A second method of cleaning is what is commonly known as hand "tumbling." Insert shot or other metallic particles through the exhaust outlet opening; then close all openings and shake the combustion tube assembly vigorously while rotating it and changing from end-to-end frequently. Be sure to pour out all of the particles and loosened material; then with all openings uncovered, direct a stream of compressed air into the combustion tube assembly from first one opening, then the other. Make sure all loose material is removed.

INSPECTION OF REMAINING COMPONENTS (Refer to Figure 21-16.**)**

1. Discard all rubber parts such as grommets, gaskets, etc. These items should always be replaced at overhaul. Also discard the asbestos gasket.
2. Inspect all wires and wiring harnesses for damage to insulation, damaged terminals, chafed or cracked insulation and broken bands. Individual wires can be replaced by making up new wires from No. 16 AWG stock and cut to correct length. It is advisable to use an acceptable crimping tool for installing terminals rather than solder for all heater wiring connections. If wiring harness damage is visible, the entire harness assembly should be replaced. If only one or more wires are damaged, cut the cable ties, make up new wires, install them in the harnesses and restore all cable ties and clamps. If heater controls were operating properly at the time of removal, reinstall them.
3. Inspect all hard parts consisting of bolts, screws. nuts, washers and lockwashers. Replace damaged parts.
4. The combustion air pressure switch must respond to delicate pressure changes and should always be checked and or replaced at overhaul. (Refer to Figure 21-15.)
5. Replace the vibrator in the ignition unit at each overhaul.
6. Inspect the ignition assembly (refer to Figure 21-16) for dented case, loose or damaged primary terminal insulator and broken or obviously damaged high voltage lead. Give particular attention to the condition of the spring connector at the end of the lead. If the spring is burned off, visibly eroded or carbon tracked, the ignition assembly should be replaced.

— NOTE —

Do not attempt a field repair of the ignition unit, as it is a sealed assembly.

7. Inspect the terminal strip for distortion and cracks and replace it if either condition exists.
8. Inspect radio-noise filters for short circuits by checking from either terminal to ground with an ohmmeter. An open circuit reading should be obtained.
9. Inspect the spray nozzle with a magnifying glass for any obstructions in the nozzle orifice and any sign of damage to the slight conical protrusion at the nozzle tip. Use compressed air to remove obstructions and reexamine the orifice to make sure it is open. Exercise care when handling the nozzle to avoid pressing or rapping on the tip face. Do not buff or scrape off deposits on the tip face. After cleaning, it 0is advisable to store the nozzle in a polyethylene bag until ready for reassembly.
10. Replace the nozzle at overhaul.

— NOTE —

The nozzle can be spray tested by installing it in the holder and connecting the fuel tube to a 7 psi fuel pressure source. The conical angle spray pattern should be even and dispersed the same in all directions. Exercise caution to keep atomized fuel away from fire.

11. Inspect the nozzle holder assembly for damaged threads at the fuel-tube fitting and for crimped or cracked fuel line or distorted housing. Check the solenoid for continuity by connecting across each wire lead with an ohmmeter. A reading of between 15 to 40 ohms should be obtained at room temperature. If not within these limits, the solenoid should be replaced.
12. Remove the brushes, one at a time, from the ventilating air blower motor by removing the brush cap and carefully withdrawing the brush from its guide. Remove foreign material from the brush guide and commutator with a stream of filtered compressed air. Check for brush wear. Inspect the commutator for grooved brush track. pitting or burning. The commutator surface should be smooth and medium brown in color. Replace the motor if the commutator or other parts show damage.
13. Inspect the combustion air blower motor as described in the preceding step.
14. Inspect the blower wheel for broken or bent vanes and replace it for either condition.

TESTING

The following tests should be performed as outlined in the succeeding paragraphs:

1. Check ventilating air and combustion air motors for correct rpm and current draw:
    a. Connect motor to 12-volt dc power supply. Rotation should be counterclockwise when viewed from the shaft end.
    b. Both motors should rotate at approximately 7500 rpm at rated voltage. Current draw is approximately five amperes.
    c. If current draw is excessive or if speed is too low, replace the brushes. Recheck both current draw and rpm after brushes are properly run in.
    d. After replacing brushes if operation is still unsatisfactory, replace the motor.

— NOTE —

The motor checks described above should be made without the blower housing attached, for both the ventilating air and combustion air motors.

2. Test the combustion tube assembly for leaks as follows:
    a. Fashion a sealing plate from approximately 1/8 inch thick flat stock to seal the combustion head opening in the combustion tube assembly. (Refer to Figure 21-14.) Use a rubber gasket under the plate and attach the plate with six screws.
    b. Make up seals for all remaining openings, except the one used to connect the air pressure source. (Refer to Figure 21-14.) Use rubber stoppers as shown. The combustion air inlet tube can be sealed best with a drilled stopper and clamp. Other openings should be sealed with expansion plugs. The seal used in the exhaust tube should be formed so that it will not deform the air pressure switch tube which protrudes into the exhaust.
    c. Install plugs and caps in all openings except the one to which the combustion air pressure switch is attached. (Any opening can be used to connect the air pressure source; however, the combustion air pressure switch opening is usually the most convenient. The drain opening would normally be considered a second choice.)

   d. Connect a regulated air supply to the opening that has not been plugged and apply a pressure of between three and five psi to the combustion tube assembly.
   e. Submerge the combustion tube assembly in water for several minutes while watching for bubbles which would indicate leaks. No air leakage is permitted from the combustion tube assembly. No weld or braze repairs are permitted on a combustion tube assembly.
3. Test the combustion air pressure switch as follows:
   a. Connect an adjustable air pressure line that can be controlled in a range of zero to 5.0 psi maximum) of gater to the switch opening with a water manometer and needle valve in the line ahead of switch. Switch must be tested in 45 degree position as shown in Figure 21-15.
   b. Connect an ohmmeter across the switch terminals to determine the exact instant of switch closing.
   c. Apply air pressure allowing it to build up very slowly from zero. The switch contacts should close at 0.5 + 0.1 inches of water which will be indicated on the manometer.

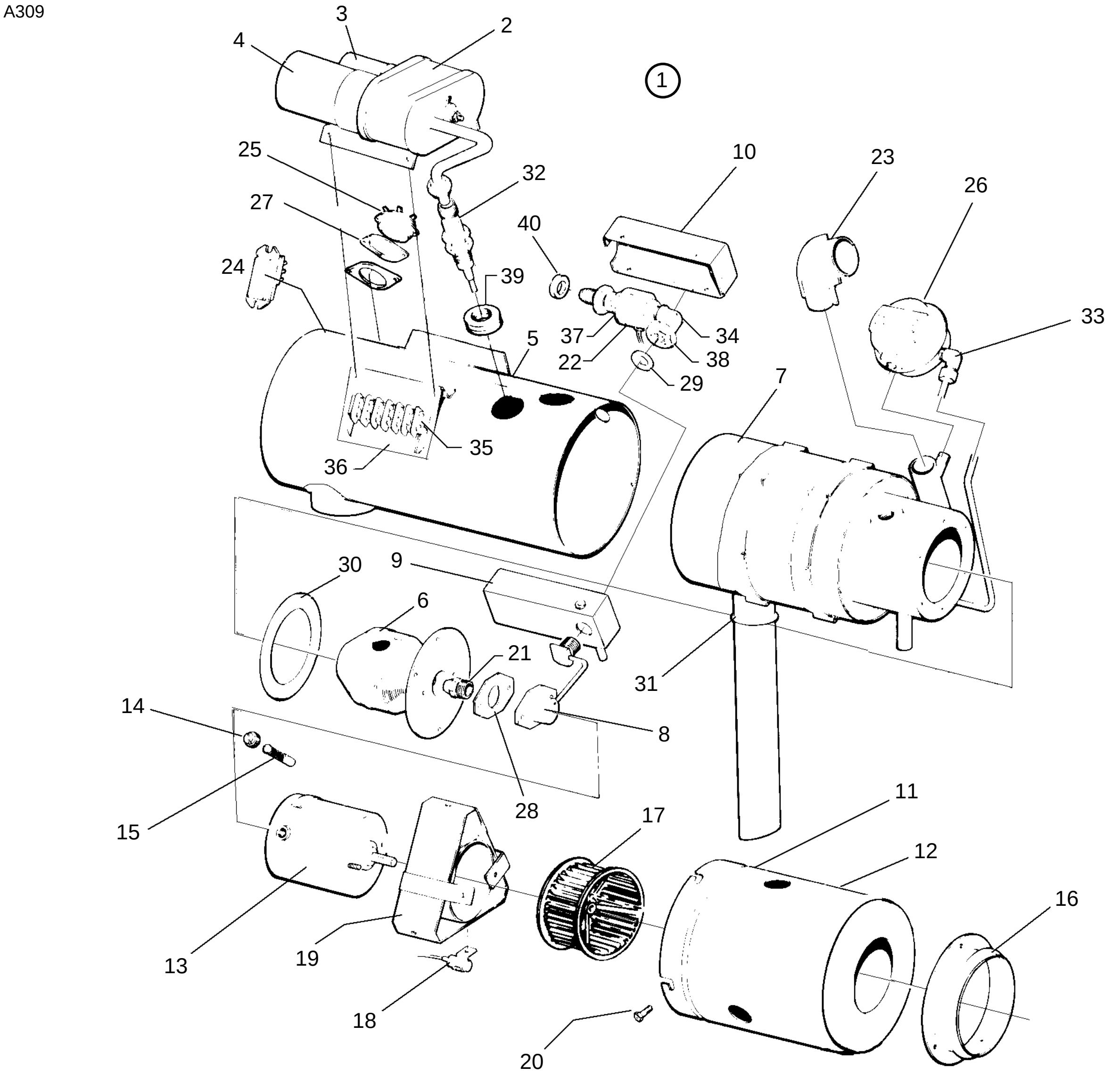
— NOTE —

The switch cover has a differential pressure tap and this opening must be left open to atmosphere during test.

   d. Make several trials to ensure switch reliability. Be sure to increase and decrease the air pressure slowly in order to produce accurate indications.
   e. If an adjustment is required, rotate the adjusting screw clockwise to increase settings and counterclockwise to decrease settings.
4. Test the fuel line and fuel line shroud tube for leaks as follows:
   a. Using filtered compressed air, apply 20 psi to the shroud drain port located on the surface near the threaded nozzle cavity.
   b. Immerse the fuel feed and nozzle holder assembly in clean water with the fuel inlet and nozzle cavity left open.
   c. Observe for bubbles which would indicate leakage. If bubbles appear at either fuel fitting, there is a leak in the fuel tube. If bubbles appear externally on the shroud tube or at either end of the shroud tube juncture, the shroud tube is leaking.
   d. In either of the above cases, the complete fuel feed and nozzle holder assembly must be replaced.
5. Spray test the nozzle as follows:
   a. Install the nozzle in the fuel feed and nozzle holder assembly and connect the fuel tube to the fuel solenoid. Connect the solenoid to a 7 psi fuel pressure source.
   b. Connect the solenoid leads to a 12-volt battery. Connect a switch in the line to open and close the solenoid when desired.

— WARNING —

BE SURE TO KEEP THE ATOMIZED SPRAY AWAY FROM FIRE.



1. HEATER ASSEMBLY
2. IGNITION ASSEMBLY
3. VIBRATOR - IGNITION
4. COIL - IGNITION
5. JACKET ASSEMBLY
6. HEAD ASSEMBLY - COMBUSTION
7. TUBE ASSEMBLY - COMBUSTION
8. FUEL FEED AND NOZZLE HOLDER ASSEMBLY
9. BOX ASSEMBLY - FUEL SHROUD, LOWER
10. BOX ASSEMBLY - FUEL SHROUD, UPPER
11. BLOWER ASSEMBLY - VENT AIR
12. HOUSING - BLOWER
13. MOTOR ASSEMBLY - VENT AIR BLOWER
14. CAP - BRUSH ASSEMBLY
15. BRUSH ASSEMBLY - M0TOR
16. ADAPTER
17. FAN - VENT AIR BLOWER
18. CAPACITOR ASSEMBLY
19. BRACKET ASSEMBLY - MOTOR
20. FASTENER
21. NOZZLE - FUEL
22. SOLENOID ASSEMBLY - FUEL
23. ADAPTER - ELBOW
24. SWITCH - CYCLING
25. SWITCH - LIMIT
26. SWITCH - PRESSURE
27. GASKET - LIMIT SWITCH
28. GASKET
29. GASKET
30. GASKET
31. GASKET - ASBESTOS
32. PLUG - SPARK
33. ELBOW
34. ELBOW
35. STRIP - TERMINAL
36. INSULATOR - TERMINAL STRIP
37. NIPPLE
38. NUT
39. GROMMET
40. GROMMET

Figure 21-16. Exploded View of Heater Assembl

c. With the switch closed (solenoid valve energized) and the fuel line connected, observe the fuel spray pattern. It should be conical in shape with even dispersion in all directions.
d. Energize and de-energize the solenoid several times. The spray should shut off permanently each time the solenoid is de-energized. There should be no sign of dribbling at the nozzle tip in excess of one or two drops.
e. If the spray pattern is distorted, check for an obstruction and clean the nozzle. If this fails to provide a normal spray pattern, replace the nozzle.
f. If the nozzle continues to dribble, the solenoid valve is not closing properly and the solenoid valve must be replaced.

REPAIR OF COMBUSTION TUBE ASSEMBLY

No weld or braze repairs of the combustion tube assembly are authorized.

REBUILDING HEATER (Refer to Figure 21-16.)

1. If removed during disassembly, secure the nipple and elbow to the fuel solenoid.
2. Insert the ventilating air motor into the motor bracket assembly; slide the blower wheel on the end of the motor shaft and rotate it until the set screw is aligned with the flat side of the motor shaft. Tighten the set screw just tight enough to hold it at this time.
3. Attach the capacitor and leads assembly to the motor bracket with screw and lock washer. Make sure a good electrical ground connection is made at this point. Install ground bracket and three new fasteners.
4. Insert this assembly into the blower housing.
5. Make sure all wires are routed and grommeted as they were prior to disassembly and then secure the assembly in the housing with three screws.
6. The motor should be positioned in the bracket to locate the blower wheel properly in the blower housing. The blower wheel should be positioned so it will rotate freely and just clear the contoured spill plate in the blower housing. Tighten the Allen-head set screw and spin the blower wheel by hand for a clearance check. Then apply the appropriate voltage to run the motor as a final clearance check.
7. Attach the inlet adapter to the end of the blower housing with three screws and lock washers.
8. Place a new asbestos gasket in position on the exhaust outlet; spring the jacket assembly open at the seam and insert the combustion tube assembly carefully into the jacket. Exercise care to clear the pressure switch tube in the exhaust outlet and see that the asbestos gasket is properly located. Close the gap on the jacket assembly and install screws to secure it at the seam. (Solenoid lead wire is grounded under one of these screws. See notations made during disassembly.) Make sure the seam is in good condition and a tight fit is effected.
9. Install cable straps at locations noted during disassembly.

— CAUTION —

The spray nozzle has a slight protrusion on the nozzle face. If this area has been struck by any object which would make a dent or destroy the original contour, the nozzle must be replaced.

10. Remove the spray nozzle from the polyethylene bag. Screw the nozzle into the nozzle holder and tighten to 75-100 inch-pounds. It is very important to torque the nozzle to this value as incorrect tightening could cause improper heater operation and nozzle “drool”.

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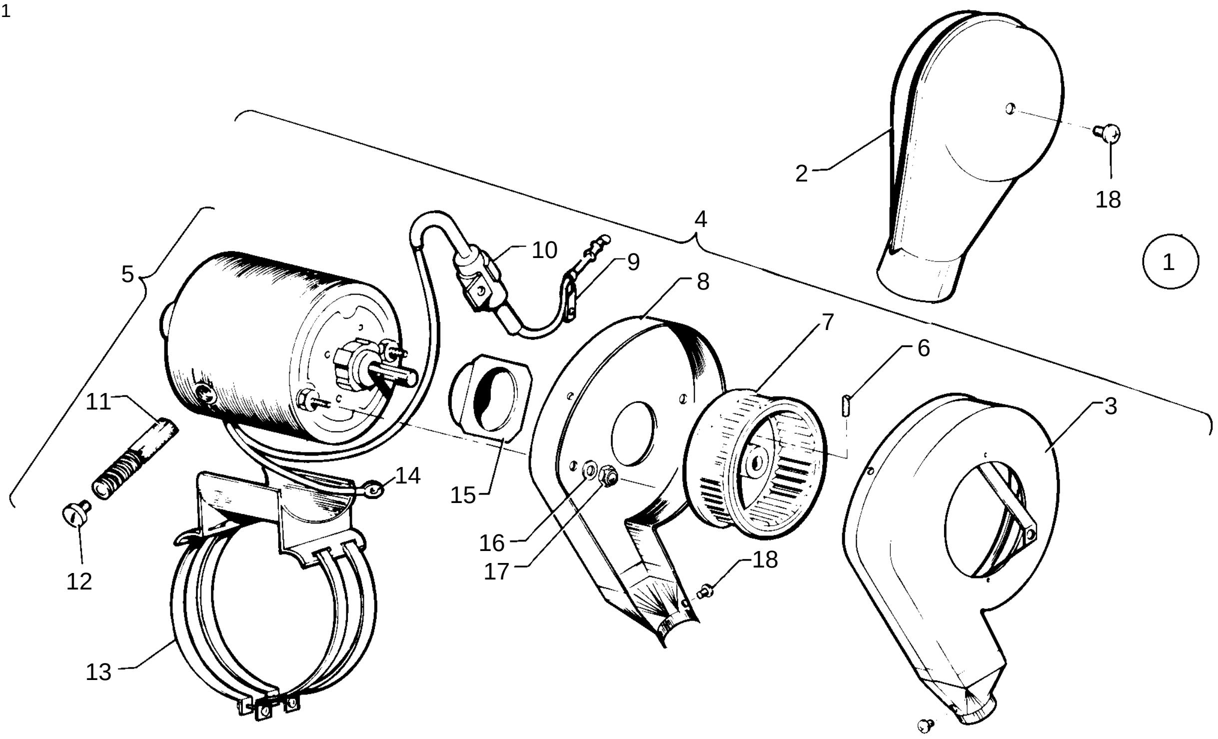

1. COMBUSTION AIR BLOWER AND MOTOR ASSEMBLY
2. ADAPTER ASSEMBLY - BLOWER INLET
3. HOUSING - BLOWER OUTER HALF
4. COMBUSTION AIR BLOWER AND MOTOR
5. MOTOR ASSEMBLY - COMBUSTION AIR BLOWER
6. SET SCREW - BLOWER FAN
7. FAN - COMBUSTION AIR BLOWER
8. HOUSING - BLOWER INNER HALF
9. STRAP - CABLE
10. CAPACITOR
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
19. SPACER
20. SWITCH - ADJUSTABLE DUCT
21. COVER - SWITCH
22. SCREW - AN565 D8 H3
23. LEVER ASSEMBLY - SWITCH

Figure 21-17. Exploded View - Combustion Air Blower and Motor Assembly

10. Remove the spray nozzle from the polyethylene bag. Screw the nozzle into the nozzle holder and tighten to 75-100 inch-pounds. It is very important to torque the nozzle to this value as incorrect tightening could cause improper heater operation and nozzle "drool."
11. Install a new gasket and the combustion head in the combustion tube and secure with the six screws.
12. Insert the fitting on end of nozzle fuel tube through the opening in jacket and attach the nozzle holder to the combustion head assembly with the two screws. It may be necessary to place a slight bend in the shrouded fuel tube to permit alignment of screw holes. Be sure to use a new gasket.
13. Using a new spark plug gasket, install the spark plug and tighten to a torque of 28 foot-pounds. Install the grommet in the jacket around the spark plug.
14. Install the ignition assembly on the jacket assembly with the four screws. Connect the high voltage lead to the spark plug and tighten it to 20 foot-pounds.
15. Attach the overheat limit switch and two spacer gaskets to the jacket assembly with the two screws. Tighten the screws securely.
16. Attach the cycling switch to the jacket assembly with the two screws.
17. Place the terminal strip insulation in position on the jacket, followed by the terminal strip. Secure both parts by installing the two screws.
18. Center the fuel fitting in jacket opening. Position the fuel fitting shroud gasket, washer and shroud; then install the nut finger tight. Insert a 3/4 inch open-end wrench inside the jacket and hold the fuel-tube fitting while tightening the nut with a 3/4 inch deep socket. Install the fuel solenoid elbow and solenoid. Avoid twisting or damaging lead. Install wires through grommet in lower shroud.
19. Rotate the combustion air switch onto the threaded fitting on the combustion air tube and tighten it firmly.
20. Install grommet over pressure switch line. Connect the tube to the elbow fitting on the combustion air pressure switch.
21. Install the wiring harness and connect all wire leads to their respective terminals. (Refer to the wiring diagram, Figure 21-6 and 7.) Place the grommet (refer to Figure 21-16) in position in the jacket; locate the ventilating air blower at the end of the jacket. Thread the quick-disconnect on the motor leads through the grommet and connect it to the mating connector on the wiring harness.
22. Place the blower housing in position on the jacket assembly and secure it by installing the four screws, if removed at disassembly. This operation is easier if the screws are started into their threads and the blower housing rotated into place allowing the screws to enter the notched openings in edge of blower housing. Tighten all screws securely.
23. Install the elbow adapter with the screw.
24. After heater is installed in the aircraft and the fuel line is connected, install the upper fuel shroud box with the screws. Ascertain that the grommet is installed.

REBUILDING COMBUSTION AIR BLOWER ASSEMBLY (Refer to Figure 21-17.)

1. Place the spacer over the end of the motor shaft and attach the motor assembly to the inner housing with the two self-locking nuts. flat washers and lockwashers.
2. Slide the blower wheel on the motor shaft and tighten the set screw lightly against the flat portion of the motor shaft.
3. Place the outer blower housing in position on the inner housing and install screws.
4. Attach the radio-noise filter at the point shown with the screw. The motor ground lead terminal can be grounded to the motor support bracket.
5. Loosen the Allen-head set screw in the blower wheel and shift the wheel on the motor shaft until it is near the inlet in the blower housing. Tighten the set screw securely. The blower wheel should just clear the inlet flange when rotated at full rpm. Spin the blower wheel by hand for clearance check; then apply proper voltage to run motor and recheck for proper clearance.
6. Attach the blower inlet adapter to blower housing with screw.

TEST PROCEDURE

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.

EQUIPMENT REQUIRED (Refer to Figure 21-18.)

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.
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.

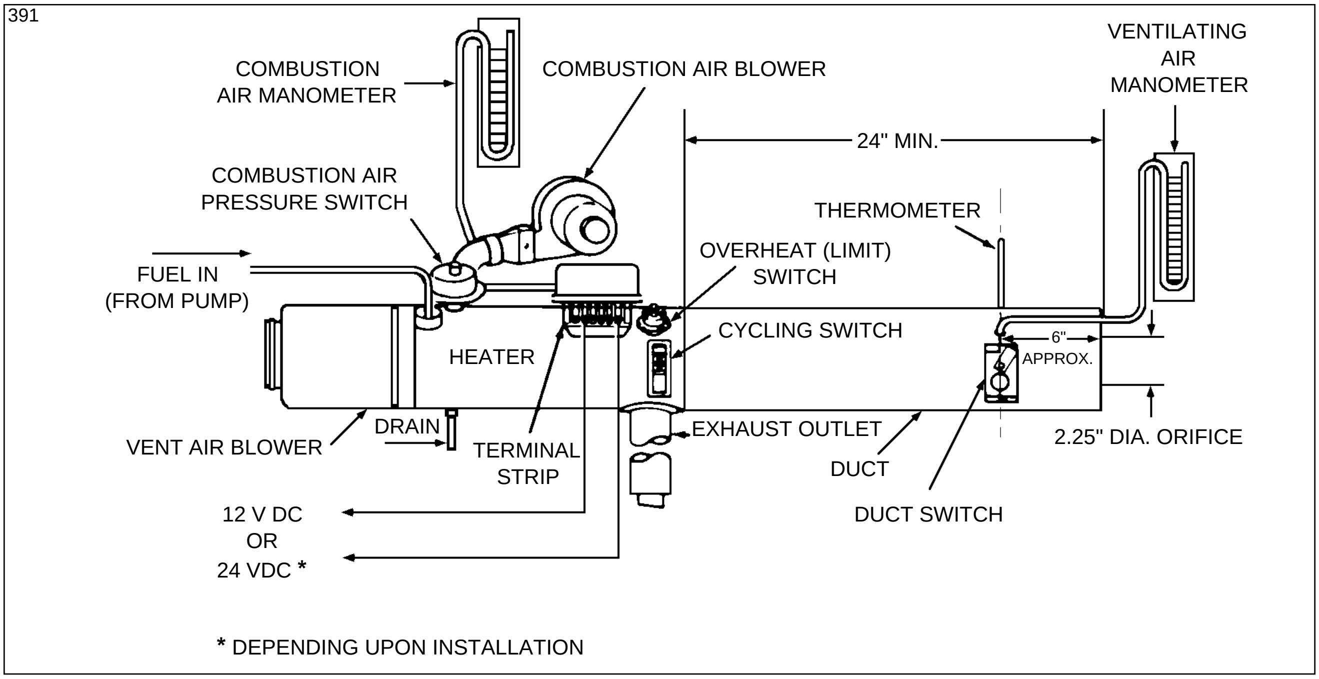

Figure 21-18. Suggested Setup of Heater Operation Test

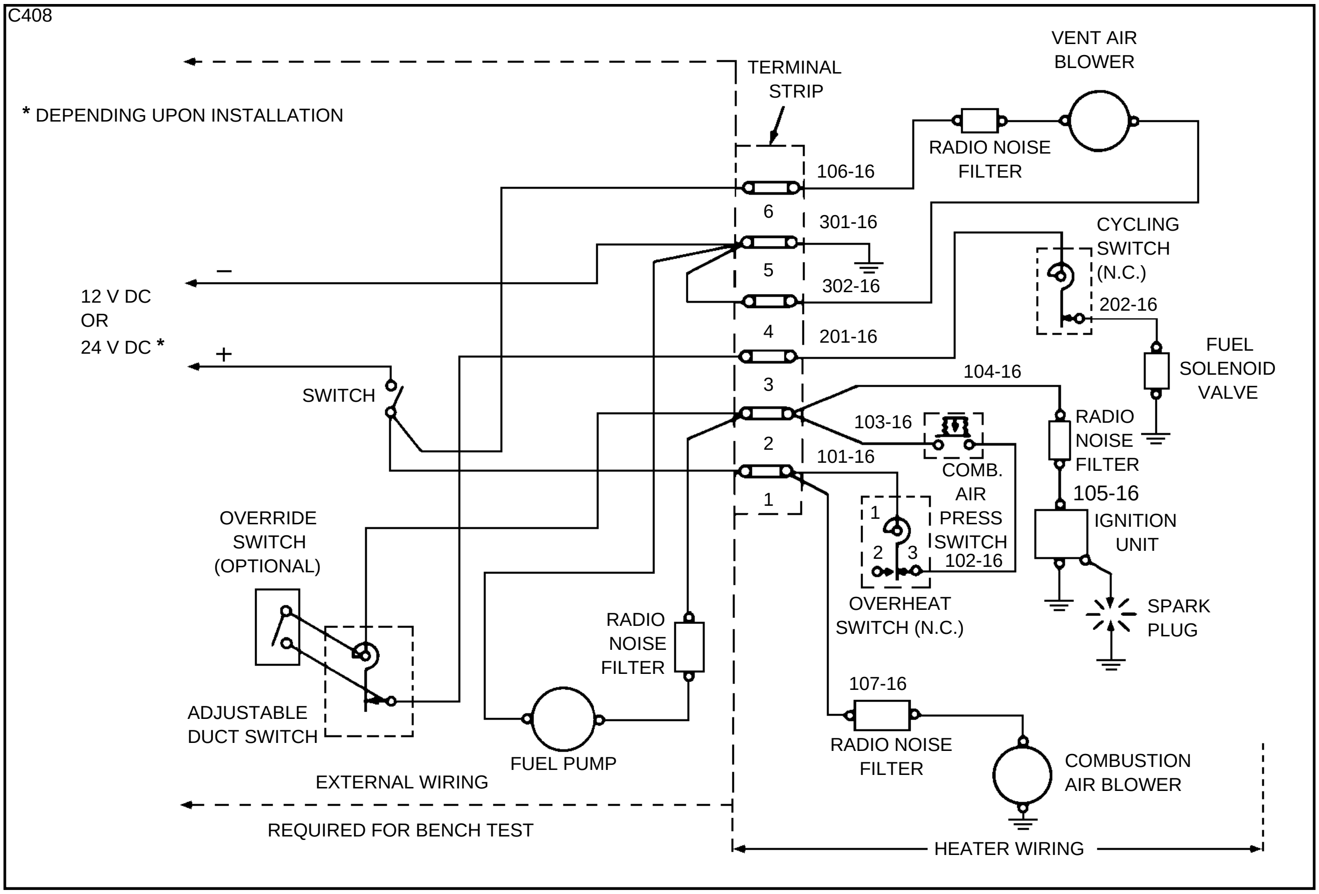

Figure 21-19. Wiring Connection for Heater Operation Test

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 21-18.
7. A thermometer with 500°F scale.
8. A fuel-pressure gauge.
9. A controlled source of compressed air for final leakage test.

OPERATIONAL TEST (ON TEST BENCH) (Refer to Figures 21-18 and 21-19.)

1. Connect the heater to the test setup as shown in Figure 21-18. 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 21-18.
3. Connect components and heater as outlined in the wiring connection diagram, Figure 21-19. 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).
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.

INSPECTION OF FUEL NOZZLE ORIFICE (Refer to Figure 21-16.)

1. 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.
2. Remove the fuel shroud cover by removing the screws. Remove solenoid and elbow.
3. 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.
4. Remove the two screws and carefully withdraw the nozzle holder and valve assembly from the combustion head assembly.
5. Carefully unscrew and remove the spray nozzle from the nozzle holder. Remove the gasket.
6. 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.

COOLING

DESCRIPTION AND OPERATION

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 (Sankyo), 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 to 4.0 ± .10 inches on the ground, and .80 ± .10 of an inch in the air. The design is such that the condenser can be cooled without increasing drag. A set of louvers further back on the nacelle allow air flow.

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.

With the system in operation, refrigerant (Refrigerant 12) is pulled into the compressor as a vapor to the condenser where it cools and changes to a liquid. The liquid refrigerant then passes to the receiver-dehydrator where air 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 now of the liquid refrigerant into the evaporator where the refrigerant 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.

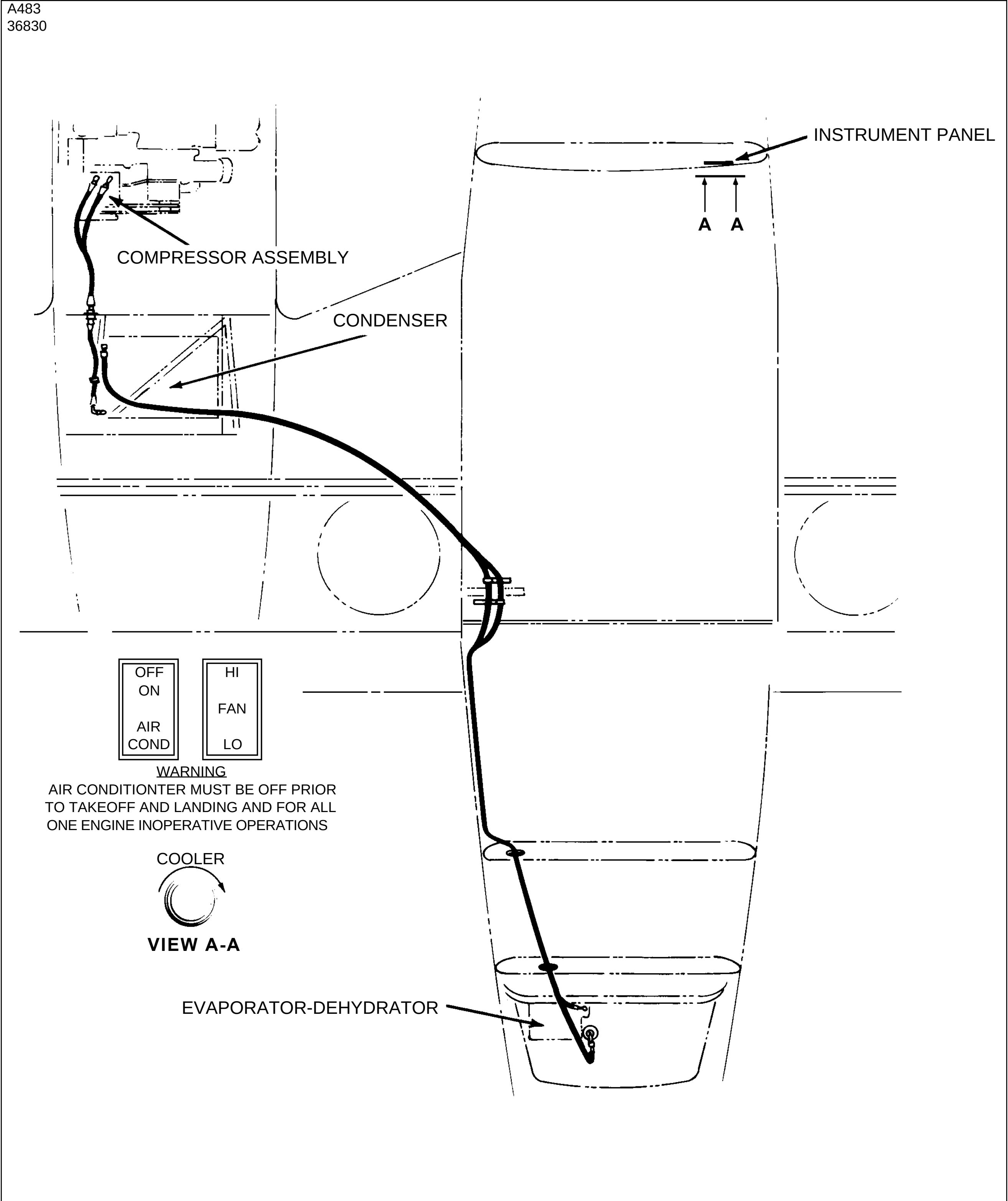

Figure 21-20. Air Conditioning System Installation

TROUBLESHOOTING SYSTEM

The detection of system malfunction largely depends on the mechanic's ability to interpret the 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 in the evaporator, allowing for a few degrees temperature rise due to loss in the 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 the tube walls and fins.

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

Detection of system malfunction is made easier with the knowledge that the temperature and pressure of Refrigerant 12 is in close proximity between the pressures of twenty and eighty pounds per square inch (psi). A glance at the temperature-pressure chart will show that there is only a slight variation between the temperature and pressure of the refrigerant in the lower range.

It is correct to assume that for every pound of pressure added to the low side, a temperature increase of about one degree Fahrenheit takes place. For instance, a pressure of 23.8 on the chart indicates a temperature of 24°F. A change of pressure of almost one pound to 24.6 psi gives us a temperature increase of 25°F.

— NOTE —

For each 1,000 feet of elevation above sea level, the gauge readings will be about one inch of mercury or 1/2 psi higher than the chart indicates.

It must be pointed out that the actual temperature of the air passing over the coils of the evaporator 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 is begun 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 aircraft 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.

CHART 2104. TEMPERATURE PRESSURE

Evaporator Pressure Gauge Reading psi	Evaporator Temperature °F.	High Pressure Gauge Reading psi	Ambient Temperature °F.
0	-21	72	40
2.4	-15	86	50
4.5	-10	105	60
10.1	2	109	62
11.2	4	113	64
12.3	6	117	66
13.4	8	122	68
14.6	10	126	70
15.8	12	129	71
17.1	14	132	72
18.3	16	134	73
19.7	18	137	74
21	20	140	75
22.4	22	144	76
23.1	23	148	77
23.8	24	152	78
24.6	25	156	79
25.3	26	160	80
26.1	27	162	81
26.8	28	165	82
27.6	29	167	83
28.4	30	170	84
29.2	31	172	85
30	32	175	86
30.9	33	177	87
31.7	34	180	88
32.5	35	182	89
33.4	36	185	90
34.3	37	187	91
35.1	38	189	92
36	39	191	93
36.9	40	193	94
37.9	41	195	95
38.8	42	200	96
39.7	43	205	97
41.7	45	210	98
43.6	47	215	99
45.6	49	220	100
48.7	52	228	102
49.8	53	236	104
55.4	57	260	110
60	62	275	115
64.9	66	290	120

SPECIAL SERVICING PROCEDURES

The air conditioning system should be serviced by a qualified shop with trained personnel. The following procedures and precautions should be observed.

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. GENERAL REFRIGERATION SYSTEM PROCEDURES.
   a. REFRIGERANT SAFETY PRECAUTIONS.
      (1) Refrigerant 12 (commonly known as R-12 or "Freon" 12) is odorless and colorless in either the liquid or gaseous state. R-12 for charging refrigeration systems is supplied in pressurized containers (approx. 70 psi at 70°F) in liquid form. Since this material is essentially inert at room temperatures the dangers are primarily associated with the pressure and the refrigeration effects of the release and subsequent evaporation of this pressurized liquid.
      (2) Wear suitable eye protection when handling R-12 due to the possibility of freezing of the eye if contacted by escaping liquid refrigerant. If liquid R-12 does strike 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.
      (3) If liquid R-12 strikes the skin, frostbite can occur. Treat with cool water and protect with petroleum jelly.
      (4) Do not discharge large quantities of R-12 into closed rooms. It may displace most of the air in the room and this could cause oxygen starvation. Gaseous R-12 is heavier than air and flows to the bottom of a container.
      (5) Do not discharge R-12 into an open flame or onto a very hot surface (500°F+). Poisonous phosgene gas is generated by the action of the heat on the refrigerant.
      (6) Do not apply direct flame or other high heat source to a R-12 container due to the high pressures which will result. If any heating is done to R-12 containers the container pressure should be monitored and kept below 150 psi.
   b. SYSTEM SERVICING PRECAUTIONS.
      (1) Systems should be discharged slowly to prevent the escape of liquid refrigerant and the loss of the lubricating oil.
      (2) Systems should not be left open to the atmosphere when discharged. Moisture and other contamination may enter and damage open systems.
      (3) Never introduce anything but pure refrigerant and refrigerant oil into a system.
      (4) Keep refrigerant oil containers tightly sealed and clean to prevent absorption of moisture or other contamination.
      (5) Use only approved refrigeration oil in the compressor. If any doubt exists about the cleanliness of the compressor oil, replace it with new oil.

(6) Never reuse oil removed from the system. Discard it.

(7) 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.

(8) 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.

— NOTE —

A very strong acid (HCL) is formed when R-12 comes in contact with moisture.

A new receiver-dehydrator should be opened and connected to the system only when ready to charge the system with refrigerant.

(9) Recommended torque values must be used on all flare fitting and O-ring joints. See Chart 2105.

CHART 2105. ALUMINUM TUBING TORQUE

Metal Tube O.D.	Thread and Fitting Size	Alum. Tubing Torque
1/4	7/16	5-7 ft-lbs.
3/8	5/8	11-13 ft.-lbs.
1/2	3/4	15-20 ft.-lbs.
5/8	7/8	21-27 ft.-lbs.
3/4	1-1/16	28-33 ft.-lbs

SERVICE VALVES

The purpose of the service valve is to service the air conditioning system. (Testing, Bleeding, Evacuating and Charging.) This aircraft is equipped with service valves mounted in the suction and discharge lines of the evaporator assembly. These valves are the "2" position type Schrader valves. All normal air conditioning service should be performed at the evaporator assembly mounted valves.

— NOTE —

Service valves are also located on the compressor. However, use of these valves in servicing is not recommended.

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

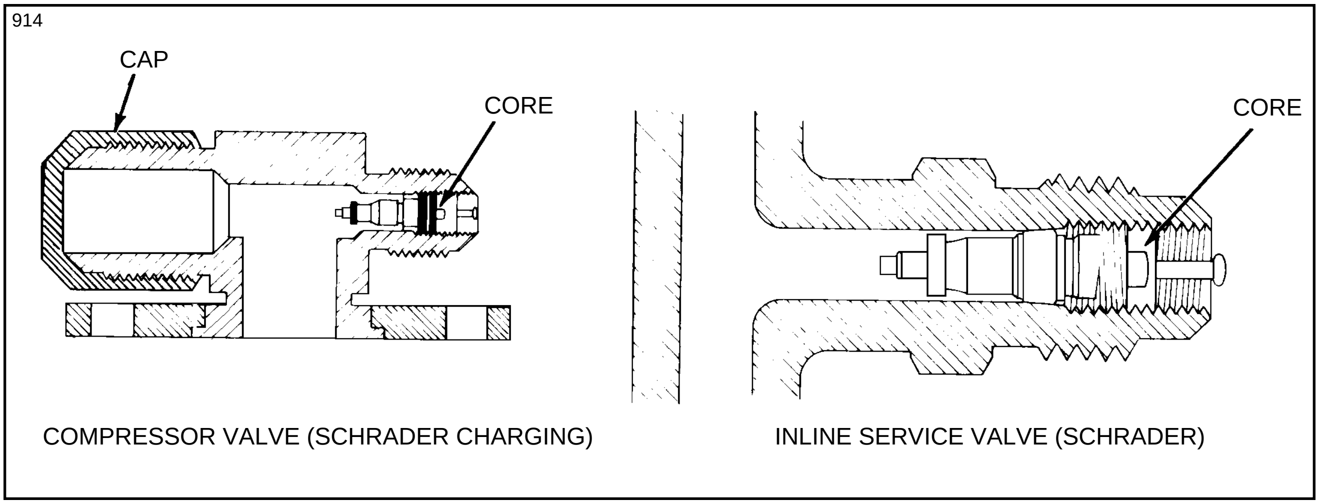

Figure 21-21. Service Valves

SERVICE VALVE REPLACEMENT

The valves on the compressor 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.

— NOTE —

Whenever the air conditioning refrigerant lines or system is opened for any reason, the lines and fittings should be capped and sealed immediately to prevent dirt and other contaminants from entering the system. (It is not advisable to put a plug into the hoses or fittings.)

TEST GAUGE AND MANIFOLD SET

The proper testing and diagnosis of the air conditioning system require that a manifold gauge set be attached into 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 21-22 and 21-23.)

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 and 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 the side of the system will, however, be recorded on the gauge above the hose.

Cracking the hand valve, in the counterclockwise direction, opens the system to the middle service port of the manifold set. This is desirable only when it is necessary to let refrigerant out or into the system. Refer to Figures 21-22 and 21-23.

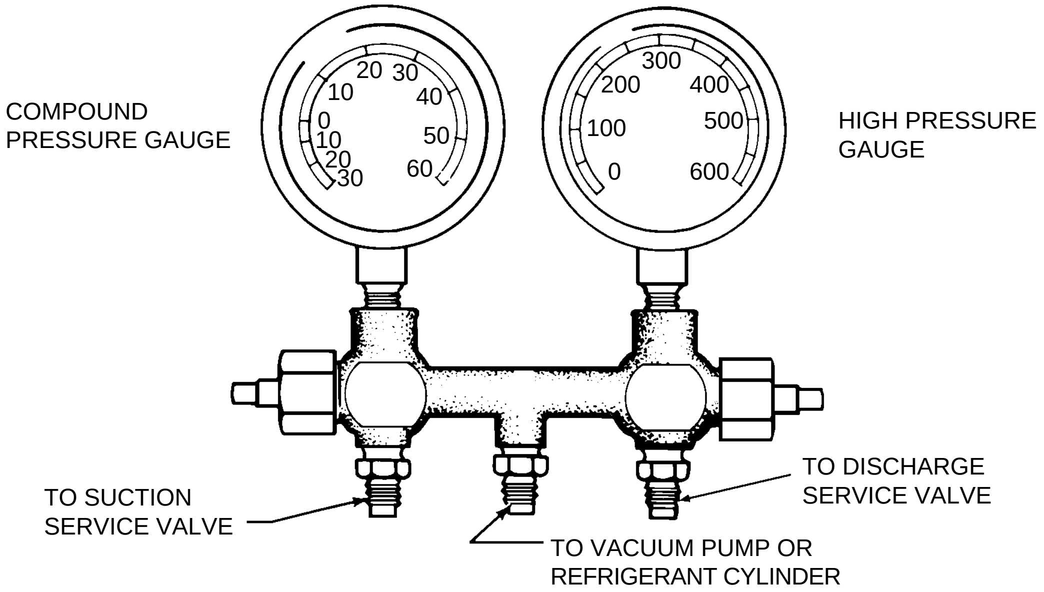

Figure 21-22. Test Gauge and Manifold Set

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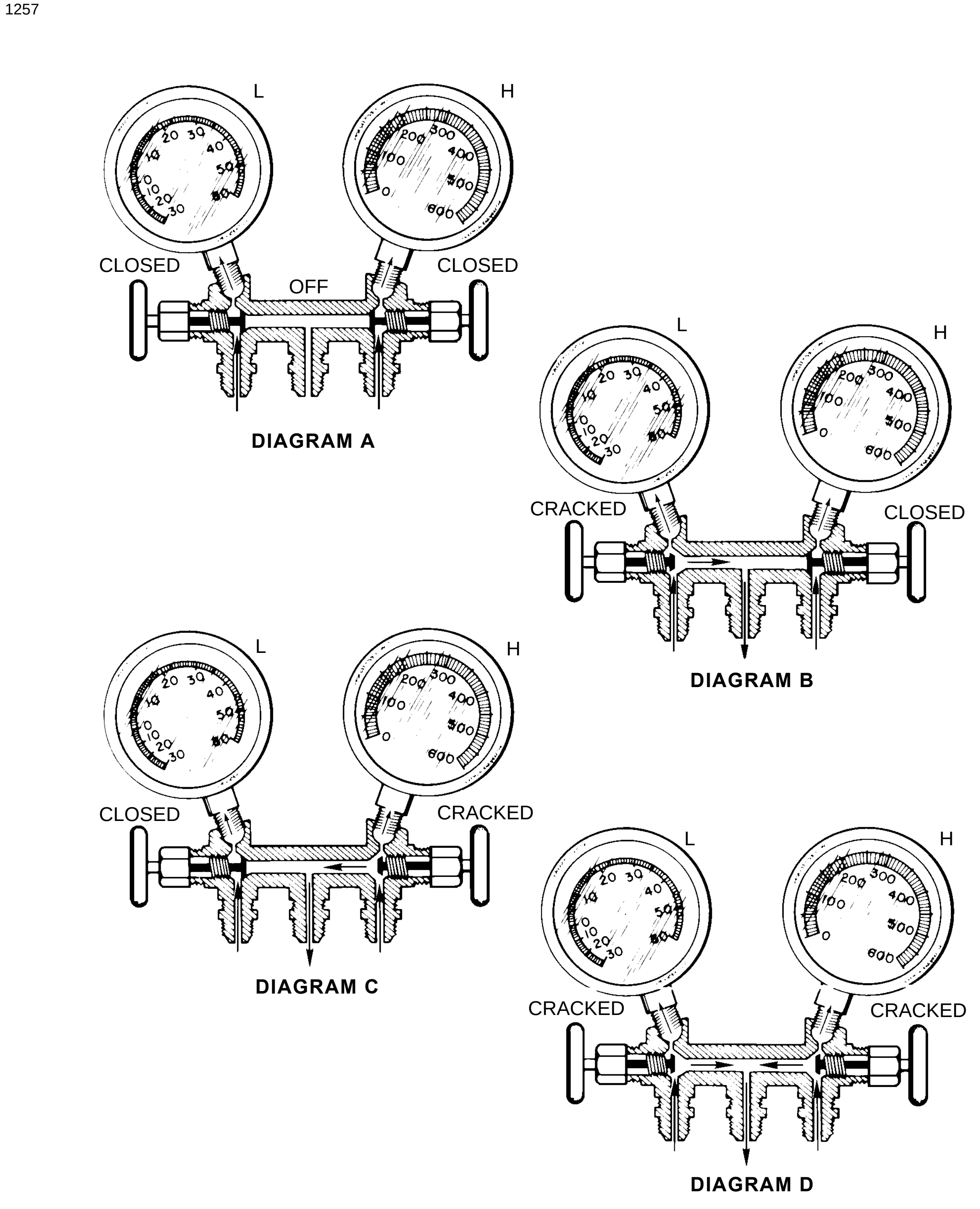


Figure 21-23. Manifold Set Operation

CHECKING SYSTEM FOR LEAKS

There are several methods of doing this operation, depending on the type of equipment which is, available. Two methods of performing this check will be covered in the following paragraphs.

— NOTE —

Evacuate system prior to leak check.

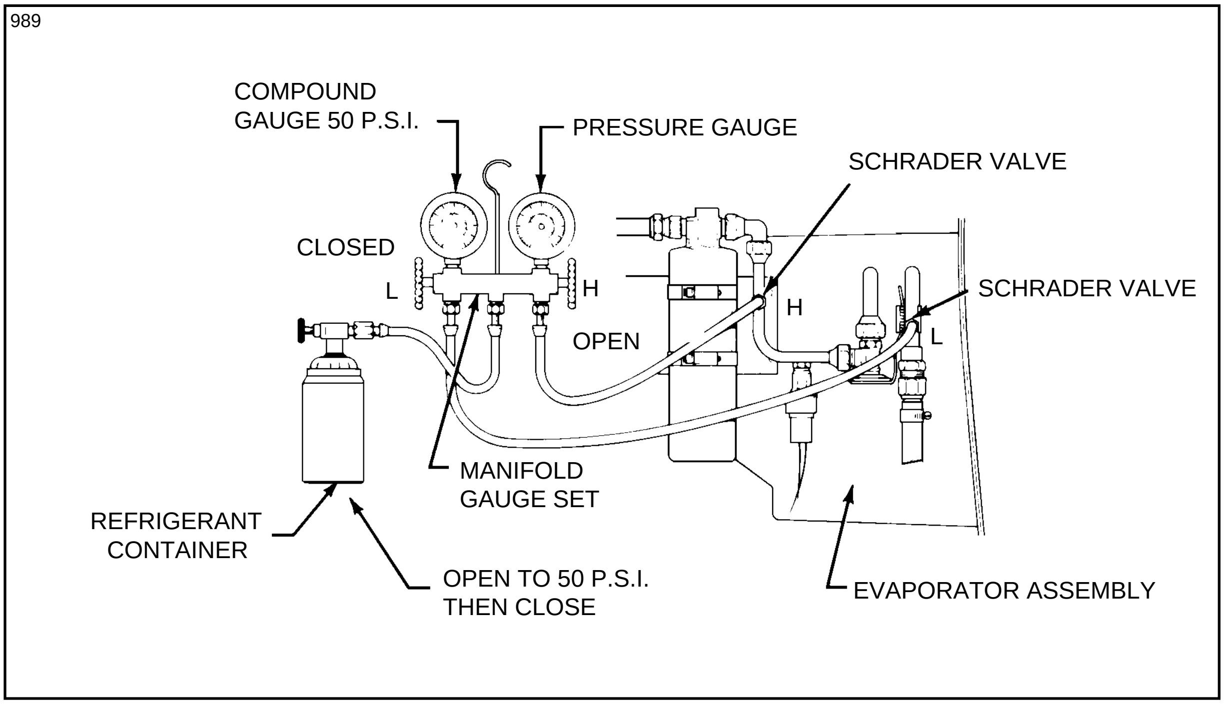


Figure 21-24. Leak Test Hookup

LEAK CHECK - METHOD I

1. Connect the manifold gauge set into the system and determine if there is any refrigerant in the system. A minimum of 50 psi refrigerant pressure in the system is needed for leak detection. (Refer to Figure 21-25.)
2. Purge the hoses of air by allowing some refrigerant to escape from the connections at the service valves. Then tighten connections at the service valve.
3. Close the low side manifold valve and open the high side manifold valve.
4. Open the refrigerant container service valve and allow the pressure at the low side gauge to reach 50 psi at Which time close the high side manifold valve.
5. Close the refrigerant container service valve and remove the hose if no leaks are evident.
6. It is advisable to use an electronic leak detector to check this system instead of an open flame leak detector due to the possible presence of gasoline fumes in the engine area.
7. If any leaks are found, purge the system of refrigerant, make the necessary repairs and check the compressor oil.
8. Add oil, if required, refer to "Checking Compressor Oil" then repeat Steps 1 thru 5.
9. If no further leaks are found, the system may be evacuated and charged. Refer to paragraphs "Evacuating the System" and "Charging the System."

LEAK CHECK - METHOD II

1. Remove the access panel at the rear of the cabin to gain access to the service valves.
2. Remove the protective cap on the high pressure Schrader valve fitting and connect a charging hose with a shut-off valve arrangement to the fitting. The charging hose must have a Schrader fitting or adapter to fit the valve.
3. Connect the other end of the charging hose to a small cylinder of refrigerant and purge the hose by allowing a slight amount of refrigerant gas to escape from the Schrader valve fitting.
4. The cylinder of refrigerant should be placed upright in a container of warm (125°F max.) water on a small scale.
5. Allow approximately 1/2 pound of refrigerant to enter the system by opening the valve on the charging hose and observing the weight change on the scale.
6. Using an electronic leak detector, check all joints and repair any leaks.
7. After repairing any leaks, proceed to check the system in accordance with one of the methods outlined for any other leaks.
8. If no further repair is required on the system, it is now ready to evacuate in accordance with the paragraph "Evacuating System."

DISCHARGING (Required only if system contains refrigerant.)

— NOTE —

Applies to Kent Moore J23500 or similar charging station. Refer to Figure 21-26.

1. Close all valves on charging station.
2. Connect red high pressure charging line to high pressure Schrader valve at the evaporator fitting.
3. Open valve 8 (high pressure control) on charging station one turn.
4. Hold end of blue low pressure charging line in a shop rag and slowly open valve 2 (low pressure control) on charging station allowing refrigerant to exhaust from system into shop rag.

— CAUTION —

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

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.

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 we lower the pressure in the air conditioning system, we lower the boiling temperature of the water (moisture) that may be present. Then we are able to pull this water, in the form of vapor, out of the system. The following table demonstrates the effectiveness of moisture removal under a given vacuum.

	System Vacuum	Temperature °F/°C
COMPOUND GAUGE READING IN INCHES OF MERCURY VACUUM	27.99	100/37.78
	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

— NOTE —

For each 1,000 feet of elevation above seal level, the compound gauge reading will be about one inch lower, numerically.

The following steps should be of help when performing this operation.

1. Remove access panel al the rear of the cabin to gain access to the Schrader service valves.

— CAUTION —

Ascertain that all system pressure is released before attempting the evacuation. (Refer to Service Valves paragraph.)

2. Connect the manifold gauge set to the airplane service values. (Refer to Figure 21-25.)
3. The high and low manifold hand valves should be in the closed position. (Refer to Figures 21-22 and 21-25.)
4. Connect the center manifold hose to the inlet of the vacuum pump.

— NOTE —

Make sure the exhaust port on the vacuum pump is open to avoid damage to the vacuum pump.

5. Start the vacuum pump and open the low side manifold hand valve. Observe the compound, low pressure gauge needle, it should show a slight vacuum.
6. Continue to operate the vacuum pump until 26 to 28 inches of vacuum is attained on the low pressure gauge, then extend the operation for another 25 minutes.
7. If the system cannot maintain 26 to 28 inches of vacuum, close both hand valves and observe the compound gauge.
8. Should the compound gauge show a loss of vacuum, there is a leak in the system which must be repaired before continuing with evacuation.
9. If no leaks are evident, reopen both manifold hand valves and continue the evacuation for another 30 minutes.

10. Close both manifold hand valves, stop vacuum pump and disconnect center manifold hose from the vacuum pump.
11. Proceed to charge the system in accordance with the paragraph "Charging the System."

— NOTE —

The system should be charged as soon as it has been evacuated.

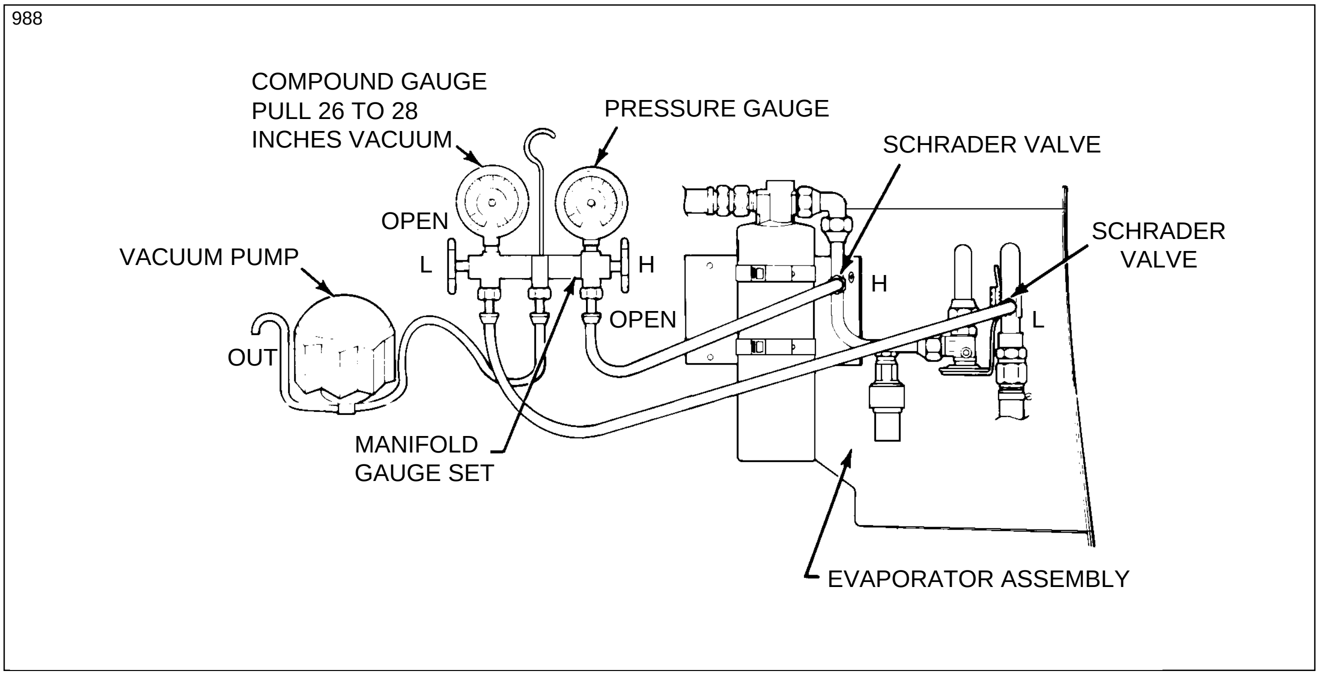


Figure 21-25. Evacuation Hookup

CHARGING THE SYSTEM

When the system is completely evacuated in accordance with instructions given in the last paragraph, one of the following procedures should be used to charge the system.

USING A CHARGING STAND

This is the preferred method of charging the system.

— NOTE —

The following instructions apply to Kent Moore, J23500 charging stand. Refer to Figure 21-26.

1. With the system discharged and evacuated, proceed to hook-up the charging stand. (Refer to Figure 21-27.)
2. Fill the charging cylinder by opening the valve at the base of the charging cylinder and filling the sight glass with two pounds of liquid refrigerant.
3. As refrigerant stops filling the sight glass, open the valve at the top of the gauge neck assembly intermittently to relieve head pressure and allow refrigerant to continue filling the sight glass to the required amount.

411

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 GUAGE
10. VALVE, HIGH PRESSURE CONTROL
11. VALVE, REFRIG. CONTROL
12. CHARGING LINE HOSE HOLDER
13. BRACKET
14. LOW PRESURE 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

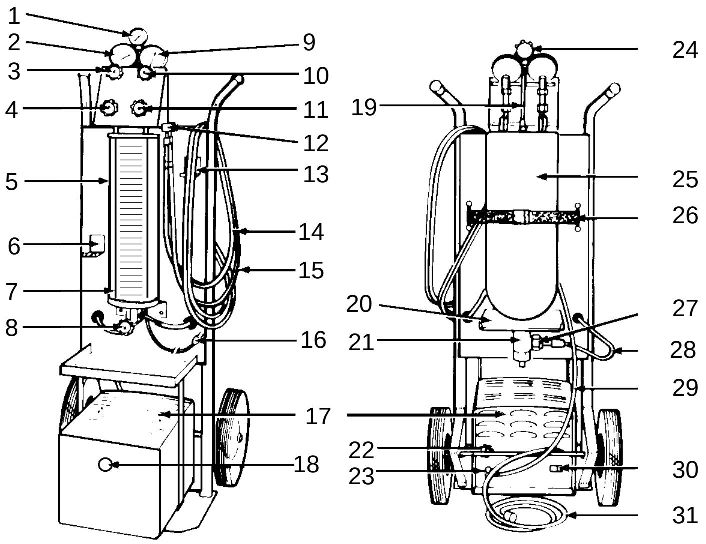


Figure 21-26. Charging Stand

4. When refrigerant reaches the required level in the sight glass, close both the valve at the base of the cylinder and the valve at the bottom of refrigerant tank. Be sure the top valve is fully closed.

— NOTE —

If bubbling occurs in sight glass, reopen the cylinder base valve momentarily to equalize drum and cylinder pressure.

5. Connect the heating element plug to a 110-volt outlet.
6. Turn cylinder sight glass to match pressure reading on cylinder pressure gauge. This scale should be used during entire charging operation.
7. Close valve 1 (low pressure control), full open valve 4 (refrigerant control) and allow all the liquid refrigerant contained in the charging cylinder to enter high side of aircraft system.
8. When the full charge of refrigerant has entered the system, close valve 4 (refrigerant control) and valve 2 (high pressure control).
9. After completion of charging, close all valve on the charging stand. Disconnect the high and low pressure charging lines from the aircraft system. (A small amount of refrigerant remaining in the lines will escape.) Replace lines on holder of charging stand to keep air and dirt out of lines. Open the valve at the top of cylinder to relieve any remaining pressure, then reclose the valve.
10. Reinstall protective caps of Schrader valves and any access panels previously removed.

USING AIRPLANE COMPRESSOR TO CHARGE SYSTEM

This method is the least desirable due to the requirement of operating the airplane's engine to run the compressor.

— WARNING —

IF THE AIR CONDITIONER IS TO BE OPERATED DURING GROUND SERVICING, THE TEST AREA SHOULD BE CLEAN AND FREE OF ANY LOOSE OBJECTS LYING ON THE RAMP. ONLY THE SERVICE VALVE LOCATED ON THE EVAPORATOR ASSEMBLY SHOULD BE USED FOR TESTING.

1. With the system evacuated as outlined in the paragraph "Evacuating the System," connect the refrigerant charging hose to the manifold (refer to Figure 21-27) and purge the charging hose of air.
2. Place the refrigerant container on a scale to observe the amount of refrigerant entering the system. Open the high pressure valve and add as much refrigerant as possible.
3. Close the high pressure valve, start the engine and operate it at 900 to 1000 rpm.
4. Operate the air conditioner and set controls to maximum cooling.
5. Open the low pressure valve and complete charging the system.
6. Close the low pressure valve after two pounds of refrigerant have been added to the system.
7. With the system still operating, observe the sight glass in the top of the receiver-dehydrator by removing the plastic plug.

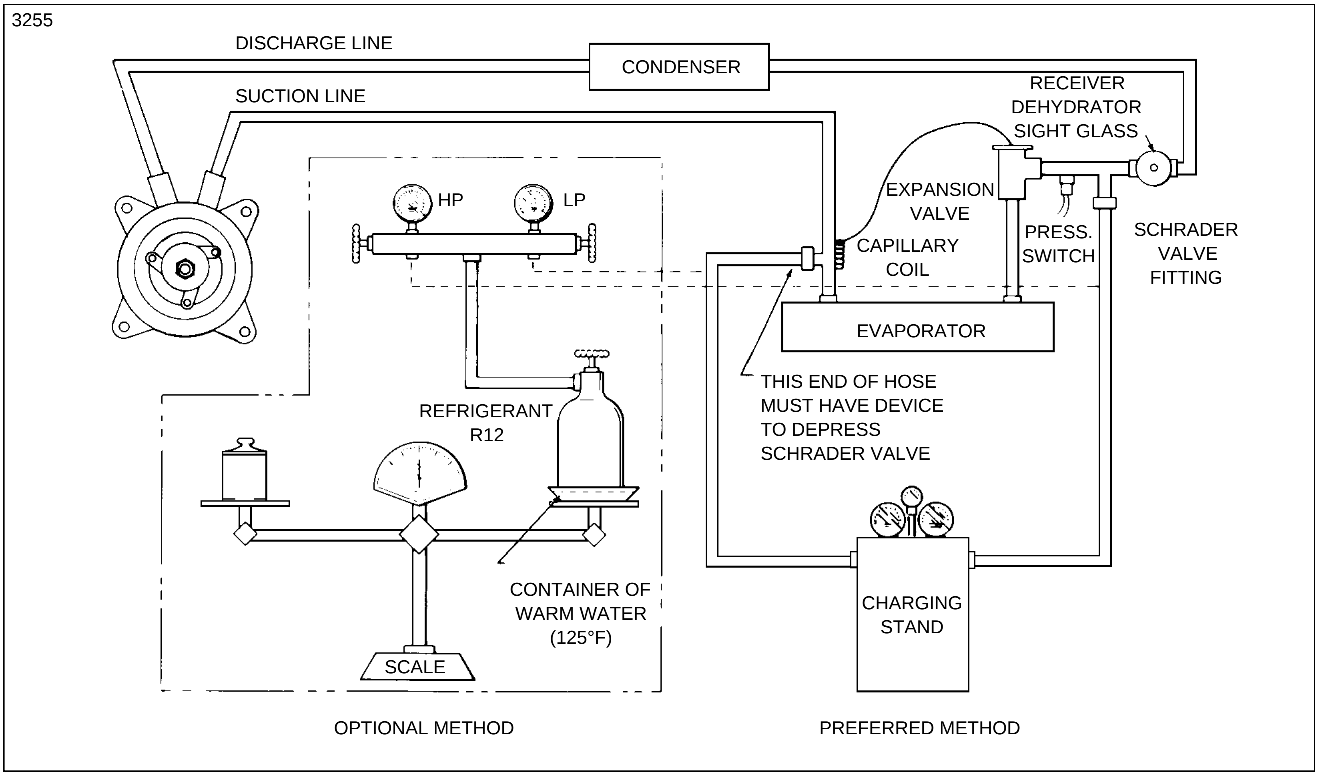


Figure 21-27. Charging Hookup

8. The sight glass should be clear of any bubbles or foam. If bubbles or foam are seen passing through the sight glass, it is an indication of a low refrigerant charge in the system and more refrigerant is required. This check should be made with OAT of 70°F or higher and with the air conditioner operating.
9. If more refrigerant must be added to the system, open the low pressure valve and increase engine speed to 2000 rpm and observe the sight glass. After the sight glass has cleared, close the low pressure valve and observe the pressure gauges. At 1000 rpm, the gauge pressure should be 15 to 20 psi on the low side and 150 to 200 on the high side.

— NOTE —

Suspect leaks or an inaccurate scale if two pounds of refrigerant does not fill the system.

10. Shut off the air conditioning system and airplane engine. Then, remove all the charging lines from the Schrader valves with care due to the refrigerant remaining in the hose.

— NOTE —

A shop cloth should be used to divert escaping refrigerant when disconnecting the charging hose from the Schrader valve. Recap the valve.

PARTIAL CHARGE TO SYSTEM

It is possible to top off this system with refrigerant by the following method.

1. Remove the access panel at the rear of the cabin.
2. Connect a charging hose to a refrigerant cylinder and also to the Schrader valve fitting on the suction line. (Refer to Figure 21-27.)
3. Purge the charging hose by allowing a small amount of refrigerant gas to escape at the Schrader valve fitting.
4. Start the engine and operate at 1000 rpm and turn the air conditioner on maximum cool.
5. Remove the plastic plug from the sight glass in the top of the receiver-dehydrator.
6. With a low refrigerant charge in the system, bubbles will be seen passing thru the sight glass when the system is operating.
7. Open the valve on the refrigerant cylinder.
8. Allow refrigerant to flow into the system until the bubbles disappear from the sight glass.
9. Close the refrigerant valve and check to see that the sight glass remains clear during system operation.
10. When the sight glass stays clear of bubbles, add an additional 1/4 pound of refrigerant to the system. (Engine should be operating at 1000 rpm.)

— NOTE —

This should be done with OAT at 70°F, or higher, with the air conditioner operating.

11. Shut off the air conditioner and engine. Remove the charging hose from the Schrader valve with care due to refrigerant remaining in the line.
    a. Replace the access panels.

COMPRESSOR SERVICE

It is not advisable to service the compressor in the field. It should be done by a qualified shop which has the special equipment and trained personnel required to properly service the unit.

Maintenance to the Sankyo compressor is limited to replacement of worn drive belt. Contact Sankyo International, 10710 Sanden Drive, Dallas, Texas 75238 (214-349-3030) for special tools and instructions for detailed compressor maintenance.

— NOTE —

An important factor in air conditioning servicing is cleanliness and care should be exercised 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.

COMPRESSOR REMOVAL

The system must be discharged per paragraph "Discharging" before removing compressor. The removal instructions for the Sankyo compressor are as follows:

1. Ascertain that air conditioning circuit protector is in the off position.
2. Remove the engine cowling.
3. Disconnect the electrical leads to the magnetic clutch on the compressor.
4. Depressurize the air conditioning system.
5. Remove the suction and discharge line from the service valves on the compressor.

— NOTE —

All open lines should be capped immediately to prevent dirt and moisture from entering the system.

6. Loosen the four bolts securing the compressor in the mounting brackets. Rotate the compressor in the bracket slots to disconnect drive belt.
7. Support compressor and remove the attachment bolts.

COMPRESSOR INSTALLATION

The installation instructions for the Sankyo compressor are as follows:

1. Place the compressor in the mounting brackets and install attachment bolts. Do not torque attachment bolts at this time.
2. Install compressor drive belt. Rotate compressor drive belt. Rotate compressor in mounting bracket slots to obtain a belt tension of 85 to 90 pounds. Torque the four attachment bolts 300 to 350 inch-pounds as described in “Adjustment of Drive Belt Tension.”
3. Check the oil level in the compressor in accordance with instructions given in the next paragraph.
4. Connect the discharge and suction lines to their respective fittings.

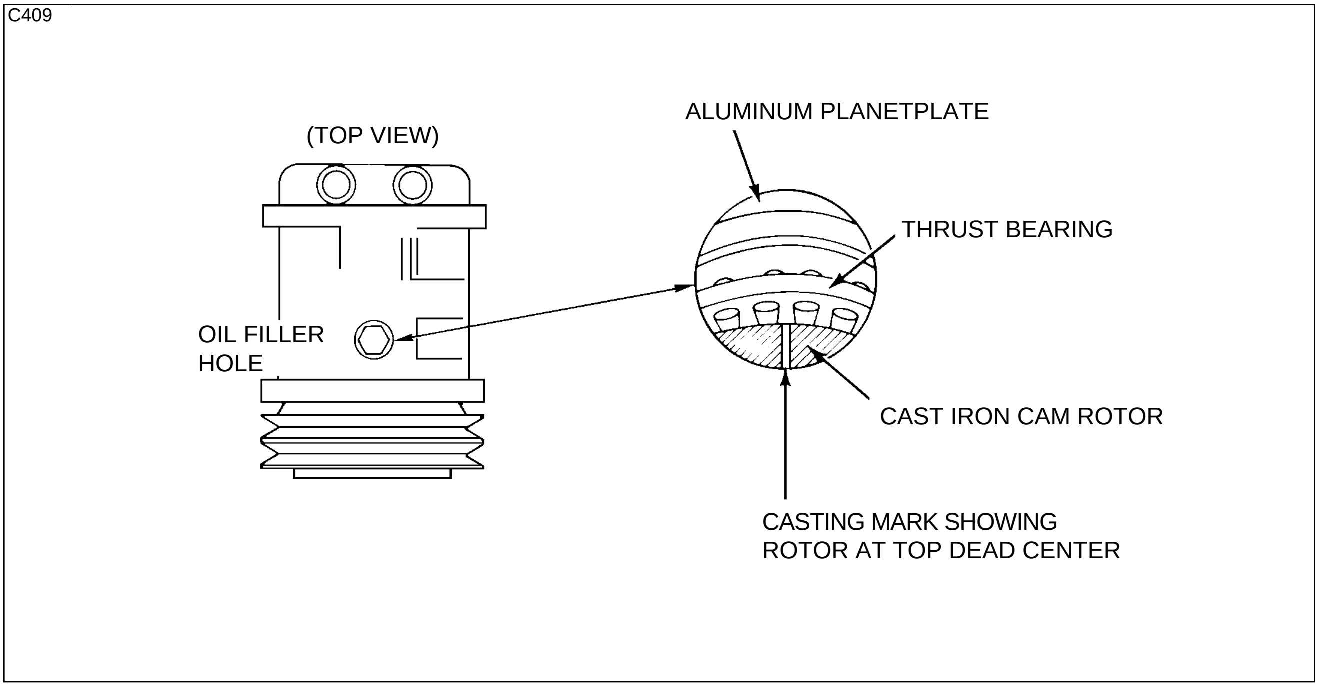


Figure 21-28. Top Dead Center Casting Mark (Sankyo Compressor)

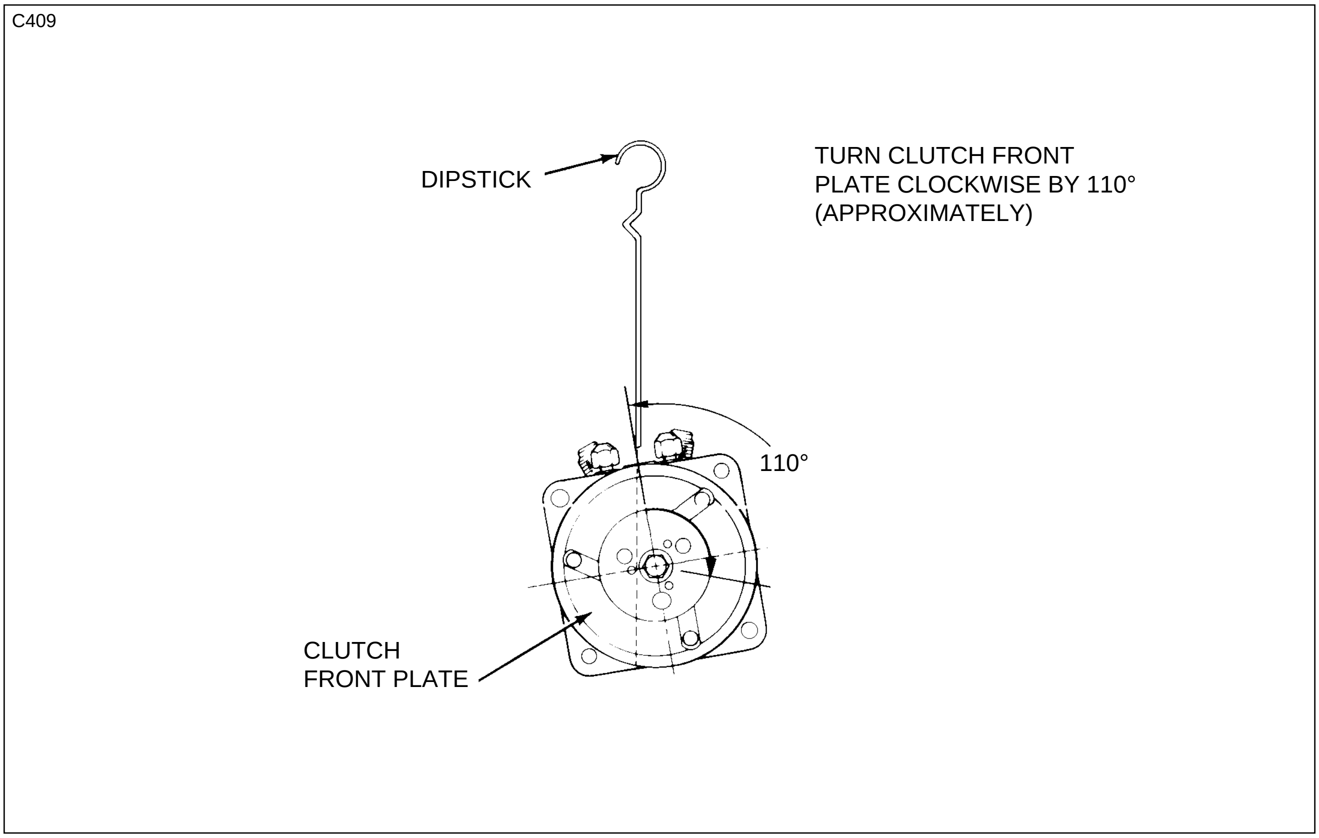


Figure 21-29. Rotation of Clutch Front Plate (Sankyo Compressor Oil Check)

COMPRESSOR INSTALLATION (continued)

5. Evacuate and charge the system per previous instructions.

—WARNING—

IF THE AIR CONDITIONER IS TO BE OPERATED ON THE GROUND FOR SERVICING, THE TEST AREA SHOULD BE CLEAN AND FREE OF ANY LOOSE OBJECTS LYING ON THE RAMP. ONLY THE SERVICE VALVES LOCATED ON THE EVAPORATOR ASSEMBLY SHOULD BE USED FOR TESTING.

CHECK COMPRESSOR OIL

The oil level should be checked any time the system is discharged. Use the following instructions for checking Sankyo compressor oil level:

1. Run the compressor for 10 minutes with engine at 1900 rpm.

—WARNING—

IF THE AIR CONDITIONER M TO BE OPERATED DURING GROUND SERVICING, THE TEST AREA SHOULD BE CLEAN AND FREE OF ANY LOOSE OBJECTS LYING ON THE RAMP. ONLY THE SERVICE VALVE LOCATED ON THE EVAPORATOR ASSEMBLY SHOULD BE USED FOR TESTING.

2. Discharge the system as previously instructed; be careful not to lose any oil.
3. Remove the oil filler plug.
4. Position the rotor to top dead center (refer to Figure 21-28) by rotating the clutch *ont plate until the casting mark is visible in the center of the hole.
5. Rotate the clutch front plate clockwise by approximately 110°. (Refer to Figure 21-29.)
6. Insert dipstick No. 32447 purchased from Sankyo. (See “Compressor Service” paragraph for Sankyo address.)
7. Remove the dipstick and count the number of increments of oil. The acceptable oil level in increments is 7 to 10. This represents between 2.6 and 4.4 fluid ounces.
8. When oil is added, use Suniso No. 5GS or Texaco Capella "E" grade or equivalent 500 viscosity refrigerant oil.
9. When installing the oil filler plug, make sure the sealing O-ring is not twisted and that no dirt or particles are on the O-ring or seat. Torque the plug to 6-9 foot-pounds. Do not overtighten the plug to stop a leak; remove the plug and install a new O-ring.
10. Evacuate and charge the system as previously described.

— CAUTION —

THE OIL PLUG SHOULD NOT BE REMOVED WITH PRESSURE IN THE SYSTEM.

ADJUSTMENT OF DRIVE BELT TENSION

Adjust the Sankyo compressor as follows:

1. Rotate the compressor to obtain tension of 100 pounds for new belt or 85 to 90 pounds for an old belt.

— WARNING —

IF THE AIR CONDITIONER IS TO BE OPERATED DURING GROUND SERVICING, THE TEST AREA SHOULD BE CLEAN AND FREE OF ANY LOOSE OBJECTS LYING ON THE RAMP. ONLY THE SERVICE VALVE LOCATED ON THE EVAPORATOR ASSEMBLY SHOULD BE USED FOR TESTING.

2. Run the engine for a 15 minute period at 1900 rpm with the compressor engaged.
3. Shut down engine and recheck the belt tensions. New belt tension should fall back to desired tension of 85 to 90 pounds. Old belts reinstalled should retain the 85 to 90 pounds span tension.
4. This tension check should be made at every 100 hours or annual inspection, whichever occurs first.

REFRIGERANT LINES AND ROUTING

The refrigerant lines in this aircraft are flexible high pressure hoses and should be handled accordingly. The hoses in the power plant area are routed so as to provide maximum protection from heat and abrasion. They couple at the firewall to hoses routed through the two inboard, external hat sections on the bottom of the fuselage, up through the floor to the condenser and evaporator in the tail cone. The discharge is in the right hat section and the suction in the left.

— NOTE —

Before any of the hose couplings are uncoupled, the system must be completely discharged.

RECEIVER-DEHYDRATOR

RECEIVER-DEHYDRATOR REMOVAL

This unit is mounted on the inboard side of the evaporator assembly housing.

1. Discharge the system of all refrigerant.
2. Uncouple the refrigerant lines at the receiver-dehydrator as described in "Special Servicing Procedures."
3. Remove the clamp attaching the unit to the evaporator housing.

— NOTE —

This part is not serviceable, it must be replaced. The receiver-dehydrator should be replaced when the system has been operated without a charge or is left open.

RECEIVER-DEHYDRATOR INSTALLATION

1. Slip the mounting bracket around the receiver and put it in place on the evaporator housing with the tube fitting on top. Align the fittings to the proper line before securing the mounting bracket.

— NOTE —

Torque the fittings. (See Chart 2105.)

2. Evacuate and recharge the system in accordance with previous instructions.

CONDENSER

The condenser is located in the left nacelle aft of the firewall, between stations 78.00 and 98.00.

CONDENSER REMOVAL

1. Remove the hatch cover assembly.
2. With the system completely discharged, disconnect the suction and discharge hoses at the condenser fitting. (See"Special Servicing Procedures.")

— NOTE —

Cap the open lines to prevent moisture and dust from contaminating the system.

3. Remove the screws which hold the condenser to the mounting brackets.
4. Remove the condenser from the nacelle, being careful not to bend the fins of the core or damage connecting tube.

— NOTE —

Cap the lines till reinstalled.

CONDENSER INSTALLATION

1. Place the condenser in the left nacelle with the line connections on the outboard side.
2. Attach the condenser to the mounting brackets.

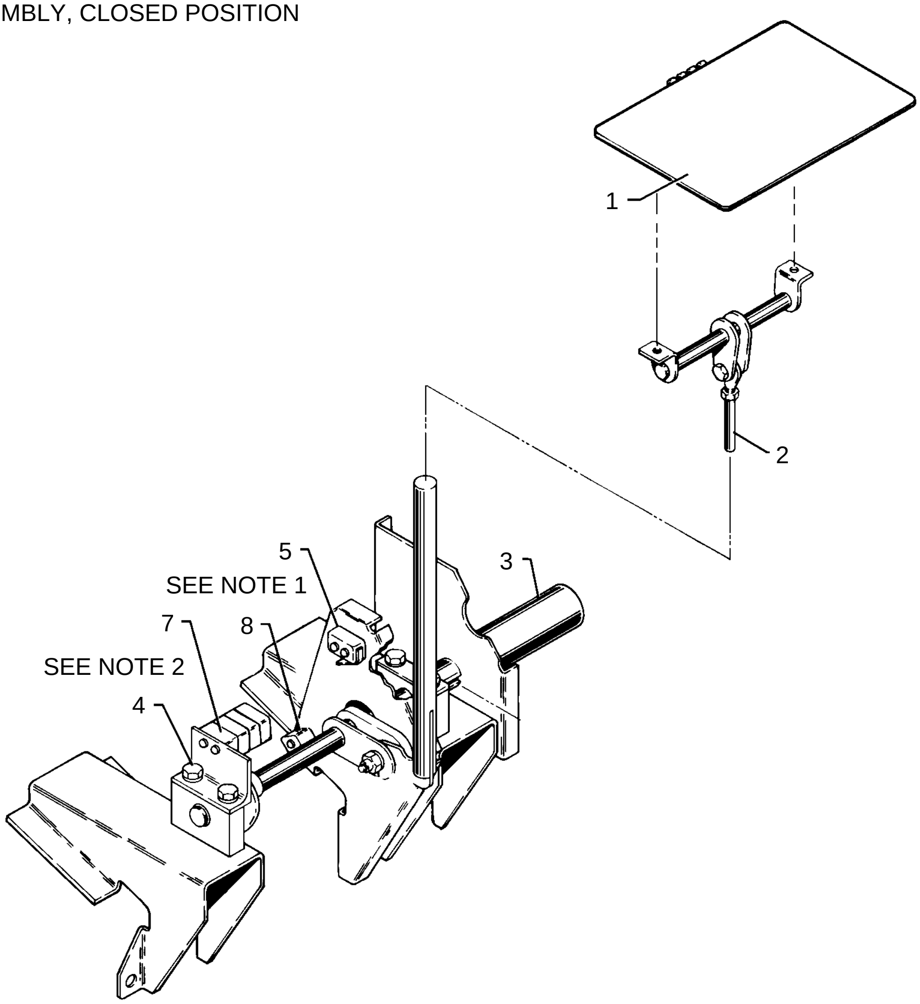
— NOTE —

It is advisable to change the receiver-dehydrator whenever the system has been open to the atmosphere.

3. Seal and couple the hose fittings. Apply a small amount of Loctite refrigerant sealant to the flare only to ensure leak free connections.
4. With the condenser secured, proceed to evacuate and recharge the system.
5. When the system is completely charged, check it for any leaks.
6. Replace and secure hatch cover assembly.

3254

1. CONDENSER SCOOP
2. SCOOP ROD ASSEMBLY
3. MOTOR
4. BEARING BLOCK
5. SWITCH ASSEMBLY, GROUND POSITION
6. SWITCH ASSEMBLY, FLIGHT POSITION
7. SWITCH ASSEMBLY, CLOSED POSITION



NOTES

1. USED ON S/N 34-8133299, 34-ER845 AND UP IF AIR CONDITIONING CONDENSER DOOR LIMIT SWITCH IMPROVEMENT KIT 764 955v HAS BEEN INSTALLED.
2. USED ON S/N 34-8133001 TO 34-8133228 AND 34-8133001 TO 34-ER845 IF AIR CONDITIONING CONDENSER DOOR LIMIT SWITCH IMPROVEMENT KIT 764 955 v HAS NOT BEEN INSTALLED.

Figure 21-30. Condenser Inlet Scoop Installation

CONDENSER SCOOP RIGGING (Refer to Figure 21-30.)

The condenser scoop assembly in the left nacelle, is operated by an electric motor through a torque tube and pushrod. Travel of the scoop is limited by switches, activated by a rotating cam plate. The scoop should be rigged to the proper specifications for the most efficient cooling results. Proceed as follows:

1. Open scoop door to ground open position. Hand rotate torque tube assembly to ground open position; lobe straight up. Insert bolt to connect scoop door and rod assembly.
2. Move door to closed position. With door in closed position, lobe will be straight down. If snug fit is not obtained adjust rod end until a snug fit is obtained.
3. Complete installation of attachment hardware at rod to door.
4. The flight open position, is obtained by adjusting the micro switch and not by a mechanical adjustment.
5. Move door to flight position until rod assembly contacts torque tube. Back rod assembly away from torque tube .06 to .08 inches and position microswitch until audible "click" is heard (no continuity, C to NC wires) and secure microswitch in place.
6. Move door to closed position and verify snug fit. Adjust the two micro switches relative to the cam, so that both micro switches are relax. (No continuity, connector pin 2 to pin 1 and 4.) Only during approximately 5° angular travel at the closed position of the crank. Tighten the two screws to maintain this adjustment.
7. Move door to ground open position and verify ground open position dimension. Position micro switch until audible "click" is heard (no continuity, C to NC wires) and secure in place.
8. Place aircraft on jacks, activate circuit breaker marked "Air Condition," cycle scoop door to verify each position.

— NOTE —

With reference to Figure 21-30, the door should be open .80 ± .10 without kit 764 955v installed and .8 + .00 -.10 inch with kit 764 955v installed for the INFLIGHT condition, and 3.50 min. inch for the GROUND position. Do not bend actuating pushrod

9. Over ride the squat switch on the right main gear by depressing micro switch lever, when inflight position is obtained ensure that the motor stops before rod assembly locks against torque tube.
10. Reinstall hatch cover assembly and remove aircraft from jacks.

EXPANSION VALVE (See Figure 21-31.)

EXPANSLON VALVE REMOVAL

The expansion valve is located in the evaporator assembly between the receiver drier and the evaporator inlet. The capillary coil is attached to the evaporator outlet line.

1. Remove the necessary access panels and discharge system.
2. Remove the capillary coil from the outlet line. (Do not kink the capillary tube.)
3. Uncouple all related tube fittings. (See "Special Servicing Procedures.'

— NOTE —

If this part is not serviceable, it must be replaced with a new part.

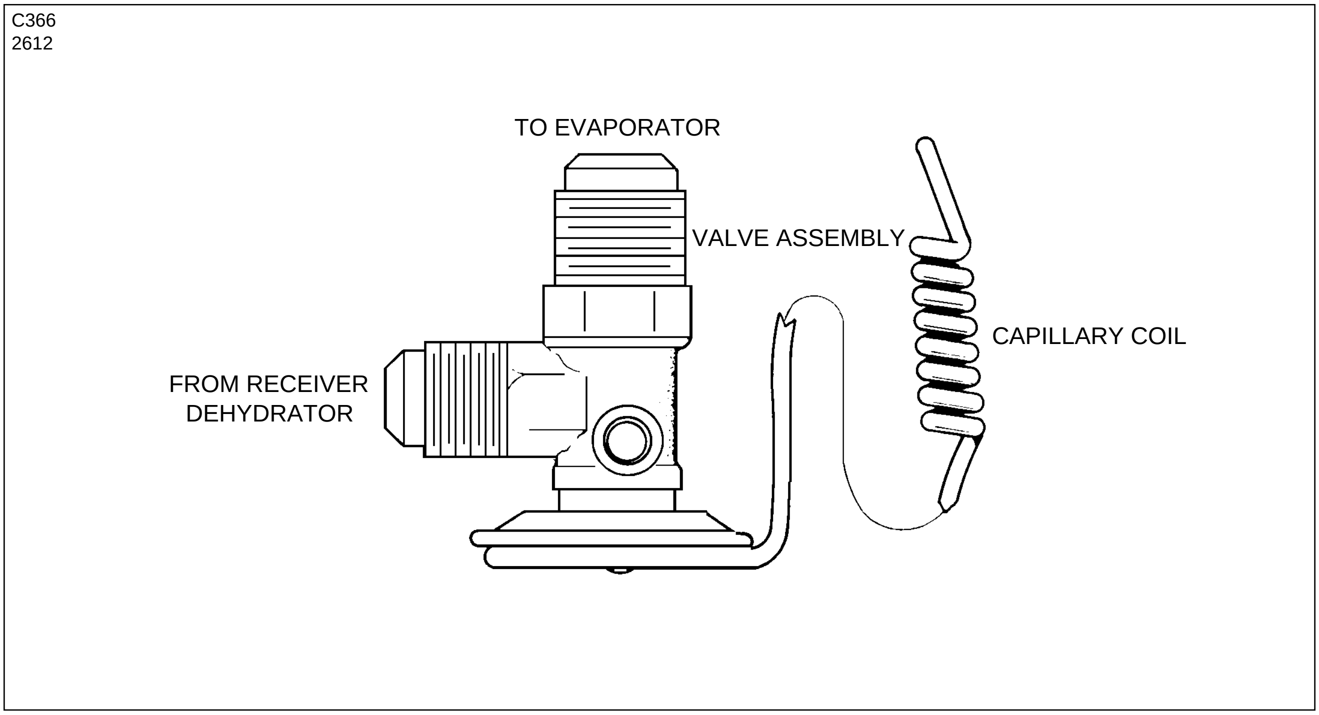


Figure 21-31. Expansion Valve

EXPANSION VALVE INSTALLATION

1. Install the expansion valve in the inlet line of the evaporator core by coupling the related fittings. (Seal all couplings with sealant applied to tube flanges only.) Torque fittings per Chart 2105.
2. Secure the capillary coil to the evaporator outlet line.
3. Evacuate and charge the system. See paragraphs on "Evacuating and Charging" the system. Check for leaks as described previously.
4. Replace access panels.

EVAPORATOR ASSEMBLY

The evaporator assembly consists of the evaporator core, receiver-dehydrator, expansion valve, circulating fan and pressure switch together with necessary housing and plumbing. The housing is fabricated of Cycolac type material. The condensed moisture is dumped overboard through a hose clamped to a fitting on the bottom of the evaporator housing.

EVAPORATOR ASSEMBLY REMOVAL

The evaporator assembly is located behind the cabin rear panel, attached to the mounting panel with 12 screws and washers and a bracket securing the back to the mounting panel.

1. Remove air conditioning filter cover, filter and rear access panels.

— NOTE —

Discharge the system before disassembling any components for service.

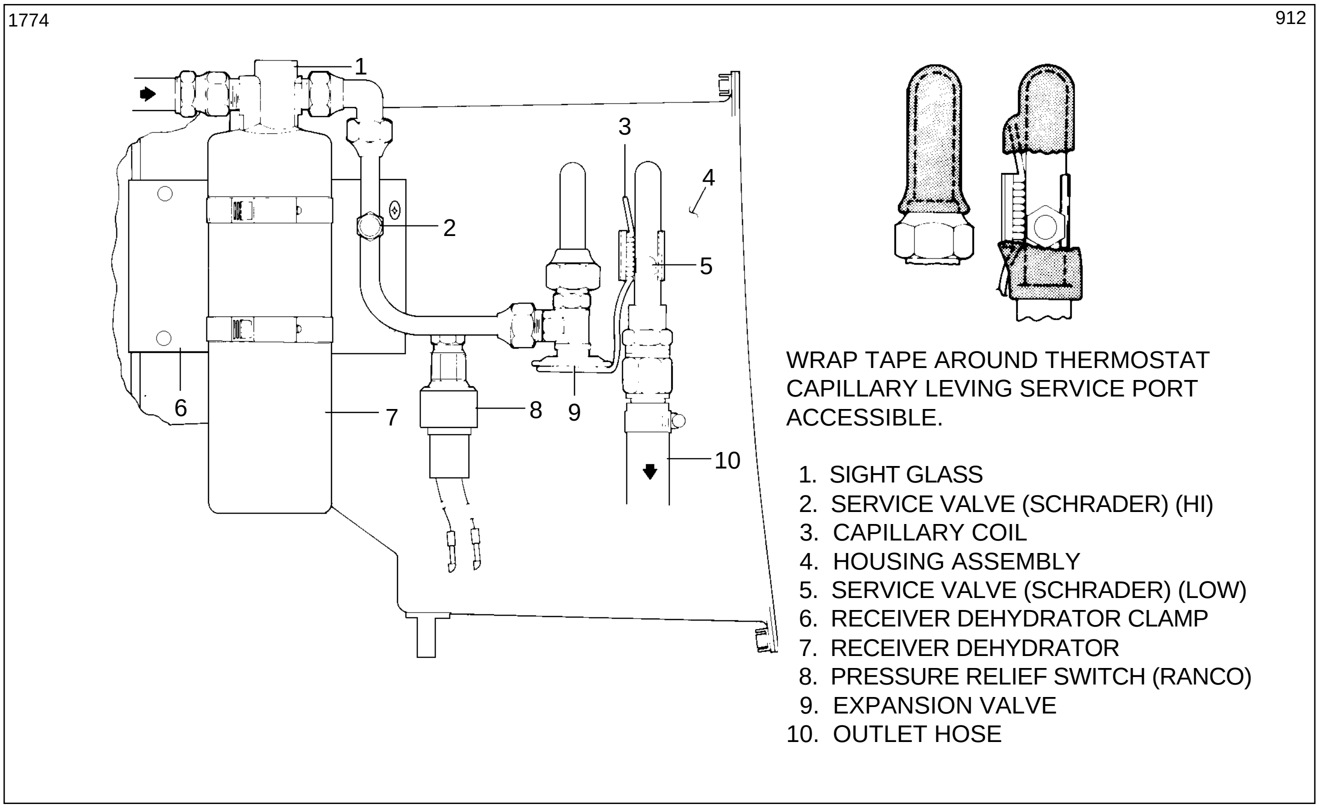
2. Uncouple the liquid line from the inlet side of the receiver-dehydrator and the suction line from the evaporator core outlet per "Special Servicing Procedures."
3. Disconnect the related electrical wires.
4. Remove flexible air duct from housing outlet. Remove drain hose from housing.
5. Remove temperature probe from evaporator housing.
6. Remove the screws attaching the support bracket and evaporator housing to the mounting panel. Remove the assembly through the access hole in the bulkhead.

EVAPORATOR ASSEMBLY INSTALLATION

1. Cement gasket in place on the flanges of the evaporator housing and attach the large end of the mounting gasket to the back of the housing.
2. Install the housing through the access hole with the air duct outlet on top. Mate the mounting flanges to the mating surface of the mounting panel and insert the screws. (Do not tighten at this time.)
3. Line up the mounting bracket with mating holes in mounting panel, insert screws and tighten. Tighten screws in the flange at this time. Be certain gasket is in place. The flange must have an air tight seal.
4. Couple the suction and discharge lines to their respective fittings (apply Loctite refrigerant sealant to tube flanges only).
5. Evacuate and charge system per previous paragraphs.
6. Check for leaks. 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.
9. Check operation of blower and refrigerant systems.
10. Install rear bulkhead panels. Be certain to seal. (See ***WARNING***.)

— WARNING —

WHENEVER IT IS NECESSARY TO REMOVE AND REPLACE THE CABIN REAR PANEL, IT SHOULD BE REPLACED AND SEALED IN THE ORIGINAL MANNER TO PREVENT EXHAUST GASES FROM ENTERING THE CABIN. AFTER REMOVING AND REPLACING THE REAR PANEL, CONDUCT A CARBON MONOXIDE TEST ON THE GROUND AND IN FLIGHT WITH AND WITHOUT THE AIR CONDITIONER OPERATING. PRESENCE OF CO SHALL NOT EXCEED ONE PART IN 20,000.



WRAP TAPE AROUND THERMOSTAT CAPILLARY LEVING 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

Figure 21-32. Components Installation

PRESSURE RELIEF SWITCH

The pressure relief switch automatically prevents the system from over pressurization by breaking the electrical circuit to the magnetic clutch, stopping the compressor until pressure is reduced. The switch is located in the line between the receiver and expansion valve, and set to cut out at 350 ± 10 psi and cut in at 250 ± 10 psi.

— NOTE —

Before the relief switch is removed, the air conditioning system must be discharged.

ELECTRICAL INSTALLATION

The electrical system, routing and component are installed and routed in the conventional aircraft manner. 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 (2) wires are taken off for the compressor clutch. The harness then passes aft along the left side of the fuselage where it connects to the blower motor, pressure relief switch and the condenser actuating motor.

FUSE REPLACEMENT

There are two fuses located behind the instrument panel. A 20 amp circuit breaker mounted in the circuit breaker panel protects the complete air conditioning electrical system.

GRIDS 1J1 THRU 1J5
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CHAPTER

22

AUTOFLIGHT

CHAPTER 22 - AUTOFLIGHT

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

Due to the wide variety of Automated Flight Control System (A.F.C.S.) options, it is mandatory to follow the service literature published by the individual manufacturer of the A.F.C.S. equipment installed in any particular airplane. This includes mechanical service such as; adjusting bridle cable tension, servo removal and installation, servo clutch adjustments, etc.

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A.F.C.S. EQUIPMENT CONTACTS

Refer to the following list of Autopilot/Flight Director manufacturers to obtain service direction, parts support, and service literature.

Allied Signal Corp.
King Radio Division
400 N. Rogers Road
Olathe, KS 66062
(913) 782-0400
Fax (913) 791-1310

Century Flight Systems
P. O. Box 610
Minerals Wells, TX 76067
(817) 325-2577
Fax (817) 325-2546

**GRIDS 1J10 THRU 1J12
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CHAPTER

23

COMMUNICATIONS

CHAPTER 23 - COMMUNICATIONS

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

—WARNING—

It is the user's responsibility to refer to the applicable vendor publication when servicing or inspecting vendor equipment installed in Piper aircraft .

This chapter 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.

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EMERGENCY LOCATOR TRANSMITTER

DESCRIPTION

The electrical power for both the Narco ELT 10 or 910 is totally supplied by its own self-contained battery. The battery must be replaced on or before the replacement date marked on battery pack label. The battery must also be replaced if the transmitter has been used in an emergency situation or it has more than one hour of accumulated test time.

BATTERY REMOVAL AND INSTALLATION (ELT 10) (Refer to Figures 23-2 and 23-3.)

The ELT is located in the aft fuselage at Fuselage Station 259.31.

1. Remove the access panel on the side of the fuselage.
2. Set the ON/OFF/ARM switch on the transmitter to OFF.
3. Disconnect antenna coaxial cable from ELT.
4. Remove ELT from its mounting bracket by releasing the latch on the strap and sliding the ELT off the bracket.
5. Extend the portable antenna. (Refer to Figure 23-2.)
6. Unscrew the four screws that hold the control head to the battery casing and slide apart.
7. Disconnect the battery terminals from the bottom of the circuit board.
8. Discard old battery pack. (DO NOT EXPOSE TO FLAME.)

— CAUTION —

THE BATTERY PACK IS SHIPPED WITH A SEALANT ON THE INSIDE LIP SO THAT A WATER TIGHT SEAL WILL BE RETAINED. DO NOT REMOVE THIS SEALANT.

9. Connect new battery pack terminals to the bottom of the circuit board.
10. Reinsert the control head section into the battery pack being careful not to pinch any wires and replace the four screws. If the four holes do not line up, rotate the battery pack 180° and reinsert.
11. Slide the portable antenna back into the stowed position.
12. Place transmitter into its mounting bracket and fasten the strap latch.
13. Connect the antenna coaxial cable to the ELT and ensure that the contact separator is inserted between the antenna contact finger and the portable antenna. (Refer to Figure 23-3.)
14. Press RESET button and set ON/OFF/ARM switch to ARM.
15. Make an entry in the aircraft logbook, including the new battery expiration date.
16. A unit operational check may now be performed on the ELT. (Refer to Testing Emergency Locator Transmitter.)

— NOTE —

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 inflight.

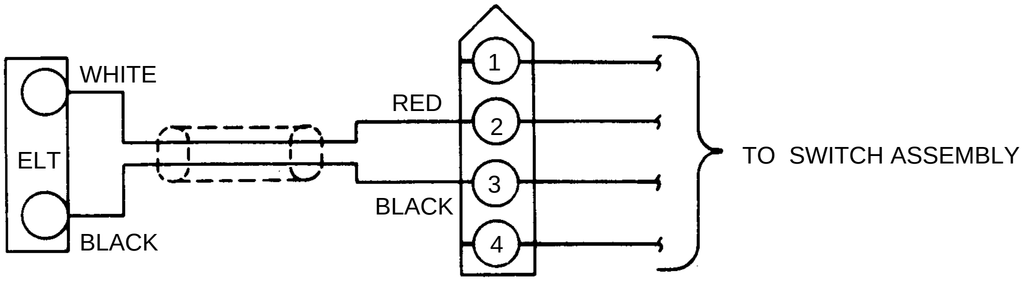

Figure 23-1. Narco 10 Emergency Locator Transmitter Schematic (Sheet 1 of 2)
(S/N's 34-8133001 thru 34-8633031 and 3433001 thru 3433101)

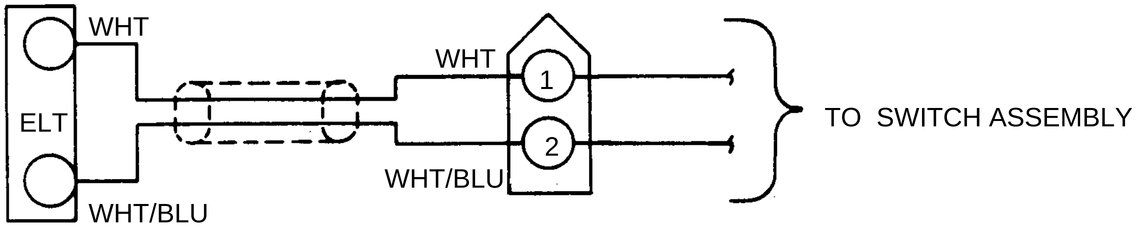

Figure 23-1. Narco 10 Emergency Locator Transmitter Schematic (Sheet 2 of 2)
(S/N's 3433102 thru 3433172)

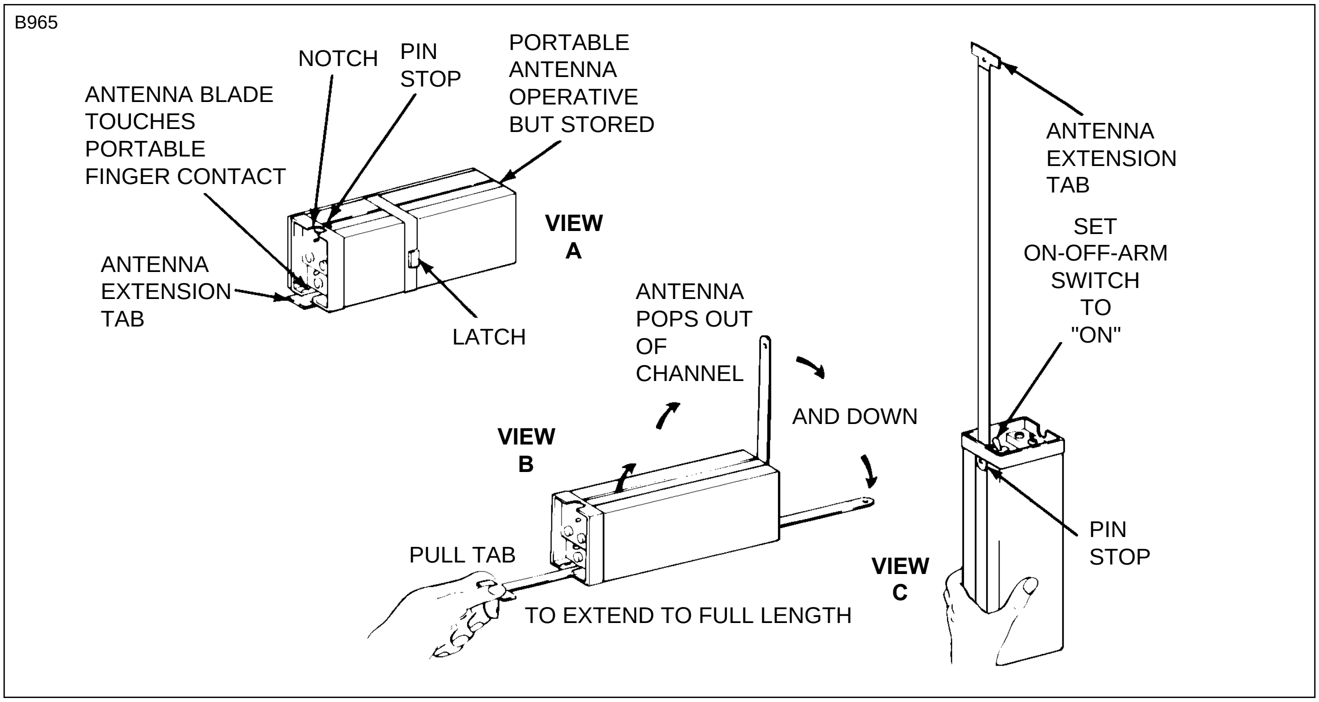

Figure 23-2. ELT 10 Portable Folding Antenna (Narco)
(S/N's 34-8133001 thru 34-8633031 and 3433001 thru 3433172)

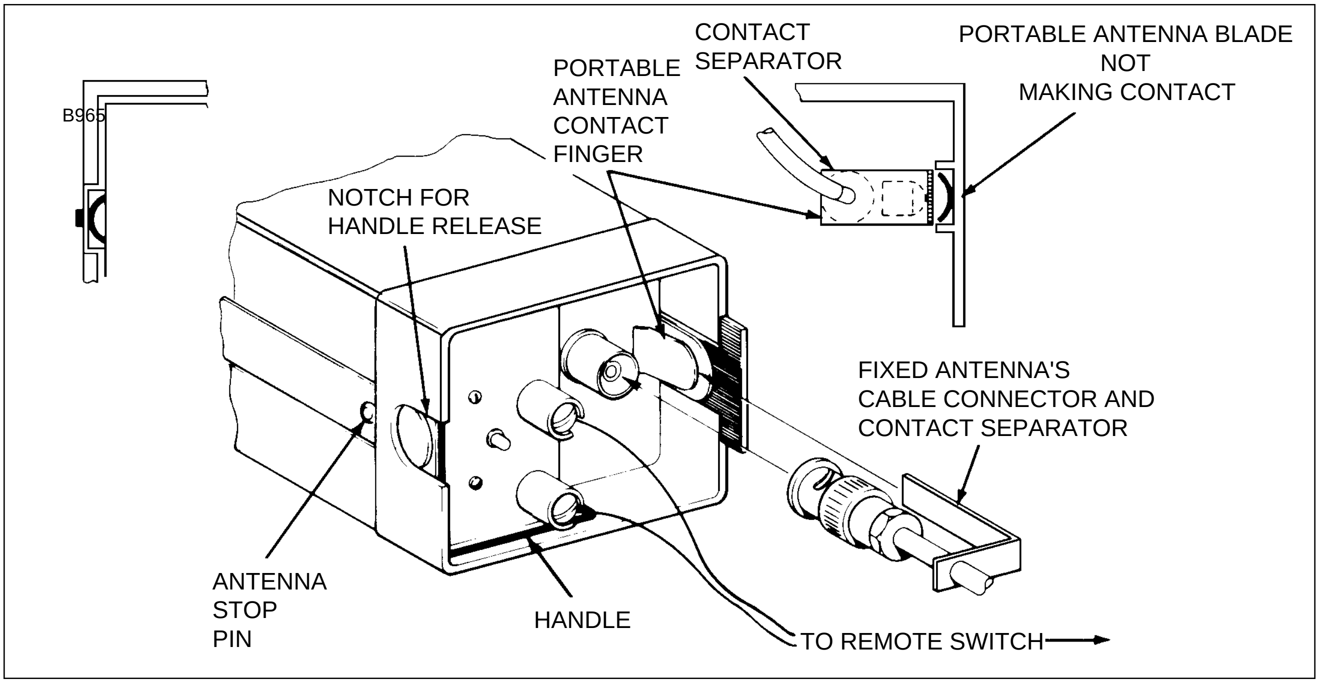

Figure 23-3. ELT 10 Using Fixed Aircraft Antenna (Narco)
(S/N's 34-8133001 thru 34-8633031 and 3433001 thru 3433172)

TESTING EMERGENCY LOCATOR TRANSMITTER (NARCO ELT 10)

The transmitter operates on the emergency frequencies of 121.5 and 243 mHz; both of these frequencies are monitored by the various FAA installations. Before performing any operation 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. **IF THE ANTENNA IS REMOVED, A DUMMY LOAD SHOULD BE SUBSTITUTED DURING THE TEST.**
3. **TEST SHOULD BE CONDUCTED ONLY WITHIN THE TIME PERIOD MADE UP OF THE FIRST FIVE MINUTES AFTER ANY HOUR.**
4. **IF THE OPERATIONAL TESTS MUST BE MADE AT A TIME NOT INCLUDED WITHIN THE FIRST FIVE MINUTES AFTER THE HOUR, THE TEST SHOULD BE CONDUCTED WITH THE CLOSEST FAA TOWER OR FLIGHT SERVICE STATION.**

CONSULT FAA ADVISORY CIRCULAR AC 20-81 FOR DETAILED INFORMATION CONCERNING THE ABOVE CAUTION.

1. Remove the access panel or cover to gain access to the transmitter.
2. Turn the aircraft master switch ON.
3. Turn the aircraft communications receiver volume up until a slight background noise is heard.

— NOTE —

The test transmission should have been picked up by the aircraft communications receiver and/or control tower. During cold weather, there may be a slight delay before transmission occurs.

4. A transmitter which is functioning properly should emit a characteristic downward swept tone.
5. When the test is completed, ascertain the transmitter ON/ARM/OFF switch is in the ARM position.
6. Place the access panel in position on the fuselage and secure with the appropriate screws.

— WARNING —

WHENEVER THE UNIT IS CHECKED BY MOVING THE TRANSMITTER ON/ARM/OFF SWITCH FROM THE ARM TO THE ON POSITION, IT MUST THEN BE MOVED TO THE OFF POSITION, IF THERE IS ONE, BEFORE REVERTING TO THE ARM POSITION AGAIN.

— CAUTION —

UNDER NORMAL CONDITIONS, THE TRANSMITTER SWITCH MUST BE SET TO ARM.

— NOTE —

Inspect the external whip antenna for any damage. A void bending the whip. Any sharply bent or kinked whip should be replaced. Antenna damage may cause structural failure of whip inflight.

DESCRIPTION, OPERATION AND TESTING OF PILOT'S REMOTE SWITCH (ELT 10 and ELT 910)

(Refer to Pilot's Operating Handbook.)

BATTERY REMOVAL AND INSTALLATION (ELT 910) (Refer to Figure 23-5.)

1. Remove access panel on dorsal fin.
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 tests as specified below.

— NOTE —

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.

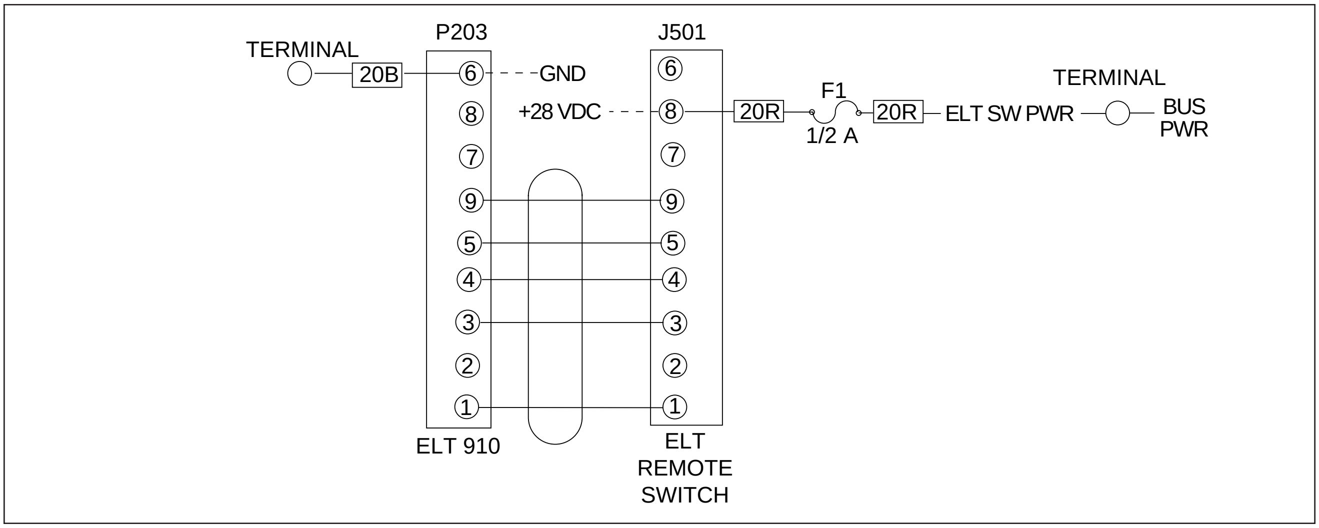

Figure 23-4 Emergency Locator Transmitter Schematic (Narco ELT 910)
(S/N's 3433173 and up, and 3448001 and up)

TESTING EMERGENCY LOCATOR TRANSMITTER (ELT 910)

— 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.
    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.

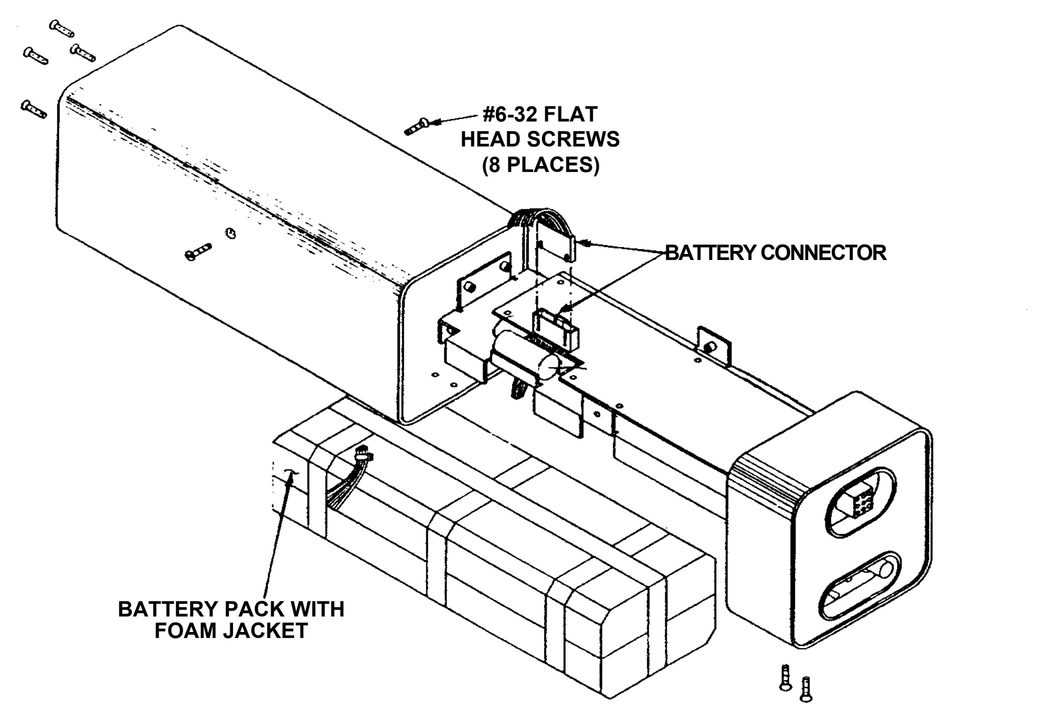

Fig 23-5 ELT 910 Battery Pack
(S/N's 3433173 and up, and 3448001 and up)

CHAPTER

24

ELECTRICAL POWER

CHAPTER 24 - ELECTRICAL POWER

TABLE OF CONTENTS/EFFECTIVITY

CHAPTER 24 - ELECTRICAL POWER

TABLE OF CONTENTS/EFFECTIVITY

— NOTE —

For Electrical Schematics or Wiring Diagrams, refer to Chapter 91.

— WARNING —

> ***WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, IT IS THE USER'S RESPONSIBILITY TO REFER TO THE APPLICABLE PUBLICATIONS.***

GENERAL

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.

DESCRIPTION AND OPERATION

14 VOLT SYSTEM

Electrical power is supplied by a 14-volt, direct current, negative ground electrical system. A 12-volt, 35 ampere hour battery is incorporated in the system to furnish power for starting and as a reserve power source in case of alternator failure; it is located in the nose section of the airplane.

The electrical generating system consists of two engine driven 65 ampere alternators. Two solid state regulators maintain effective alternator load sharing while regulating the system bus voltage at 14.0-volts. Also, incorporated in the system are overvoltage relays; one for each alternator circuit which prevents damage to electrical and avionic equipment in case of regulator malfunction. 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. The loads from the electrical bus system are protected by manual reset type circuit breakers mounted on the lower right-hand instrument panel.

28 VOLT SYSTEM

Electrical power is supplied by a 28-volt, direct current, negative ground electrical system. A 24-volt, 38 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; it is located in a compartment located on the right side of the nose section of the airplane.

The electrical generating system consists of two engine driven Teledyne Critten 60 ampere alternators, that are individually protected by 70 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 alternator output is lost and the system is drawing power from the battery alone. The loads from the electrical bus system are protected by manual reset type circuit breakers mounted on the lower right-hand instrument panel.

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 2401 and 2403 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.

CHART 2401. TROUBLESHOOTING (ALTERNATOR)

Trouble	Cause	Remedy
Zero output indicated on ammeter regardless of rpm (refer to alternator system test procedure).	Open field circuit.	With battery switch turned on, check for battery voltage from airplane's main buss through entire field circuit to alternator field terminal. Measure voltage from ground (-) to the following points (+) in sequence; bus bar, output circuit breaker (60A), field circuit breaker (5A), field terminals of master switch voltage regulator and alternator field terminal.

CHART 2401. TROUBLESHOOTING (ALTERNATOR) (continued)

Trouble	Cause	Remedy
Zero output indicated on ammeter regardless of rpm (refer to alternator system test procedure). (continued)		Interruption of voltage through any of these points isolates the faulty component or wire which must be replaced. (See wiring schematic, Chapter 91.)
	Open output circuit.	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. Interruption of voltage through any of these points isolates the faulty component or wire which must be replaced. (See wiring schematic, Chapter 91.) Open circuit in alternator output will usually burn out the ALT annunciator lamp and the 50 ohm resistor. Check the 5A in-line fuse.

CHART 2401. TROUBLESHOOTING (ALTERNATOR) (continued)

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. **— CAUTION —** **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.	Start engine, turn on load (ref: alternator test procedure), set throttle at 2300 rpm. Check voltage at buss bar [convenient check point, remove cigar lighter and check from center contact (+) to ground (-)]. Voltage should be 13.5-volts minimum. If voltage is below this value, replace regulator.

CHART 2401. TROUBLESHOOTING (ALTERNATOR) (continued)

Trouble	**Cause**	**Remedy**
Output indicated on ammeter does not meet minimum values specified in alternator system test procedure. (continued)	High resistance connections in field or output circuit.	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.
	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. It 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.)

CHART 2401. TROUBLESHOOTING (ALTERNATOR) (continued)

Trouble	Cause	Remedy
Field circuit breaker trips. (continued)	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.) 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. **— CAUTION —** **TURN MAGNETO SWITCH TO OFF BEFORE TURNING PROPELLER.**
Ammeter indicates 60 amps at 1400 rpm and above, ALT annunciator light on.	Short to ground in alternator output wiring.	Check condition of teflon insulators on feet of diode heat sink. When the mounting screws are overtorqued, they can cut through insulators causing a short-to-ground. Check other wiring for chafing, etc.

CHART 2401. TROUBLESHOOTING (ALTERNATOR) (continued)

Trouble	Cause	Remedy
Battery installed with reversed polarity.	Battery charged backwards.	Remove battery and reinstall with correct polarity. 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. — NOTE — 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. c. Overvoltage relay.
	Defective voltage regulator.	Replace voltage regulator.

GRID 1K9
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DC GENERATION

ALTERNATOR SYSTEM

The alternators (14 and 28 Vdc) are mounted on the accessory case 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 and holding the breakers down will not prevent continual tripping, 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.

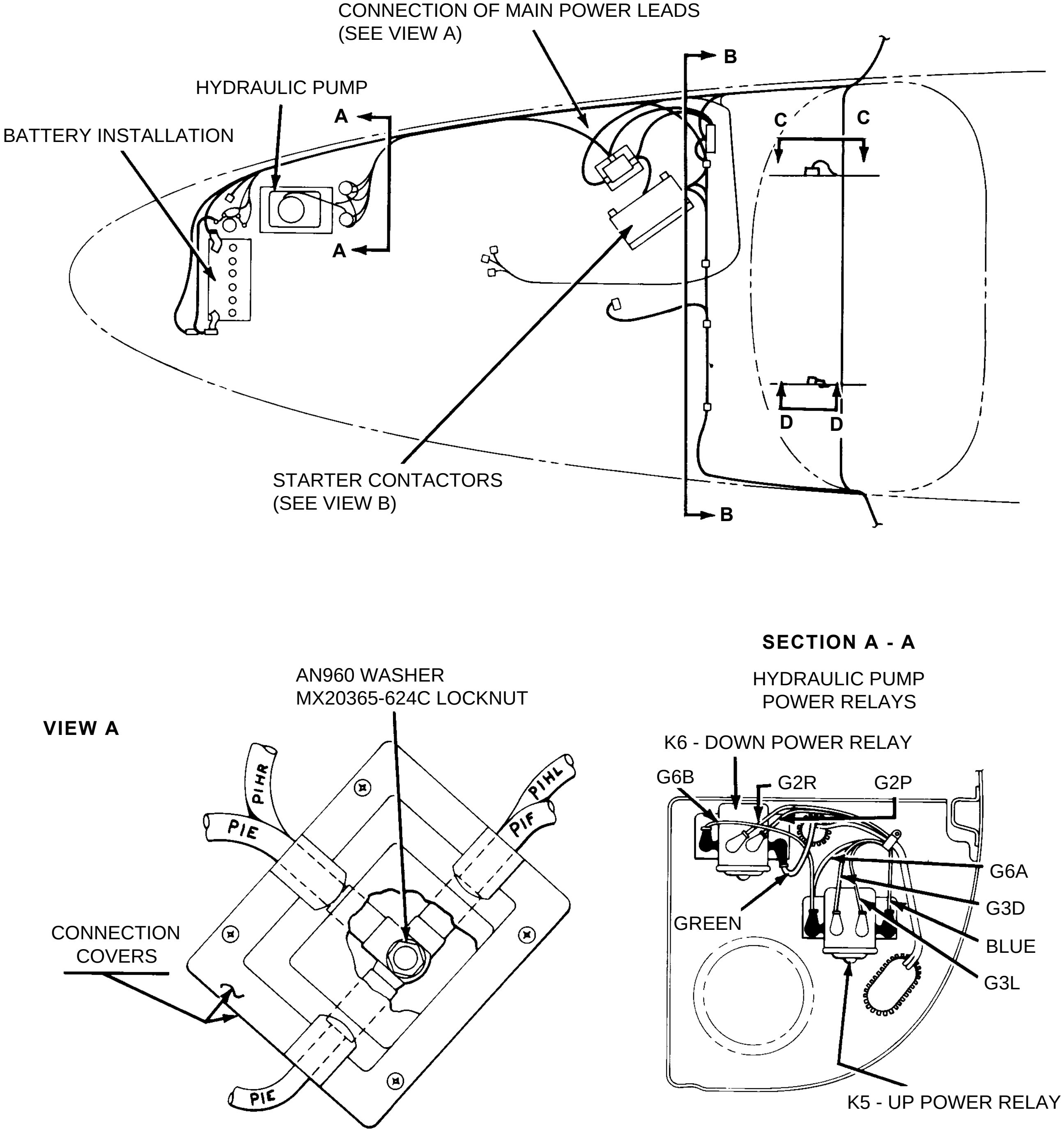


Figure 24-1. Base Electrical Installation (14 Volt System)

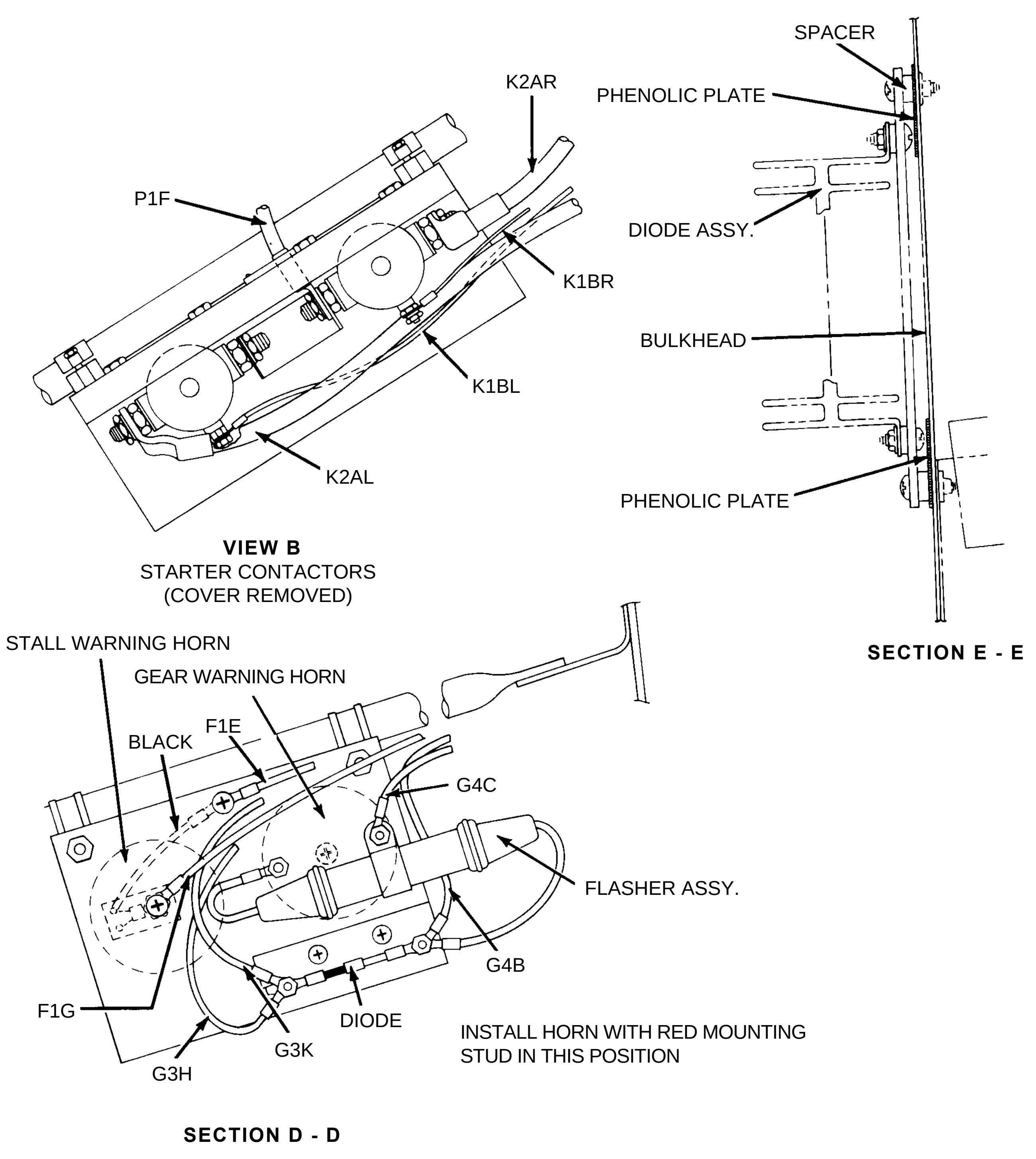


Figure 24-1. Base Electrical Installation (continued) (14 Volt System)

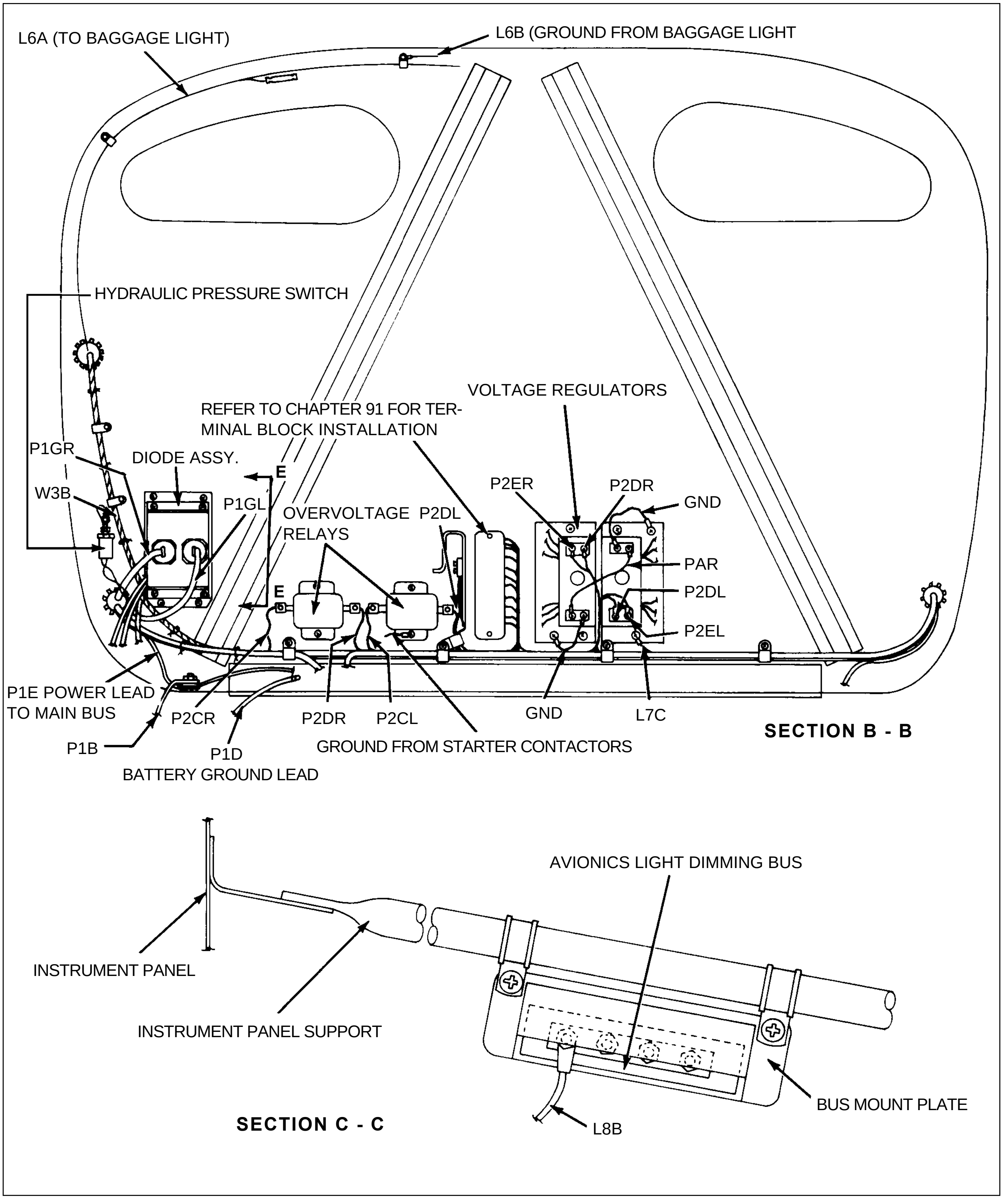


Figure 24-1. Base Electrical Installation (continued) (14 Volt System)

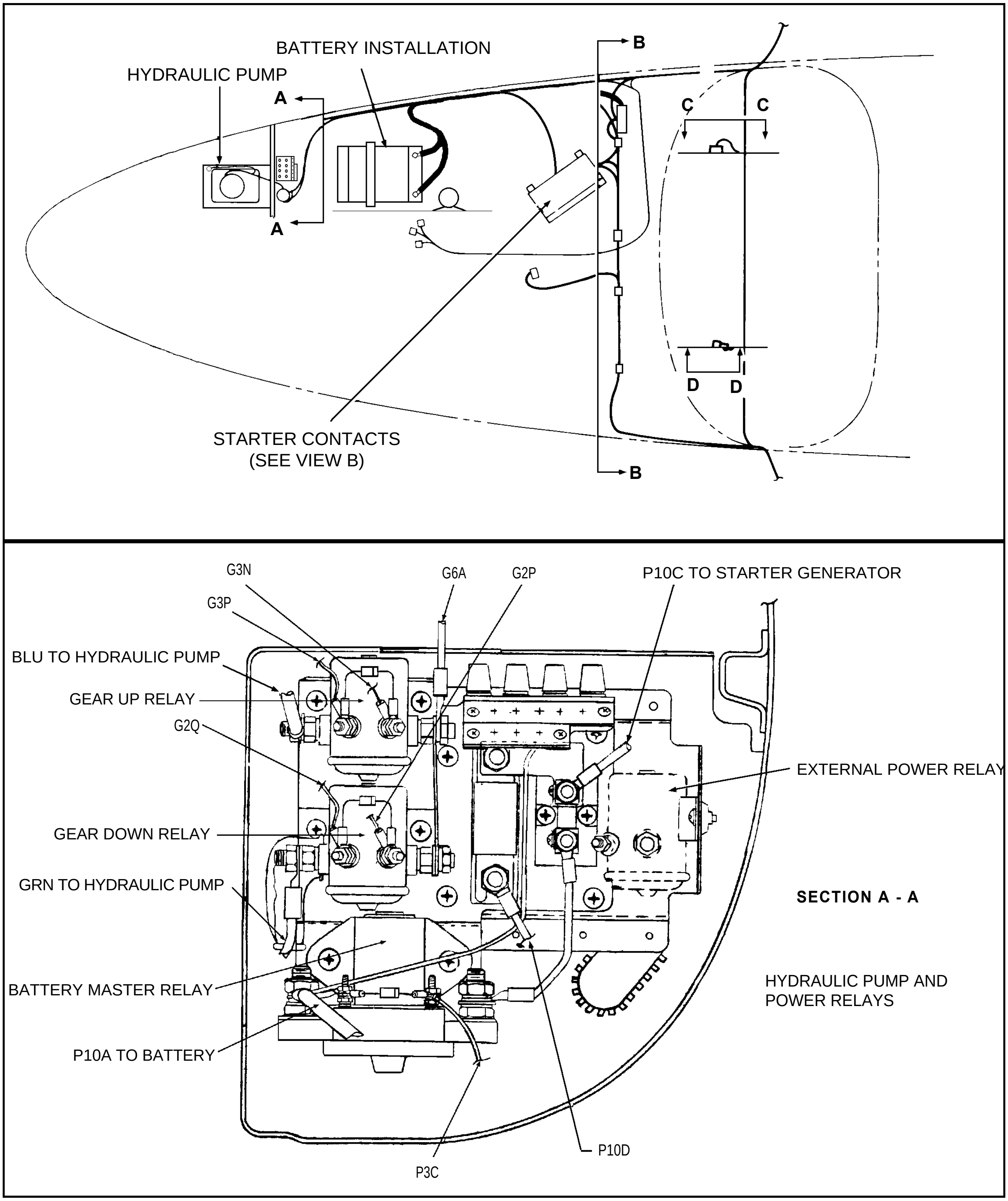
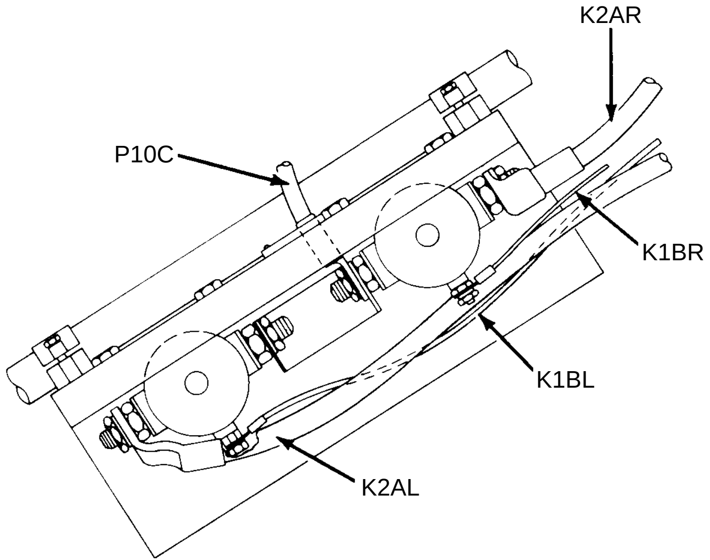
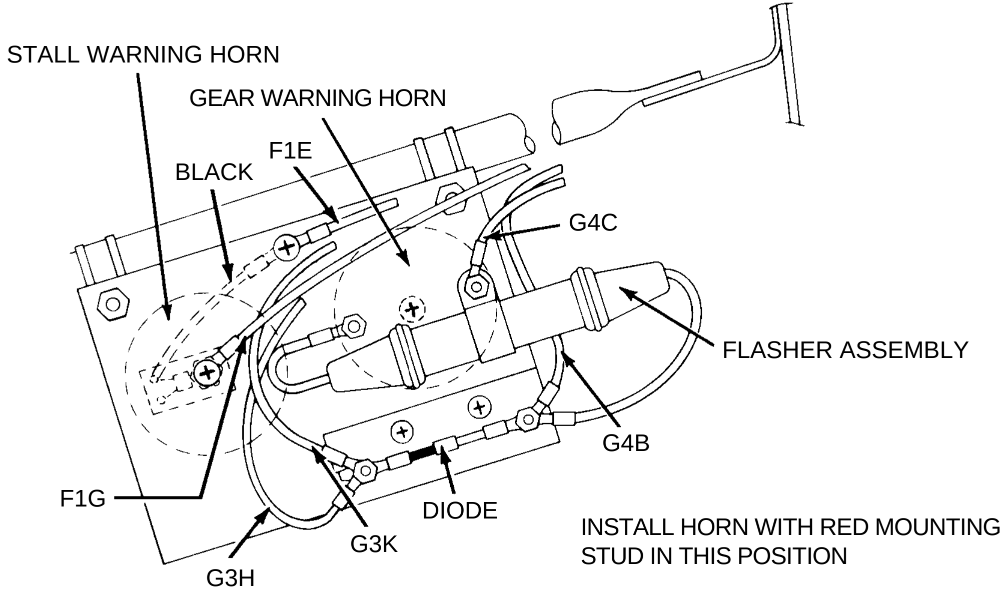


Figure 24-2. Base Electrical Installation (28 Volt System)



VIEW B
STARTER CONTACTORS
(COVER REMOVED)



INSTALL HORN WITH RED MOUNTING
STUD IN THIS POSITION

SECTION D - D

Figure 24-2. Base Electrical Installation (continued) (28 Volt System)

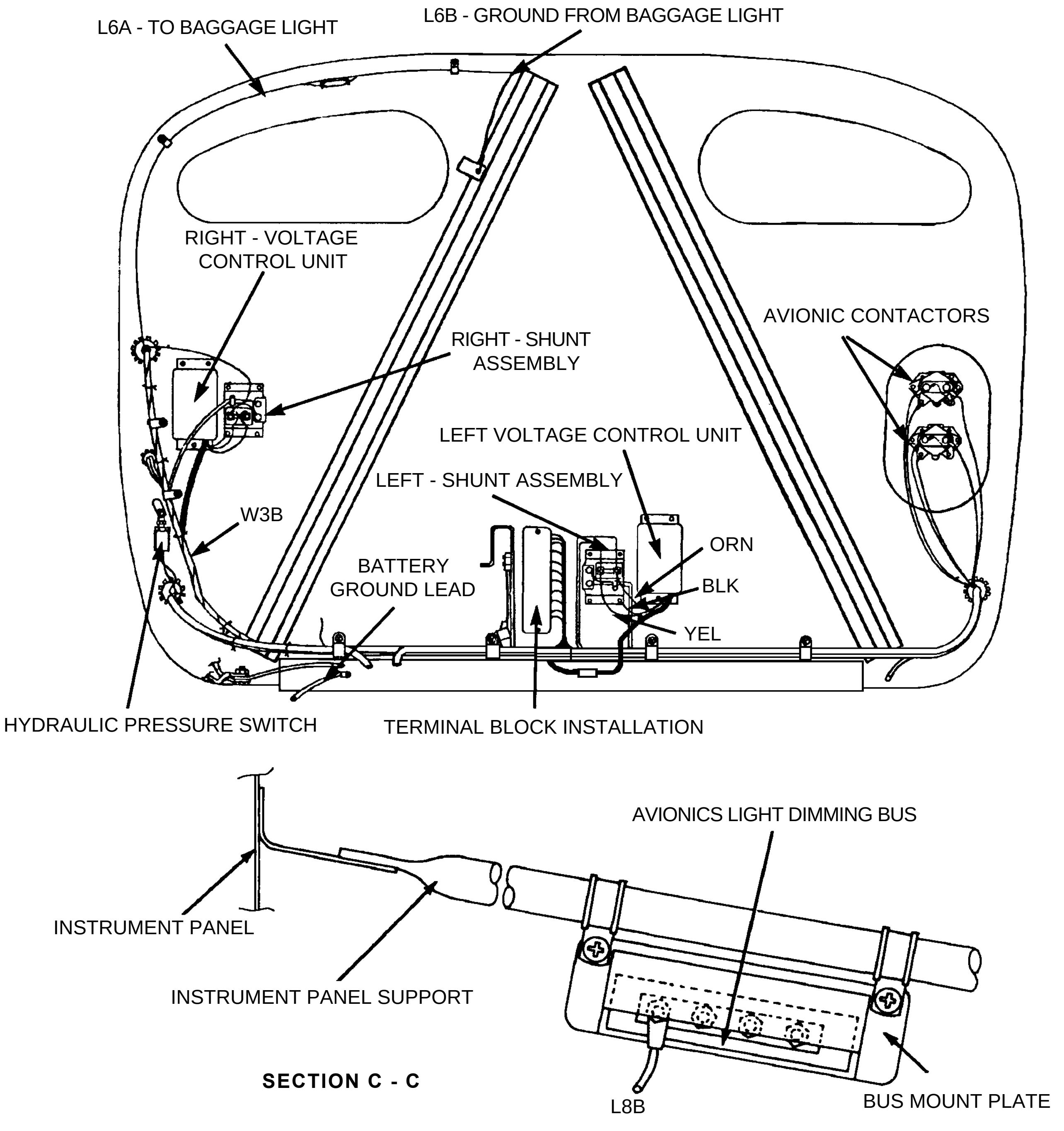


Figure 24-2. Base Electrical Installation (continued) (28 Volt System)

— *WARNING* —

WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, IT IS THE USER'S RESPONSIBILITY TO REFER TO THE APPLICABLE VENDOR PUBLICATION.

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. In addition, a shroud designed to aid in cooling covers the alternator. 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.

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 Chapter 91.)

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 or 12)-volt test light to the battery lead and to ground. If a reading of approximately (24 or 12)-volts register 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.
8. Check the field circuit by the following procedure:
   a. On lead connected to (F1) terminal, connect a voltmeter to the field lead and to ground. If voltmeter indicates any voltage, the circuit is operational.
9. If voltage is indicated at both the battery lead and field lead, the alternator should be checked for possible malfunction.

PRECAUTIONS

The following precautions are to be observed when testing or servicing the electrical system:

1. Disconnect the battery before removing or replacing any unit or wiring. Accidental grounding will cause severe damage to the units and/or wiring.
2. The alternator must not be operated on an open circuit with the rotor winding energized.
3. No polarization of the alternator is required. Any attempt to do so may result in damage to the alternator, regulator or circuits.
4. Grounding of the alternator output terminal will cause possible damage to the alternator and/or its circuit and components.
5. 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.
6. If a booster battery or fast charger is used, its polarity must be connected correctly to prevent damage to the electrical system components.

SERVICE PROCEDURES

Since the alternator, and alternator control unit or regulator are designed for use on only one polarity system, the following precautions must be observed when testing or servicing the electrical system. Failure to observe these precautions will result in serious damage to the electrical equipment.

1. Disconnect the battery before connecting or disconnecting test instruments (except voltmeter) or before removing or replacing any unit or wiring. Accidental grounding or shorting at the regulator, alternator control unit, ammeter or accessories, will cause severe damage to the units and/or wiring.
2. The alternator must not be operated on open circuit with the rotor winding energized.
3. Do not attempt to polarize the alternator. No polarization is required. Any attempt to do so may result in damage to the alternator, regulator or circuits.
4. Grounding of the alternator output terminal may damage the alternator and/or circuit and components.
5. Reversed battery connections may damage the rectifiers, wiring or other components of the charging system. Battery polarity should be checked with a voltmeter before connecting the battery. Most aircraft are negative ground.

— CAUTION —

WHEN USING A BATTERY CHARGER OR BOOSTER BATTERY, THEY MUST BE CONNECTED CORRECTLY FOR PROPER POLARITY, TO PREVENT DAMAGE TO THE ELECTRICAL SYSTEM COMPONENTS.

6. If a booster battery or fast charger is used, its polarity must be connected correctly to prevent damage to the electrical system components.

OVERHAUL OF ALTERNATOR

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 aircraft, it is the user's responsibility to refer to the applicable vendor publication.

— NOTE —

The drive assembly used on these alternators are not manufactured or serviced by the vendor, but are available from the engine manufacturer.

TESTING ALTERNATOR

1. Wiring connections for bench testing the alternator are shown in Figure 24-2. Refer to the individual specification Chart 2402 for output test figures. Adjust the carbon pile, if necessary, to obtain the specified voltage.
2. After bench testing the alternator, install the safety wire and install the alternator on the engine.

— NOTE —

Always refer to the wiring diagram (refer to Figure 24-2) when installing the alternator or testing the alternator.

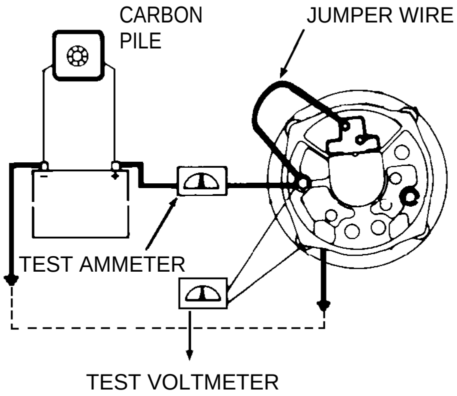


Figure 24-3. Testing Alternator

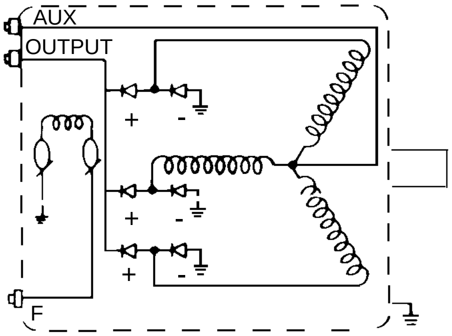


Figure 24-4. Internal Wiring Diagram

ALTERNATOR SERVICE TEST SPECIFICATIONS

CHART 2402. ALTERNATOR SPECIFICATIONS

Alternator Model	**ALX 9402**	
Voltage	12-volts	
Rated Output	65 amperes	
Ground Polarity	Negative	
Rotation	Bi-Directional	
Rotor:		
Current Draw (77°F)	3.2A nominal	4.0 max.
Resistance (77°F)	4 ohm nominal	3 ohm min.
Output Test (77°F):		
Volts	14.0 ± .2	
Amperes Output	65	
Field Amperes	3.2A nominal	
Alternator RPM	5167	
Alternator Model	**Continental-Teledyne 649280**	
Voltage	28-volts	
Rated Output	60 amperes	
Ground Polarity	Negative	
Rotation	Bi-Directional	
Output Test (77°F):		
Volts	28.0 ± .2	
Amperes Output	60	
Alternator RPM	5290	

BATTERY

— NOTE —

In the past, aluminum cable was used in wiring the battery circuit from battery to ground, battery to master relay, master relay to starter solenoid, starter solenoid to starter, and engine return ground wire to airframe. (See schematics for your airplane.)

If, during inspection, a fault in the aluminum cable is found, Piper considers it mandatory that the complete cable assembly be replaced with copper wire and suitable terminals.

CHART 2403. TROUBLESHOOTING (BATTERY)

Trouble	Cause	Remedy
Discharged battery.	Battery worn out.	Replace battery.
	Charging rate not set right.	Reset.
	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
Battery life is short.	Overcharge due to level of electrolyte being below top of plates.	Maintain electrolyte.
	Sulfation due to disuse.	Replace.
	Impurities in electrolyte.	Replace battery.
	Low charging rate.	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 transistor regulator.

CHART 2403. TROUBLESHOOTING (BATTERY) (continued)

Trouble	Cause	Remedy
Electrolyte runs out of vent plug and/or into acid recovery jar.	Too much water added to battery and charging rate too high.	Drain and keep at proper level and adjust voltage regulator.
Excessive corrosion inside container.	Spillage from overfilling.	Use care in adding water.
	Vent lines leaking or clogged.	Repair or clean.
	Charging rate too high.	Adjust voltage regulator.
Battery freezes.	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.
	Cracked jar (one cell only).	Replace battery.

SERVICING BATTERY

14 VOLT SYSTEM

The battery is mounted in a fiberglass box and located in the center forward portion of the nose cone. The battery and box are covered by an assembly of ABS thermoplastic which also acts as a cover for the nose wheel and gear. Fumes accumulated from the natural charging process are vented to the outside of the aircraft requiring the vents be checked for any adverse corrosion. A drain also extends from the battery box through the bottom of the nose cone and should be uncapped regularly to allow any accumulation to drain. The water level in the battery, which should never be above the baffle plates, should be checked at every inspection. A check with a hydrometer should also be made. Make sure all connections are clean and tight.

28 VOLT SYSTEM

The battery is a Gill-247 38 amp .5 hour lead acid manifold type 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. Fumes accumulated from the natural charging process are vented to the outside of the aircraft requiring the vents be checked for any adverse corrosion. A positive and negative drain also extends from the battery manifold and acid recovery jar that exit through vent tubes located on the bottom of the nose cone and should be uncapped regularly to allow any accumulation to drain. 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.

REMOVAL OF BATTERY (14 Volt System)

1. Remove the cover over nose wheel and battery in the nose baggage compartment.

— CAUTION —

ALWAYS REMOVE THE GROUND CABLE FIRST AND INSTALL LAST TO PREVENT AN ACCIDENTAL SHORT CIRCUIT OR ARCING.

2. Disconnect the battery cables.
3. Lift the battery from the box.

REMOVAL OF BATTERY (28 Volt System)

1. From within forward baggage compartment door, remove battery access cover by removing the eight hold down screws.
2. Remove battery tie-down strap.
3. Remove access panel on right side of nose.

— CAUTION —

ALWAYS REMOVE THE GROUND CABLE FIRST AND INSTALL LAST TO PREVENT AN ACCIDENTAL SHORT CIRCUIT OR ARCING.

4. Disconnect the battery ***ground*** cable ***first***; then the positive cable.
5. Disconnect manifold overflow tube. (Refer to Figure 24-6.)
6. Disconnect positive vent line. (Refer to Figure 24-6.)
7. Remove battery through right side access panel.

INSTALLATION OF BATTERY (14 Volt System)

1. Ensure that battery and battery box have been cleaned and are free of acid.
2. Ensure that battery box vent outlet is free of obstructions and restrictions.
3. Install battery in box.
3. Connect positive lead to the positive battery terminal and secure.
4. Connect the ground cable to the negative battery terminal and secure.
5. Install cover.

INSTALLATION OF BATTERY (28 Volt System)

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 through right side access panel.
3. Connect positive vent line. (Refer to Figure 24-6.)
4. Connect manifold overflow tube. (Refer to Figure 24-6.)
5. Connect ***positive*** cable to battery ***first*** and secure. Connect ground cable to battery and secure.
6. Install battery tie-down strap
7. Install battery floor cover and secure with eight screws.
8. Close and secure forward baggage compartment door.
9. Install right side access panel.

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.

REMOVAL OF BATTERY ACID RECOVERY JAR (28 Volt System)

1. Remove battery as described above.
2. Remove the acid recovery jar by removing the 2 bracket screws that secure jar to bulkhead.

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. 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.
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. 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.
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 in aircraft by installing the bracket to the bulkhead with 2 each bracket screws.
10. Install battery per as described above.

BATTERY CHARGING (14 Volt System)

— CAUTION —

IN THE OPERATION OF THE BATTERY, GASES ARE FORMED WHICH MAY BE EXPLOSIVE IF IGNITED. NEVER CREATE SPARKS OF ANY KIND OR BRING AN OPEN FLAME NEAR A BATTERY. VENTILATE THE BATTERY WHEN CHARGING TO DISPOSE OF THE GAS GENERATED BY THE BATTERY.

If the battery is not up to normal charge, remove the battery and recharge starting with a charging rate of 4 amperes and finishing with 2 amperes. A fast charge is not recommended.

BATTERY CHARGING - (GILL MODEL G-247) (28 Volt System)

— 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.)
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 of 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 2404. 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

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 it is 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. Refer to Chart 2405 for the temperature corrections. Specific gravity values for a fully charged battery are as follows:

CHART 2405. ELECTROLYTE TEMPERATURE CORRECTIONS

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 raeding 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, the 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.

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 2406. 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	+.012	Reading

CHART 2406. SPECIFIC GRAVITY TEMPERATURE CORRECTION (continued)

Electrolyte Temperature °C	°F	Corrections	
38	100	+.008	Add to
33	90	+.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	

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. Listed below are recommended discharge rates:

CHART 2407. DISCHARGE RATES

TELEDYNE Battery Type	Volts	(.5 HRS.) Ampere Hours
GILL-G-247	24	38.0

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)

BATTERY TEMPERATURE CONSIDERATIONS (continued)

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 2408.

— NOTE —

Lead-acid batteries are subject to a constant discharge due to the internal chemical action.

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 2408. 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.

PREPARING NEW DRY CHARGED BATTERY FOR INSTALLATION

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.

PREPARING NEW DRY CHARGED BATTERY FOR INSTALLATION (continued)

— CAUTION —

PRIOR TO INSTALLING A NEW DRY-CHARGED BATTERY, FOLLOW THE PREPARATION/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.

CORROSION PREVENTION

14 VOLT SYSTEM

The battery should be checked for spilled electrolyte or corrosion at least each 50 hour inspection or at least every 30 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 box and battery cleaned by the following procedure:

1. Remove the box drain cap from the underside of the fuselage and drain off any electrolyte that may have overflowed into the box.
2. Clean the battery and the box. Corrosion effects 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.

— CAUTION —

DO NOT ALLOW SODA SOLUTION TO ENTER BATTERY.

3. Rinse the battery and box with clean water and dry.
4. As necessary, paint the battery box with an acid resistant paint. Allow paint to dry thoroughly.
5. Place the cap over the battery box drain.
6. Reinstall the battery.

28 VOLT SYSTEM

The battery should be check 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:

1. Remove the manifold vent drain caps from the underside of the nose cone and drain off any electrolyte that may have overflowed into the manifold.
2. 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.

— CAUTION —

DO NOT ALLOW SODA SOLUTION TO ENTER BATTERY.

3. Rinse the battery and shelf area with clean water and dry thoroughly.
4. As necessary, paint the battery shelf area with an acid resistant paint. Allow paint to dry thoroughly.
5. Place the cap over the battery manifold drains.
6. Install battery.

VOLTAGE REGULATOR

REGULATOR COMPONENTS

Alternator output voltage can, within limits of the design capability of the alternator, be controlled by properly varying the average level of current flow in the rotor winding. The solid state electronic regulator is well suited for this purpose. The alternator, due to its design, has self-limiting current characteristics and therefore needs no current limiting element in the regulator.

1. Transistor: The transistor (Symbol "Q") is an electronic device which can control the flow of current in an electric circuit. It has no mechanical or moving parts to wear out.
2. Rectifier Diode: The rectifier diode (Symbol "D") will pass current in only one direction (forward direction), and in this respect, it may be compared to a check valve.
3. Zener Diode: The zener diode (Symbol "Z") in addition to passing current in the forward direction will also pass current in the reverse direction when a particular value of reverse voltage is applied. This property makes it useful as a voltage reference device in the regulator.
4. Capacitor: The capacitor (Symbol "C") is a device which will store electrical energy for short periods of time. This property makes it useful as a filter element to smooth variations of voltage.
5. Resistor: The resistor (Symbol "R") is a device which is used to limit current flow.

REGULATOR OPERATION

1. When the alternator is turned on, battery voltage is applied to the BUS terminal of the regulator and via Q4 through the FIELD terminal of the regulator to the alternator field terminal F2. The amount of voltage applied to the field of the alternator is controlled automatically by action of the regulator in response to alternator output as described below.
2. Current flow through R6 and Z1 establishes a reference voltage across Z1.
3. Resistors R1 and R2/R3 comprise a voltage divider which is adjustable by means of the variable portion R3. Voltage at the junction of R1 and R2 and the reference voltage across Z1 are applied to comparison transistor Q1. R3 is adjusted so that these voltages are balanced with the desired alternator output voltage present on the BUS terminal of the regulator.
4. Thereafter, whenever alternator output voltage (as applied to the BUS terminal) falls below the desired regulation value, the comparison transistor Q1 will supply increased current to driver transistors Q2/Q3, which in turn will drive power transistor Q4 to a higher value of field current. This will result in alternator output voltage increasing to a value which will restore balance between the two voltages applied to Q1.
5. Conversely, if alternator output voltage (as applied to the BUS terminal) increases due to a greater engine speed or reduced loading of the electrical system, the comparison transistor Q1 will act to reduce current flow to the driver transistors Q2/Q3, and thus reduce the drive to power transistor Q4. This will result in a reduction of alternator field current and automatically restore balance between the two voltages applied to comparison transistor Q1.
6. Capacitors C1 and C2 function together with their related transistors in a way to smooth alternator output ripple and voltage spikes so that the alternator field current is controlled at a steady value.
7. The solid state regulator controls alternator field current to a steady value as required by the electrical load conditions and engine speed. It does not continuously switch field current between high and low values as do mechanical regulators and the switching type of electronic regulators.
8. The design of this unit is such as to provide an alternator output voltage that does not vary with ambient temperature.

BALANCING CIRCUIT

These instructions take into consideration that the two identical alternators and regulators have the PAR terminals of the regulators connected.

BALANCING CIRCUIT (continued)

1. Balancing circuit operation is initiated within one regulator whenever individual field voltages delivered by the regulator units to their related alternators are not equal.
2. When a difference in individual field voltages occurs, one-half the difference is impressed across R12 within each regulator and is thus applied to the input of Q5.
3. In that regulator which is delivering the lower field voltage, the polarity of R12 voltage drop causes Q5 collector current flow.
4. Q5 collector current flow results in conduction occurring in the collector circuit of Q6.
5. Q6 collector current flows from regulator divider R1/R2+R3 through limiting resistor R17 to ground.
6. Conduction through R17 effectively alters the ratio of the regulator divider R1/R2+R3 in the direction to increase Q1 collector current flow.

ALTERNATOR CONTROL UNIT — LAMAR B-00382-1

ADJUSTMENT OF 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.

BENCH TEST OF ALTERNATOR CONTROL UNIT — LAMAR B-00382-1

— CAUTION —

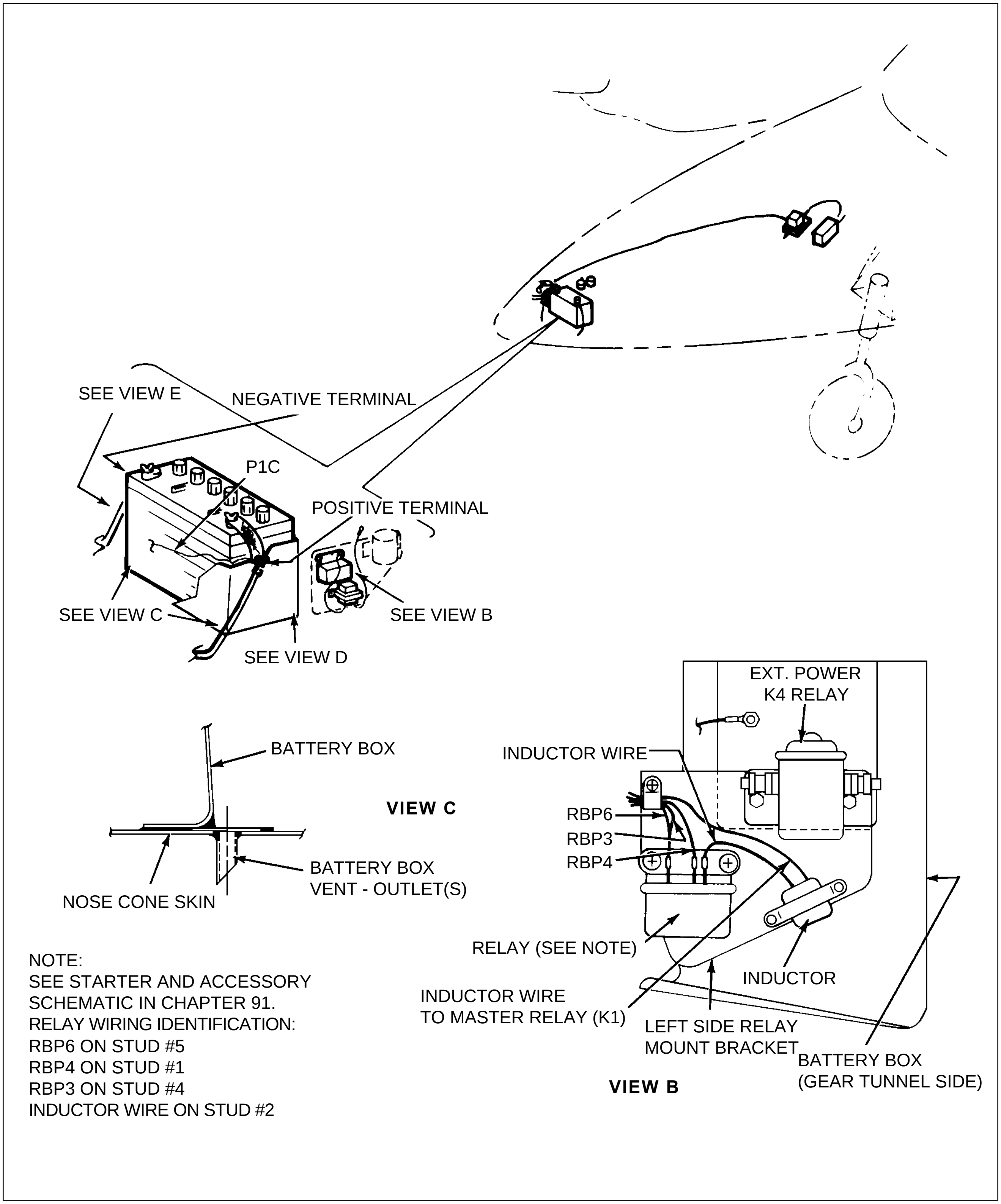
IN-AIRCRAFT TESTING WITH ALTERNATOR RUNNING IS NOT RECOMMENDED. DO NOT BYPASS REGULATOR BUS TO FIELD AS A MEANS OF CHECKING ALTERNATOR OR OVERVOLTAGE PROTECTION WITH ALTERNATOR RUNNING.

SETTING UP TEST EQUIPMENT

1. Remove unit from aircraft.
2. Set up the following equipment as shown in Figure 24-4:

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 Ω).
   c. Remove jumper.



NOTE:
SEE STARTER AND ACCESSORY SCHEMATIC IN CHAPTER 91.
RELAY WIRING IDENTIFICATION:
RBP6 ON STUD #5
RBP4 ON STUD #1
RBP3 ON STUD #4
INDUCTOR WIRE ON STUD #2

Figure 24-5. Battery and Master Relays Installation (14 Volt System)

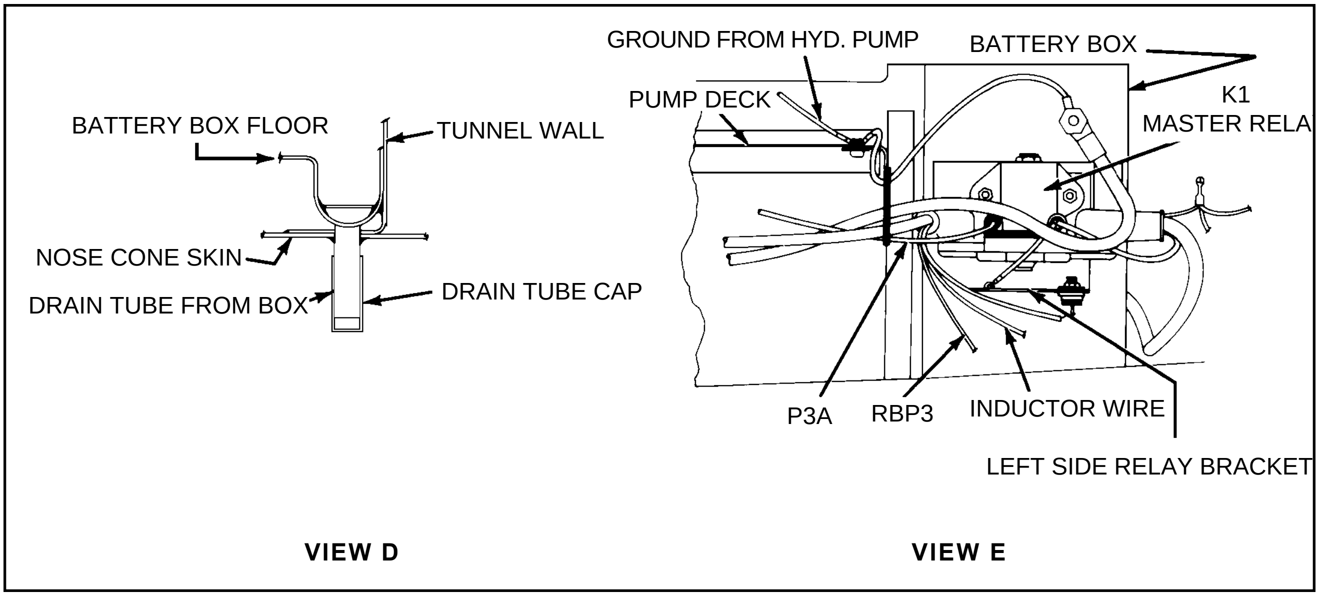


Figure 24-5. Battery and Master Relays Installation (continued) (14 Volt System)

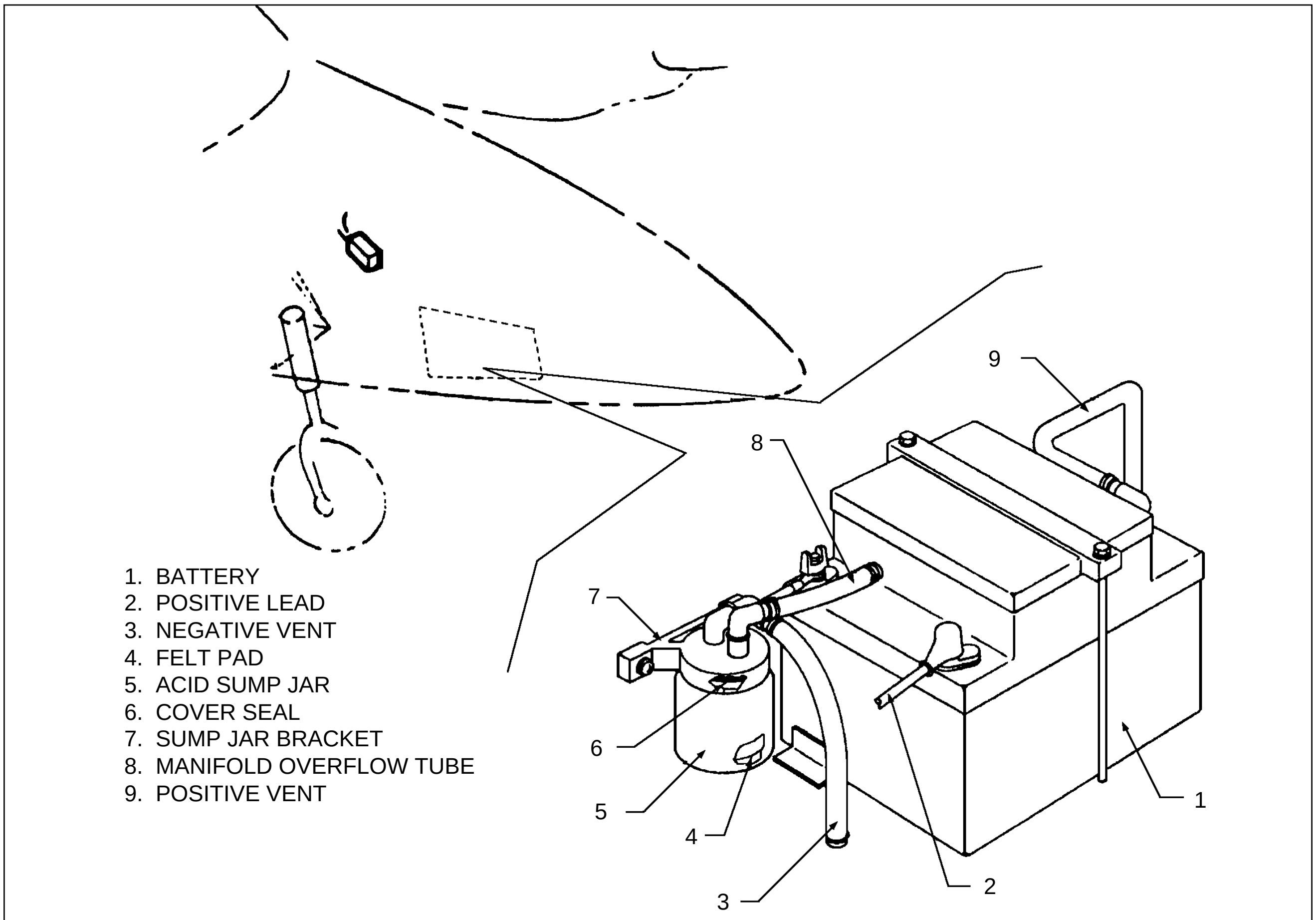


Figure 24-6. Battery and Master Relays Installation (28 Volt System)

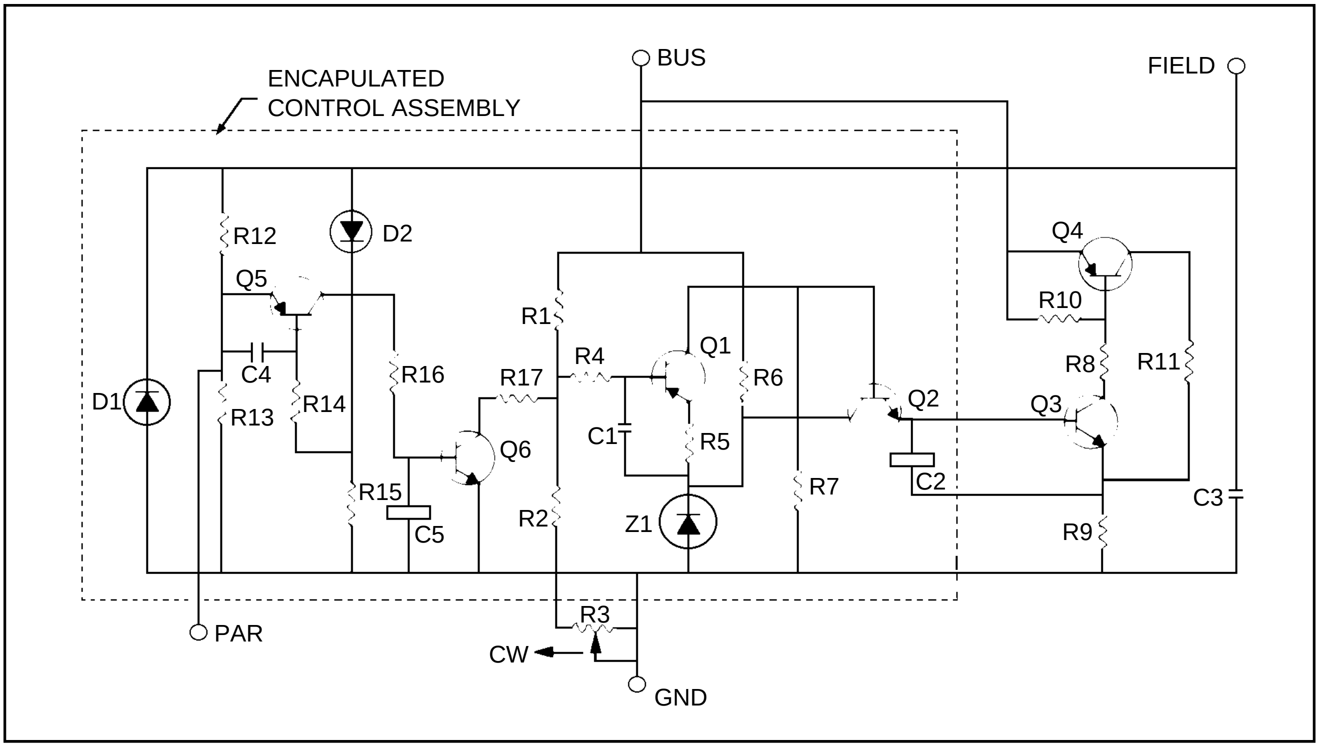


Figure 24-7. Control Unit Diagram (14 Volt System)

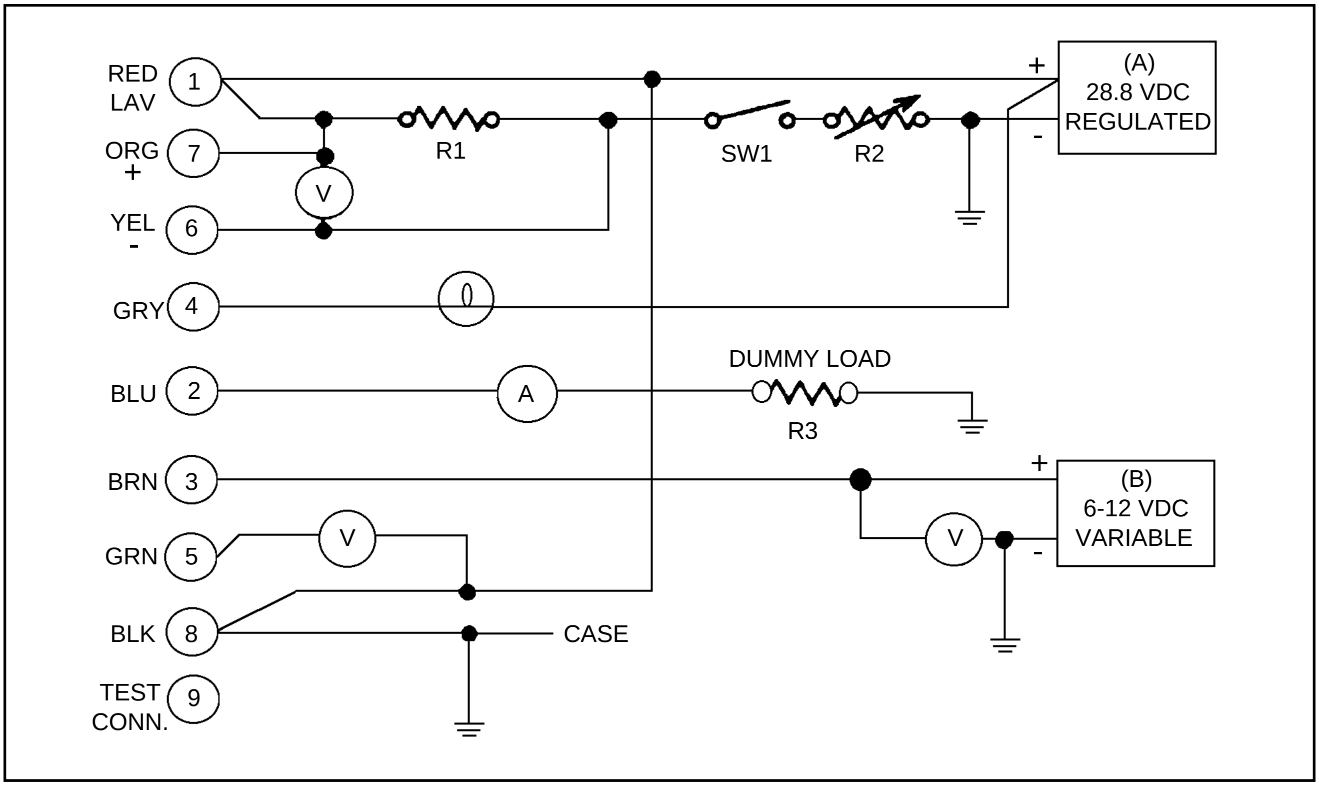


Figure 24-8. Bench Test of Alternator Control Unit — Lamar #B-00382-1 (28 Volt System)

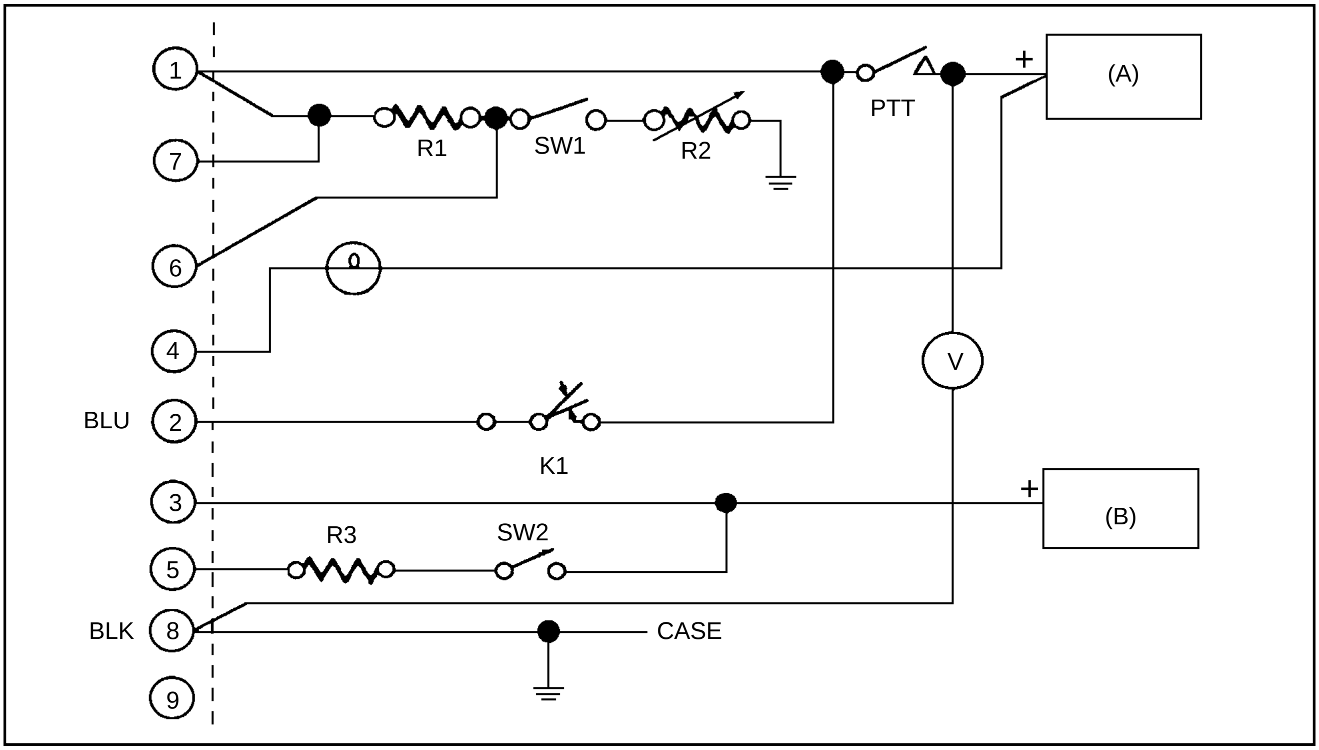


Figure 24-9. Overvoltage Test of ACU (Procedure D) (28 VOLT)

VOLTAGE CONTROL UNIT TEST (28 VOLT SYSTEM)

1. Turn power off.
2. Mate unit with test connector.
3. Open switch 1.
4. Apply regulated power supply (A). Hold constant @ 28.8V ± 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 ± 0.75V.

EQUALIZER TEST (28 VOLT SYSTEM)

1. Apply voltmeter at pins #5 and #8 (equalizer and ground). Equalizer voltage should read 5.75V ± 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 Ω).
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 ± 0.25V.

OVERVOLTAGE PROTECTION TEST (28 VOLT SYSTEM)

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.

BALANCING CIRCUIT

These instructions take into consideration that the two identical alternators and voltage control units have the PAR terminals of the control units connected.

1. Balancing circuit operation is initiated within one alternator control unit whenever individual field voltages, delivered by the control units to their related alternators, are not equal.
2. When a difference in individual field voltages occurs, one-half the difference is impressed across R12 within each control unit and is thus applied to the input of Q5.
3. In that control unit which is delivering the lower field voltage, the polarity of R12 voltage drop causes Q5 collector current flow.
4. Q5 collector current flow results in conduction occurring in the collector circuit of Q6.
5. Q6 collector current flows from control unit divider R1/R2 + R3 through limiting resistor R17 to ground.
6. Conduction through R17 effectively alters the ratio of the control unit divider R1/R2 + R3 in the direction to increase Q1 collector current flow.
7. Increased Q1 current results in increased output from the control unit to the field of its related alternator.
8. Feedback action results in Q6 collector current stabilizing at a value that results in nearly equal field voltage being delivered by the two control units to their respective alternator fields.
9. The balancing circuit will thus automatically maintain, at a low value, the difference voltage applied to the alternator fields. In a parallel system having identical alternators operating at the same rpm, the output currents of the alternators will thus be maintained nearly equal.
10. In whichever control unit of a pair is set to deliver the highest voltage, the balancing circuits are inactive. Thus, system voltage is determined by the control unit of a pair which is set to higher voltage. The lower set control unit will adjust itself automatically as described above to deliver the same field voltage as the one which is set higher within the limits of its design capability.
11. The balancing alternator control unit system as described provides for automatic load balancing of parallel operated alternators having independent field excitation circuits. The pilot can, while in flight, remove either alternator system completely from the aircraft system and maintain operation of the other system.

PREPARATION FOR TESTING.

— WARNING —

EXTRA CAUTION MUST BE EXERCISED DUE TO THE PROXIMITY OF THE REGULATIONS TO THE PROPELLERS. IT IS NECESSARY TO OPERATE ONLY ONE ENGINE FOR THIS PROCEDURE.

Alternator control units or regulators may be tested using the aircraft's alternator or an alternator test stand.

— CAUTION —

DO NOT INTERCHANGE CONTROL UNIT LEADS. THIS WILL DESTROY CONTROL UNIT AND VOID WARRANTY.

1. The aircraft technician or other electrical system's specialist must disconnect the battery ground cable at the battery before connecting or disconnecting a test ammeter or other test equipment or before making wiring changes in the electrical system.
2. Voltmeters with test probes or clips are not recommended. Fully insulated bolted terminal connections are best and these should be attached when all power is removed as described above.
3. When installing a battery in an aircraft, be sure that the battery negative terminal is in a position so that this terminal can be connected to the battery ground cable for negative ground systems.
4. The control unit under test is to be mounted on a grounded metallic surface using three No. 8 screws pulled up tight. For extended test periods, the heat transfer from control unit to the mounting surface is significant.
5. A ground wire between the control unit GND terminal and the aircraft or test stand structure is essential for proper operation. The alternator frame must also be solidly bonded to the system ground.
6. The alternator does not need to be polarized; therefore, never connect ground even momentarily to either the voltage control field terminal or to the alternator field terminals. Do not interchange leads to control units as they will destroy the control unit.

— CAUTION —

NEVER, UNDER ANY CIRCUMSTANCE, PERMIT A GROUND TO CONTACT THE FIELD CIRCUIT EVEN FOR AN INSTANT WHILE POWER IS APPLIED TO THE SYSTEM.

7. The alternator should be in good condition and capable of producing full output and the alternator drive belt must be adjusted tight enough to prevent slippage.
8. The battery must be in good condition and should be fully charged.
9. The voltmeter and ammeter should be of the best quality and should be accurate.
10. A carbon pile, connected across the battery, may be used to load the charging circuit while testing the regulator.

TESTING REGULATOR

1. The procedure for testing the regulator whether on the airplane or on the test bench remains the same. Connect the test meters and regulator wiring as shown in Figure 24-9.
2. All circuit connections should be clean and tight. This includes the test instrument connections which must not come loose or open the charging circuit at any time while the system is operating.
3. The voltmeter will not indicate the true regulator setting until the regulator has been operating in the charging system or on the test bench for at least five minutes, at a charge rate of from 10 to 15 amperes.
4. With the connections made as shown in Figure 24-9, start the engine and adjust its speed to approximately 920 to 1250 rpm to obtain 3,000 to 4,000 alternator rpm. Turn on accessories as needed to establish a 10 to 15 ampere load value. Note that the battery charge current is indicated by the ammeter. Therefore, the current value may change downward at the beginning of a test run. This will be especially true if the battery was used for engine starting.
5. After one minute operating time, check the regulator operating voltage as indicated by the voltmeter. Refer to Alternator Service Test Specifications for the correct operating voltage. The operating voltage is shown for the ambient temperature in which the regulator is operating.
6. If the voltmeter reading indicates that the operating voltage is not within limits, left the plastic plug from top of regulator and adjust the voltage to the desired value. Replace the plug after adjustment. Before condemning the regulator, recheck the alternator and the battery, making sure that they are in good condition. Recheck all circuit connections and all wiring for unwanted resistance (voltage drop test). Recheck the voltmeter for accuracy and repeat the entire operating test.

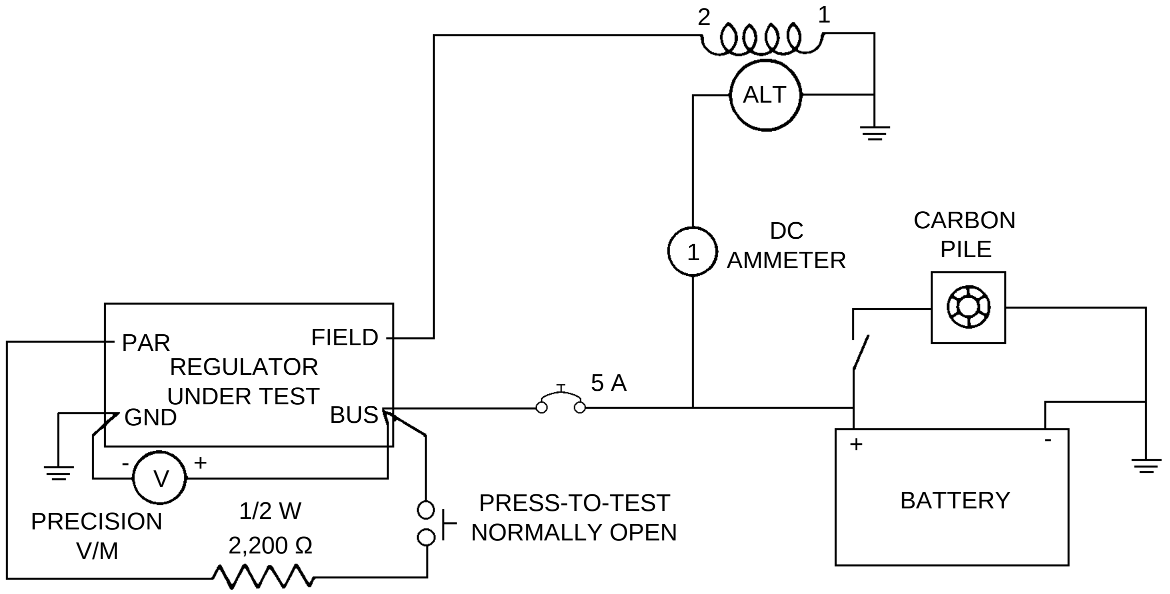


Figure 24-10 Testing Regulator

ADJUSTING REGULATOR (14 VOLT)

These regulators are normally used in parallel alternator systems of multi-engine aircraft. Their final adjustment should be made in actual operation in the aircraft system with test equipment connected as shown in Figure 24-10. The balance adjustment is made while operating only one engine, either left or right. The engine to be operated must be selected so as to permit the technician a completely safe access to both of the regulators, so that they may be adjusted while the engine is operative without danger.

— CAUTION —

EXTRA CAUTION MUST BE EXERCISED DUE TO THE PROXIMITY OF THE REGULATORS TO THE PROPELLERS. IT IS NECESSARY TO OPERATE ONLY ONE ENGINE FOR THIS PROCEDURE.

1. Gain access to the regulators by removing the right rear closeout cover in the nose baggage compartment aft of the nose gear. Remove the plugs from the regulator adjustment holes.
2. Open the paralleling circuit by removing the wire from the PAR terminal of either regulator and insulate the free end so it will not contact other circuits or ground during the adjustment procedure. Breaking this circuit disables the balancing circuits in both regulators.
3. Operate the RIGHT engine at approximately 1750 rpm and at a load of 15 to 30 amperes for approximately 5 minutes for warm-up; then turn the LEFT alternator switch OFF and set the RIGHT voltage regulator (to the left while facing aft) to 14.0-volts; then replace its plug button. This regulator should require no further adjustment.

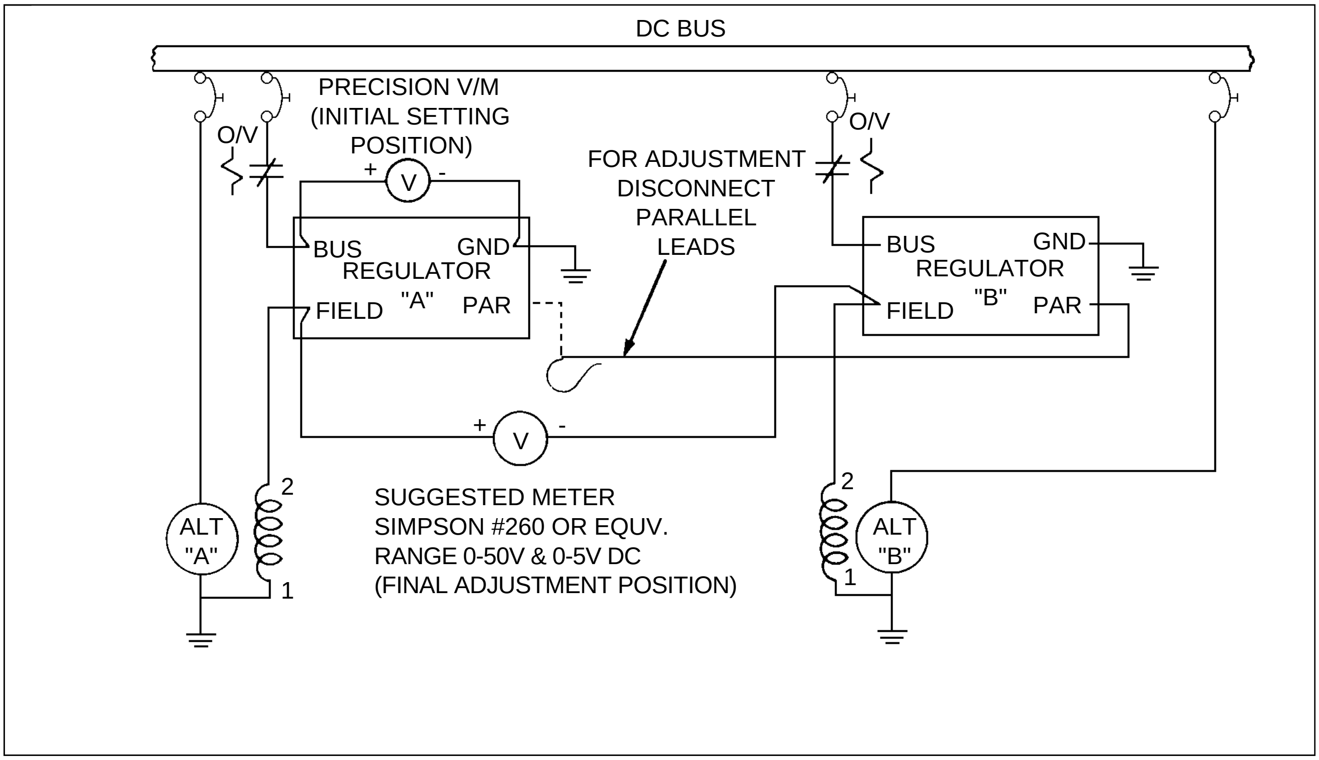


Figure 24-11. Adjusting Regulator

4. Connect a voltmeter between the two FIELD terminals, turn the LEFT alternator switch ON, and adjust for minimum voltage; however, the voltage should not exceed 8-volts. This adjustment will be "touchy" and polarity will reverse as zero is passed.
5. Reconnect the PAR wire and note that the voltage as observed in Step 4 drops to less than .5-volt and becomes steady. Check that bus voltage is still 14.0-volts; then shutdown engine.
6. Replace the plug in the regulator; remove all voltmeter leads and test equipment and install the close-out panel in the baggage compartment.

OVERVOLTAGE RELAY

CHECKING OVERVOLTAGE RELAY (14 VOLT)

The relay may be tested with the use of a good quality, accurate voltmeter, with a scale of at least 20-volts and a suitable power supply, with an output of at least 20-volts, or sufficient batteries with a voltage divider to regulate voltage. The test equipment may be connected by the following procedure:

1. B+ is connected to BAT of the overvoltage control.
2. B- is connected to the frame of the overvoltage control.
3. Be sure both connections are secure and connected to a clean bright surface.
4. Connect the positive lead of the voltmeter to the BAT terminal of the overvoltage control.
5. Connect the negative lead of the voltmeter to the frame of the overvoltage control.
6. The overvoltage control is set to operate between 16.5-volts to 17.5-volts. By adjusting the voltage, an audible "click" may be heard when the relay operates.
7. If the overvoltage control does not operate between 16.5 to 17.5-volts, it must be replaced.

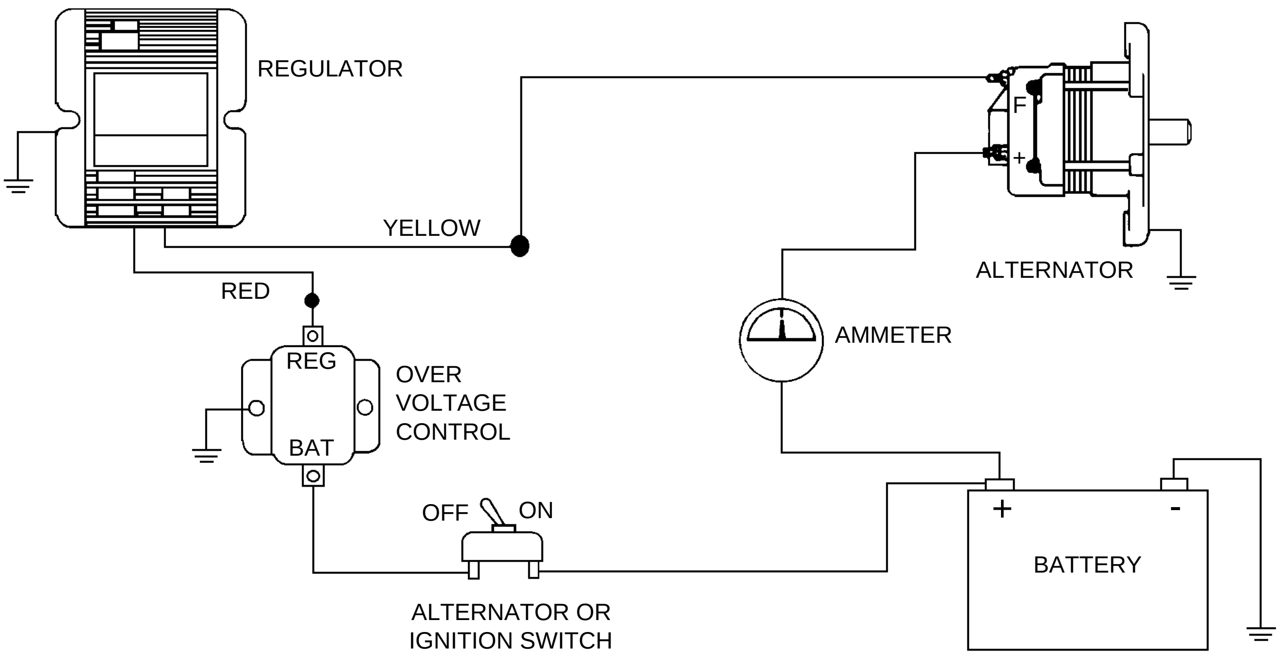


Figure 24-12. Application of Overvoltage Control

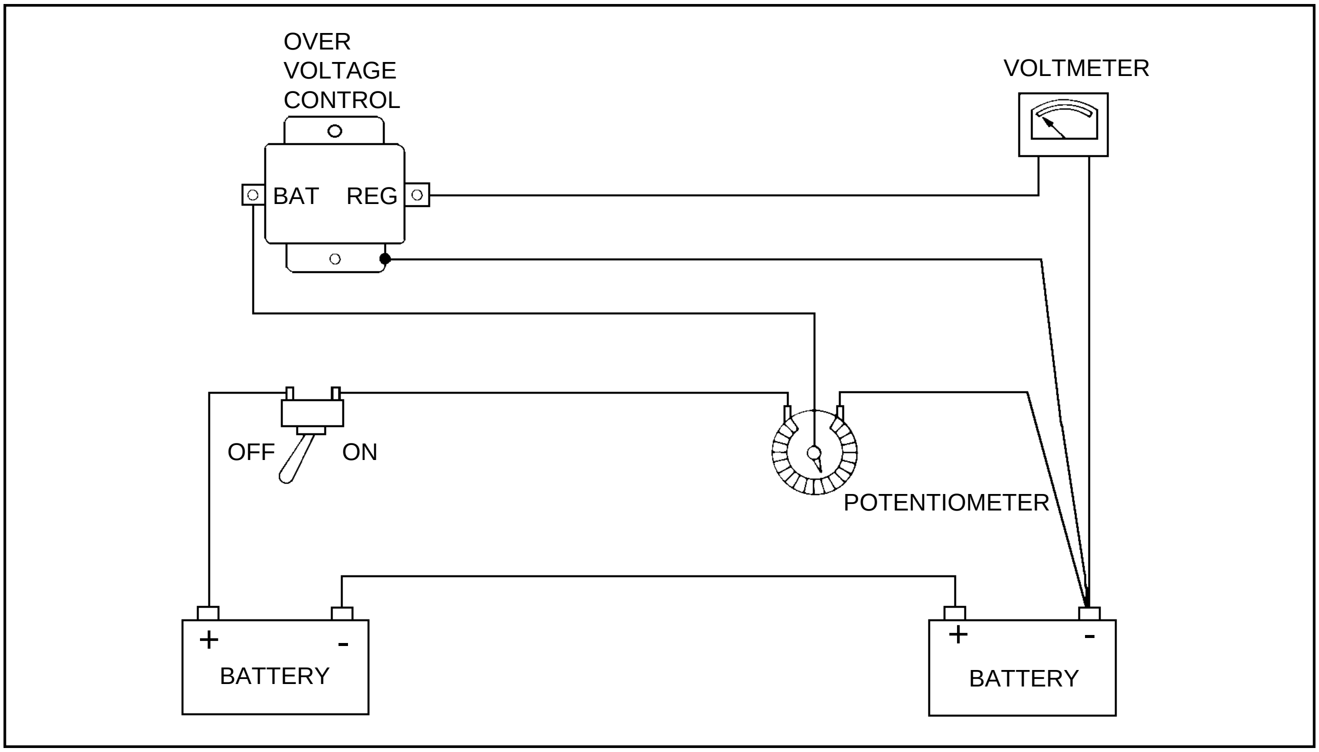


Figure 24-13. Testing Overvoltage Control

GRID 1L18
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GRID 1L19
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EXTERNAL POWER

STARTING THROUGH EXTERNAL POWER RECEPTACLE

On aircraft equipped with external power receptacles, the unit is located on the left side of the nose. The receptacle is also available in kit form if it is not already installed. Refer to the aircraft Parts Catalog for the kit designation.

— NOTE —

> 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.
>
> For all normal operations using the Piper External Power (PEP) 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.

1. If the airplane's battery is nearly depleted, the following procedure should be used when using a (12 or 24)-volt battery for external power:
    a. 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.
    b. Check to ensure that all electrical equipment is turned off.
    c. With the external battery connected to the receptacle, start the RIGHT engine only with normal starting procedures.
    d. Disconnect the external battery and, if applicable, reconnect the ship's battery.
    e. Switch on the battery switch and check ammeter for battery charging current.
2. 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.***

3. Start engine and move ground power unit well away from aircraft.

— CAUTION —

> **EXERCISE GREAT CARE DISCONNECTING GROUND PLUG. DISCONNECT THE PLUG ONLY FROM THE PILOT'S SIDE OF THE AIRPLANE.**

4. Turn ON Battery Master Switch.
5. Observe ammeter indicates alternator electrical current to ammeter on both left and right systems.
6. With the alternator(s) on line, observe charging current on ammeter.
7. Do not takeoff until charging current falls below 20 amps.

— CAUTION —

IF AIRCRAFT BATTERY IS WEAK, CHARGING CURRENT WILL BE HIGH. DO NOT TAKEOFF UNTIL CHARGING CURRENT FALLS BELOW 20 AMPS.

ELECTRICAL LOAD DISTRIBUTION

CHART 2409. ELECTRICAL SYSTEM COMPONENT LOADS

Duty Cycle					
Cont.	Inter.	Equipment	Circuit Breaker	Load (Amps)	Optional
X	X	Alternator Field (2)	5	5.0	
		Anti-Collision (Strobe)	10	4.4	
	X	Cabin Lights (4)	10	4.0	
	X	Cigar Lighter	10	8.0	
	X	Combustion Heater	15	13.0	
	X	Defroster Blower	10	3.0	
	X	Fuel Pump (2)	5	10.0	
	X	Heated Windshield	15	13.8	X
	X	Hydraulic Pump	25	25.0	
X		Instrument Lights	5	3.0	
	X	Landing Lights (2)	10	8.0	
X		Master Contactor	—	0.6	
	X	Pitot Heat	15	13.2	
X		Position Lights	5	4.0	
	X	Prop Deice		20.0	X
		Red Flood Lights	5	5.0	
	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	0.5	
	X	Electric Flaps	15		
X	X	Alternators	70		

GRIDS 1L22 AND 1L24
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AIRPLANE

MAINTENANCE MANUAL

CARD 2 OF 5

PA-34-220T SENECA III
PA-34-220T SENECA IV

THIRD EDITION

PIPER AIRCRAFT CORPORATION

(PART NUMBER 761 751) November 29, 1993

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Manufacturers Association

INTRODUCTION

This PIPER AIRCRAFT Maintenance Manual is prepared in accordance with the GAMA (General Aviation Manufacturers Association) format. This maintenance manual is divided into various Groups which enable a broad separation of contents (Chapters) within each group.

The various Chapters are broken down into major systems such as Electrical Power, Flight Controls, Fuel, Landing Gear, etc. The System/Chapters are arranged more or less alphabetically rather than by precedence or importance. All System/Chapters are assigned a number, which becomes the first element of a standardized numbering system. Thus the element "32" of the number series 32-00-00 refers to the System/Chapter on "Landing Gear". All information pertaining to the landing gear will be covered in this System/Chapter.

The major System/Chapters are then broken down into Sub-System/Sections. These sections are identified by the second element of the standardized numbering system. The number "40" of the basic number series 32-40-00 is for the "Wheels and Brakes" portion of the landing gear.

The individual units within a Sub-System/Section may be identified by a third element of the standardized numbering system, such as 32-40-01. This number could be assigned by the manufacturer to fit the coverage requirements of the publication.

Example:

CHAPTER/SYSTEM
LANDING GEAR

SUB-SYSTEMS
WHEELS AND BRAKES

32-40-01

INDIVIDUAL UNITS
NOSE WHEEL REMOVAL

This manual 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 761 750 and FAR 43 for proper utilization.

WARNINGS, CAUTIONS, and NOTES are used throughout this manual to emphasize important information.

— WARNING —

OPERATING PROCEDURES, PRACTICES, ETC., WHICH MAY RESULT IN PERSONAL INJURY OR LOSS OF LIFE IF NOT CAREFULLY FOLLOWED.

— CAUTION —

OPERATING PROCEDURES, PRACTICES, ETC., WHICH IF NOT STRICTLY OBSERVED MAY RESULT IN DAMAGE TO EQUIPMENT.

— NOTE —

An operating procedure, condition, etc., which is essential to emphasize.

AEROFICHE EXPLANATION AND REVISION STATUS

The Maintenance Manual information incorporated in this set of Aerofiche cards has been arranged in accordance with the general specifications of Aerofiche adopted by the General Aviation Manufacturer's Association, (GAMA). 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.

Conversion of Aerofiche alpha/numeric code numbers:
First number is the Aerofiche card number.
Letter is the horizontal line reference per card.
Second number is the vertical line reference per card.
Example: 2J16 = Aerofiche card number two of given set, Grid location J16.

To aid in locating the various chapters and related service information desired, the following is provided:

1. A complete manual System/Chapter Index Guide is given for all fiche in this set.
2. A complete list of Illustrations is for all fiche in this set following System/Chapter Index.
3. A complete list of Charts is for all fiche in this set following list of illustration.
4. A complete list of paragraph titles and appropriate Grid location numbers is given at the beginning of each Chapter relating to the information within that Chapter.
5. Identification of Revised Material:

   Revised text and illustrations are indicated by a black vertical line along the left-hand margin of the frame, opposite revised, added or deleted material. Revision lines indicate only current revisions with changes, additions to or deletions of existing text and illustrations. Changes in capitalization, spelling, punctuation, indexing, the physical location of the material or complete page additions are not identified by revision lines.

   A reference and record of the material revised is included in each chapter's Table of Contents/Effectivity.

   The codes used in the effectivity columns of each chapter are defined as follows:

TABLE OF CONTENTS/EFFECTIVITY CODES

Original Issue:	None
First Revision:	Revision Indication, (1R Month-Year)
Second Revision:	Revision Indication, (2R Month-Year)
All subsequent revisions will follow with consecutive revision numbers such as 3R, 4R, etc., along with the appropriate month-year	
Added Subject:	Revision Identification, (A Month-Year)
Deleted Subject:	Revision Identification, (D Month-Year)

AEROFICHE EXPLANATION AND REVISION STATUS (CONTINUED)

6. Revisions to Maintenance Manual 761 751 issued December 19, 1980, are as follows:

Effectivity	Publication Date	Aerofiche Card Effectivity
ORG801219	December 19, 1980	1, 2 and 3
CR891220	December 20, 1989	1, 2, 3 and 4
CR931129	November 29, 1993	1, 2, 3, 4 and 5

The date on Aerofiche cards can not preceed the date noted for the respective card effectivity. Consult the latest Aerofiche card in the series for current Aerofiche card effectivity.

SERIAL NUMBER INFORMATION

The serial numbers of the PA-34-220T Seneca III airplanes covered by this Maintenance Manual are as follows:

34-8133001 through 34-8133277
34-8233001 through 34-8233205
34-8333001 through 34-8333129
34-8433001 through 34-8433088
34-8533001 through 34-8533069
34-8633001 through 34-8633031
3433001 and up
3448005 through 3448037

The serial numbers of the PA-34-220T Seneca IV airplanes covered by this Maintenance Manual are as follows:

3448038 and up

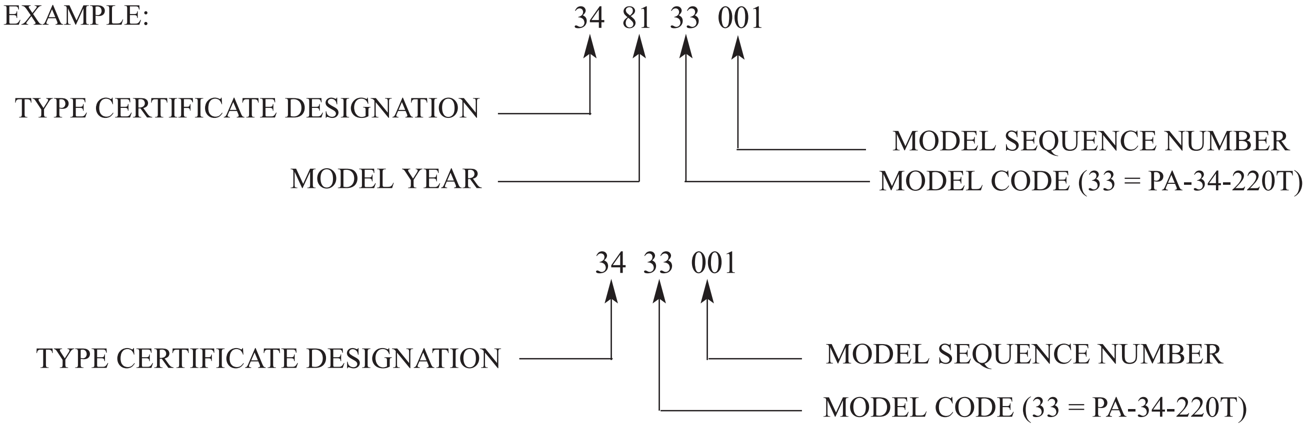
SERIAL NUMBER EXPLANATION

The serial number on the Manufacturer's Identification Plate is based on either a 3 or 4 set numbering system.

In the 4- set system, the first set defines the Type Certificate Designation, the second set is the Model Year, the third set is the Model Code, and the fourth set is the Model Sequence Number (within a model year).

The 3-set system omits the model year and begins a new sequence with 3433001. This new sequence continues without renumbering for a new year.

EXAMPLE:



VENDOR PUBLICATIONS

— WARNING —

WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, IT IS THE USER'S RESPONSIBILITY TO REFER TO THE APPLICABLE VENDOR PUBLICATION.

ENGINE:

Overhaul Manual =	CONTINENTAL - OVERHAUL MANUAL Form No. X-30030A Teledyne Continental Motors - Aircraft Products Division Mobile, Alabama 36601
Parts Catalog =	CONTINENTAL- Form No. X-30032A Teledyne Continental Motors - Aircraft Products Division Mobile, Alabama 36601
Operators Handbook =	CONTINENTAL - Form No. X-30553 Teledyne Continental Motors - Aircraft Products Division Mobile, Alabama 36601

PROPELLER:

Overhaul Instructions =	HARTZELL COMPACT CONSTANT SPEED and FEATHERING PROPELLER- P/N 117 D - Hartzell Propeller Inc. 1 Propeller Place Piqua, Ohio 45356
Service Manual =	McCAULEY C500 SERVICES FULL FEATHERING CONSTANT SPEED PROPELLER- P/N 7512 01 - McCauley Accessory Division 335 McCauley Drive P.O. Box 430 Vandalia, Ohio 45377

MAGNETOS:

Installation, Operation and Maintenance Instructions =	S6LN-25P IGNITION SYSTEM- P/N L-928 Bendix Electrical Components Division Sidney, New York 13838

VOLTAGE CONTROL:

Overhaul Manual and Illustrated Parts List:	LAMAR INC. POWER EQUIPMENT DIVISION 71 Inidel Aveneu P. O. Box 251 Rancocas, New Jersey 08073

VENDOR PUBLICATIONS (CONTINUED)

AUTOFLIGHT (continued)

Flight Control:	Bendix/King
System Flight Line	KFC 150
Installation Manual	P/N 006-0287-00
System Flight Line	KFC 200
Maintenance Manual:	P/N 006-5134-01
Vendor Address:	Bendix/King Radio Corporation 400 N. Rogers Road Olathe, Kansas 66062

WHEELS AND BRAKES:
Installation, Maintenance
and Overhaul Manual: Cleveland
Parker Hannifin Corporation
Aircraft Wheel and Brake Division
1160 Center Road
Avion, Ohio 44011

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

CORROSION INHIBITING COMPOUND:
DINOL International
25200 Malvina
Box 1065
Warren, Michigan 48090

OXYGEN SYSTEM
Components: Scott Aviation
225 Erie Street
Lancaster, New York 14086

FIRE EXTINGUISHER (PORTABLE)
Polk Fire Extinguisher Service, Inc.
P. O. Box 384
Lakeland, Florida 33802

PIPER PUBLICATIONS

AUTOFLITE:	
AutoFlight II Service Manual =	Piper P/ N 761 481
Pitch Trim Service Manual =	Piper P/N 753 771
AutoControl IIIB and Altimatic IIIB Service Manual =	Piper P/N 753 502
Altimatic IIIC Service Manual =	Piper P/N 761 602
PARTS CATALOG:	761 750
PROGRESSIVE INSPECTION 50 HOUR EVENT:	761 837
PERIODIC REPORT	230 1061

SYSTEM/CHAPTER INDEX GUIDE

— NOTE —

The following chapters are not applicable to this Maintenance Manual: 31, 36, 38, 49, 53, 54, 60, 72, 78, and 83.

SYSTEM/CHAPTER INDEX GUIDE (CONTINUED)

SYSTEM/CHAPTER INDEX GUIDE (CONTINUED)

SYSTEM/ CHAPTER	SUB-SYSTEM/ SECTION	TITLE	GRID NO.
28	FUEL		2E11
	00	General	
	10	Storage	
	20	Distribution	
	40	Indicating	
29	HYDRAULIC POWER		2F24
	00	General	
	10	Main	
30	ICE AND RAIN PROTECTION		2H12
	00	General	
	10	Airfoil	
	30	Pitot and Static	
	40	Windows, Windshields and Doors	
	60	Propellers/Rotors	
	80	Detection	
32	LANDING GEAR		3B5
	00	General	
	10	Main Gear and Doors	
	20	Nose Gear and Doors	
	40	Wheels and Brakes	
	60	Position and Warning	
33	LIGHTS		3D17
	00	General	
	10	Flight Compartment	
	20	Passenger Compartment	
	40	Exterior	
34	NAVIGATION AND PITOT /STATIC		3E24
	00	General	
	10	Flight Environment Data And Pitot/ Static	
	20	Attitude & Direction	
35	OXYGEN		3F21
	00	General	
	10	Crew/Passeng	
37	VACUUM		3H8
	00	General	
	10	Distribution	

SYSTEM/CHAPTER INDEX GUIDE (CONTINUED)

SYSTEM/ CHAPTER	SUB-SYSTEM/ SECTION	TITLE	GRID NO.
39	ELECTRICAL/ELECTRONIC PANELS & MULTIPURPOSE PARTS		3H24
	00	General	
	10	Instrument and Control Panels	
51	STRUCTURES		3I14
	00	General	
	10	Structural Repairs	
52	DOORS		3J11
	00	General	
	10	Passenger/Crew	
	30	Cargo	
55	STABILIZERS		3J24
	00	General	
	20	Stabilator	
	30	Vertical Stabilizer	
	40	Rudder	
56	WINDOWS		3K15
	10	Flight Compartment	
	20	Cabin	
57	WINGS		3K24
	00	General	
	20	Auxiliary Structure	
	40	Attach Fittings	
	50	Flight Surfaces	
61	PROPELLERS		4B5
	00	General	
	10	Propeller Assembly	
	20	Controlling	
70	STANDARD PRACTICES — ENGINES		4C9
	00	General	
71	POWER PLANT		4C13
	00	General	
	10	Cowling	
	20	Mounts	
	60	Air Intakes	
73	ENGINE FUEL AND CONTROL		4D11
	00	General	
	10	Distribution	
	30	Indicating	

SYSTEM/CHAPTER INDEX GUIDE (CONTINUED)

SYSTEM/ CHAPTER	SUB-SYSTEM/ SECTION	TITLE	GRID NO.
74	IGNITION		4D19
	00	General	
	10	Electrical Power Supply	
	20	Distribution	
76	ENGINE CONTROLS		4E15
	00	General	
	10	Power Control	
77	ENGINE INDICATING		4F6
	00	General	
	10	Power	
	20	Temperature	
79	OIL		4F18
	00	General	
	20	Distribution	
	30	Indicating	
80	STARTING		4G3
	00	General	
	10	Cranking	
81	TURBINES		4G13
	00	General	
	20	Turbocharger	
91	CHARTS AND WIRING DIAGRAMS		5B5
95	SPECIAL EQUIPMENT		5G9

LIST OF ILLUSTRATIONS

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LIST OF ILLUSTRATIONS

— NOTE —

Refer to Chapter 91 For Electrical Schematic Index

LIST OF ILLUSTRATIONS

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LIST OF CHARTS

LIST OF CHARTS

GRIDS 2B1 THROUGH 2B4
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CHAPTER

25

EQUIPMENT/FURNISHINGS

CHAPTER 25 - EQUIPMENT/FURNISHINGS

TABLE OF CONTENTS/EFFECTIVITY

— *WARNING* —

WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, IT IS THE USER'S RESPONSIBILITY TO REFER TO THE APPLICABLE PUBLICATIONS.

GENERAL

The Seneca III has the capacity of seating up to six passengers in different arrangements. Information on seat installations and other options are included in this chapter.

FLIGHT/PASSENGER COMPARTMENT

REMOVAL AND INSTALLATION OF SEATS (Refer to Figure 25-1.)

1. The pilot's and copilot's seats are on rails and can be removed as follows. Reverse this procedure for installation.
   a. Lift up on handle just under the front of the seat and move the seat to the center of its travel.
   b. Remove the screws from the clips (fore and aft) on the rails and move the control column full forward.
   c. Pull the release and move the chair 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.
   d. With the front legs clear, move the seat aft until the rear legs can also be moved clear.
2. To remove the seats three through six on the standard arrangement proceed as follows:
   a. 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.
3. With the club seating arrangement, seats five and six can be removed as previously described. However, the center seats (three and four) must be removed as follows:
   a. Disconnect safety belt.
   b. Remove the two mounting bolts from the seat's front legs.
   c. With the front legs of the seats disconnected, slide the seat aft until its back legs are clear of the retainers.
4. To reinstall the standard seats, align the four legs of the chair with the openings in their retainers and while pushing down on the part of the chair where the legs are over the keeper pin, push the chair forward into the retaining plate.
5. The club seats are installed by aligning the chairs' legs in the retaining plates and reinstalling the mounting bolts.

— NOTE —

Make sure the plates are clean of dirt that might prevent the leg foot from entering its retaining plate.

CONSOLE REMOVAL AND INSTALLATION (Refer to Figure 25-1.)

The console, which is only available with club seating, is mounted to the center floor in the same manner as the club seats. Remove and install as follows:

1. Remove the bolts from the aft legs of the console that are held to the stud plates.
2. Slide the unit aft and lift up on the forward part of the console till the legs clear the retainers.
3. Install in the reverse order.

— NOTE —

If the console is not going to be reinstalled any time soon, it is recommended that the retaining and stud plates be taped over to prevent dirt from fouling the assemblies.

RIGGING INSTRUCTIONS - SEAT BACK LOCK AND RELEASE (Refer to Figure 25-2.)

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.
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.

SHOULDER HARNESS INERTIA REEL ADJUSTMENT

1. Allow the harness to wind up on the reel as much as possible.
2. On the end of the reel, pry off the plastic cap over the spring, making sure the spring does not come out of the plastic cap, and set cap aside.
3. Unwind the harness completely, then measure and mark the harness 24 inches from the reel center.
4. Wind the harness onto the reel until the 24 inch mark is reached, then hold reel and place cap with spring over the reel shaft end.
5. Aligning slot in shaft with spring tang, wind spring 6 turns ± 1/2 turn and snap the plastic cover into holes in reel end shaft.
6. Release harness and, allowing it to wind up, extend the harness for a few times to check reel for smooth operation.
7. With reel fully wound, hold with inertia mechanism end up and pry off plastic cap over mechanism and set reel aside.
8. Install nut in plastic cap so that stud in cap is flush with nut surface, then reposition cap over reel end and, orientating properly, snap in place. Extend harness a few times to make sure action is correct.

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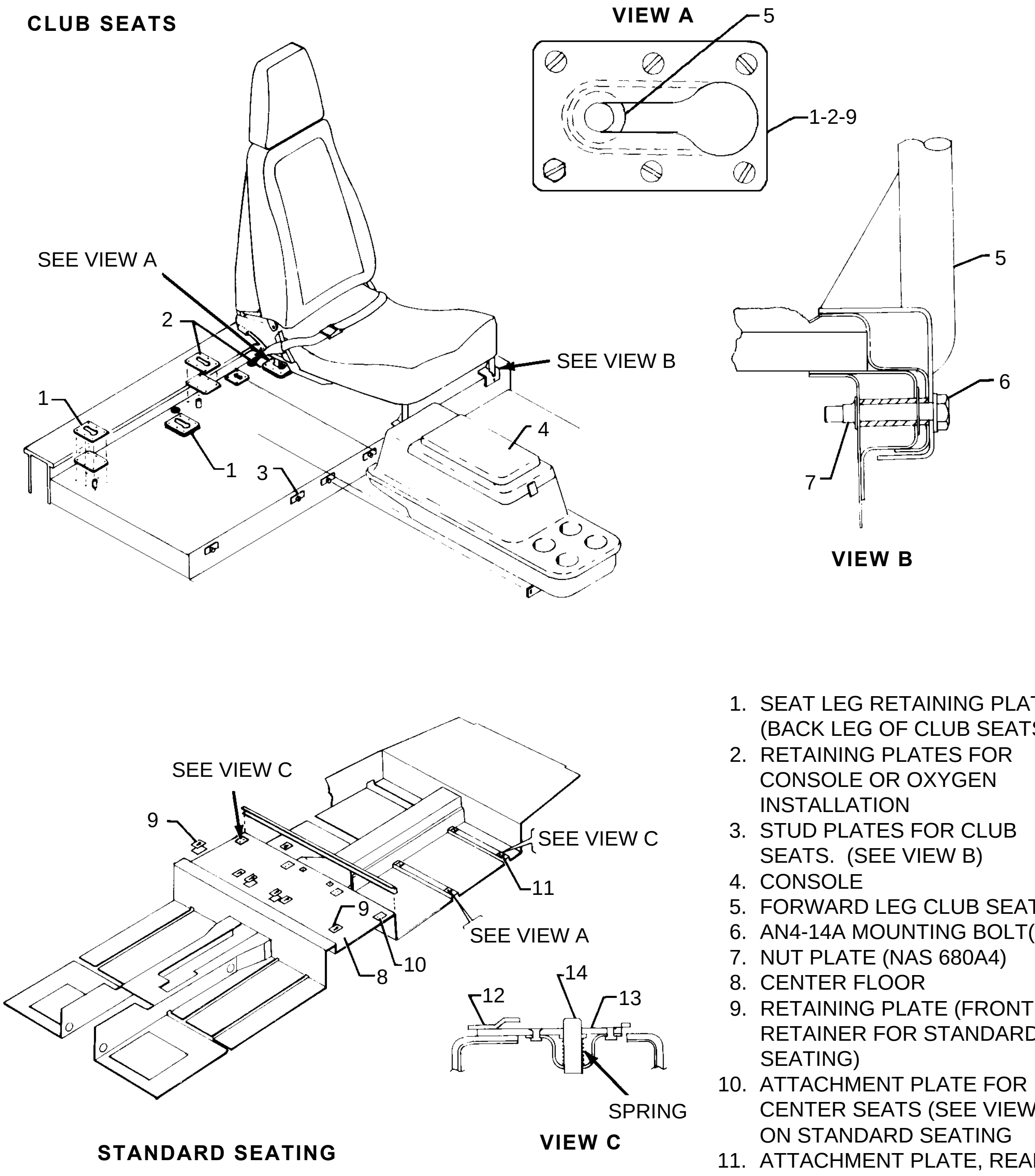

1. SEAT LEG RETAINING PLATE (BACK LEG OF CLUB SEATS)
2. RETAINING PLATES FOR CONSOLE OR OXYGEN INSTALLATION
3. STUD PLATES FOR CLUB SEATS. (SEE VIEW B)
4. CONSOLE
5. FORWARD LEG CLUB SEAT
6. AN4-14A MOUNTING BOLT(S)
7. NUT PLATE (NAS 680A4)
8. CENTER FLOOR
9. RETAINING PLATE (FRONT LEG RETAINER FOR STANDARD 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

Figure 25-1. Seats and Console Installation

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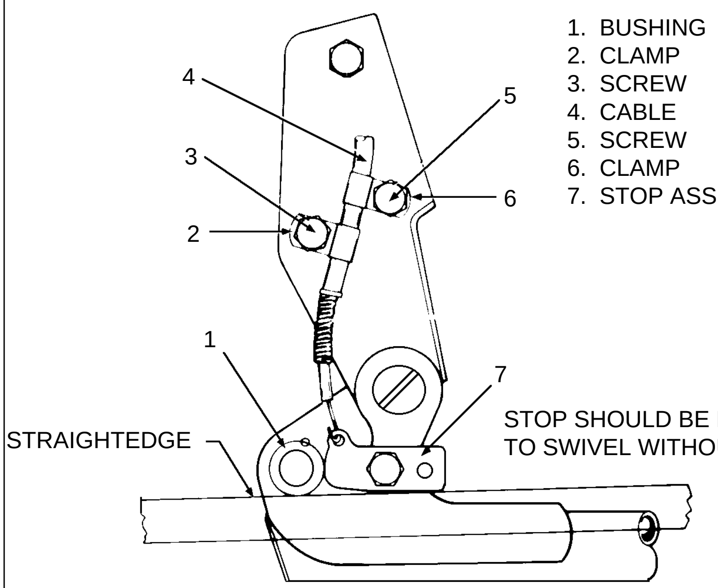

1. BUSHING
2. CLAMP
3. SCREW
4. CABLE
5. SCREW
6. CLAMP
7. STOP ASSEMBLY

NOTE

IF ADJUSTING PILOT AND COPILOT SEAT BACK ANGLE, FIRST MOVE SEAT TO FIFTH HOLE (OF STOP MECHANISM) FROM FRONT OF RAIL.

STOP SHOULD BE LUBRICATED AND FREE TO SWIVEL WITHOUT EXCESSIVE PLAY

Figure 25-2. Seat Back Lock

LUMBAR SEATS (Refer to Figure 25-3.)

DESCRIPTION

Lumbar pilot and co-pilot seat installations are available as an option. The installation consists of an inflatable bladder attached to the seat back filler and a inflation bulb located under and on the inboard side of each pilot and co-pilot seat.

REMOVAL OF LUMBAR BLADDER

To remove the lumbar bladder for repair or replacement:

1. Remove seat from airplane.
2. Loosen velcro securing seat back filler cover.
3. Remove only enough of seat back filer 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.

4. Remove inflation tube from bladder.

CAUTION

Do not use a chemical solvent to remove bladder. Solvent may damage seat back filler

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.

INSTALLATION OF LUMBAR BLADDER

NOTE

An installation kit is required for airplanes not previously equipped with a lumbar support Refer to Piper's Illustrated Parts Catalog for kit part number.

1. If necessary to assemble pad and bladder:
   a. Apply a layer of 3M 847 cement to smooth side of bladder pad.
   b. Apply a layer of 3M 847 cement to back side of bladder (side away from inflation tube nipple).
   c. 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.

2. Apply a layer of 3m 847 cement to rough side of bladder pad.
3. Apply a layer of 3m 847 cement to seat back filler where bladder is to be located.
4. 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.
5. Install seat back filler cover and secure velcro fastenings.
6. Install seat in airplane.

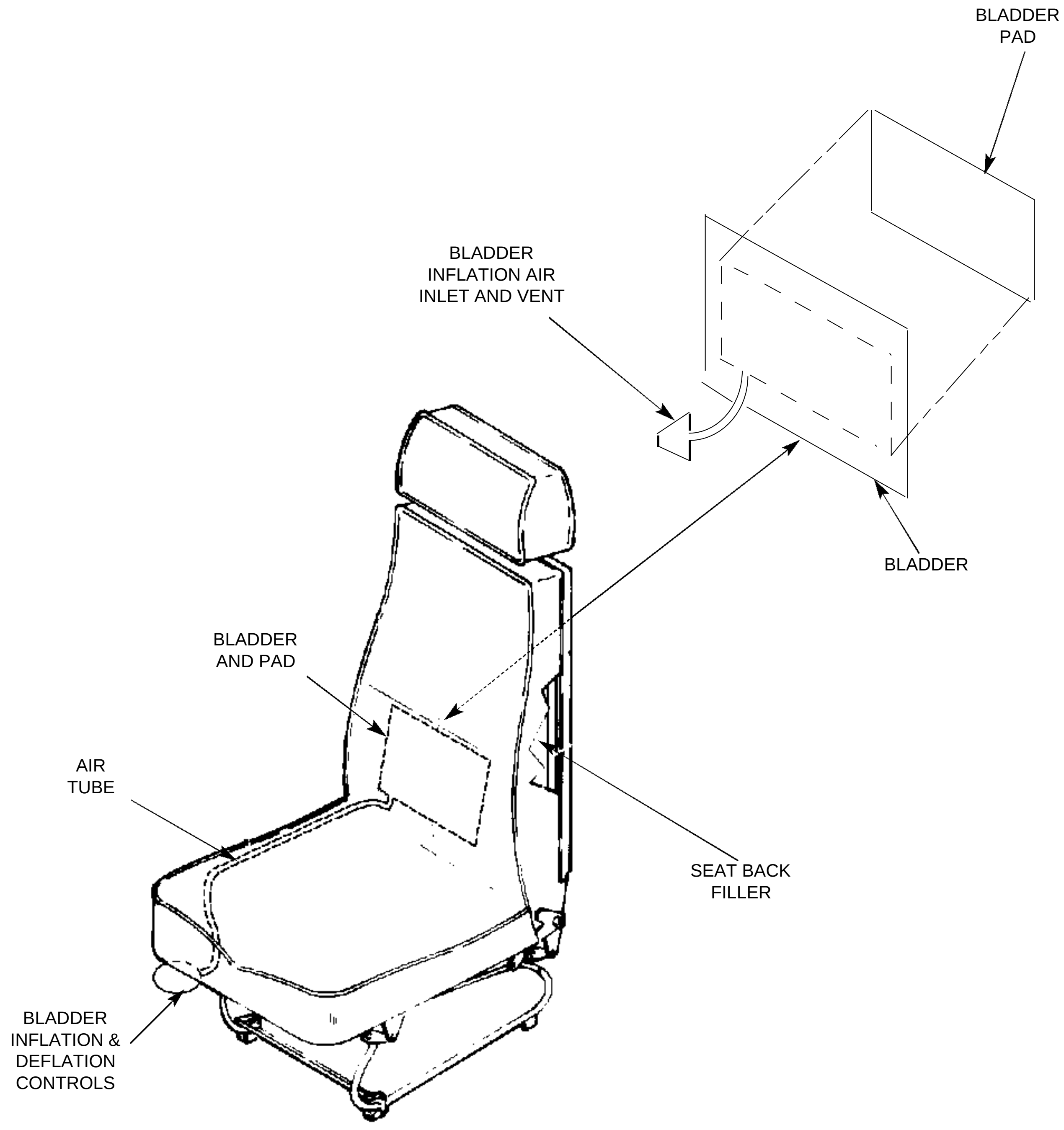

Figure 25-3 Lumbar Seat Bladder Installation

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CHAPTER

26

FIRE PROTECTION

CHAPTER 26 - FIRE PROTECTION

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

This chapter contains information pertaining to basic information data, maintaining and servicing of the portable fire extinguisher unit.

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EXTINGUISHING

Some Senecas may be equipped with Amerex Model No. 344 fire extinguishers (Piper Aircraft P/N 459 885), while others are equipped with Badger Model No. 9-1.25.1211A extinguishers (Piper Aircraft P/N 459 886). Both models contain 1 1/4 pounds of Halon 1211, and have a discharge rate of no less than 10 seconds.

— NOTE —

Changes in temperature may cause the indicator on the gauge dial to vary. The GREEN area is the “Charged Zone”. A true reading may be check by placing the extinguisher in a normal room temperature of 70°F (21°C) for several hours.

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, squeeze the lever with the palm of the hand. 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. Ejection of the indicator disc provides visual indication of partial or total discharge. A partly or totally discharged extinguisher assembly should be replaced immediately after use.

The extinguisher shall be inspected monthly or unless otherwise specified intervals. The nozzle shall be examined to ensure that they are unobstructed. The tamper tag or tamper indicator shall be intact. The extinguisher shall be pressurized as intended and weight shall be within tolerance on the label.

— WARNING —

AFTER DISCHARGE OF EXTINGUISHER, AVOID EXPOSURE TO SMOKE, VAPORS AND OTHER BY-PRODUCTS OF FIRE.

— WARNING —

DO NOT INCINERATE.

— CAUTION —

PRESSURE VESSEL. PROTECT FROM CORROSIVE CONDITIONS; IF THERE IS ANY CORROSION OR DAMAGE, EXTINGUISHER SHOULD BE CAREFULLY EMPTIED AND DISCARDED. USE ONLY AS DIRECTED.

The required service checks are as follows:

1. 12 year hydro-static test.

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CHAPTER

27

FLIGHT CONTROLS

CHAPTER 27 - FLIGHT CONTROLS

TABLE OF CONTENTS/EFFECTIVITY

CHAPTER 27 - FLIGHT CONTROLS

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

DESCRIPTION AND OPERATION

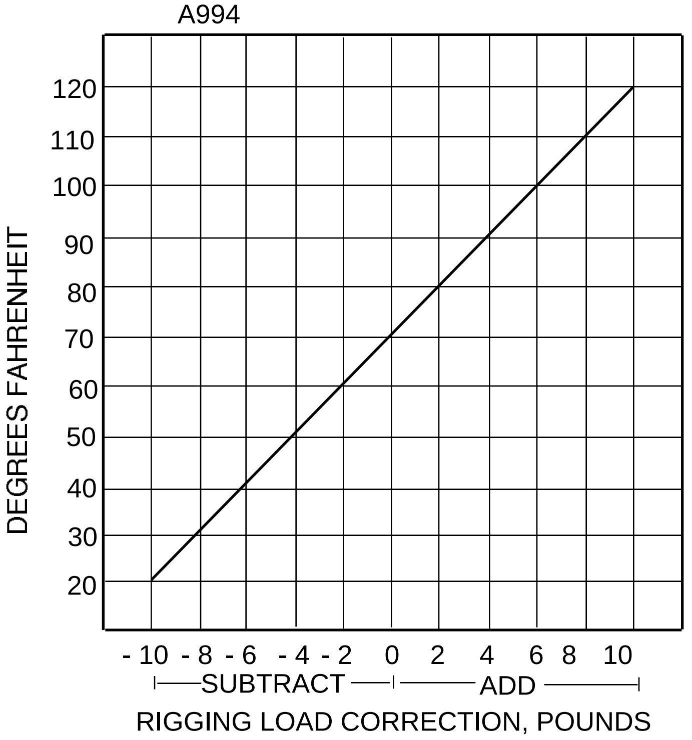
The airplane is controlled in flight by the use of three primary control surfaces, consisting of ailerons, stabilator, and rudder. Operation of these controls is through the movement of the control column-tee bar assembly and rudder pedals. On the forward end of each control column is a sprocket assembly. 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 mechanically operated on early models and electrically operated on 1985 models.

STANDARD PROCEDURES

The following tips may be helpful where applicable in the individual control system procedures.

1. 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.
2. 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. Locking clips which have been installed and removed must be scrapped and new clips used.
3. Torque all nuts in the flight control surface rigging system in accordance with AC 43.13-1A or to torques specified within this manual text.
4. After completion of adjustment, each jam nut must be tightened securely and inspected.
5. 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.
6. All cable rigging tensions given must be corrected to ambient temperature in the area where the tension is being checked by using Chart 2702.
7. See Figure 27-1 for the proper method of adjusting rod ends to prevent possible damage and binding of bearing surface in rod end.
8. All pulley guard pins should be properly installed.

CHART 2701. CABLE TENSION VS. AMBIENT TEMPERATURE



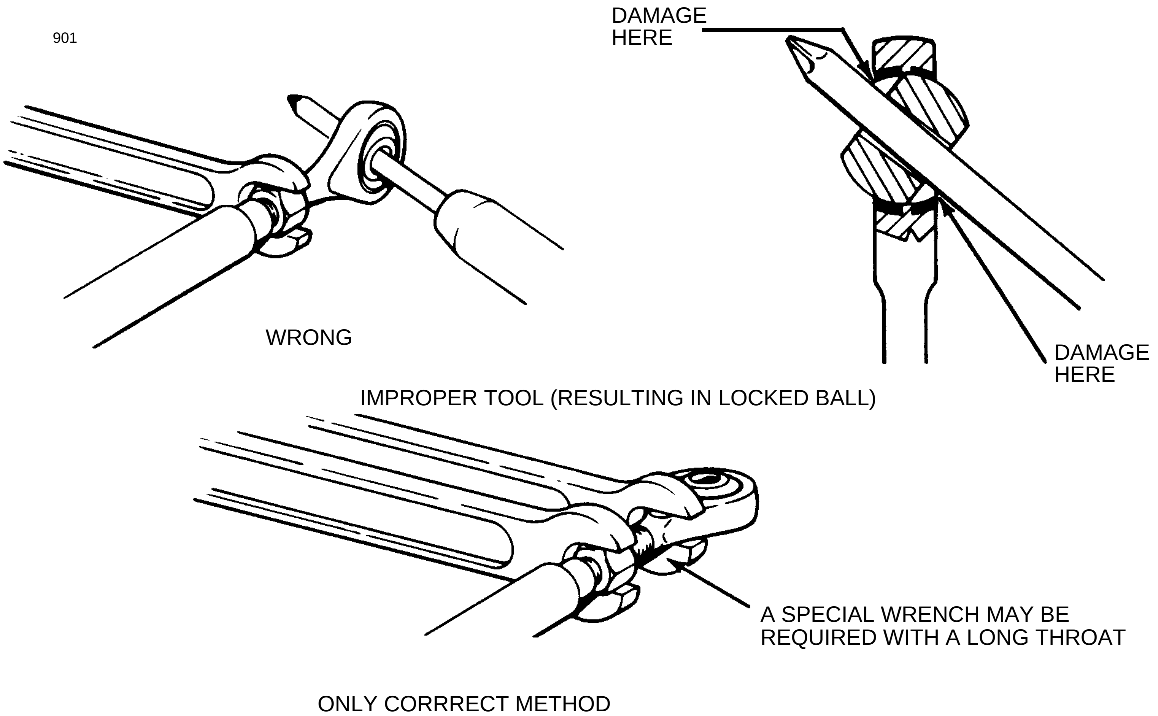


Figure 27-1. Rod End Installation Method

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:

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 270-2A 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 27-2B) when the cable was removed and bent using the techniques depicted in Figure 27-2C.

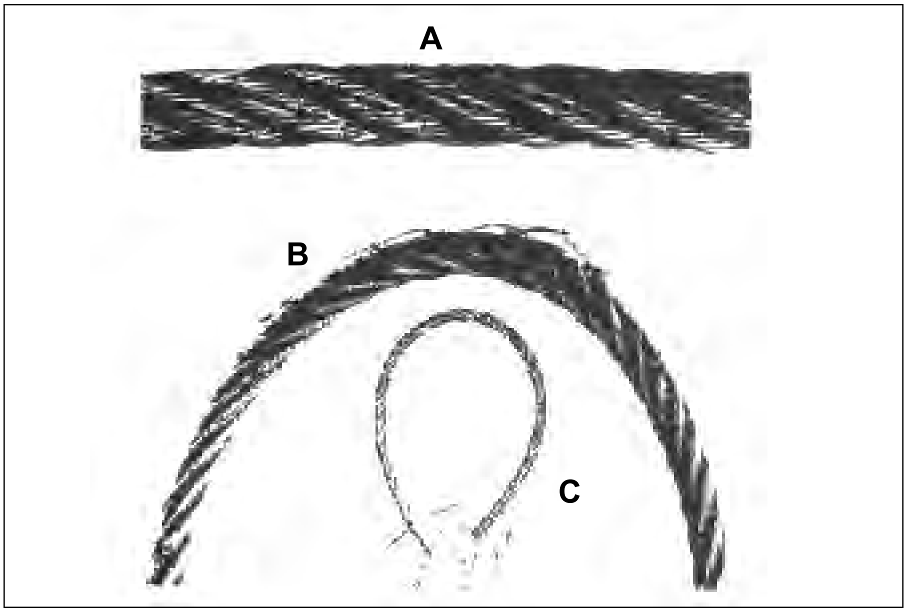
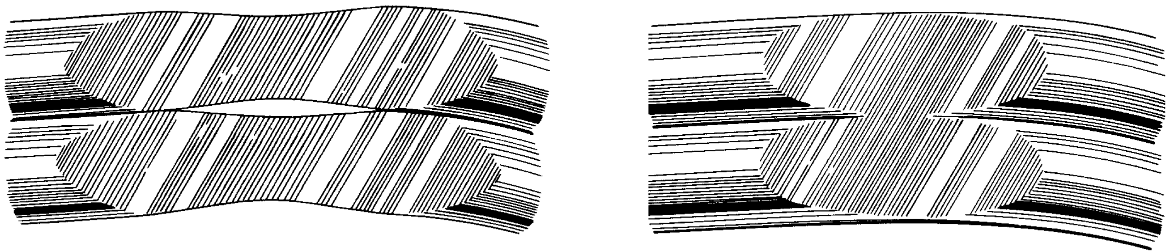


Figure 27-2 Control Cable Inspection Technique

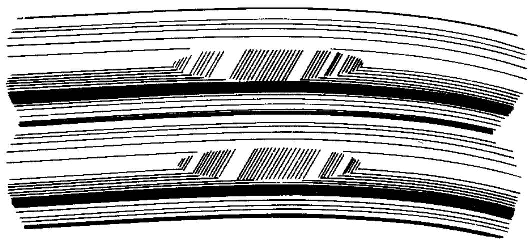
External Wear Patterns

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 27-3.



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)

Figure 27-3 Cable Wear Patterns

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 27-4, 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.

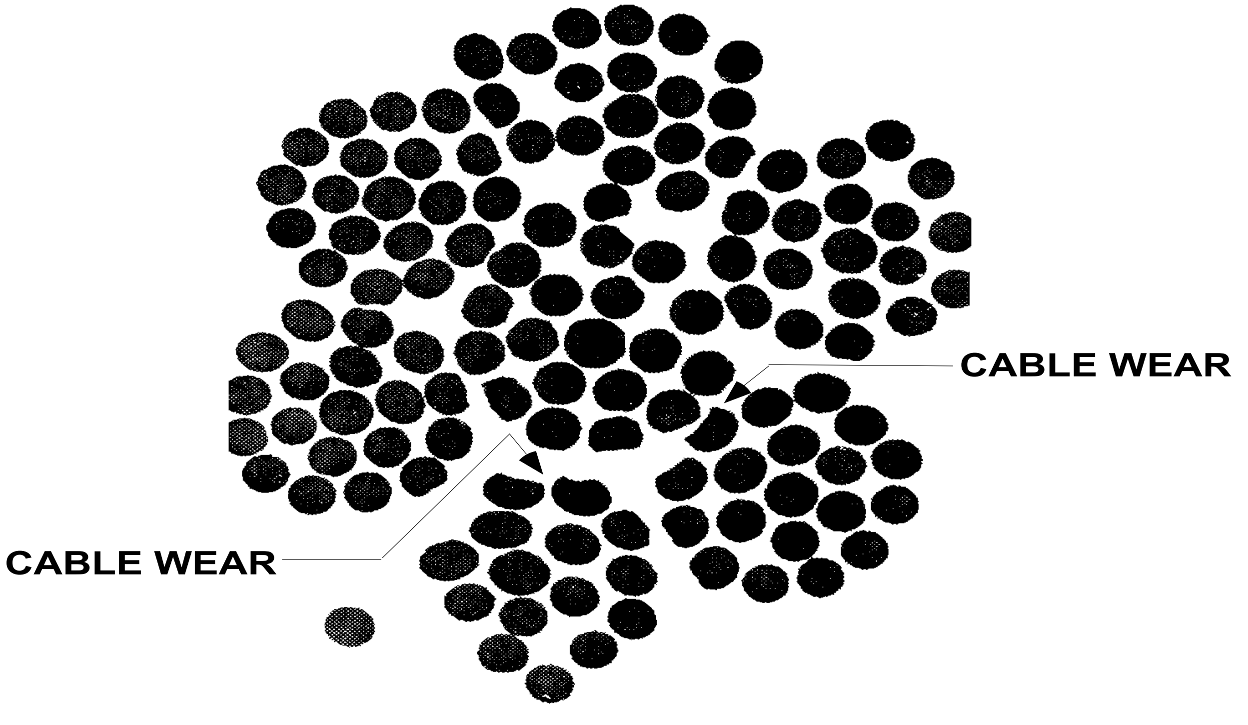


Figure 27-4 Internal Cable Wear

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.

Cable Maintenance

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 with a light coat of graphite grease or general purpose, low-temperature oil.

– CAUTION –

Avoid use of vapor degreasing, steam cleaning, methylethylketone (MEK) or other solvents to remove corrosion-preventative compounds, as these methods will also remove cable internal lubricant.

Cable Fittings

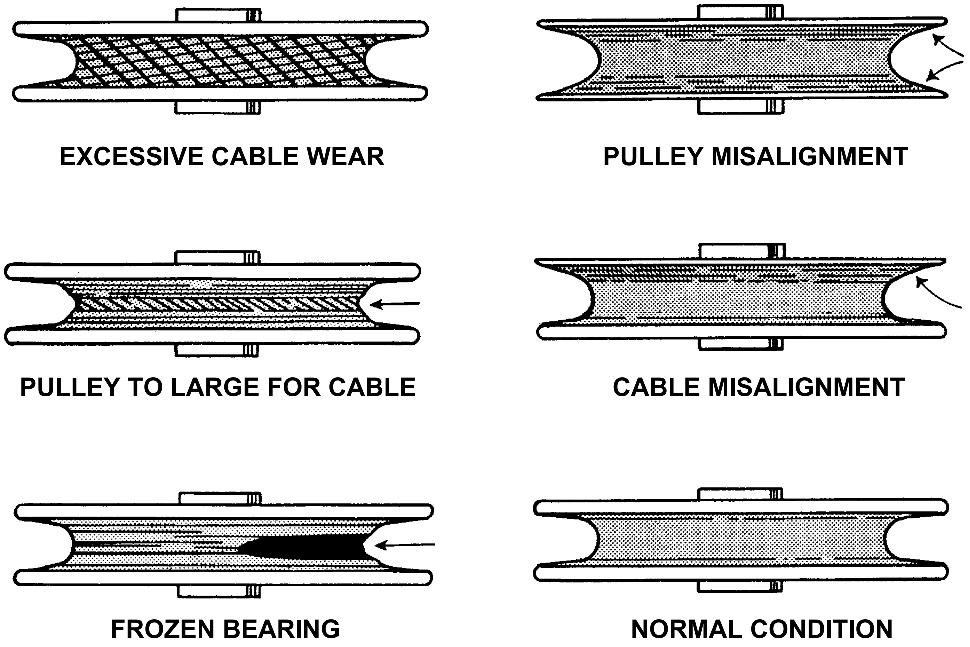
Check swaged terminal reference marks for an indication of cable slippage within fitting. Inspect fitting assembly for distortion and/or broken strands at the terminal. Assure that all bearings and swivel fittings (bolted or pinned) pivot freely to prevent binding and subsequent failure. Check turnbuckles for proper thread exposure and broken or missing safety wires/clips.

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.

1. 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 27-5.



EXCESSIVE CABLE WEAR

PULLEY MISALIGNMENT

PULLEY TO LARGE FOR CABLE

CABLE MISALIGNMENT

FROZEN BEARING

NORMAL CONDITION

Figure 27-5 Pulley Wear Patterns

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AILERON CONTROLS

TROUBLESHOOTING

Chart 2702 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 2702. 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. or replace.	Check linkage and tighten
	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 chain improperly adjusted.	Adjust chain 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 incorrect.	Check routing of control cables.

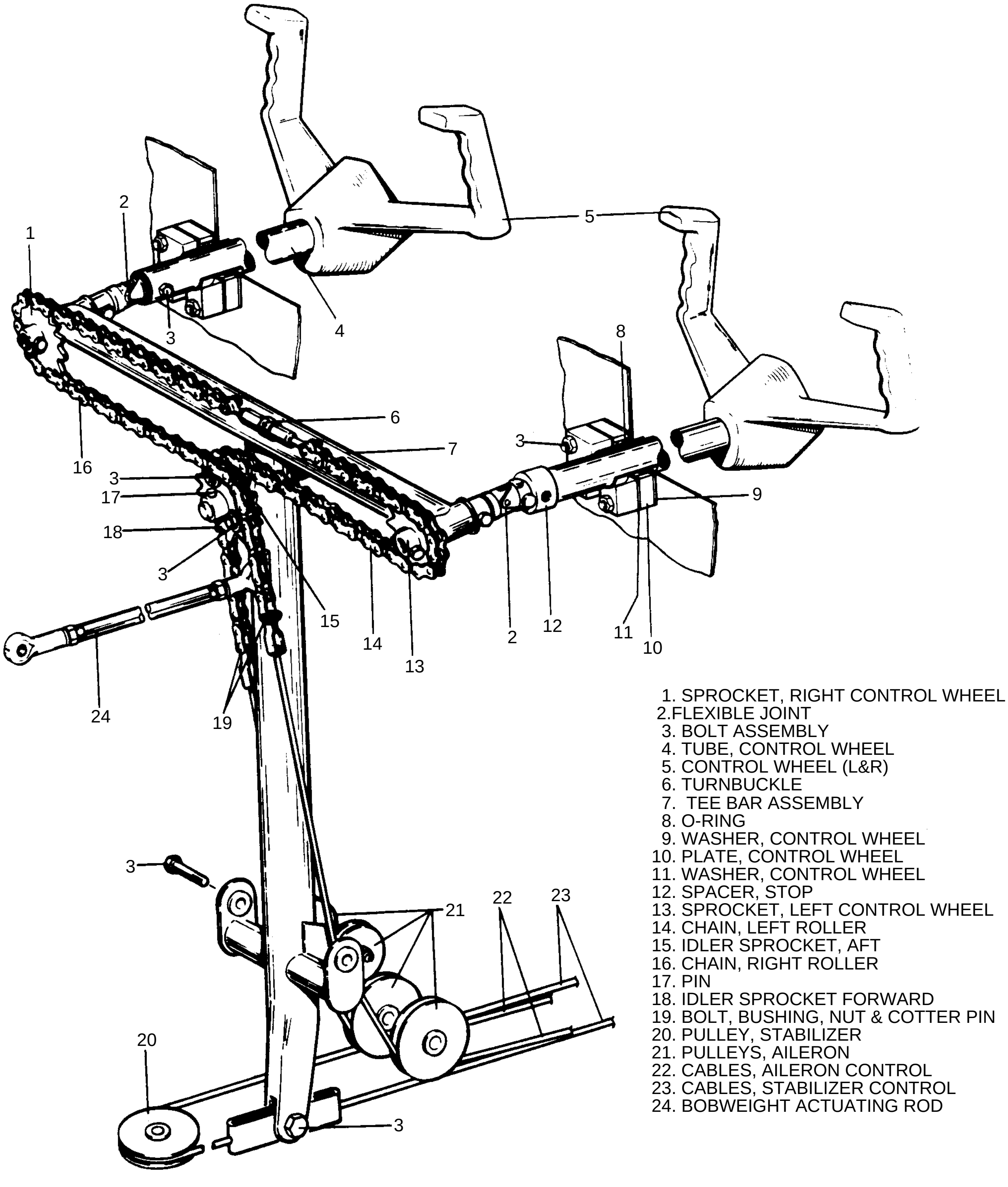
CHART 2702. TROUBLESHOOTING AILERON CONTROL SYSTEM (continued)

Trouble	Cause	Remedy
Control wheels not synchronized.	Incorrect control column rigging.	Rerig control column.
Control wheels not horizontal when ailerons are neutral.	Incorrect rigging of aileron system.	Rerig aileron system.
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 bellcrank stops.	Incorrect rigging of aileron cables, control wheel and control rod.	Rerig controls.
Control wheel stops before control surfaces reach full travel.	Incorrect rigging between control wheel and control cables.	Rerig controls.

CONTROL COLUMN

REMOVAL OF CONTROL COLUMN ASSEMBLY (Refer to Figure 27-6)

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 maybe 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.



1. SPROCKET, RIGHT CONTROL WHEEL
2.FLEXIBLE JOINT
3. BOLT ASSEMBLY
4. TUBE, CONTROL WHEEL
5. CONTROL WHEEL (L&R)
6. TURNBUCKLE
7. TEE BAR ASSEMBLY
8. O-RING
9. WASHER, CONTROL WHEEL
10. PLATE, CONTROL WHEEL
11. WASHER, CONTROL WHEEL
12. SPACER, STOP
13. SPROCKET, LEFT CONTROL WHEEL
14. CHAIN, LEFT ROLLER
15. IDLER SPROCKET, AFT
16. CHAIN, RIGHT ROLLER
17. PIN
18. IDLER SPROCKET FORWARD
19. BOLT, BUSHING, NUT & COTTER PIN
20. PULLEY, STABILIZER
21. PULLEYS, AILERON
22. CABLES, AILERON CONTROL
23. CABLES, STABILIZER CONTROL
24. BOBWEIGHT ACTUATING ROD

Figure 27-6. Control Column Installation

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.
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.

INSTALLATION OF CONTROL COLUMN ASSEMBLY (Refer to Figure 27-6)

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. (Refer to Figure 27-7 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 2702. 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.
   l. Install the floor tunnel plate and secure with screws. Fasten the tunnel carpet in place.

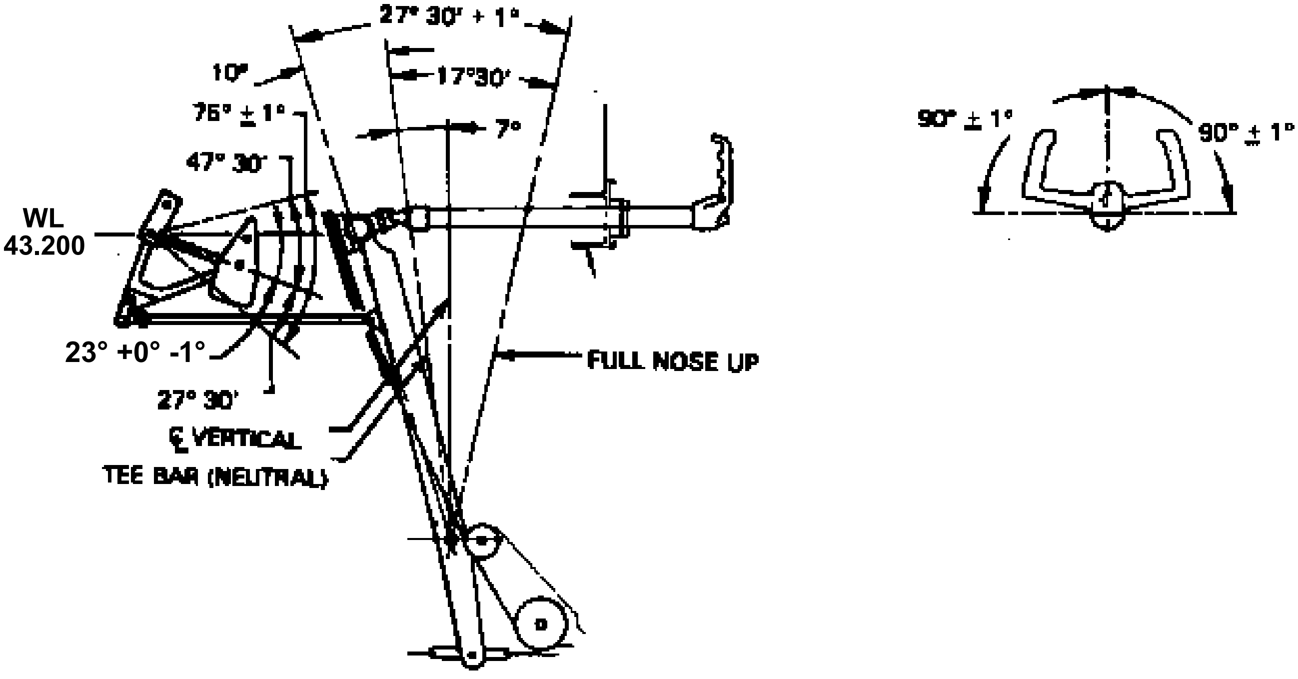


Figure 27-7 Control Column Rigging

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.
3. To Install Flex Joint Replacement (Refer to Figures 27-6 and 27-8)
   a. Carefully lay out location for hole to be drilled in flex joint tube to match hole in control cloumn shaft.
   b. Using a #5 (0.2055) drill bit, drill hole through flex joint tube at location determined in paragraph a.
   c. Ream drilled hole, in steps, with a #1 reamer, checking to insure proper depth for taper pin and sufficient pin thread protrusion for proper installation.

– NOTE –

Reamer may be purchased from Enstice Tool Co., Palm Bay, Florida.

(d) Install pin through tube and shaft.
  1 If pin shoulder does ***not*** protruded past tube surface, install a AN960-10 washer
  2 If pin shoulder ***does*** protruded past tube surface, install a MS20364-1032C washer

(e) Install nut. Torque 35 - 40 inch-pounds.

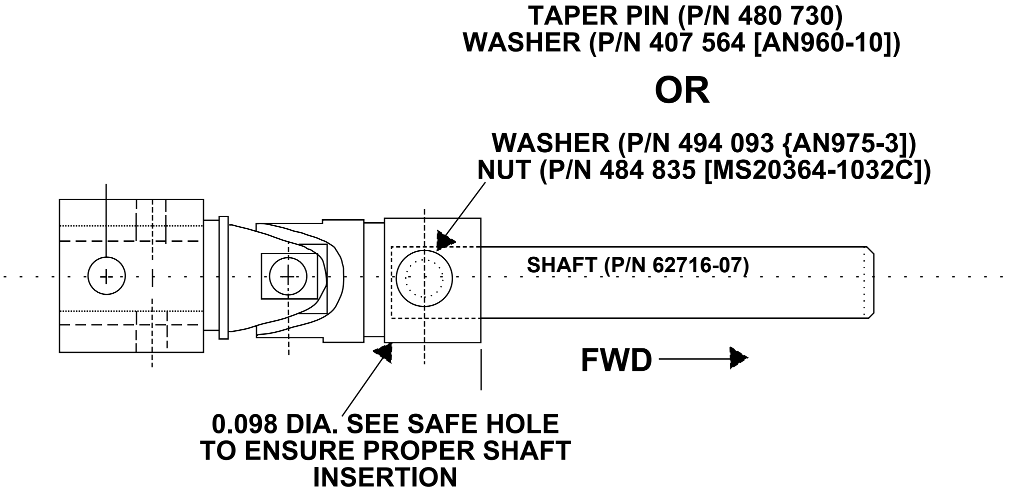
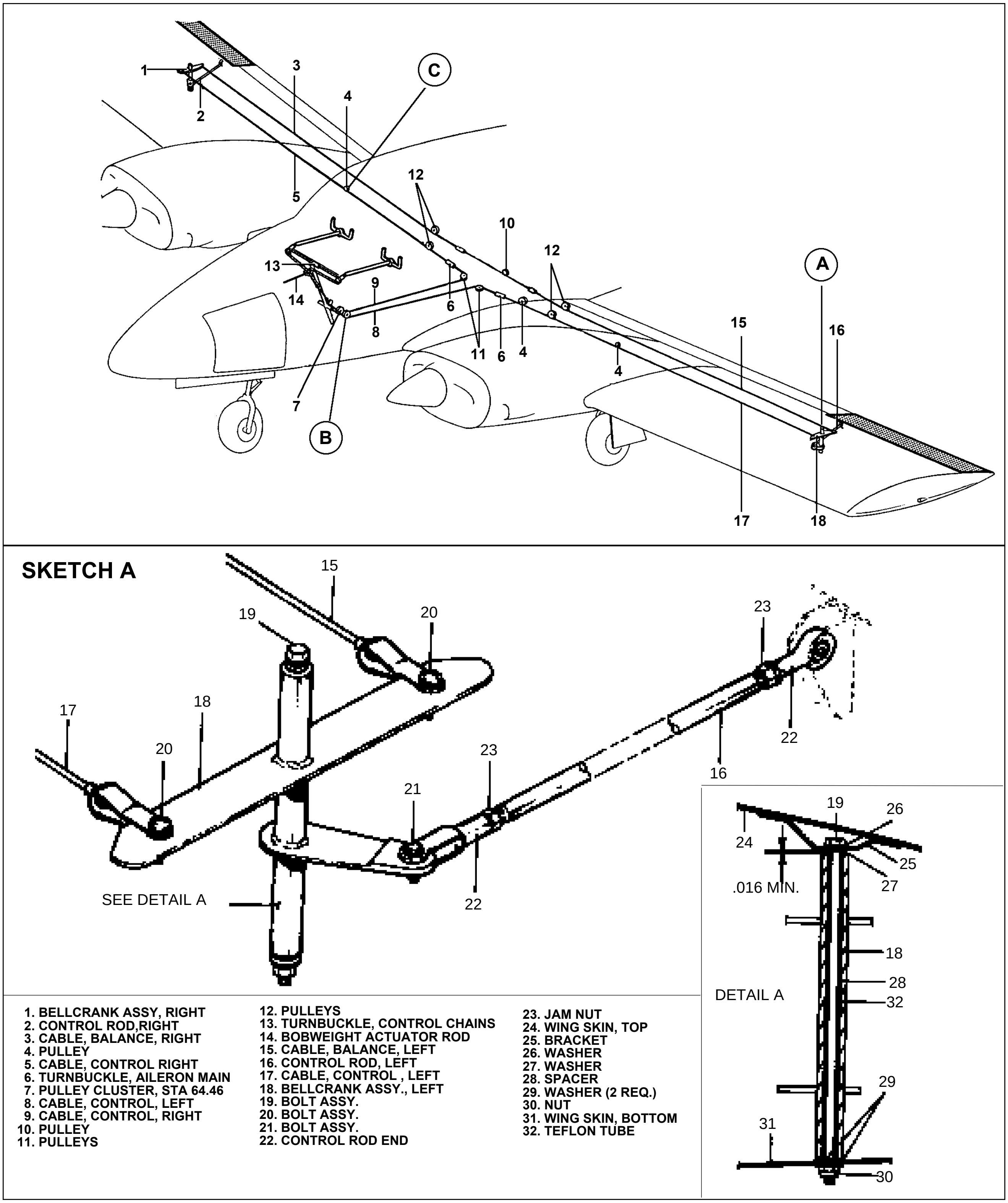


Figure 27-8 Flex (Universal) Joint Assembly

REMOVAL OF AILERON CONTROL CABLES (Refer to Figure 27-9.)

1. For the removal of any of the control cables in the fuselage or wings, first remove the floor panel that is 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 airplane.
2. To remove either the right or left primary control cables that are located in the fuselage. the following procedure may be used:
   a. Remove the tunnel plate just aft of the tee bar by laying back enough tunnel carpet to remove the plate attachment screws.
   b. Separate the primary control cable at the turnbuckles located in the floor opening aft of the main spar.
   c. Remove the cable pulleys attached to the lower section of the control column tee bar assembly by removing the pulley attachment bolt.
   d. Move the cable guard (see 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.



1. BELLCRANK ASSY, RIGHT
2. CONTROL ROD,RIGHT
3. CABLE, BALANCE, RIGHT
4. PULLEY
5. CABLE, CONTROL RIGHT
6. TURNBUCKLE, AILERON MAIN
7. PULLEY CLUSTER, STA 64.46
8. CABLE, CONTROL, LEFT
9. CABLE, CONTROL, RIGHT
10. PULLEY
11. PULLEYS
12. PULLEYS
13. TURNBUCKLE, CONTROL CHAINS
14. BOBWEIGHT ACTUATOR ROD
15. CABLE, BALANCE, LEFT
16. CONTROL ROD, LEFT
17. CABLE, CONTROL , LEFT
18. BELLCRANK ASSY., LEFT
19. BOLT ASSY.
20. BOLT ASSY.
21. BOLT ASSY.
22. CONTROL ROD END
23. JAM NUT
24. WING SKIN, TOP
25. BRACKET
26. WASHER
27. WASHER
28. SPACER
29. WASHER (2 REQ.)
30. NUT
31. WING SKIN, BOTTOM
32. TEFLON TUBE

Figure 27-9. Aileron Controls

3. 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.

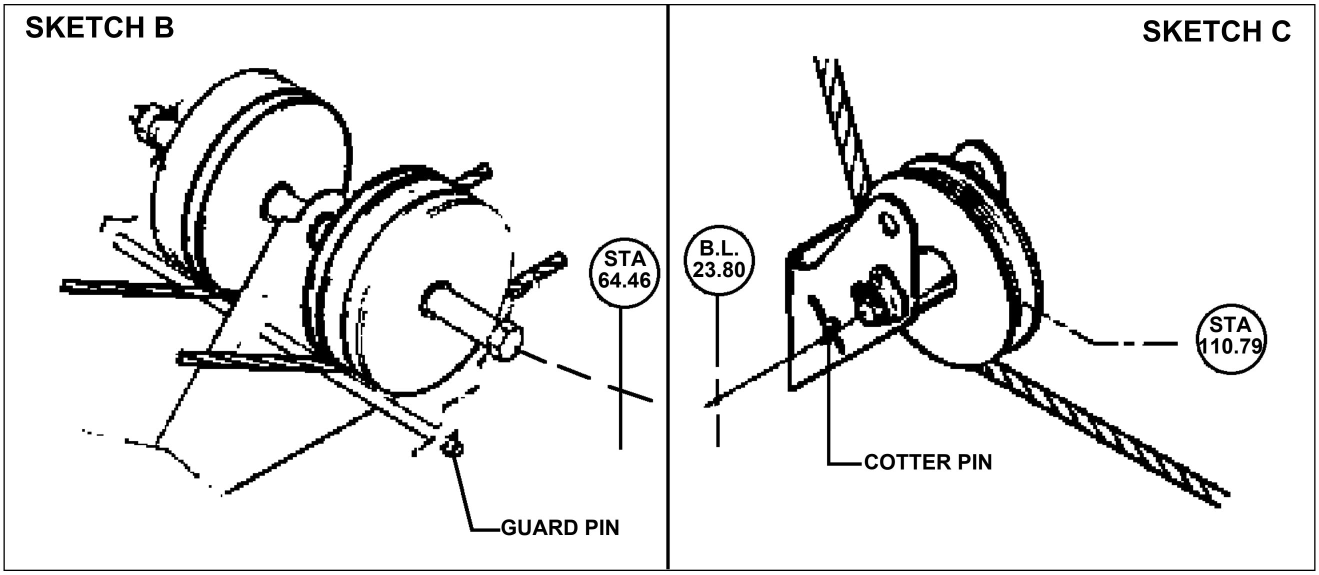


Figure 27-9. Aileron Controls (continued)

4. 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.

INSTALLATION OF AILERON CONTROL CABLES (Refer to Figure 27-9.)

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 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. (Refer to Figure 27-2.)

   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.
   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.

REMOVAL OF AILERON BELLCRANK ASSEMBLY (Refer to Figure 27-9.)

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 (Sketch A) at the aft or forward end as desired.
6. Remove the nut, pivot bolt (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.

INSTALLATION OF AILERON BELLCRANK ASSEMBLY (Refer to Figure 27-9)

1. Install first the teflon tube then the spacer in the torque tube portion of the bellcrank. (See 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 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. (Refer to Figure 27-9. Sketch A, Detail A.)
4. Install and adjust control rod (Sketch A) and check aileron travel per "Rigging and Adjustment of Aileron Controls."
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.

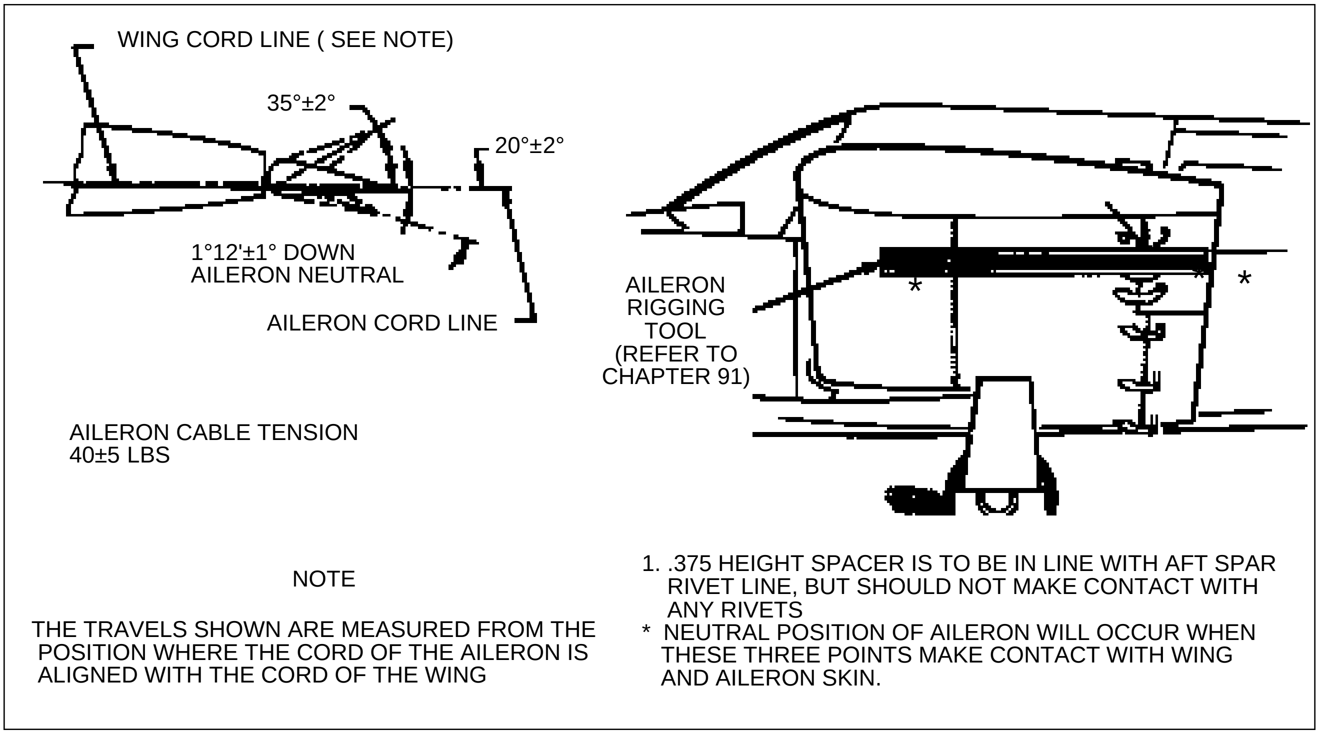
RIGGING AND ADJUSTMENT OF AILERON CONTROLS (Refer to Figures 27-10 and 27-11)

1. Ensure that the control wheels are properly rigged as described previously under “Installation of Control Column Assembly,” and lock them in their center of travel.
2. 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.
3. 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. (Refer to Figure 27-11 for installation.)
4. Adjust the turnbuckles on the primary and balance cables (located under the floor behind the spar carry through) to the tension specified in Figure 27-5. 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.

5. The aileron’s neutral position is designed to be at a point where the chord line of the aileron forms a 1° 12' ± 1° down angle with the wing chord, viewed at the inboard end of the aileron. The tool to determine neutral position is shown in use in Figure 27-10 with reference to Chapter 91 for specific dimensions. The following procedure should be used for determining aileron neutral position.
   a. Make sure the bellcrank rigging tools fit snug between the bellcranks and their respective ribs.
   b. 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.



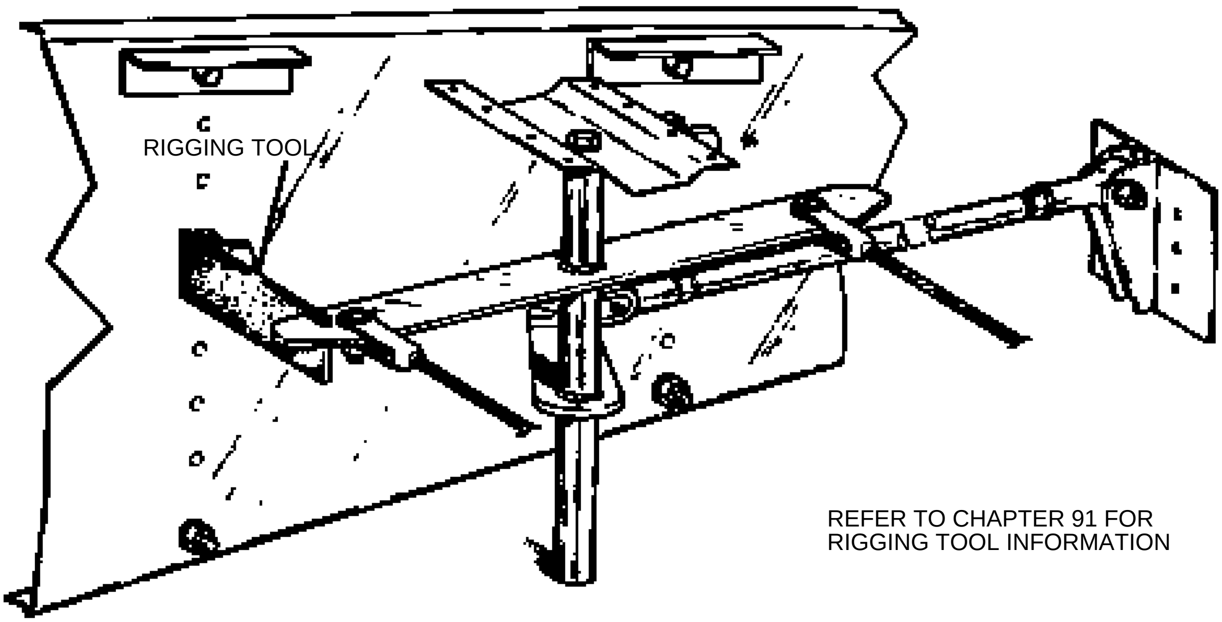
NOTE

THE TRAVELS SHOWN ARE MEASURED FROM THE POSITION WHERE THE CORD OF THE AILERON IS ALIGNED WITH THE CORD OF THE WING

1. .375 HEIGHT SPACER IS TO BE IN LINE WITH AFT SPAR RIVET LINE, BUT SHOULD NOT MAKE CONTACT WITH ANY RIVETS

* NEUTRAL POSITION OF AILERON WILL OCCUR WHEN THESE THREE POINTS MAKE CONTACT WITH WING AND AILERON SKIN.

Figure 27-10. Aileron Rigging



REFER TO CHAPTER 91 FOR RIGGING TOOL INFORMATION

Figure 27-11. Aileron Bellcrank Rigging Tool Utilization

c. If not already done, connect the aileron/ bellcrank push rod to its mounting points.

d. 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.

6. Remove the bellcrank and control wheel locks.

7. 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.

a. With one of the ailerons in its neutral position, center the bubble of the protractor over the aileron's surface and note the reading.

b. 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.

c. 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.

8. 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.

9. 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.

10. Check control operation, bolts and turnbuckles for safety.

11. 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.

RUDDER CONTROLS

TROUBLESHOOTING

Charts 2703 and 2703A 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 2703. 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 when rudder is streamlined.	Rudder cables incorrectly rigged.	Rerig rudder cables.
Incorrect rudder travel.	Rudder bellcrank stop incorrectly adjusted.	Rerig bellcrank stops.
	Nose wheel contacts stops before rudder.	Rerig nose wheel stops.

CHART 2703A. TROUBLESHOOTING RUDDER TRIM CONTROL SYSTEM

Trouble	Cause	Remedy
Trim control knob moves with excessive resistance.	System not lubricated properly.	Lubricate system.

RUDDER PEDAL ASSEMBLY

REMOVAL OF RUDDER PEDAL ASSEMBLY (Refer to Figure 27-12.)

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.

INSTALLATION OF RUDDER PEDAL ASSEMBLY (Refer to Figure 27-12.)

1. Assemble the torque tube assembly as shown in Figure 27-12. 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, Chapter 32.
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.

REMOVAL OF RUDDER CONTROL CABLES (Refer to Figure 27-7.)

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 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 Sketch B) that are attached to the spar housing by removing the block attachment screws.
    f. Remove the cable guard pin (see 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. (Refer to Figure 27-8.)
    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.

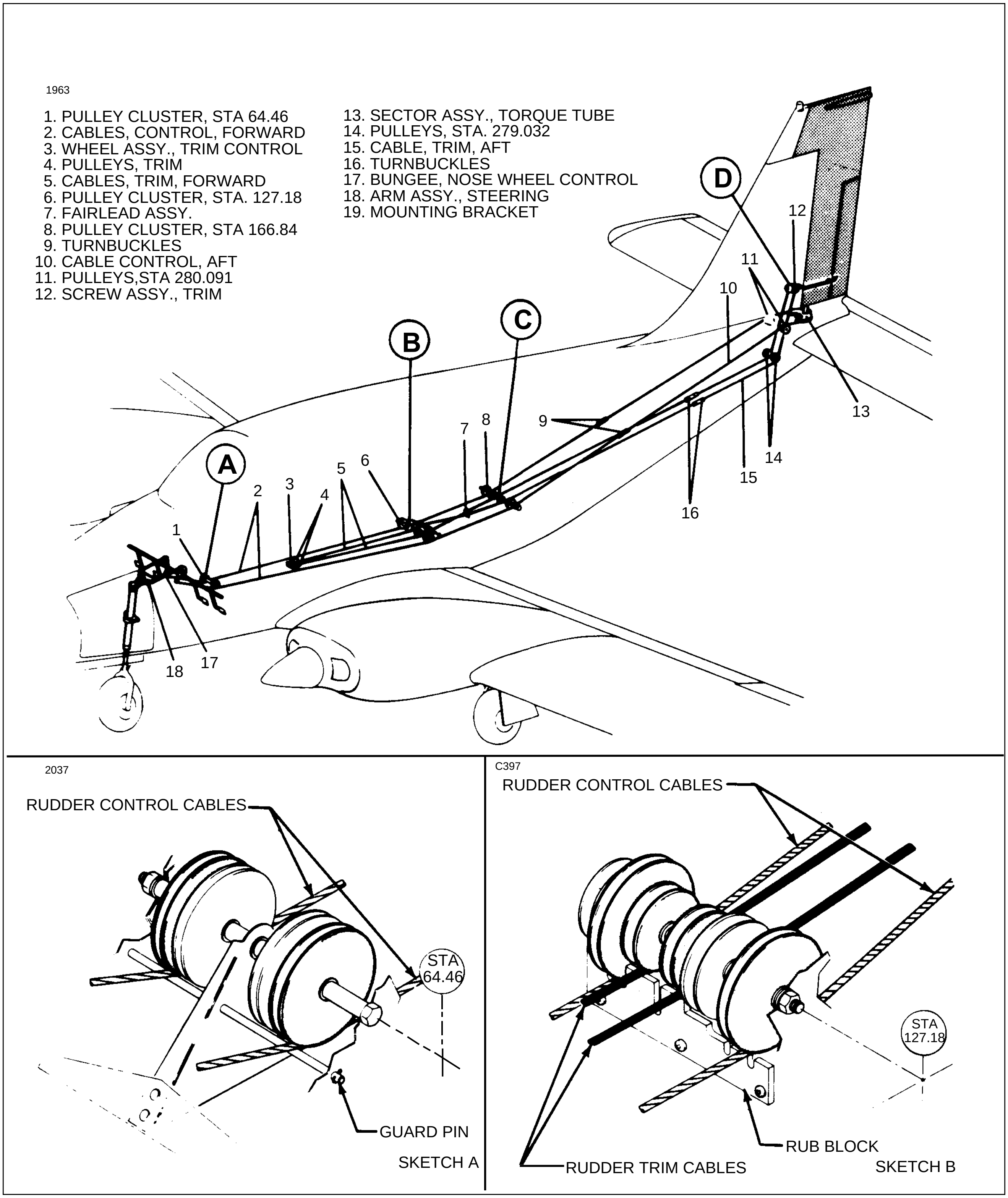
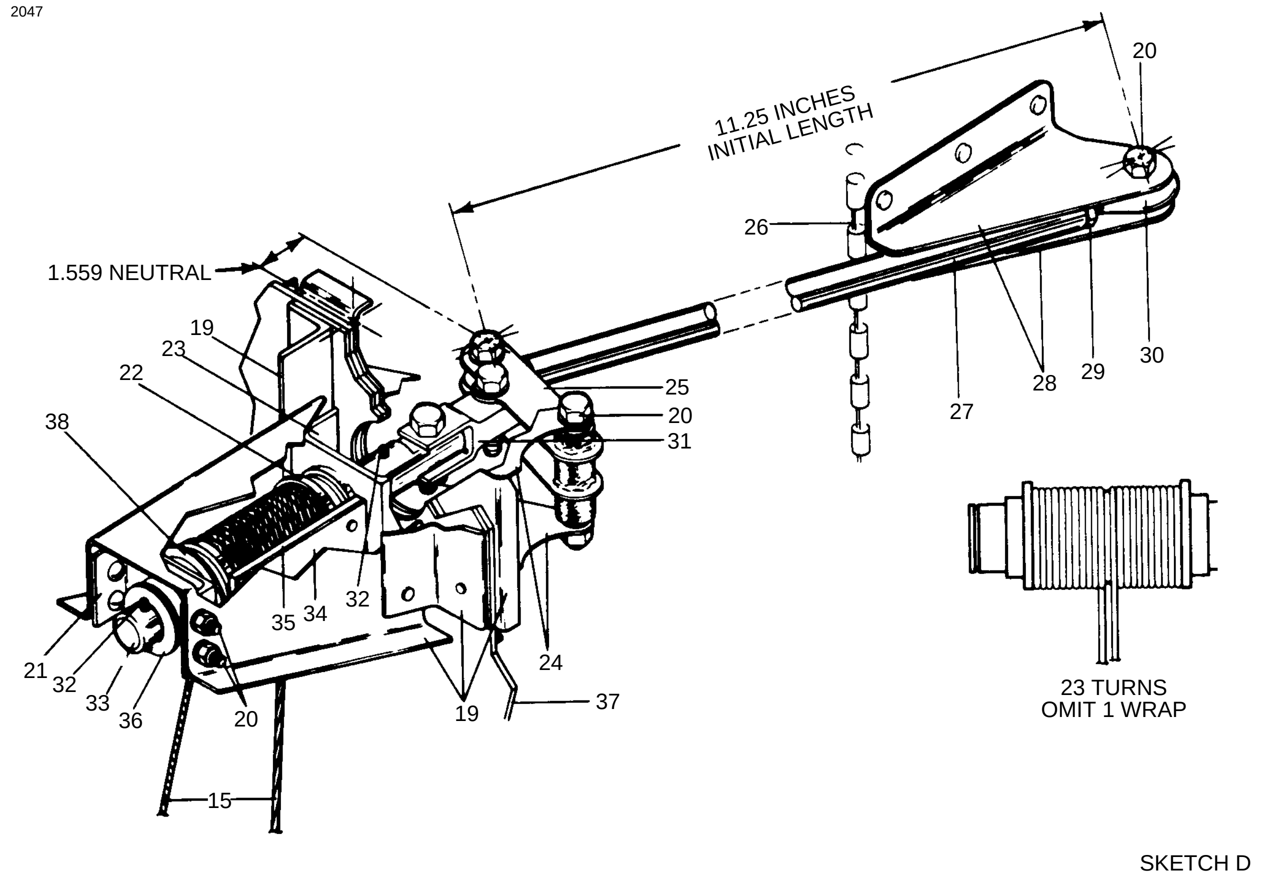
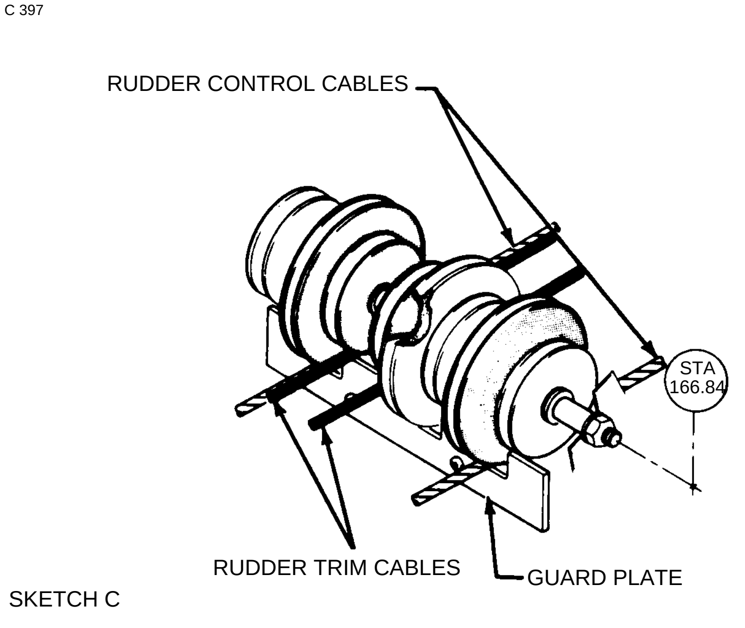


Figure 27-12. Rudder Controls Installation





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 CSREW
34. SHIM
35. CABLE GUARD
36. STOP WASHERS AN960-816 AND AN960 816L (AS REQ. UP TO 5)
37. SPAR
38. SHIM

Figure 27-12. Rudder Controls Installation (continued)

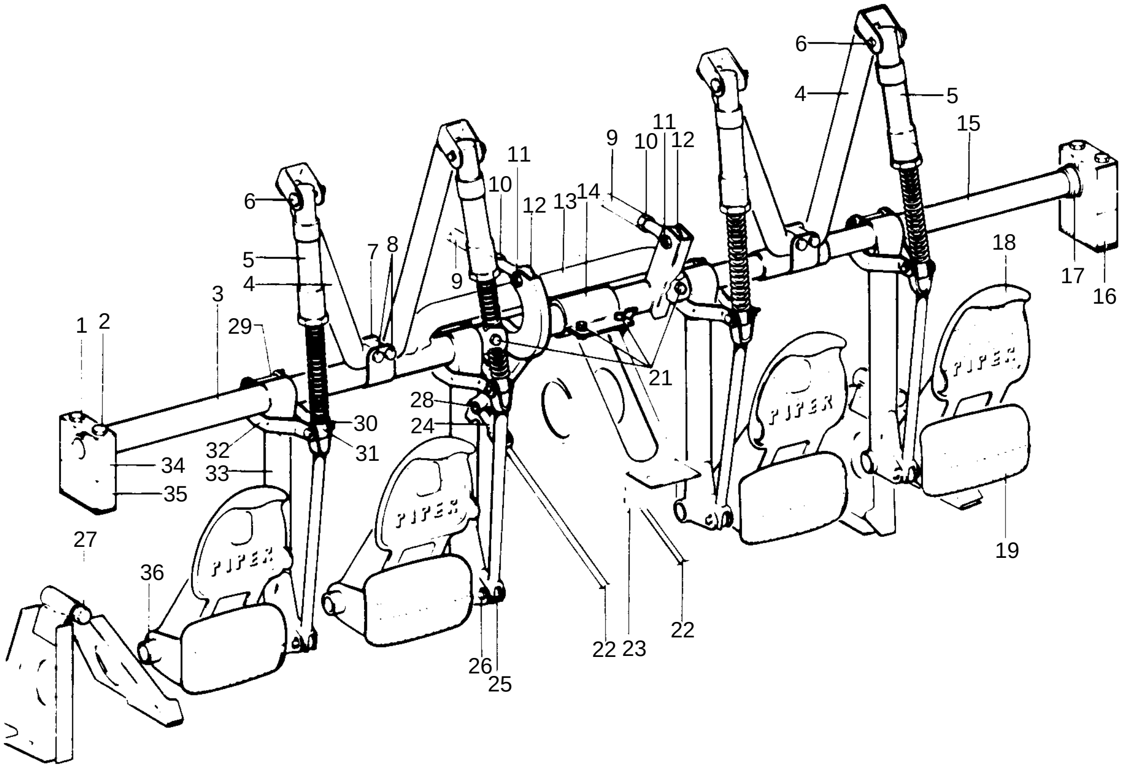
INSTALLATION OF RUDDER CONTROL CABLES. (Refer to Figure 27-12.)

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 (refer to Figure 27-13) 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 27-14 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 27-14 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.

RIGGING AND ADJUSTMENT OF RUDDER PEDALS. (Refer to Figures 27-14 and 27-15.)

Measurements for determining rudder travel are initiated from the neutral position, (when the rudder is streamlined with the vertical stabilizer).

1. Using the rudder pedals as necessary, check and set the correct degree of rudder travel as follows:
   a. Swing the rudder until it contacts the stop and hold it in that position. Refer to Figure 27-14 for travels.
   b. Using the rigging tool as shown in Figure 27-14, align the tool at the root against the side of the vertical stabilizer and rudder, making sure to keep it clear of rivets.
   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 27-10 for reference.
   d. Swing the rudder in the opposite direction and complete the same procedure.



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

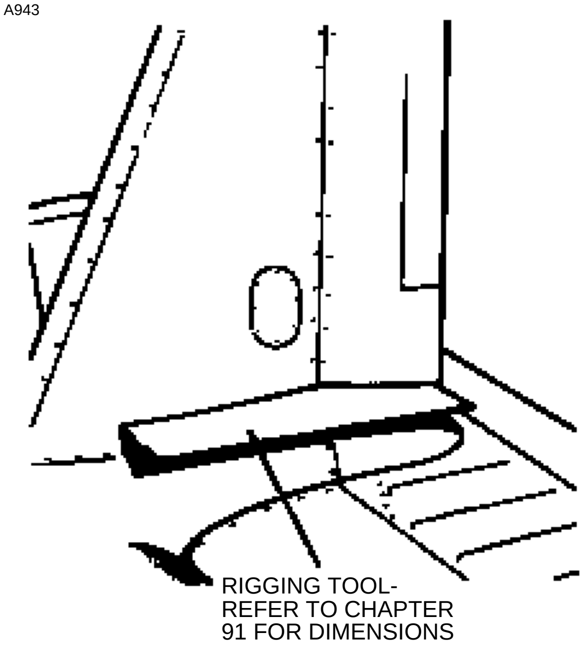
Figure 27-13. Rudder Pedals Installation

2. 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 27-14. If the nose gear steering is found to be out of alignment refer to Chapter 32 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.
3. 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.
4. The same procedure and clearance applies to the copilot’s right pedal.
5. Install tail cone and the access panel.

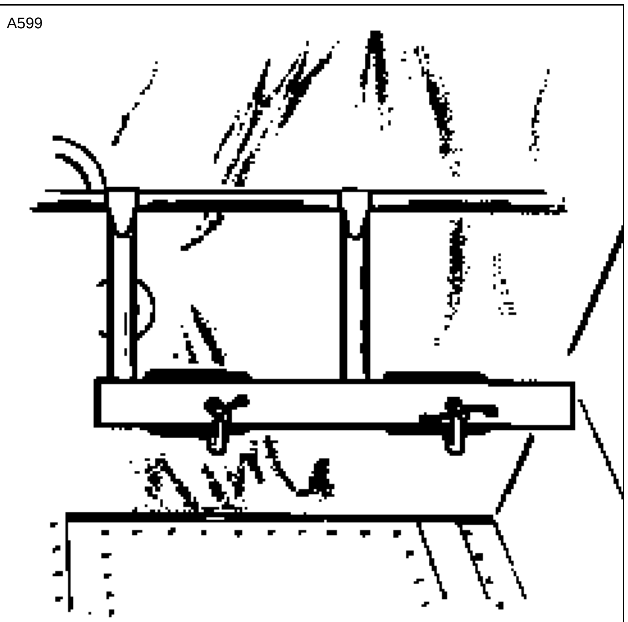
RUDDER TRIM CONTROLS (Refer to Figure 27-12.)

REMOVAL OF RUDDER TRIM CONTROLS (FORWARD) (Refer to Figure 27-12.)

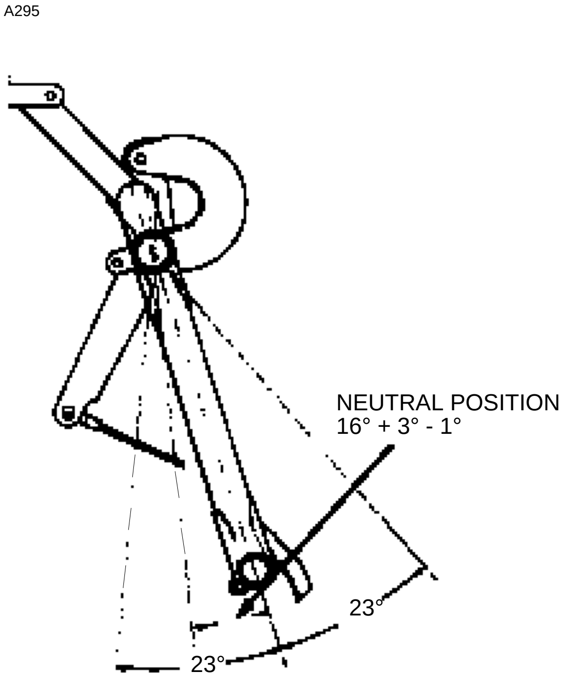
1. To remove the trim control wheel assembly and/or trim control cables, first remove the panel to the aft section of the fuselage.
2. If the aft trim cable is not being removed, block the cables aft to the turnbuckles to prevent the cables from unwrapping at the trim barrel in the fin. (Refer to Figure 27-11.)
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 Sketch C) at pulley cluster.
   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.



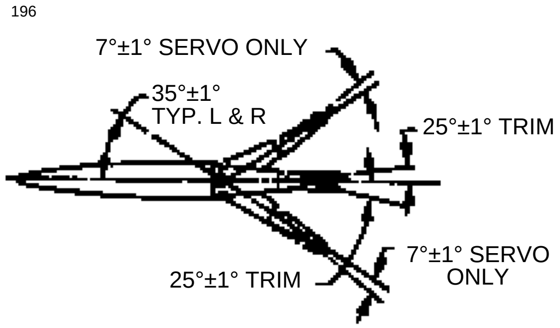
USING RIGGING TOOL



NEUTRALIZING PEDALS



PEDAL TRAVELS



RUDDER TRAVEL

CABLE TENSIONS	
RUDDER CABLES	40± 5 LBS.
RUDDER TRIM CABLES	10± 2 LBS.

Figure 27-14. Rigging Rudder and Controls

INSTALLATION OF RUDDER TRIM CONTROLS (FORWARD). (Refer to Figure 27-12.)

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 27-12)
    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. (Refer to Sketches B and C of Figure 27-12.)
    f. Set trim cable tension in accordance with specifications given in Figure 27-14 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.

REMOVAL OF RUDDER TRIM CONTROLS (AFT) (Refer to Figure 27-12.)

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. (Refer to Figure 27-16, Grid 2D8.)
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.

INSTALLATION OF RUDDER TRIM CONTROLS (AFT) (Refer to Figure 27-12.**)**

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. (Refer to Sketch D of Figure 27-12.)
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 Chapter 12.
10. Install the access panel and tail cone fairing.

RIGGING AND ADJUSTMENT OF RUDDER TRIM CONTROLS. (Refer to Figure 27-12.**)**

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. 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. Refer to the previous subject paragraphs for appropriate instructions.

6. Remove the blocks securing the rudder in its neutral position.
7. 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" contacts its stop.
   c. With a bevel protractor or other suitable tool measure the degree of deflection which should be 7 ± 1 degrees from its neutral point.
   d. Repeat the last two steps with the right rudder pedal again checking for 7 ± 1 degrees.
   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. As necessary refer back to Step 3 of this subject paragraph.
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 0.06 inch.

STABILATOR CONTROLS

TROUBLESHOOTING

Charts 2704 and 2705 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 2704. 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.
Resistance to stabilator control movement. (continued)	Cables not in place on pulleys.	Install cables correctly.
	Cables crossed or routed incorrectly.	Check routing of control cables.
	Bent stabilator hinge.	Repair or replace stabilator hinge.
Incorrect stabilator travel.	Stabilator stops incorrectly adjusted.	Adjust stop screws.
Correct stabilator travel cannot be obtained by adjusting stops. position.	Stabilator cables incorrectly rigged.	Rerig stabilator cables.

CHART 2705. TROUBLESHOOTING STABILATOR MANUAL TRIM CONTROL

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 control wheel moves with excessive resistance. (continued)	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.

REMOVAL OF STABILATOR CONTROL CABLES (Refer to Figure 27-12.)

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.

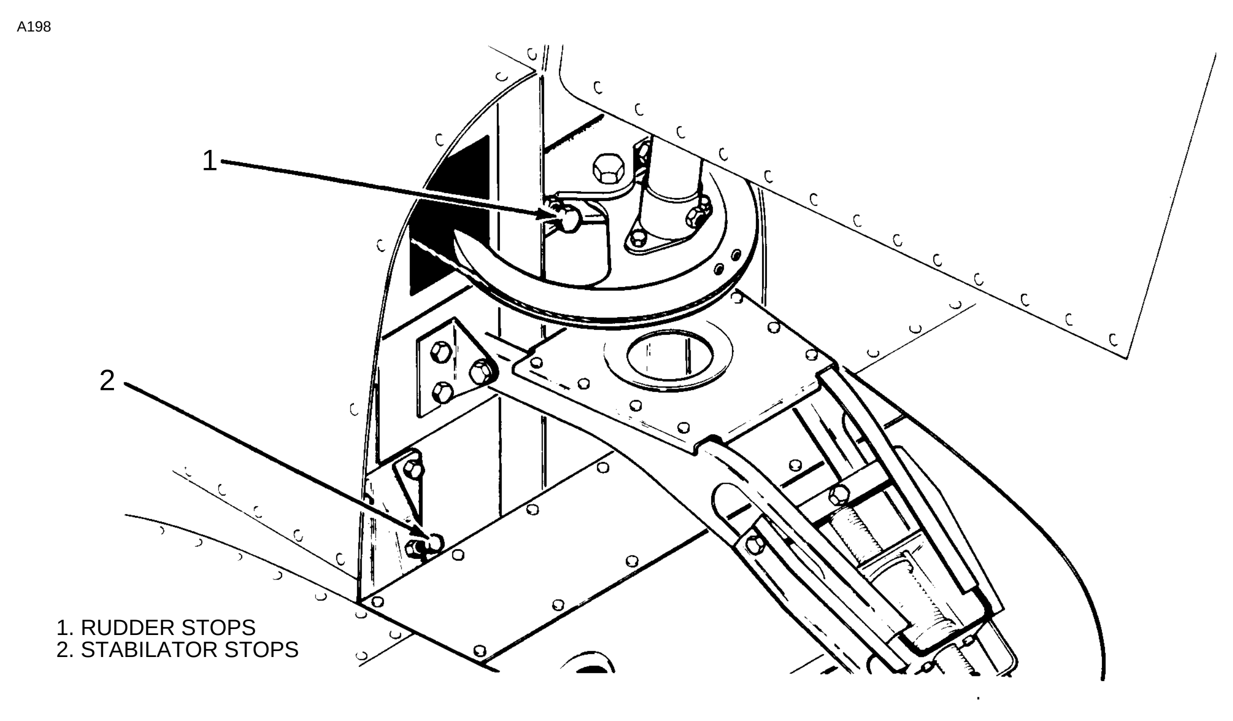


Figure 27-15. Rudder and Stabilator Adjustments

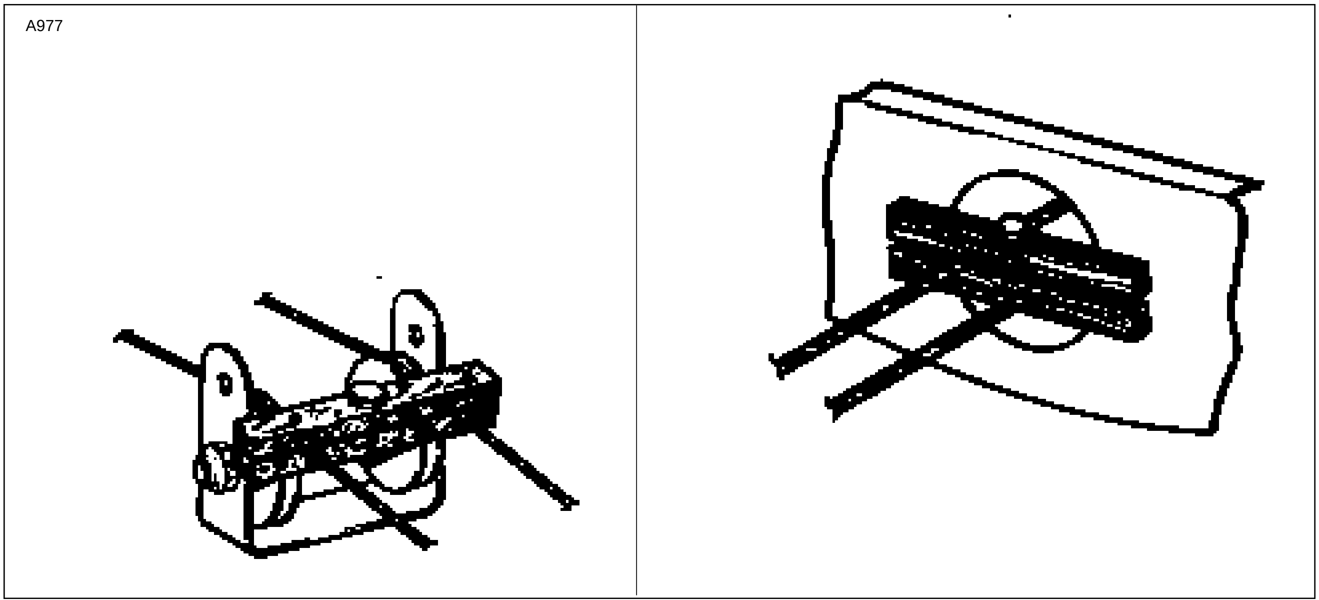


Figure 27-16. Method of Securing Trim Cables

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.
    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.

INSTALLATION OF STABILATOR CONTROL CABLES. (Refer to Figure 27-16.)

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 27-18 and check rigging and adjustment.

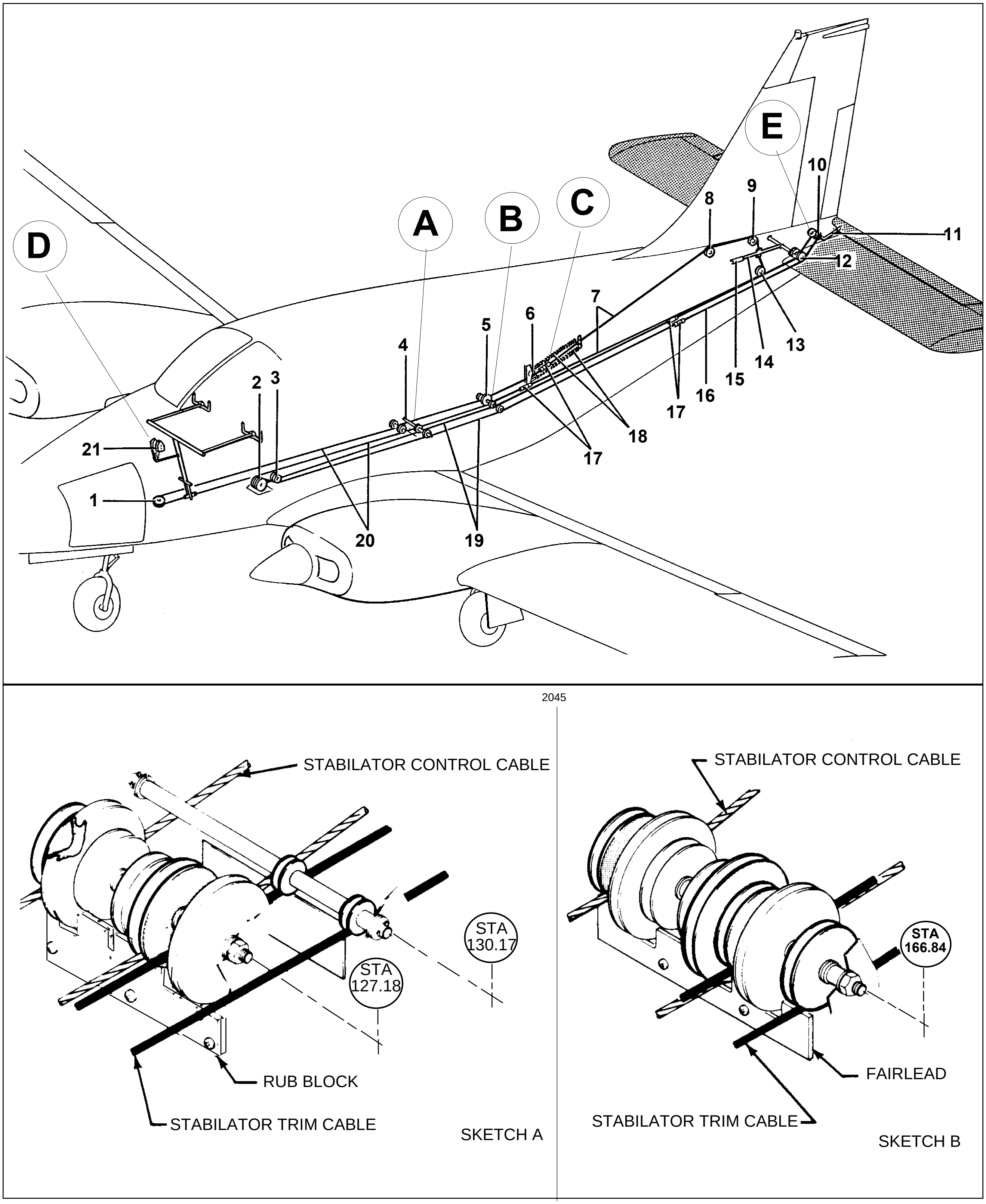
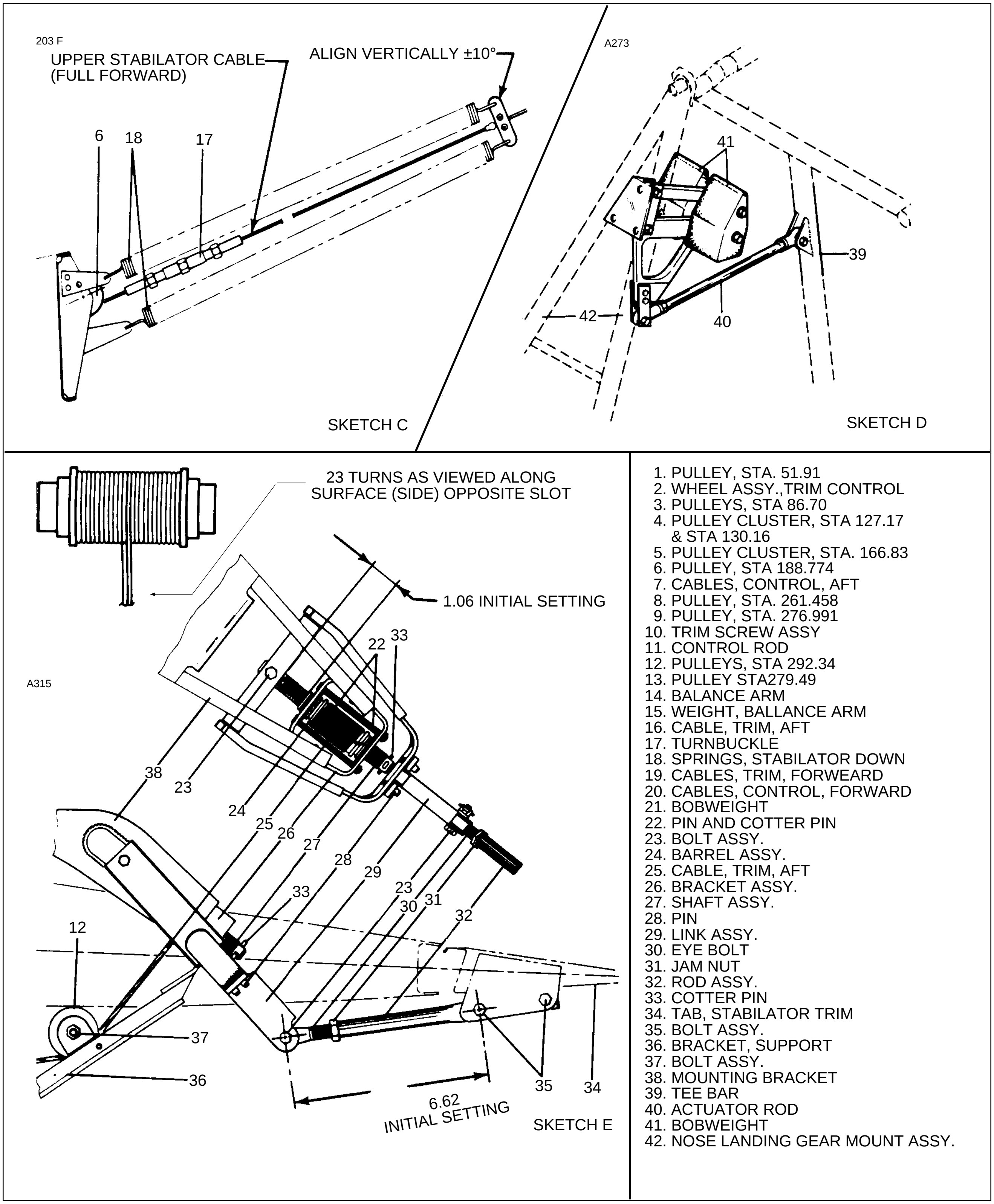


Figure 27-17. Stabilator Controls Installation

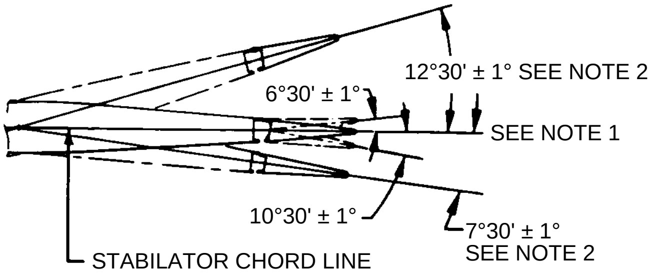


1. PULLEY, STA. 51.91
2. WHEEL ASSY.,TRIM CONTROL
3. PULLEYS, STA 86.70
4. PULLEY CLUSTER, STA 127.17 & STA 130.16
5. PULLEY CLUSTER, STA. 166.83
6. PULLEY, STA 188.774
7. CABLES, CONTROL, AFT
8. PULLEY, STA. 261.458
9. PULLEY, STA. 276.991
10. TRIM SCREW ASSY
11. CONTROL ROD
12. PULLEYS, STA 292.34
13. PULLEY STA279.49
14. BALANCE ARM
15. WEIGHT, BALLANCE ARM
16. CABLE, TRIM, AFT
17. TURNBUCKLE
18. SPRINGS, STABILATOR DOWN
19. CABLES, TRIM, FORWEARD
20. CABLES, CONTROL, FORWARD
21. BOBWEIGHT
22. PIN AND COTTER PIN
23. BOLT ASSY.
24. BARREL ASSY.
25. CABLE, TRIM, AFT
26. BRACKET ASSY.
27. SHAFT ASSY.
28. PIN
29. LINK ASSY.
30. EYE BOLT
31. JAM NUT
32. ROD ASSY.
33. COTTER PIN
34. TAB, STABILATOR TRIM
35. BOLT ASSY.
36. BRACKET, SUPPORT
37. BOLT ASSY.
38. MOUNTING BRACKET
39. TEE BAR
40. ACTUATOR ROD
41. BOBWEIGHT
42. NOSE LANDING GEAR MOUNT ASSY.

Figure 27-17. Stabilator Controls Installation (continued)

j. Connect stabilator down springs and clamps to upper aft stabilator control cable. (See 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.

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 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 LBS.
STABILATOR TAB	14 ± 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

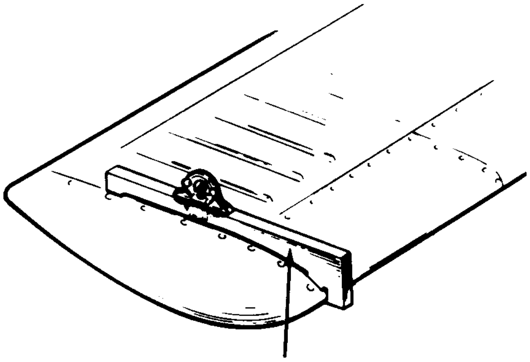


Figure 27-18 Stabilator Rigging

RIGGING AND ADJUSTMENT OF STABILATOR CONTROLS. (Refer to Figures 27-17 and 18)

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 27-18, are measured from the neutral point.

1. Before proceeding with any of the following instructions, level the airplane as described in Chapter 8.

   — 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 27-18. The stabilator travel can be determined using the rigging tool as shown and is described in Chapter 91. To check stabilator travel proceed as follows:

   — NOTE —

   Ensure the stabilator contacts both its stops 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 27-18.
   b. Position the stabilator in neutral and, using a bubble protractor, set the number of degrees up travel as specified in Figure 27-18.
   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 27-18, 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 (refer to Figure 27-7). 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 27-16) 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 27-18.
   d. Adjust the control column-to-bobweight pushrod as necessary to achieve an angle of 25° +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 27-7 for reference.
   e. Remove the control column blocking mechanisms.
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 27-18.
   - 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.

STABILATOR TRIM CONTROLS

REMOVAL OF STABILATOR TRIM ASSEMBLY (FORWARD) (Refer to Figure 27-17.)

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. (Refer to Figure 27-16.)
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.
   - 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 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 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.

INSTALLATION OF STABILATOR TRIM ASSEMBLY (FORWARD). (Refer to Figure 27-17.)

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 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 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.
    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.

REMOVAL OF STABILATOR TRIM CONTROLS (AFT) (Refer to Figure 27-17.)

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.

INSTALLATION OF STABILATOR TRIM CONTROLS (AFT). (Refer to Figure 27-17.**)**

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.
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 27-18 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.

RIGGING AND ADJUSTMENT OF STABILATOR TRIM (Refer to Figures 27-17 and 27-18.)

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 27-13. 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 27-12.
    b. The trim screw is adjusted to an initial length of 1.06 inches as shown in Figure 27-12.
    c. The actuating rod is initially adjusted to 6.62 inches in length as shown in Figure 27-12.
    d. Set the trim cable tension in accordance with Figure 27-13. 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 27-13. 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.
12. Reinstall tail cone.

STALL WARNING

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 10°, or 25° and 40°. To accomplish this, the system utilizes two lift detectors, two micro switches, a horn, and a 5 amp circuit breaker.

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 10° the outboard detector gives the indication of stall, while the inboard detector gives the indication with flaps at 25° or 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 (refer to Figure 27-18). 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.

TROUBLESHOOTING STALL WARNING SYSTEM

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. Refer to 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.

REMOVAL OF LIFT DETECTOR

1. Remove four screws holding the unit in place and remove the unit from the wing.
2. Identify the electrical leads to facilitate reinstallation. Disconnect the electrical leads.

INSTALLATION OF LIFT DETECTOR

1. Attach electrical leads to the appropriate terminals of the lift detector.
2. 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.

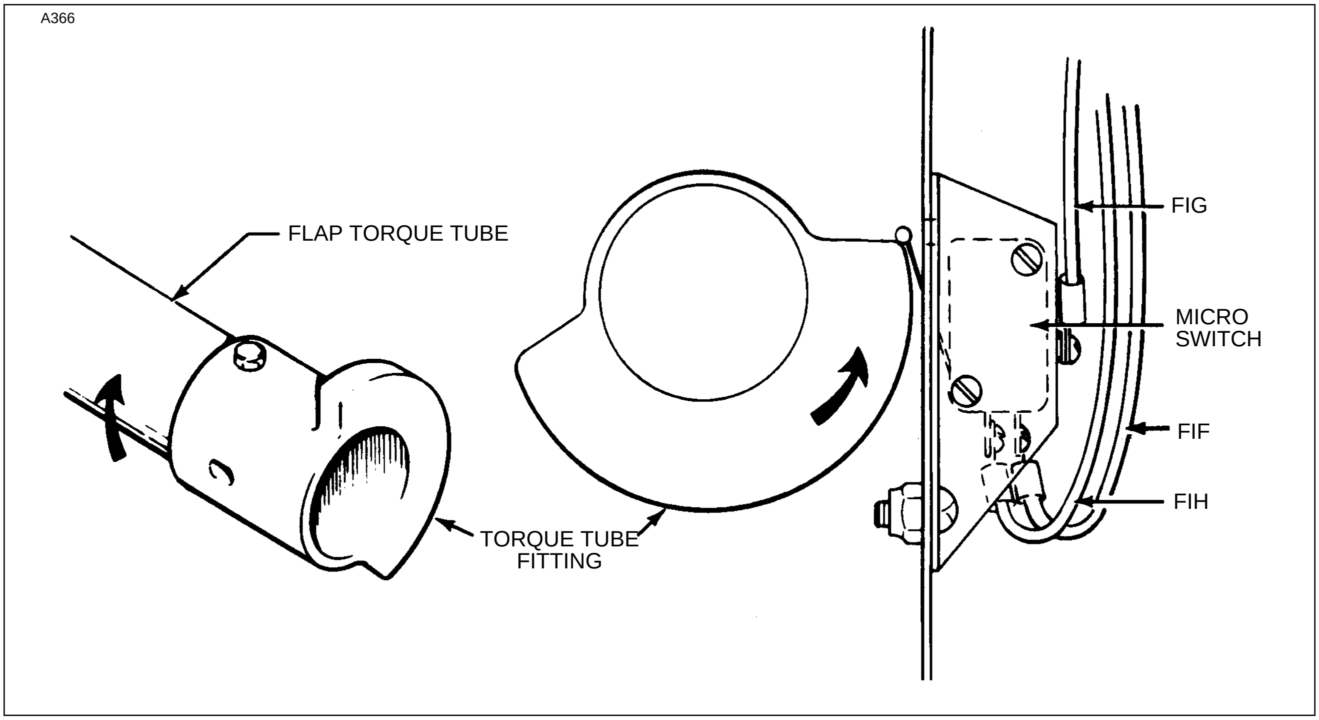


Figure 27-19. Stall Warning Flap Microswitch Adjustment

FLAP CONTROLS

TROUBLESHOOTING

Charts 2706 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 rudder control system for security and operation.

CHART 2706. TROUBLESHOOTING FLAP CONTROL SYSTEM

Trouble	Cause	Remedy
Flaps fail to extend or retract.	Control cable broken or disconnected.	Replace or reconnect control cable.
Flaps not synchronized or fail to move evenly when retracted.	Incorrect rigging of system.	Adjust flaps.

REMOVAL OF MANUALLY OPERATED WING FLAPS (Refer to Figure 27-20.)

1. The flap torque tube assembly may be removed by the following procedure:
   a. Remove the access plate located between the underside of the aft section of each wing and the fuselage by removing attaching screws.
   b. Remove the floor panel located 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 airplane.
   c. The left and right flap control tubes (rods) may be disconnected either at the flaps by removing the nuts, washers and bolts or at the torque tube cranks (arms) by removing the bolts and washers from the inner side of each crank. It will be necessary to remove the bolt through a hole in the side skin of the fuselage. The hole is located over the torque tube when the flap handle is moved to its 40 degree position.
   d. With the flap handle, fully extend the flaps and disconnect the flap tension spring at the spar or the aft end of the control cable as desired.
   e. Grasp the flap handle; release the plunger and allow the flap to return to the retracted position. Use caution as forward pressure will be on the handle with the tension spring disconnected.
   f. Disconnect the flap return spring at the spar or return chain as desired.
   g. Disconnect the control cable from the chain by removing cotter pin, nut, and clevis bolt.
   h. Remove the tube support bearing blocks by removing the block attachment bolts.
   i. Remove the nuts, washers and bolts securing the right and left cranks and stop fittings on the torque tube.
   j. From between each wing and the fuselage, remove the cranks from the torque tube.
   k. Disconnect one bearing block from its mounting brackets by removing nuts, washers and bolts.
   l. Slide the tube from the bearing block still attached to its brackets; raise the end and lift it from the floor opening.
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. Disconnect the flap tension spring from the cable if not previously disconnected by extending the flaps to relieve spring tension.

   c. Retract the flap. Use caution as forward pressure will be on the handle with the spring disconnected.
   d. Disconnect the cable from the chain by removing cotter pin, nut, clevis pin and bushing.
   e. Remove the flap handle bracket and trim control wheel cover.
   f. Remove the aft heat deflectors on each forward floor tunnel by sliding far enough to release the spring fasteners.
   g. Lift the aft section of the tunnel carpet far enough to remove the screws securing the tunnel cover that is between the flap handle and the spar cover. Remove the cover.
   h. Remove the cotter pin cable guard from the flap cable pulley located inside the floor tunnel just ahead of the spar housing.
   i. Remove the cable rub blocks located in the floor opening on the aft side of the spar housing by removing the attachment screws.
   j. Disconnect the cable turnbuckle at the end of the cable by removing cotter pin, nut and bolt.

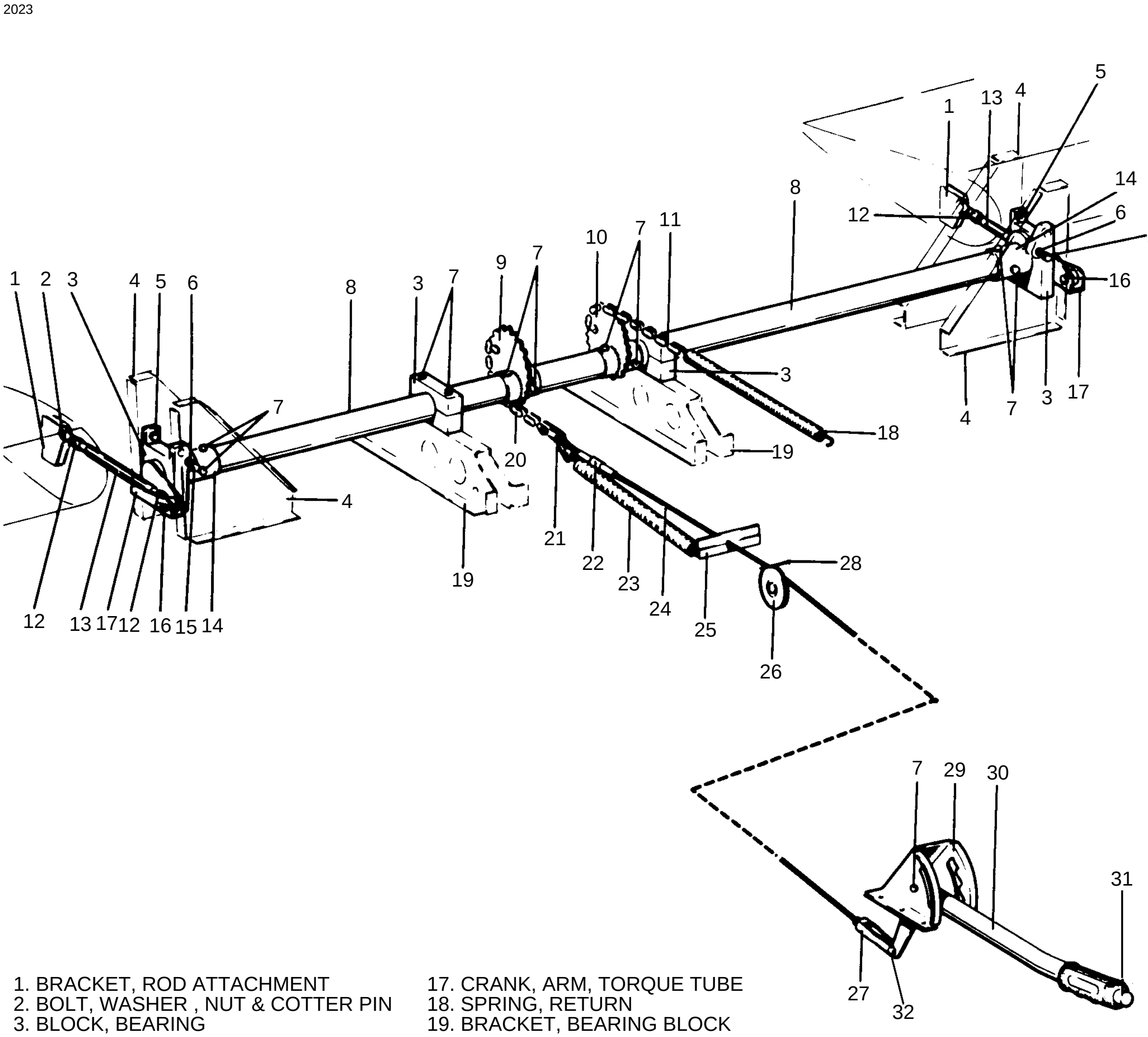
WARNING

REFER TO PIPER SERVICE BULLETIN 965

3. Remove the flap handle and bracket by disconnecting the cable clevis from the handle and removing the bolts securing the bracket to the floor tunnel.

INSTALLATION OF MANUALLY OPERATED WING FLAPS (Refer to Figure 27-20)

1. The flap torque tube assembly may be installed by the following procedure:
   a. Install the chain sprockets and chains on the torque tube.
   b. Slide the tube stop fittings on their respective ends of the torque tube.
   c. Ascertain that one bearing block fitting is installed between its attachment brackets.
   d. Slide the other bearing block over its respective end of the torque tube.
   e. Position the torque tube by placing the end with the bearing block on it between the mounting bracket and sliding the other end into the previously attached bearing block.
   f. Position the remaining bearing block and secure with the appropriate hardware.
   g. Push the torque tube cranks (arms) on each end of the torque tube and slide the stop fitting in place. Align the bolt hole of the crank and stop fitting with the holes in the torque tube and install bolts. The holes in the stop fitting are elongated to allow the stop fitting to be pushed against the bearing blocks thus allowing no side play of the assembly. Tighten the bolt assemblies on the stop fittings.
   h. Install the tube support blocks on their support brackets and secure them with their bolts.
   i. Connect the flap return spring to the return chain and/or at the spar housing.
   j. Connect the control cable end to the tension chain and secure with bushing, clevis bolt, nut and cotter pin.
   k. Pull the flap handle full back and connect the tension spring. Release the flap handle to the forward position.
   l. Connect the flap control tube to the flap and/or torque tube crank and secure. The bolt and bushing that connects the control tube to the crank is installed through a hole in the side of the fuselage located over the torque tube.
2. To install the flap handle with bracket, place the assembly on the floor tunnel and secure with bolts.



1. BRACKET, ROD ATTACHMENT
2. BOLT, WASHER , NUT & COTTER PIN
3. BLOCK, BEARING
4. BRACKET, BEARING BLOCK
5. BOLT, BEARING BLOCK ATTACHMENT
6. LOCKNUT
7. BOLT
8. TORQUE TUBE
9. SPROCKET, TENSION SPRING
10. SPROCKET, RETURN SPRING
11. CHAIN, RETURN SPRING
12. JAM NUT
13. ROD, FLAP CONTROL
14. FITTING, TORQUE TUBE STOP
15. SCREW, FLAP ADJUSTMENT
16. BOLT, WASHER & BUSHING
17. CRANK, ARM, TORQUE TUBE
18. SPRING, RETURN
19. BRACKET, BEARING BLOCK
20. CHAIN, TENSION SPRING
21. CLEVIS BOLT, BUSHING, NUT & COTTER PIN
22. TURNBUCKLE
23. SPRING, TENSION
24. CABLE, FLAP CONTROL
25. RUB BLOCK
26. PULLEY
27. CLEVIS BOLT, NUT, WASHER & COTTER PIN
28. SAFETY COTTER PIN
29. BRACKET, FLAP HANDLE
30. HANDLE, FLAP
31. BUTTON, FLAP RELEASE
32. CLEVIS BOLT ***AND BUSHING (SEE PIPER S.B. 965)***

Firure 27-20. Manually Operated Flap System

3. The flap control cable may be installed by the following procedure:
   a. Attach the cable and turnbuckle to the chain using the clevis bolt assembly. Ascertain that the turnbuckle end is free to rotate on the chain. If the chain is not installed because of the torque tube assembly being removed, install the assembly in accordance with instructions given in Step 1 of this subject.
   b. Route the cable through the tunnel and spar housing.
   c. Install the cable rub blocks on the aft side of the spar housing and secure with screws.d. Install the cotter pin cable guard over pulley located just ahead of the spar housing in the forward floor tunnel.

WARNING

CHECK THAT BUSHING (PIPER P/N 6390-174) HAS BEEN INSTALLED. REFER TO PIPER SERVICE BULLETIN 965

   e. Attach the end of the cable to the flap handle arm and secure using the clevis bolt, washer, nut, and cotter pin. . Adjust cable tension with handle in the FLAPS UP position.
   f. Pull the flap handle full back and connect the tension spring to the cable end.
4. Install the tunnel cover and secure with screws. Also, the tunnel carpet and bracket cover.
5. Install the floor panel and seat belt attachments. Secure with screws and install seats.

RIGGING AND ADJUSTMENT OF MANUALLY OPERATED FLAPS (Refer to Figure 27-21.)

1. As applicable, remove the floor panel just aft of the main spar.
2. Make sure the flap handle is in its full forward position.
3. Back off the left hand torque tube stop screw, and adjust the stop screw on the right hand torque tube until approximately 0.60 inch is obtained between the stop fittings and bearing block. Adjust other screw as necessary.

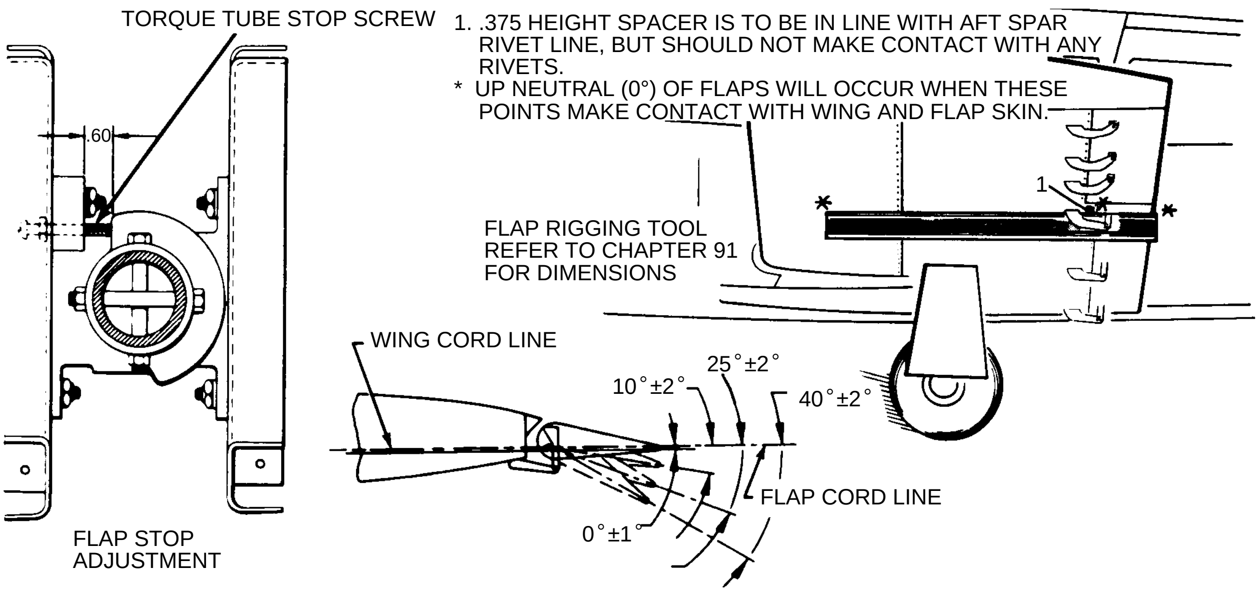


Figure 27-21. Rigging of Manual Flap Controls

4. With a 0.125 spacer between the right hand stop screw and stop fitting, apply a down pressure on top of flap to see if flap will come down. If flap extends, turn adjustment screw out a few threads at a time until flap remains in the up locked position, and tighten jam nut.
5. Remove the 0.125 spacer..
6. With the right hand stop screw against the stop, adjust the left hand stop screw to contact the stop. Make sure to tighten the jam nut.
7. Adjust the cable turnbuckle only as necessary to remove all slack. Do not tighten cable to the point that the stop screw comes off the stop.
8. To check up-neutral position of the flaps, place a flap rigging tool as shown in Figure 27-21 against the underside of the wing and flap as close as possible to the outboard end of the flap without contacting any rivets. The tool must be positioned parallel with the wing ribs with the aft end of the tool even with the trailing edge of the flap. (This tool may be fabricated from dimensions given in Chapter 91.)
9. With the flap control rod connected between the torque tube crank arm and the flap, check that the surface of the wing contacts the tool at its forward surface and at the spacer, and the aft end of the flap contacts the aft end of the tool. The flap is neutral at this position.
10. Should the three points not contact, loosen the jam nuts on each end of the control rod and rotate the rod until the three points contact. Apply a slight up pressure, enough to take slack out of linkage, against the trailing edge of the flap while making this adjustment. After adjustment, retighten the jam nuts.
11. Check and adjust the other flap in a like manner.

—NOTE—

In the event of wing heaviness during flight, the flap on the side of the heavy wing can be adjusted down from neutral to remedy this condition by lengthening the control rod. Check the inspection hole in each rod end to ascertain that there are sufficient threads remaining and a wire cannot be inserted through these holes. Do not raise the flap of the other wing above neutral.

12. Check the flap for full down travel to the degrees required in Figure 27-21. Should the travel not be as that required, readjust the torque tube stop screw in or out as required. After readjusting the screw, it will be necessary to review Steps 4 thru 11.
13. Check operation of the flap and flap handle ratchet mechanism.
14. Install access plates and panels.

REMOVAL OF ELECTRICALLY OPERATED WING FLAPS (Refer to Figure 27-22.)

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.

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.

INSTALLATION OF ELECTRICAL OPERATED WING FLAPS (Refer to Figure 27-22)

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.

1. CABLE ASSEMBLY
2. PULLEYS
3. BRACKET, FLAP SELECTOR DETENT
4. FLAP INDICATOR LIGHT ASSY.
5. FLAP SELECTOR LEVER ASSY.
6. BRACKET
7. RETAINER, TORQUE TUBE
8. COTTER PIN
9. PULLEY, FLAP TORQUE TUBE
10. SWITCHES
11. WASHERS
12. LEVER, SWITCH MOUNTING
13. TORQUE TUBE ASSY.
14. CAM, FLAP TORQUE TUBE
15. RELAYS, FLAP ACTUATOR
16. BELLCRANCK ASSY.
17. COVER, FLAP ACTUATOR
18. FLAP ACTUATOR
19. FLAP ACTUATOR MOTOR
20. ACTUATOR MOUNTING BRACKET

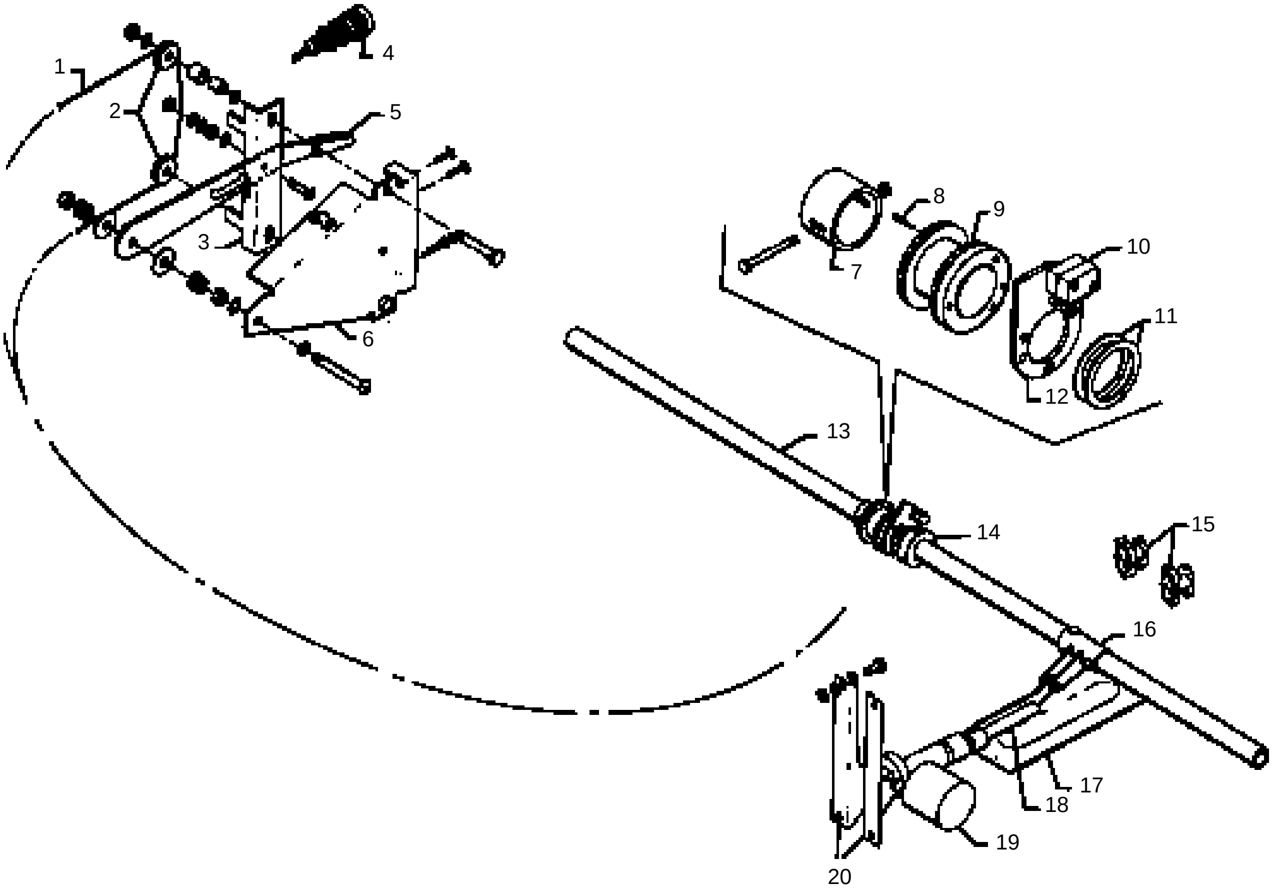


Figure 27-22. Electrically Operated Flap System

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.
  - 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.

RIGGING AND AJUSTMENT OF ELECTRICALLY OPERATED WING FLAPS:

CONTROL CABLE RIGGING (Refer to 27-23)

1 Loosen lever cable clamp nut so that cable can move freely through cable clamp. Secure lever in the full down position. (Refer to Figure 27-23).

2 Position the swash plate assembly on torque tube and secure inplace. (Refer to Figure 27-23.)

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. (Refer to Figure 27-24.)

4 Tighten lever cable lamp nut so that cable is compressed to 1/2 its full diameter. (Refer to Figure 27-23.)

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. (Refer to Figure 27-24.)
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. (Refer to Figure 27-24.)

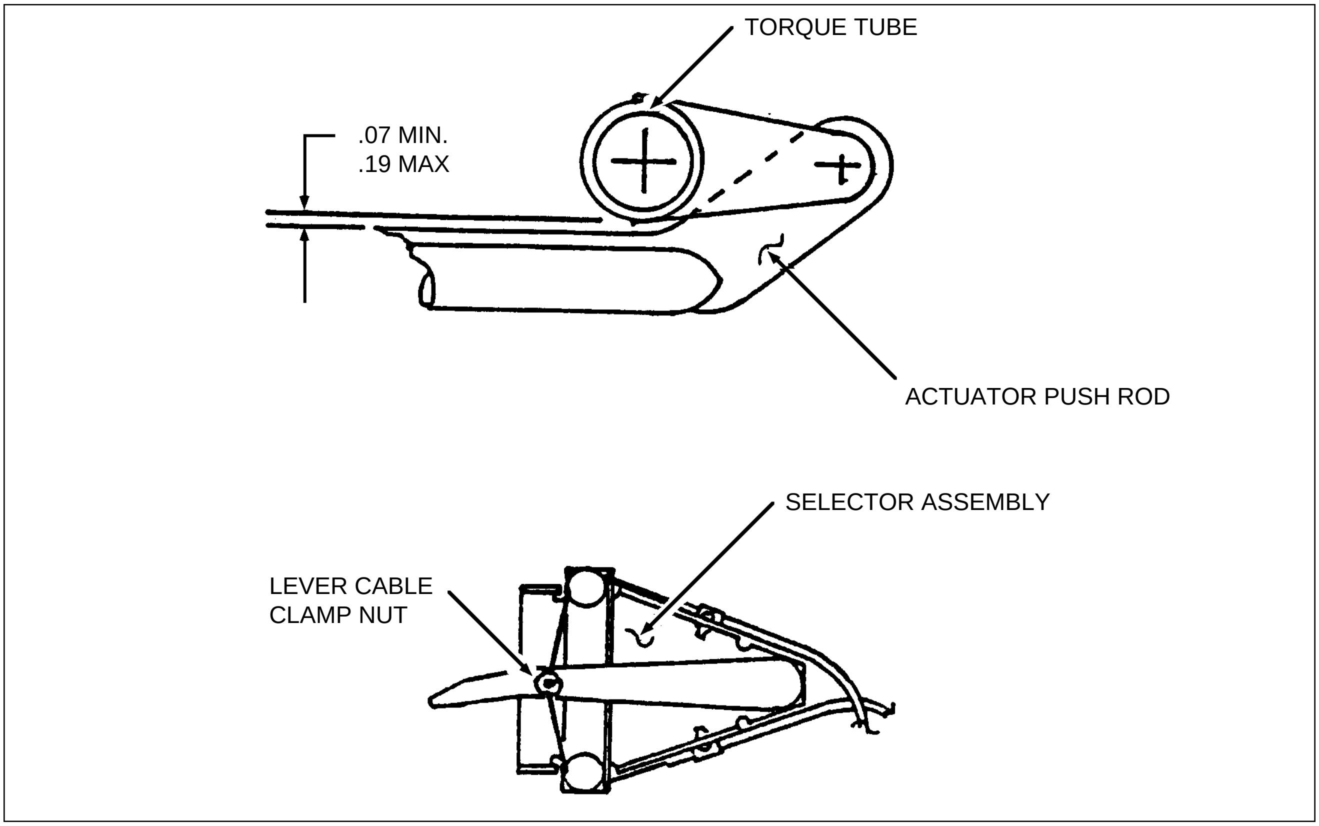


Figure 27-23. Rigging of Electric Flap Controls

— NOTE —

Ensure that the switch rollers are in the cam “null point” as shown in Figure 27-23 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 .4 inch short of bottoming out.
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. (Refer to Figure 27-23.)
11. Adjust the left and right stop screws so that contact is just made with the stop. Tighten the jamb nuts. (Refer to Flap Stop, Figure 27-25.)

FLAP ANGLE SETTING

1. With the flap selected UP, adjust each flap pushrod so that the chord line of the flap forms a 0° ± 1° angle with the wing chord at the outboard end of the flap.

— 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.

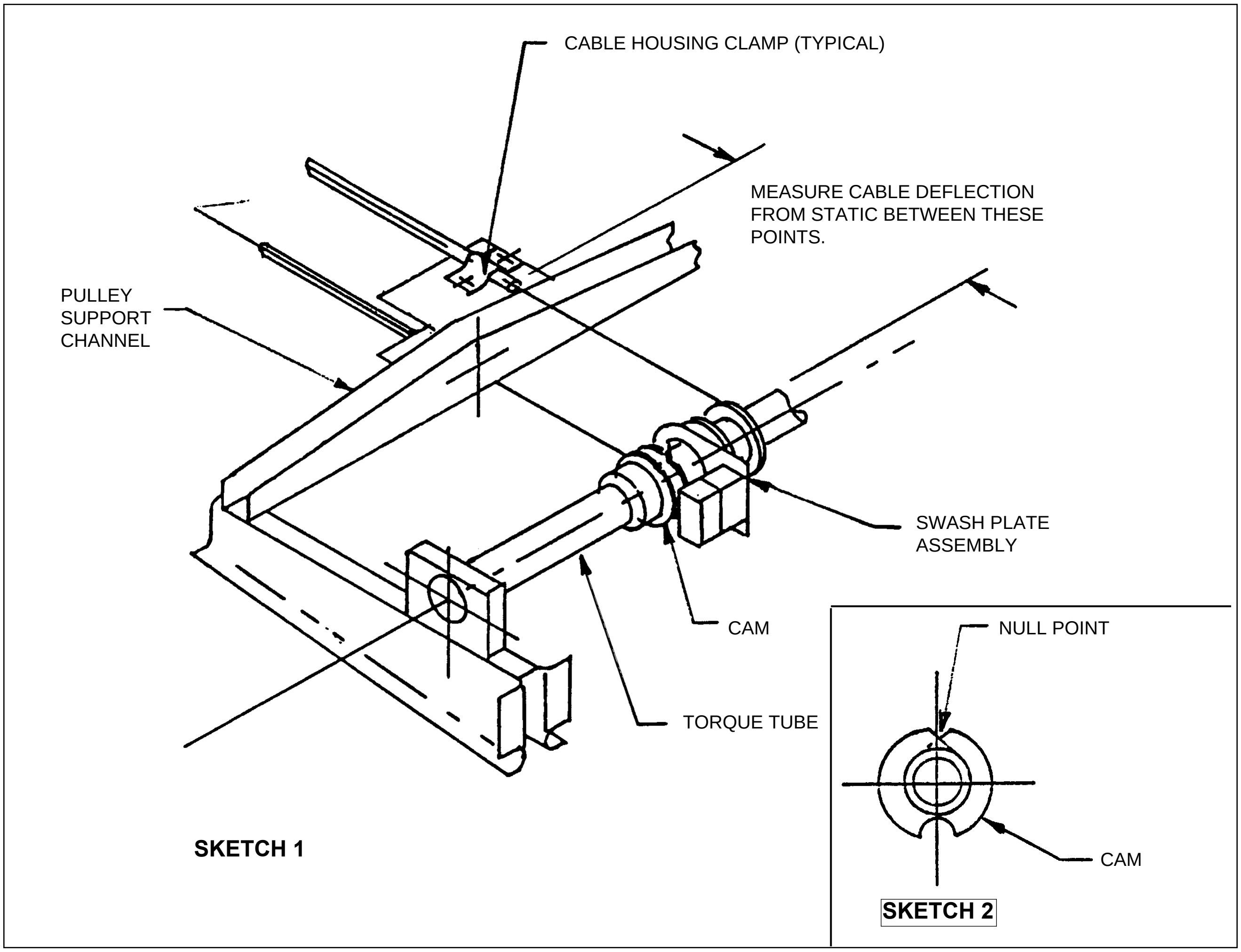


Figure 27-24 Rigging of Flap Cam-Cable Assembly

FLAP TRAVEL CHECK

While maintaining a light “up” pressure on the underside of the flap, check that the flap travel is:

1. 0° ± 1° in full UP position.
2. 10° ± 2° at the FIRST stop.
3. 25° ± 2° at the SECOND stop.
4. 40° ± 2° at the full DOWN position.

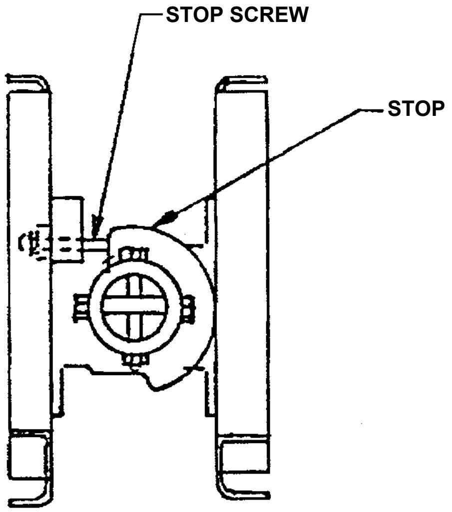


Figure 27-25 Stop Screws Adjustment

GRIDS 2E6 THRU 2E10
INTENTIONALLY LEFT BLANK

CHAPTER

28

FUEL

CHAPTER 28- FUEL

TABLE OF CONTENTS/EFFECTIVITY

CHAPTER 28- FUEL

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

This chapter to provides information for the maintenance of repairable components of the fuel system. A troubleshooting section is included to assist in isolating and correcting troubles which may occur.

DESCRIPTION AND OPERATION

The fuel system is actually made up of two individual systems, one for each engine. Crossfeed lines are included, providing a source of fuel from one side to the other when needed and selected.

The ***Seneca III*** standard system consists of two aluminum fuel tanks in each wing that form an integral part of the wing surface. The two aluminum tanks are interconnected providing each side with 49 U. S. gallons and a total capacity for the aircraft of 98 U. S. gallons. A bladder cell interconnected between the two tanks, makes up the optional system, providing each wing with a capacity of 64 U. S. gallons, giving a total capacity of 128 U. S. gallons.

The ***Seneca IV*** standard system consists of two aluminum fuel tanks and a bladder cell in each wing. The aluminum fuel tanks form an integral part of the wing surface. The two aluminum fuel tanks and bladder cell in each wing are interconnected providing each wing with a capacity of 64 U. S. gallons, giving a total capacity of 128 U. S. gallons.

On ***Seneca III*** airplanes, fuel quantity transmitters are mounted in the inboard and outboard aluminum tanks on both the standard and optional systems. The transmitters are interconnected to their respective side on a dual gauge. The gauge senses the total resistances sent by the transmitters and thereby indicates the level of fuel.

On ***Seneca IV*** airplanes, fuel quantity transmitters are mounted only in the inboard and outboard aluminum tanks. The transmitters are interconnected on their respective side to a single fuel quantity gauge with dual (LEFT and RIGHT) indications. The gauge senses the total resistances sent by the transmitters and thereby indicates the level of fuel.

With the tanks interconnected, fuel for the respective engine is taken off the inboard tank. Fuel, drawn by one of the engines or electric pumps, leaves the inboard tank through a finger strainer to the fuel selector valve. The fuel is directed by the valve either to crossfeed or to its specific engine. From the selector valve, fuel goes through a filter to the electric pump and into the engine driven pump which supplies fuel pressure to the metering unit.

A fuel flow gauge showing both left and right flow rates is located on the pilot’s side of the instrument panel. The gauge is connected to a vent line from the intake manifold and to the fuel manifold valve. Each engine has an engine driven fuel pump that is part of the fuel injection system. An auxiliary fuel system is provided to supply fuel to the engine in case of engine driven fuel pump failure or malfunction, for ground and inflight starting, and for vapor suppression. The two auxiliary fuel pump switches are located on the lower left instrument panel and consist of, three position, rocker type switches, (LO, HI and center OFF). The LO auxiliary fuel pressure is selected by pushing the top of the switch. The Hi auxiliary fuel pressure is selected by pushing the bottom of the switch. To prevent accidental activation of the Hi position, a switch guard must be unlatched before the switch is placed in the Hi position. When the Hi auxiliary fuel pump is activated, an amber light near the annunciator panel is illuminated for each pump. These lights dim whenever the pump pressure reduces automatically due to the manifold pressure dropping below approximately 21 inches.

In case of a failed engine driven fuel pump, auxiliary fuel pressure may be selected. Adequate pressure and fuel now will be supplied for up to approximately 75% power. Manual leaning to correct fuel flow will be required at altitudes above 15,000 feet and for rpm’s less than 2300. An absolute pressure switch automatically selects a lower fuel pressure when the throttle is reduced below 21 in. Hg manifold pressure and the Hi auxiliary fuel pump is on.

— CAUTION —

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.

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.

An cold weather primer system is available as an option on the ***Seneca III***; the primer system is standard on the ***Seneca IV***. Primer operation is accomplished with two separate spring.loaded OFF. primer 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.

Seneca III airplanes equipped with an optional engine primer system, as a result of having installed Piper Service Kit No. 761 094, will have the primer switch location and actuation the same as the standard airplane. However. this system includes several parts not found in the standard airplane, but which make up an integral part of the engine fuel system. These components are: an electrically operated diverter valve, located on the engine in the metered fuel supply line between the air throttle valve and the manifold valve; two primer nozzles, located in the intake manifold on each side of the engine; interconnecting fuel lines; and fine wire spark plugs. Actuation of the engine primer switch operates the auxiliary electric fuel pump on HI and energizes the diverter valve which supplies fuel to each primer nozzle in the intake manifold. The diverter valve does not shut off all fuel flow to the manifold valve therefore some quantity of fuel is also supplied to each cylinder nozzle during priming. Operation of the auxiliary fuel pump on HI and LO is unchanged.

TROUBLESHOOTING

Troubles peculiar to the fuel system are listed in chart 2801 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.

CHART 2801. 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.

CHART 2801. TROUBLESHOOTING FUEL SYSTEM (continued)

Trouble	Cause	Remedy
	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.

— NOTE —

Refer to Chart 7101 for additional Fuel System Troubleshooting.

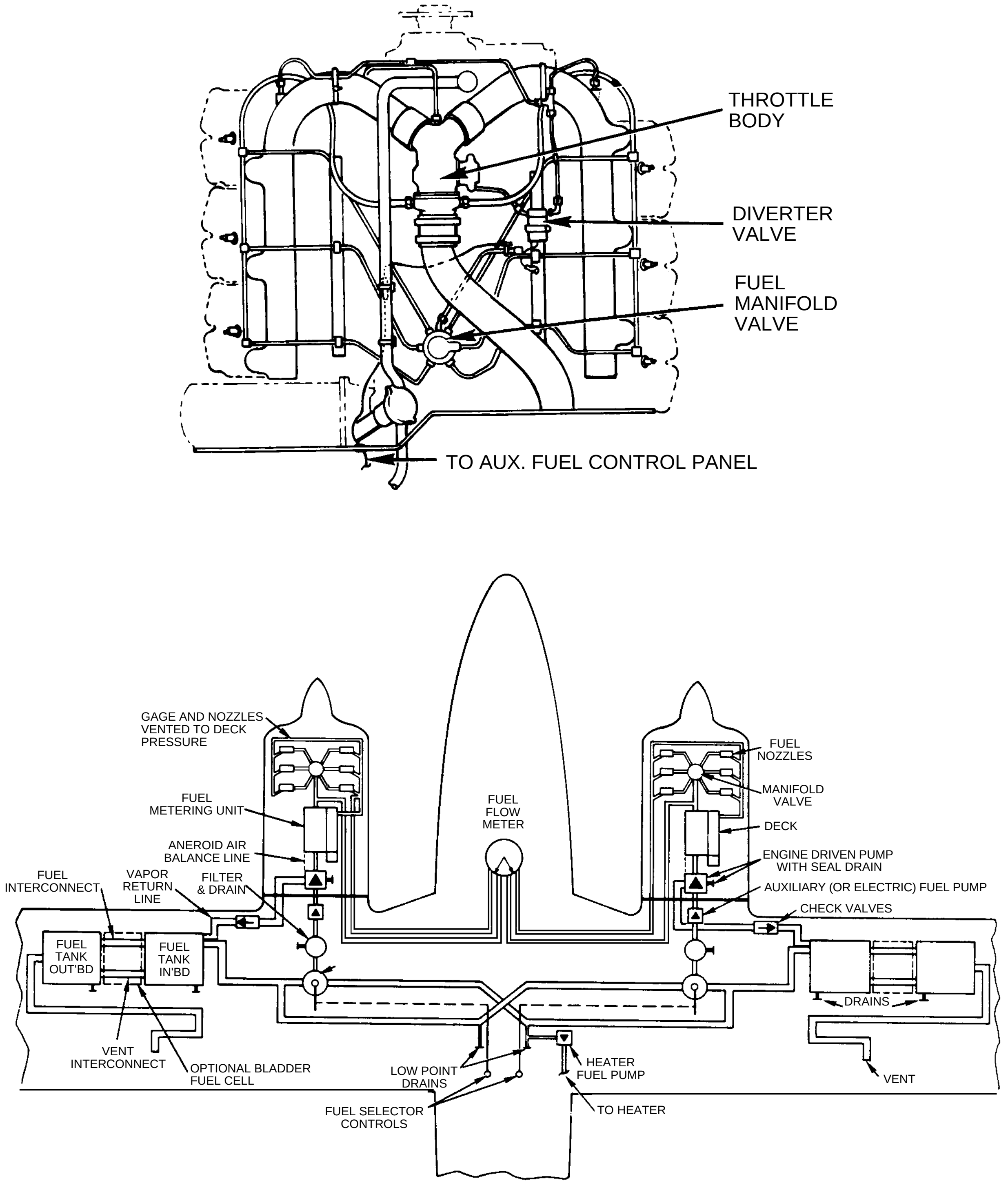


Figure 28-1. Fuel System Schematic

STORAGE

INSPECTION AND REPAIR OF FUEL TANKS

– WARNING –

If drain valves are removed to drain tanks, apply Parker Hannifin thread lube, Piper code no. 913 224, to male pipe threads before installing. Do not allow lubricant to enter fuel system.

Completely drain fuel tanks. (Refer to Draining Fuel Systems, Chapter 12.) 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: (Refer to Repair of Fuel Cells for repairing bladder-type outboard tanks.)

– WARNING –

Sloshing of fuel tanks not approved

(1) 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.

(2) Seal leaks with Products Research Corporation PR 1422A series or PR1433G series sealant. For example: PR1422A1

REMOVAL OF INBOARD FUEL TANK

1. Locate and remove cover from access hole located on underside of wing between Wing Station 138 and Wing Station 161.
2. With fuel completely drained from tank, loosen clamps at hose connections on fuel line and fuel vent line. Slide hose connections away from fuel tank.
3. Remove screws from around the perimeter of the tank. Carefully pull tank away from the wing far enough to gain access to/and remove sender wire and fuel line.
4. The tank is now free to be removed.

INSTALLATION OF INBOARD FUEL TANK.

1. Position fuel tank in its recess in the wing. Connect fuel line and fuel sender wires. Slide tank completely into position and secure with screws around its perimeter.
2. Using access hole located on underside of wing, slide hose on interconnecting fuel line and fuel vent line into position and tighten clamps.
3. Fill fuel tanks and check for leaks, unrestricted fuel flow, accurate sender indications on fuel quantity gauge, and security of attachment of ground wire to interconnecting fuel line, fuel vent line and wing rib at Wing Station 138.

OUTBOARD FUEL TANK

REMOVAL OF OUTBOARD FUEL TANK

1. Using the same access hole described in “Removal of Inboard Fuel Tank” and, with fuel completely drained from the tank, loosen clamps at hose connections on fuel line and fuel vent line. Slide hose connections away from fuel tank.
2. Remove screws from around the perimeter of the tank. Carefully pull tank away from the wing far enough to gain access to remove sender wires and fuel vent line located on outboard side of tank.
3. The tank is now free to be removed.

— NOTE —

In the event the interconnecting fuel line and fuel vent line are being removed, it will be necessary to first disconnect the ground wire attached to the rib at Wing Station 138.00.

INSTALLATION OF OUTBOARD FUEL TANK

1. Position fuel tank in its recess in the wing. Connect vent line on outboard side and fuel sender wires. Slide tank completely into position and secure with screws around its perimeter.
2. Using access hole located on underside of wing, slide hose on interconnecting fuel vent line into position and tighten clamps.
3. Slide hose connection on interconnecting fuel line into position and tighten clamps.
4. Fill the fuel tank and check for leaks and unrestricted fuel flow, accurate sender indications on fuel quantity gauge, and security of attachment of ground wire to interconnecting fuel line, fuel vent line and wing rib at Wing Station 138.00.

INBOARD FUEL TANK (Optional Fuel Cell Installed.)

REMOVAL OF INBOARD FUEL TANK (Optional Fuel Cell Installed.)

1. Remove optional fuel cell before proceeding. Refer to the appropriate paragraph.
2. With fuel tank completely drained, remove screws from around perimeter of the tank. Carefully pull tank away from the wing far enough to gain access to and remove sender wire and fuel line.
3. The tank is now free to be removed.

INSTALLATION OF INBOARD FUEL TANK (Optional Fuel Cell Installed.)

1. Position fuel tank in its recess in the wing. Connect fuel line and fuel sender wires. Slide tank completely into position and secure with screws around its perimeter.
2. Install optional fuel cell.
3. Fill fuel tanks and check for leaks, unrestricted fuel flow, accurate sender indications on fuel quantity gauge.

OUTBOARD FUEL TANK (Optional Fuel Cell Installed.)

REMOVAL OF OUTBOARD FUEL TANK (Optional Fuel Cell Installed.)

1. Remove optional fuel cell before proceeding.
2. With fuel completely drained from the tank, remove screws from around the perimeter of the tank. Carefully pull tank away from the wing far enough to gain access to remove sender wires and fuel vent line located on outboard side of tank.
3. The tank is now free to be removed.

INSTALLATION OF OUTBOARD FUEL TANK (Optional Fuel Cell Installed.)

1. Position fuel tank in its recess in the wing. Connect vent line on outboard side and fuel sender wires. Slide tank completely into position and secure with screws around its perimeter.
2. Install optional fuel cell.
3. Fill the fuel tank and check for leaks, unrestricted fuel flow and accurate sender indications on fuel quantity gauge.

OPTIONAL FUEL CELL

REMOVAL OF OPTIONAL FUEL CELL (Refer to Figure 27-2.)

— WARNING —

OBSERVE ALL FUEL SYSTEM FIRE HAZARD PRE-CAUTIONS THROUGHOUT ALL REMOVAL OR INSPECTION PROCEDURES. USE VAPOR-PROOF LIGHT FOR INSPECTION.

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.
6. Carefully fold fuel cell and remove through fuel cell access hole.

— NOTE —

Pad edges of access hole to prevent possible damage to fuel cell.

INSTALLATION OF OPTIONAL FUEL CELL (Refer to Figure 27-2.)

— WARNING —

OBSERVE ALL FUEL SYSTEM FIRE HAZARD PRECAUTIONS THROUGHOUT ALL INSTALLATION OR INSPECTION PROCEDURES. USE VAPOR-PROOF LIGHT FOR INSPECTION.

1. Before installing fuel cell inspect airframe cavity for cleanliness.
2. Place fuel cell into airframe cavity through access opening. Make sure no wrinkles exist in fuel cell upon installation.

— NOTE —

Pad edges of access hole to prevent possible damage to fuel cell.

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 28-2. Place access panel over opening and secure with screws. Torque to 25 in. lbs.
9. Reinsert wing plugs in openings on underside of wing.
10. Service fuel tanks and inspect for leaks.

MAINTENANCE OF FUEL CELLS

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.

—WARNING—

USE A VAPOR-PROOF LIGHT FOR INSPECTION.

CLEANING AND INSPECTION OF FUEL CELLS (continued)

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.

FUEL CELL COMPARTMENT

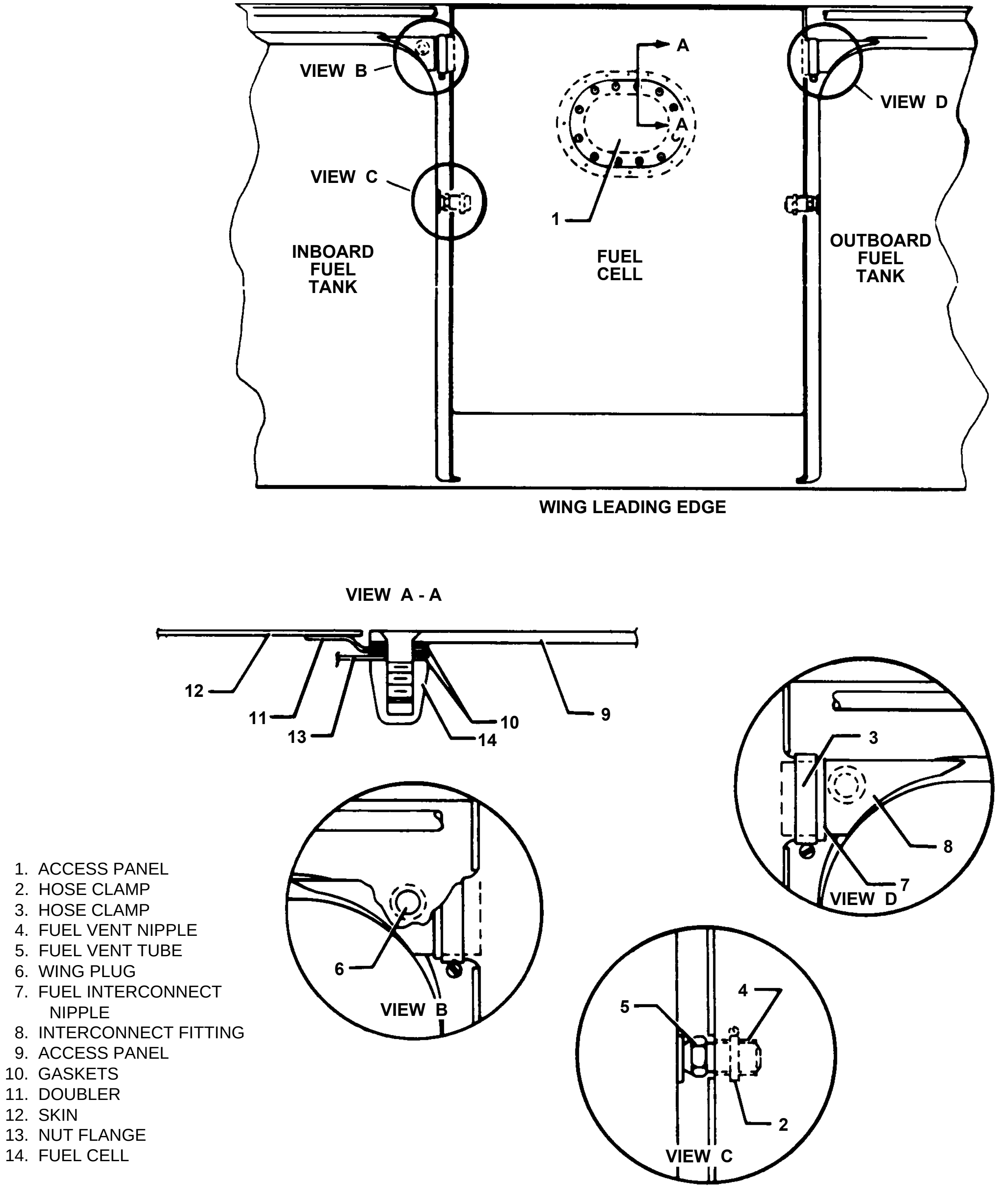
1. Thoroughly clear the cell compartment of all fittings, trimmings. Loose washers, bolts or nuts.
2. Round off all sharp edges of the fuel cell compartment.
3. Inspect the fuel cell compartment just prior to fuel cell installation.
4. Tape over all sharp edges and all rough rivets.

HANDLING AND STORAGE OF FUEL CELLS

— WARNING —

DO NOT PERMIT SMOKING OR OPEN FLAME NEAR REPAIR AREA OR 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.
   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.



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

Figure 28-2. Fuel Cell Installation

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.

— 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 6°F, air cure for 92 hours instead of 72 hours.

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.

REPAIR PROCEDURES FOR GOODYEAR VITHANE FUEL CELLS

— NOTE —

The repair of Goodyear Vithane fuel cells is restricted to authorized personnel. Authorized personnel are those who have been certified and tried by Goodyear representatives, or those who have received their training from persons who have been certified and trained by Goodyear representatives.

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.
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).
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 Goodyear Tire & Rubber Company, Rockmart, Georgia, for repair.

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.

FUEL CELL REPAIR EQUIPMENT INFORMATION

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 Toruqes (in.-lb.)
1/4" - 1/2"	12 - 16
3/4" - 1"	15 - 20
1 1/2"	25 - 30
2"	30 - 35
3"	35 - 40

— NOTES —

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.

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.

— 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.

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.

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.

TESTING FUEL CELLS

Either of the following test procedures may be used to detect leaks in the bladder cells.

1. Soap Suds Test.
    a. Attach test plates to all fittings.
    b. Inflate the cell with air to a pressure of 1/4 psi MAXIMUM.
    c. 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.
    d. After test, remove all plates and wipe soap residue from the exterior of the cell.
2. Chemical Test.
    a. Attach test plates to all fitting openings except one.
    b. 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.

c. 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.
d. Inflate the cell with air to a pressure of 1/4 psi MAXIMUM, and maintain pressure for fifteen minutes.
e. 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.
f. 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 resoaking the cloth in the solution.
g. 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.

After the test, remove all plates and test equipment. Allow the cell to air out.

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.

— NOTE —

The chemical test is the more sensitive and the preferred test.

FLUSH FUEL CAP MAINTENANCE (Refer to Figure 28-3)

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. 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.

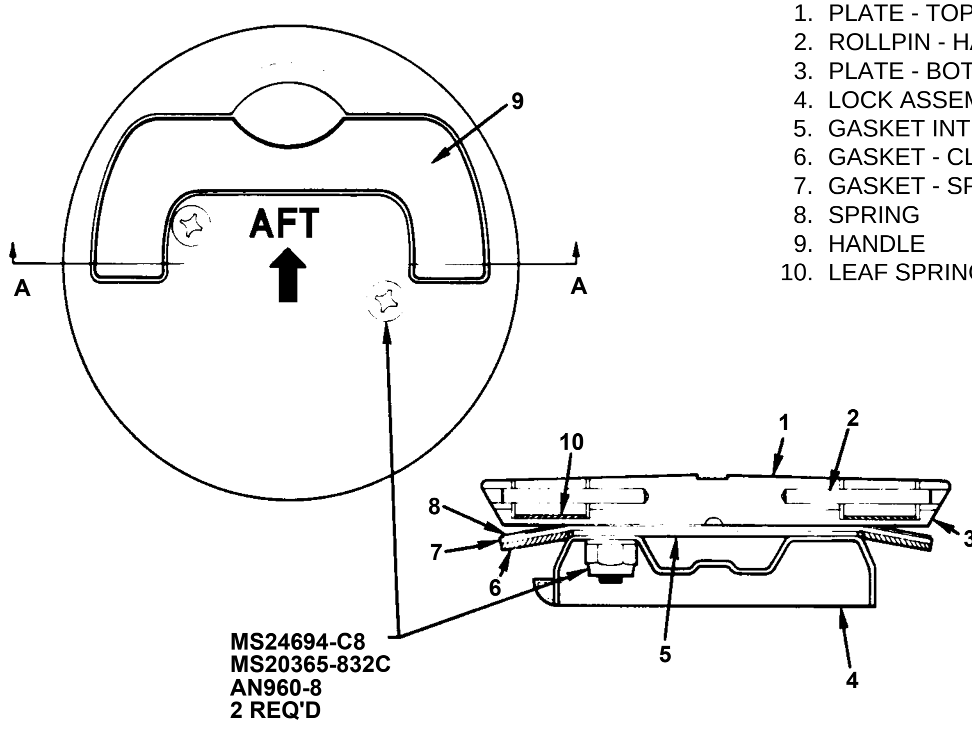
The cap should be reassembled as follows:

1. Reinstall 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.

LOCKING FUEL CAP

DISASSEMBLY OF LOCKING FUEL CAP (Refer to Figure 28-4)

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.



1. PLATE - TOP
2. ROLLPIN - HANDLE HINGE/MOUNT
3. PLATE - BOTTOM
4. LOCK ASSEMBLY
5. GASKET INTERNAL/LOCK
6. GASKET - CLOSING SEAL
7. GASKET - SPRING
8. SPRING
9. HANDLE
10. LEAF SPRING - HANDLE

Figure 28-3. Flush Fuel Cap Assembly

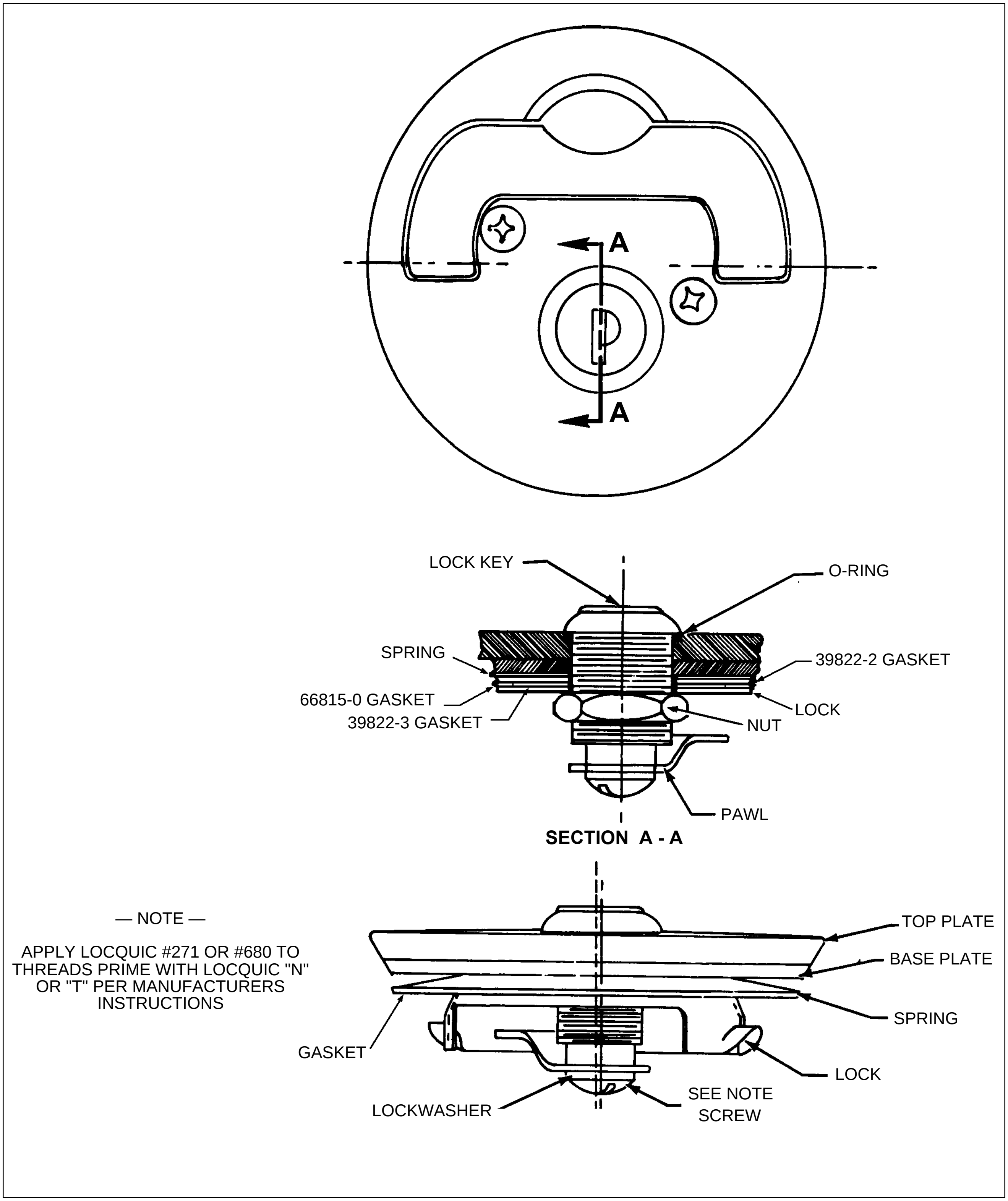
4. Slide lock, gaskets and spring over the back of the key lock.
5. The key lock may be removed by removing the O-ring and pushing the key lock through the cover. Ensure that the teflon lock gasket is not lost.

ASSEMBLY OF LOCKING FUEL CAP

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.

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.

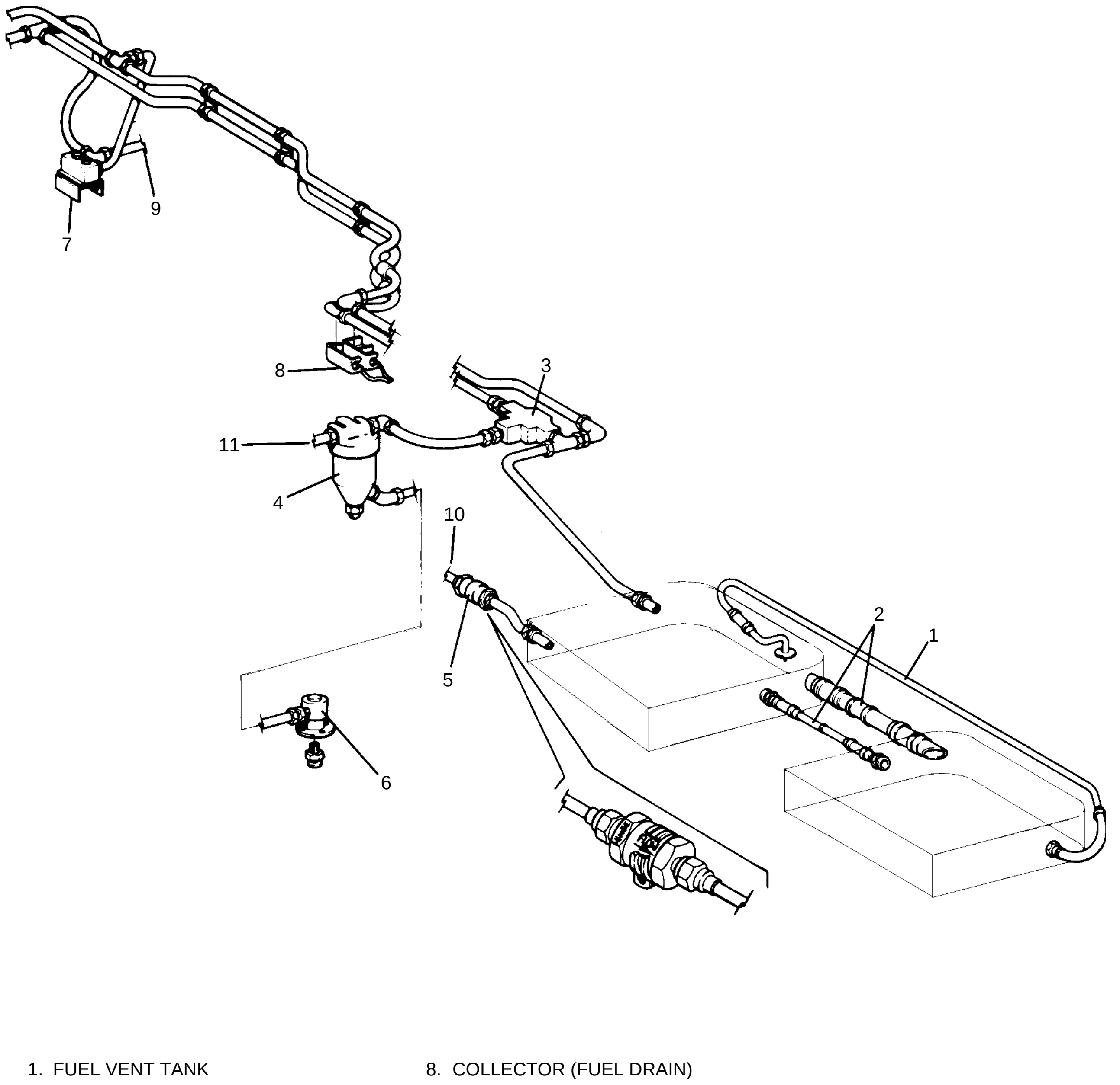


— NOTE —

APPLY LOCQUIC #271 OR #680 TO THREADS PRIME WITH LOCQUIC "N" OR "T" PER MANUFACTURERS INSTRUCTIONS

Figure 28-4. Installation of Locking Fuel Cap

DISTRIBUTION



1. FUEL VENT TANK	8. COLLECTOR (FUEL DRAIN)
2. FUEL TANK INTERCONNECT TYBE	9. DRAIN
3. FUEL SELECTOR VALVE	10. TUBE (VAPOR RETURN)
4. FUEL FILTER	11. TUBE (TO PUMP)
5. CHECK VALVE	12. HANDLE (DRAIN VALVE)
6. FUEL DRAIN	13.VALVE ASSEMBLY
7. MANIFOLD (FUEL DRAIN)	14. DALE (CONTROL BOOT VALVE)

Figure 28-5. Fuel Vent and Vapor Return System

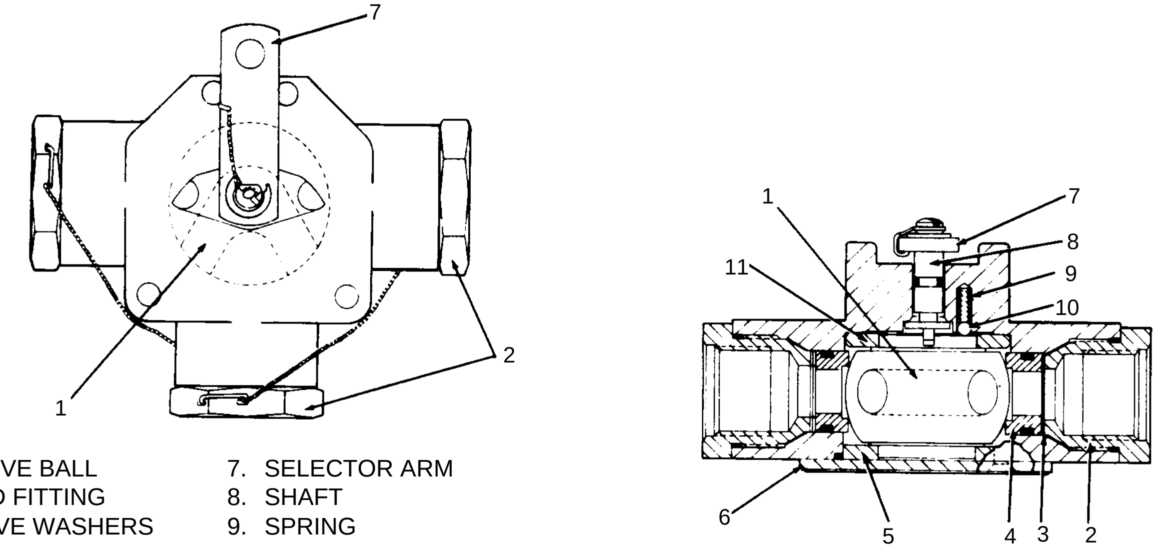
FUEL VENT AND VAPOR RETURN SYSTEMS

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 28-5). Access to the valve can be made by removing the leading edge fairing at the outboard root of the wing and nacelle.

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.



1. VALVE BALL
2. END FITTING
3. WAVE WASHERS
4. TEFLON SEAL
5. BRASS BEARING
6. COVER
7. SELECTOR ARM
8. SHAFT
9. SPRING
10. BALL
11. BEARING, BRASS OR PHOSPHORUS BRONZE

Figure 28-6. Fuel Selector Valve

FUEL SELECTOR VALVE

REMOVAL OF FUEL SELECTOR VALVE

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.

— NOTE —

Except for replacement of O-rings, the fuel selector valve should be overhauled only when necessary. To remove and replace O-rings, follow the instructions outlined in this section.

DISASSEMBLY OF SELECTOR VALVE (Refer to Figure 28-6)

1. Remove the four screws which hold the cover to the valve body.
2. Remove the brass bearing which is located behind the cover.
3. Remove the three end fittings, wave washers, and teflon seals from the valve body.
4. Slide the valve ball from the valve assembly.

— NOTE —

Use caution to ensure that the two detent balls are not lost when removing the valve ball.

5. Remove the screw which holds the selector lever to the shaft.
6. Remove washer and selector lever.
7. Push shaft through valve body.

CLEANING, INSPECTION AND REPAIR OF SELECTOR VALVE

1. Clean the valve components in a dry cleaning solvent.
2. Inspect the valve for the following.
   a. Check that the friction surfaces of the valve are free from nicks, dents and burrs.
   b. Check that the threaded surfaces are not stripped or cross threaded.
   c. Check that the selector detent mechanism is operating properly.
3. Repair to the valve is limited to minor reconditioning of parts, such as smoothing out small nicks or scratches and replacing O-rings and seals.

ASSEMBLY OF SELECTOR VALVE (Refer to figure 28-6)

1. Lubricate shaft O-ring with silicone grease and insert shaft in valve body.
2. Place selector lever on the shaft and secure with screw and washer. Safety wire screw to lever.
3. Insert two springs and balls in the holes in the body of the valve.
4. Place bearing and valve ball in body of the valve.

— CAUTION —

REFER TO FIGURE 28-6, FUEL SELECTOR VALVE, FOR CORRECT PLACEMENT OF VALVE BALL.

INCORRECT INSTALLATION OF VALVE BALL COULD RESULT IN NO FUEL BEING ABLE TO PASS THROUGH THE SELECTOR VALVE REGARDLESS OF SELECTOR VALVE HANDLE POSITION.

5. Install the three teflon seals, wave washers and end fittings. Safety wire the fittings to each other as shown in Figure 28-6.
6. Insert the brass bearing which goes between the cover and valve ball. Install the cover with the four screws.

LEAK TEST OF SELECTOR VALVE

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 5O 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.

INSTALLATION OF FUEL SELECTOR VALVE

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.

RIGGING OF SELECTOR VALVE

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.

CLEANING THE FUEL SYSTEM

1. To flush the fuel tank and selector valve, disconnect the fuel line from the injector.
2. 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.
3. Repeat this procedure for each fuel tank.
4. When all the tanks are flushed, clean the filter and fuel tank finger screens.

ELECTRIC FUEL PUMP

REMOVAL AND INSTALLATION OF ELECTRIC FUEL PUMP

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:

1. Remove rectangular hatch assembly located on the top of the nacelle, aft of the firewall.
2. Remove fuel lines from the pump and disconnect the electrical leads.
3. Remove straps holding pump in position and withdraw pump through hatch opening.
4. Do not attempt to disassemble or repair the fuel pump. If fuel pump proves to be defective, it should be replaced.
5. Reinstall pump in reverse order of removal.

AUXILIARY FUEL SYSTEM ADJUSTMENT.

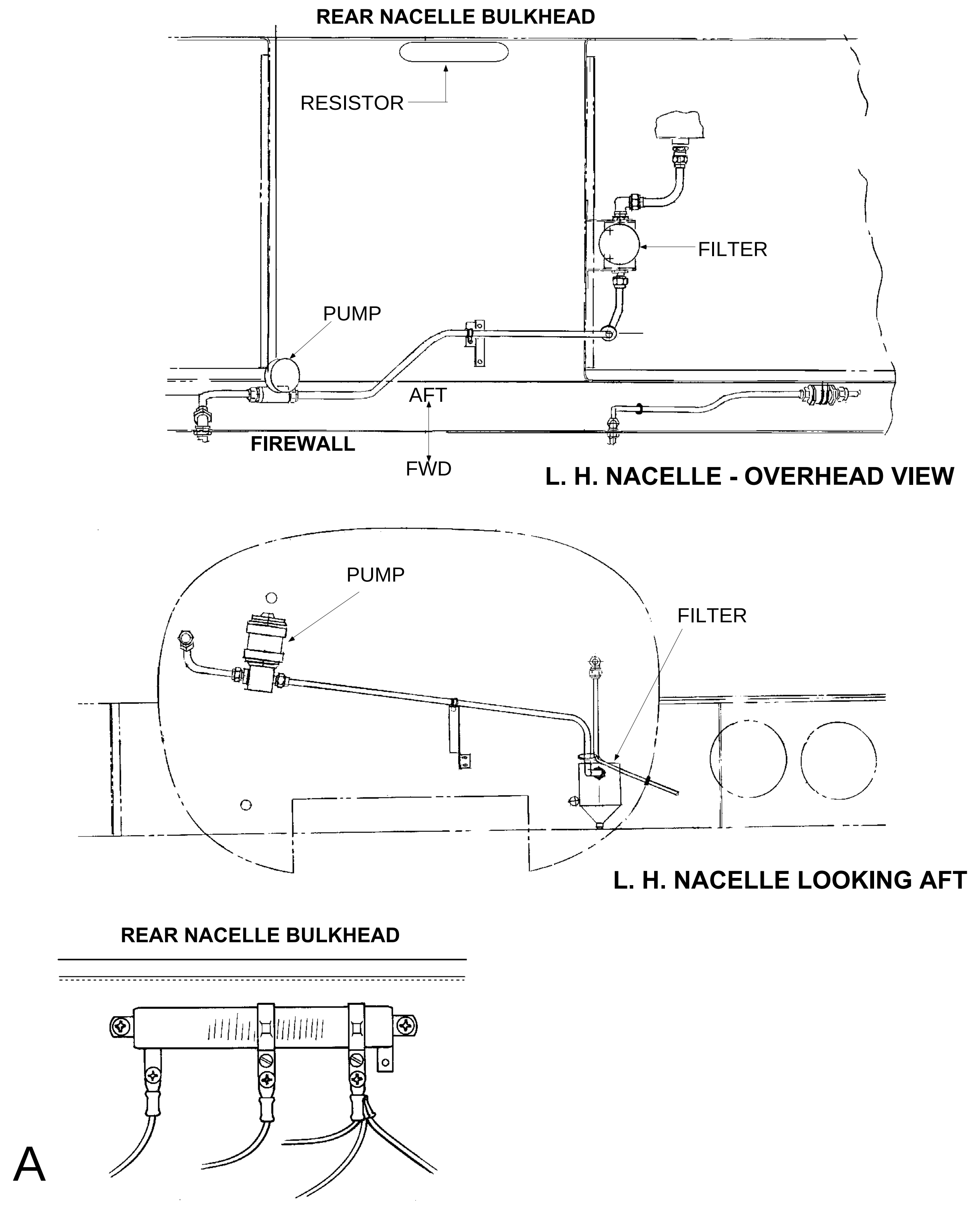
Adjustment of the auxiliary fuel system if installed is accomplished as follows for each engine:

1. Remove the access panels from the top of each engine nacelle to gain access to the slider resistor mounted on the nacelle bulkhead.
2. Install a calibrated pressure gauge (31 to 37 psi) in the fuel line forward of the firewall.

3. 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.
4. 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 28-7.)
5. 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.
6. The calibrated pressure gauge should indicate 31 to 37 psi.
7. Connect the positive lead from the external power source to the slider resistor low position. (Refer to Figure 28-7.) Adjust the power supply voltage level to the same voltage obtained in Step 5.
8. 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 5, then secure the slider in position on the resistor.
9. Disconnect the manifold pressure switch located on the firewall, and connect the positive lead from the power supply to the slider resistor medium position.
10. Adjust the power supply voltage level to the same voltage obtained in Step 5.
11. 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 5, then secure the slider in position on the resistor and reconnect the manifold pressure switch.
12. 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.
13. Perform Steps 1 thru 10 on the opposite engine, then reinstall the access panels.
14. Refer to Chapter 72, Engine Setup Procedures, for additional adjustments relating to the power plant fuel control system.

AUXILIARY FUEL SYSTEM OPERATIONAL CHECK

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.



28-7. Fuel Pump. Slide Resistor and Filter Installation

FUEL FILTERS

REMOVAL OF FUEL FILTER (Refer to Figure 28-8.)

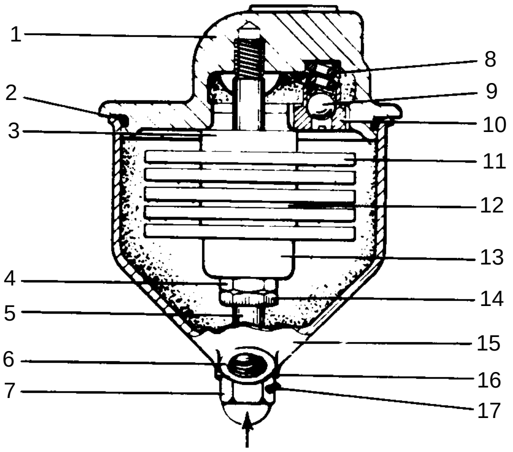
The instructions given are for the removal of the complete filter from the airplane. For cleaning and servicing purposes, only Steps 1 and 2 of this paragraph are necessary; then proceed to the next paragraph.

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.

DISASSEMBLY OF FUEL FILTER (Refer to Figures 28-7 and 28-8.)

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 element outer tube for normal cleaning.

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



TORQUE 60 TO 80 POUNDS

Figure 28-8. Fuel Filter Assembly

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.

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.

ASSEMBLY OF FUEL FILTER (Refer to Figure 28-8.)

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.

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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INDICATING

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° ± 2°.

INSTALLED FUEL QUANTITY SENDER/GAUGE CHECK (SENECA III, 14 AND 28 VDC)

Fuel quantity sender units and fuel quantity gauges can be checked while mounted in the airplane by using the following procedure:

1. Level airplane laterally and longitudinally, ± 1° (refer to Leveling, Chapter 8).
2. Put the fuel selector levers in the OFF position. If tanks have previously been drained, add 1 1/2 gallons of fuel to left and right wing tanks. Completely drain fuel tanks that relate to the fuel quantity senders and gauge to be checked. (Refer to Draining Fuel System, Chapter 12.)

NOTE

Measure all fuel added with a suitable device

3. Place 2 1/2 gallons of fuel in the left wing fuel tanks and 2 1/2 gallons of fuel in the right wing fuel tanks.
4. With 12 to 14 Vdc or 24 to 28 Vdc, as applicable, supplied to the electrical system, the fuel gauge needle shall be centered on the “0” radial mark,+ zero, – one needle width. If needle does not read within tolerance, replace gauge. If replacing gauge does not correct problem, check sender. The recheck as specified above.
5. With 12 to 14 Vdc or 24 to 28 Vdc, as applicable, supplied to the electrical system and the master switch in the OFF position, and with fuel already in the tanks as specified in paragraph 3, add fuel to the left and right tanks to total quantities shown in Chart 2802. The fuel quantity reading at each increment shall be within the tolerance specified in Chart 2802.

INSTALLED FUEL QUANTITY SENDER/GAUGE CHECK (SENECA IV)

1. Level airplane laterally and longitudinally, ± 1° (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 28-10.)
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 28-10.)

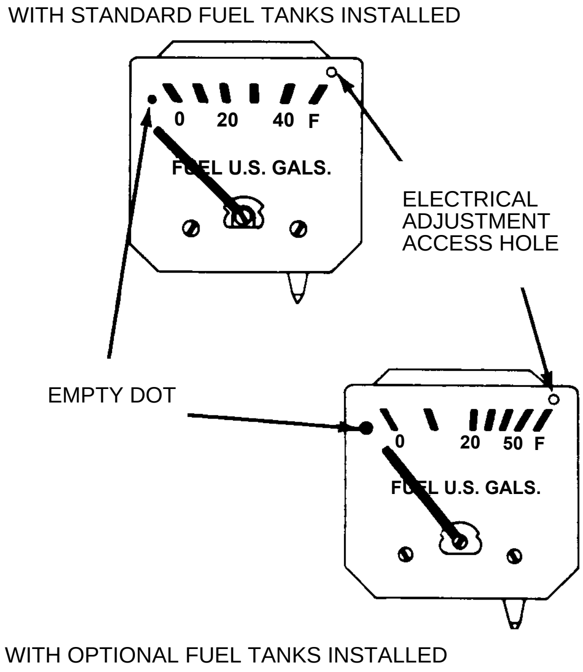

Figure 28-9. Seneca III Fuel Quantity Indicators

CHART 2802. FUEL QUANTITY SENDER GAUGE TOLERANCES (Seneca III)

STANDARD FUEL SYSTEM (Without Bladder Tanks)

Additional Fuel Added	***Total*** Fuel Within Tanks (U.S. Gallons)	Gauge Reading (U.S. Gallons)	Total Resistance Of Senders (Ohms)
10	12.5	10 (±1)	26
10	22.5	20 (±2)	44
20	42.5	40 (±2)	80

OPTIONAL FUEL SYSTEM (With Bladder Tanks Installed)

Additional Fuel Added	***Total*** Fuel Within Tanks (U.S. Gallons)	Gauge Reading (U.S. Gallons)	Total Resistance Of Senders (Ohms)
10	12.5	10 (±1)	26
10	22.5	20 (±2)	39
30	52.5	50 (±2)	74

NOTE: Values in parentheses are needle-width tolerances.

INSTALLED FUEL QUANTITY SENDER/GAUGE CHECK (SENECA IV) (Continued)

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 2803.
   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 2803.

9. Replace appropriate gauge and/or sender of any system that fails to meet the accuracy requirements specified above.

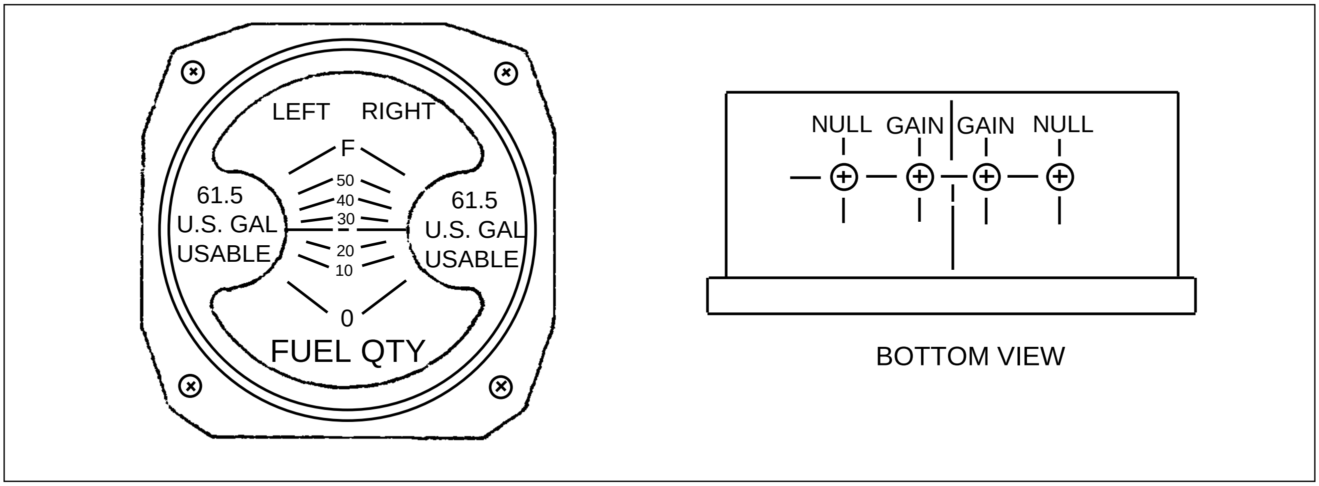

Figure 28-10 Seneca IV Fuel Quantity Indicators

CHART 2803. 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 (± 1 1/2)	90.0
11 1/2	52 1/2	50 (± 1 1/2)	73.5
10	42 1/2	40 (± 1 1/2)	62.5
10	32 1/2	30 (± 1 1/2)	53.5
10	22 1/2	20 (± 1)	38.5
10	12 1/2	10 (± 3/4)	26.5
10	2 1/2	0 (+0, −1)	6.5

NOTE: Values in parentheses are needle-width tolerances.
NOTE: If starting test with empty tanks, add 2 1/2 U. S. gallons to each tank and start at bottom of table and progress upward.

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CHAPTER

29

HYDRAULIC POWER

CHAPTER 29 - HYDRAULIC POWER

TABLE OF CONTENTS/EFFECTIVITY

CHAPTER 29 - HYDRAULIC POWER

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

The PA-34-220T 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 Chapter 32.

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.

— CAUTION —

PRIOR TO STARTING ANY INVESTIGATION OF THE HYDRAULIC SYSTEM, PLACE THE AIRPLANE ON JACKS. (REFER TO JACKING, CHAPTER 7)

DESCRIPTION

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 Prestolite hydraulic pump is a gear type unit driven by a 12-volt reversible motor designed to operate in a pressure range of 2,000 to 2,500 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 2250 ± 250 psi.

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.

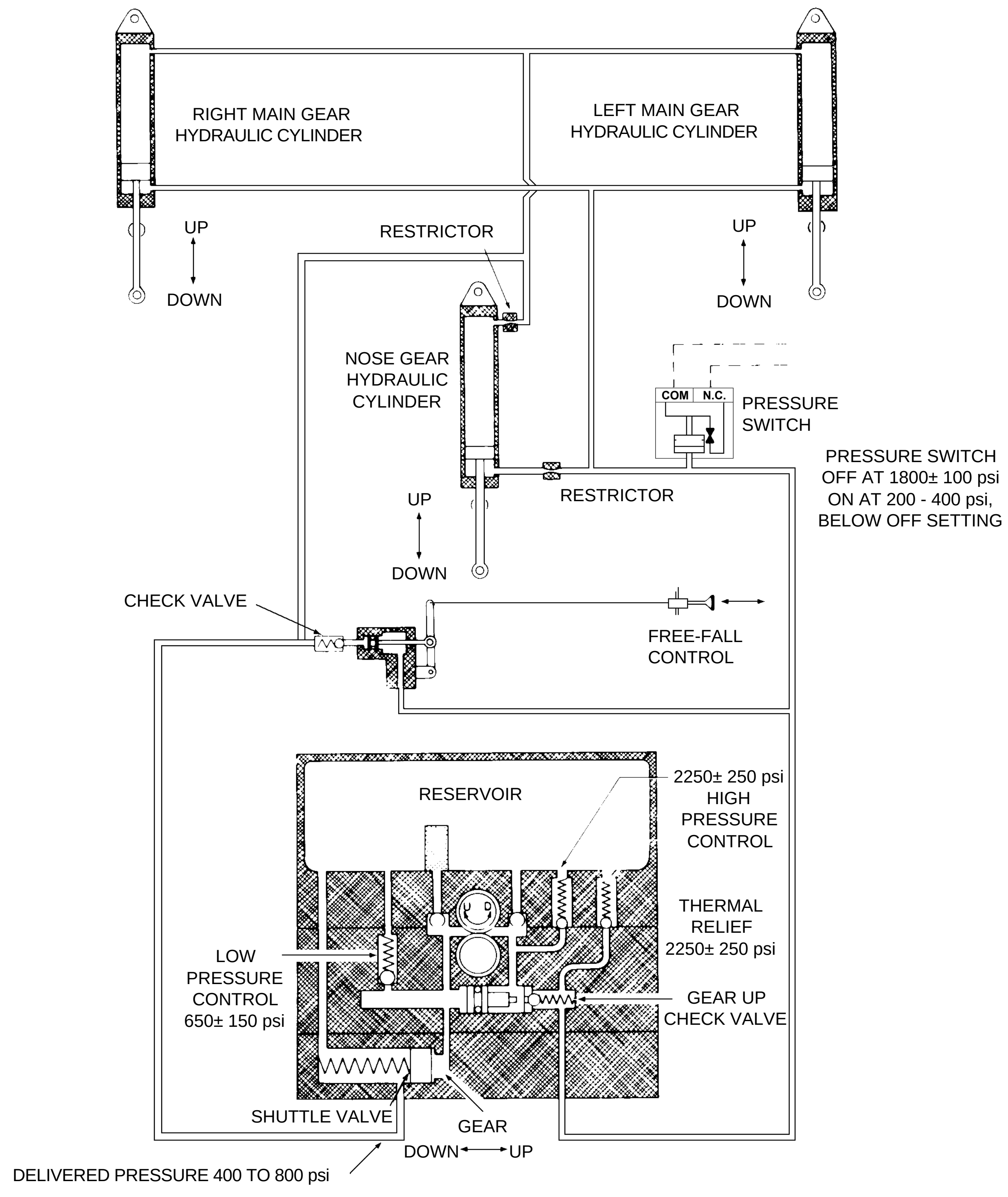


Figure 29-1. Schematic Diagram of Prestolite Hydraulic System

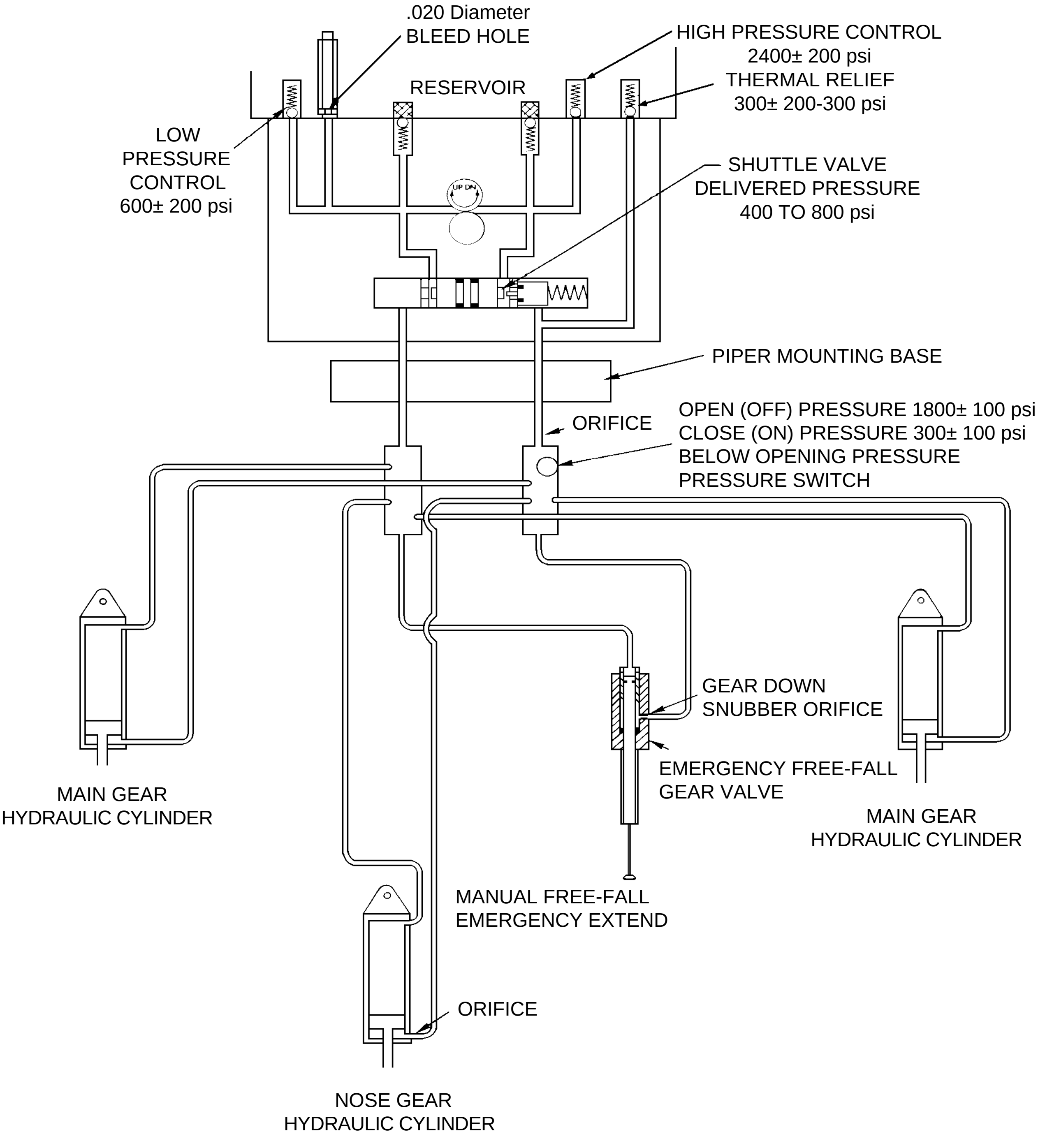


Figure 29-2. Schematic Diagram of Oildyne Hydraulic System

For a description of the landing gear and electrical switches, refer to Chapter 32, Landing Gear and Brake System.

CHART 2901. LEADING PARTICULARS, HYDRAULIC PUMP - PRESTOLITE

Hydraulic Pump: High Pressure	2,000 to 2,500 psi
Low Pressure	650 ± 150 psi
Flow Rate @ 1000 psi	45 cu. in. per min.
High Pressure Control	2,250 to 250 psi
Hydraulic Fluid	MIL-H-5606
Thermal Relief Valve	2,250 ± 250 psi
Shuttle Value Delivered Pressure	400 to 800 psi
Pressure Switch	
Open (OFF) Pressure	1,800 ± 100 psi
Close (ON) Pressure	Pressure decreasing 200 to 400 psi

CHART 2902. LEADING PARTICULARS, HYDRAULIC PUMP - OILDYNE

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 Value Delivered Pressure	400 to 800 psi
Pressure Switch	
Open (OFF) Pressure	1,800 ± 100 psi
Close (ON) Pressure	Pressure decreasing 200 to 400 psi

TROUBLESHOOTING

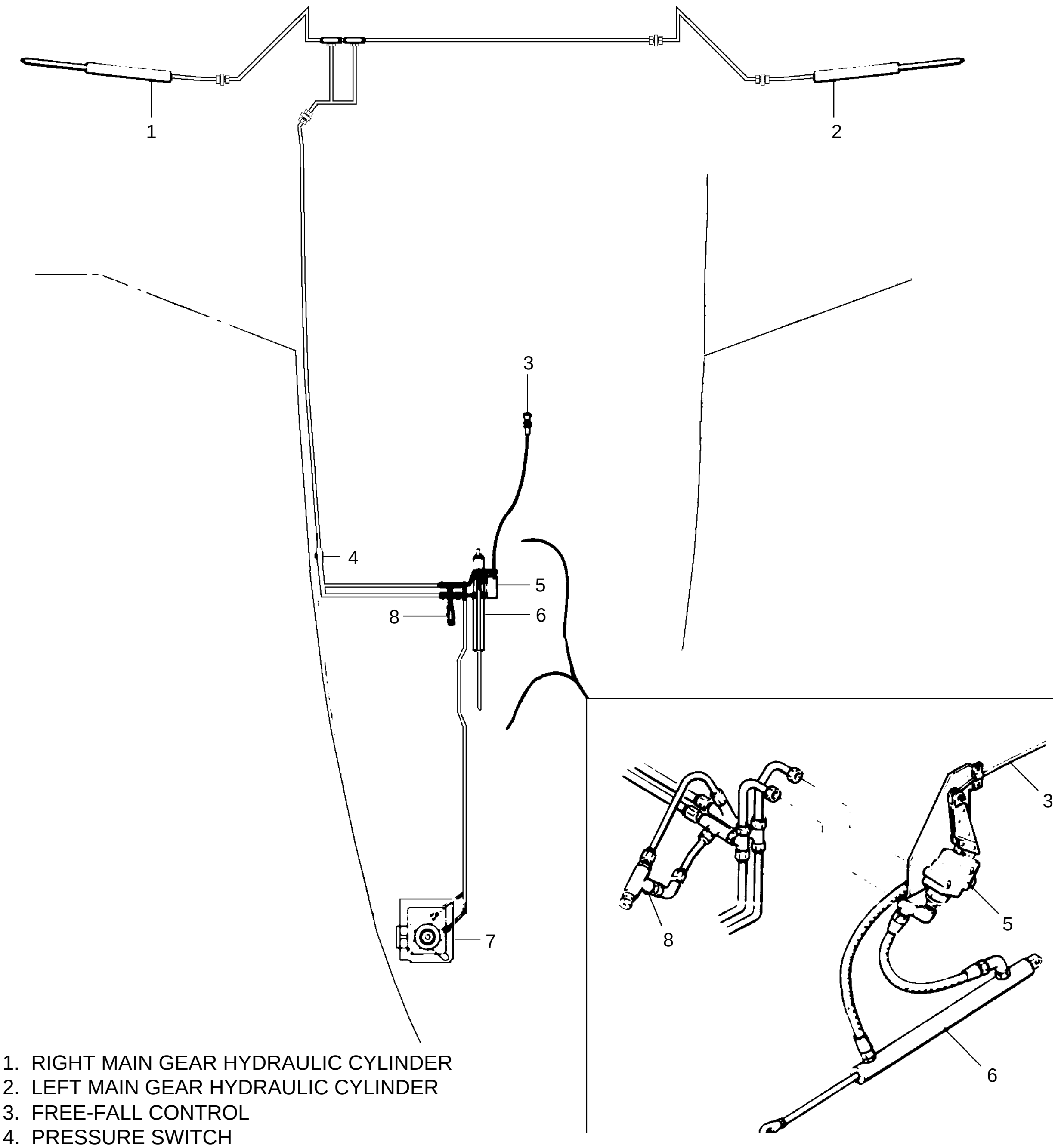
— CAUTION —

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 (refer to Jacking, Chapter 7) 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 2903 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 29-1, 29-2, or 29-3. 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 —

If it is found that the hydraulic pump is at fault and requires disassembly, it is recommended that it be overhauled by an accredited over haul facility. Pressure checks with adjustments may be accomplished in accordance with instructions given in paragraphs, "Disassembly by Hydraulic Pump" through "Test and Adjustment of Hydraulic Pump."



1. RIGHT MAIN GEAR HYDRAULIC CYLINDER
2. LEFT MAIN GEAR HYDRAULIC CYLINDER
3. FREE-FALL CONTROL
4. PRESSURE SWITCH
5. FREE-FALL CONTROL
6. NOSE GEAR HYDRAULIC CYLINDER
7. HYDRAULIC PUMP
8. THERMAL RELIEF VALVE ON -0 ONLY

Figure 29-3. Hydraulic System Installation

CHART 2903. 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 (inboard solenoid).	Replace solenoid.

— 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.

Trouble	Cause	Remedy
	Gear selector switch ground incomplete.	Check ground.
	Gear selector switch inoperative.	Replace switch.
	Hydraulic pump ground incomplete.	Check ground.

CHART 2903. TROUBLESHOOTING (HYDRAULIC SYSTEM (continued)

Trouble	Cause	Remedy
Landing gear retraction system fails to operate. (continued)	Hydraulic pump inoperative operative.	Replace or overhaul pump. (continued)
	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.
Landing gear extension system fails to operate.	Landing gear actuator circuit breaker open.	Reset circuit breaker and 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 (outboard solenoid).	Replace solenoid.

— 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

CHART 2903. TROUBLESHOOTING (HYDRAULIC SYSTEM) (continued)

Trouble	Cause	Remedy
Landing gear extension system fails to operate. (continued)	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.
	Low or dead battery.	Check condition of battery.
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.

CHART 2903. TROUBLESHOOTING (HYDRAULIC SYSTEM) (continued)

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.

CHART 2903. TROUBLESHOOTING (HYDRAULIC SYSTEM) (continued)

Trouble	Cause	Remedy
Pump fails to shut off though the gear has fully extended. (continued)	Nose gear down limit switch actuator out of Nose Gear Down Limit Switch, Chapter 32.)	Adjust switch actuator.
	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.

— NOTE —

The out of adjustment or failed switch may be determined by noting which down light is not lit.

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.

CHART 2903. TROUBLESHOOTING (HYDRAULIC SYSTEM) (continued)

Trouble	Cause	Remedy
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.

CHART 2904. CHARACTERISTICS, HYDRAULIC PUMP MOTOR - PRESTOLITE

Electrical Characteristics:	
Voltage	12 DC
Rotation	Reversible
Polarity	Negative ground
Operating Current	75 amps, max. at 12 volts (both rotations)
Operating Time	12 seconds max. with a current load of 75 amperes at 77° F
Overload Protcction	Thermal circuit breaker
Automatic Reset Time	12 seconds, max.
Location, Automatic Reset	Commutator end head of motor
Mechanical Characteristics:	
Bearings	Absorbent bronze (Drive end bearing in upper pump and valve assembly casting) Steel ball (Thrust, between commutator end head and end of armature shaft)
End Play, Armature	.005 inch, min. (Adjust by selection of thrust washers on drive end of armature shaft)

CHART 2905. 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	Continueous with circuit breaker protection.
Overload Protcction	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.

GRID 2G16
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MAIN

HYDRAULIC PUMP

REMOVAL OF *PRESTOLITE* HYDRAULIC PUMP

The Prestolite 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. Disconnect the pump electrical leads from the pump solenoid relays and the ground wire from the battery shelf.
2. Disconnect the hydraulic lines from the pump. Cap the line ends to prevent contamination.
3. Remove pump by removing pump attaching bolts.
4 Cap or plug all ports.
5. Clean exterior of pump using a dry cleaning solvent to remove accumulated dirt and dust.

DISASSEMBLY OF *PRESTOLITE* HYDRAULIC PUMP (Refer to Figure 29-4.)

It is recommended that faulty Prestolite hydraulic pumps be sent to an accredited overhaul facility for disassembly and repair.

The major components of the pump assembly are the pump base, pump motor, and valve, reservoir, and gear case. These major components should be disassembled as follows:

1. Remove pump base from valve and gear case by:
   a. Cutting safety wire and removing bolts with washers securing pump base to pump and gear case.
   b. The check valve within the pump base should be removed for cleaning purposes only. To remove valve, cut safety wire and remove bolt, spring and steel ball. Replace O-ring at reassembly.
2. Remove pump motor from the pump and disassemble as follows:
   a. Remove thru bolts from head of motor. Using a knife cut the seal coating between the motor head and case.
   b. Lift the head up from the case approximately 0.50 of an inch. This will allow inspection of brushes without the brushes unseating from the commutator. (Refer to the next paragraph for brush inspection.) The brush leads are secured to the head assembly.
   c. Raise the head assembly off the armature and note the small thrust ball located between the end of the armature and motor head. Do not misplace this bearing.
   d. Draw the armature from the motor frame. Note the number of thrust washers mounted on the drive end of the armature shaft.
   e. Remove the motor frame from the pump reservoir.
3. Remove valve and gear case from reservoir as follows:
   a. Remove eight screws from flange of body and separate the two assemblies.
   b. Pump gears and valves should be removed for cleaning purposes only. To remove cap securing Gears, remove attaching bolts. The two valve springs should be positively identified with their cavities; otherwise, it will be necessary to readjust each valve for proper operating pressure.

1. HEAD, MOTOR
2. SPRING, BRUSH
3. BRUSH
4. BOLT, THROUGH
5. O-RING (MS28775-012)
6. WIRE LEAD
7. BALL, THRUST
8. ARMATURE
9. FRAME, MOTOR
10. SLEEVE
11. WASHER, THRUST
12. SCREW, VENT AND FILLER
13. RESERVOIR
14. SEAL
15. CASE, VALVE AND GEAR
16. BASE, PUMP
17. BOLT
18. SCREW (8)
19. 401 269 BOLT (3 REQUIRED)
20. 494 192 WASHER (3 REQUIRED)
21. 494 192 WASHER (9 REQUIRED)
22. DECK ASSEMBLY
23. PUMP BASE
24. 434 120 GROMMET (3 REQUIRED)
25. 65003-30 BUSHING (3REQUIRED)

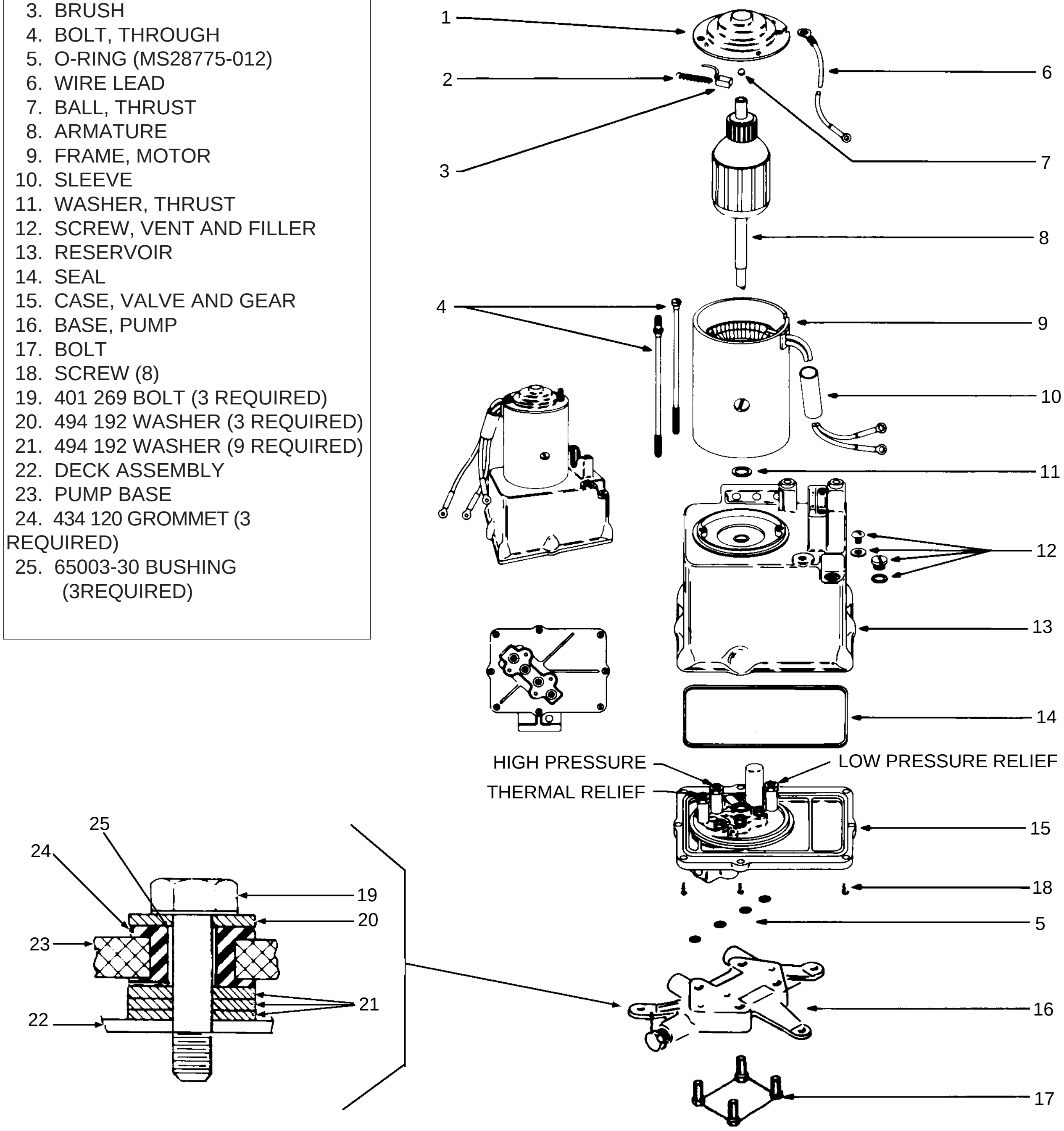


Figure 29-4. Hydraulic Pump/Reservoir, Exploded View (Prestolite)

CLEANING, INSPECTION AND REPAIRS OF *PRESTOLITE* HYDRAULIC PUMP

— CAUTION —

REPAIR FACILITIES MUST BE CLEAN TO PREVENT CONTAMINATION OF PUMP COMPONENTS. PROPER AND CAREFUL HANDLING SHOULD BE EXERCISED TO PREVENT DAMAGING PUMP COMPONENTS.

1. Discard all O-rings.
2. Remove caps or plugs and clean all components with a dry type cleaning solvent and dry thoroughly.
3. Inspect pump components for scratches, scores, chips, cracks and wear.
4. Inspect motor for worn brushes (minimum of .218 of an inch brush remains between the braided and commutator end), excess commutator wear and excess bearing wear.
5. Repairs are limited to O-ring and brush replacement as follows:
    a. One brush holder has the winding wire attached. Locate this wire and remove by using a soldering gun.
    b. The head assembly can now be removed and worked on for ease of brush replacement if required.
    c. Remove brush wire and brush from bimetal heat protector.
    d. Solder new brush wires to head assembly and bimetal heat protector, and wire from winding to one brush holder.
    e. Install brush springs and brushes into brush holders and secure in place (temporary) with a piece of string looped around the brush and holder and tied in a knot.

— NOTE —

Ensure that the braided wire is in the holder slot for proper brush.

    f. Install the head assembly with new brushes to the frame and commutator in accordance with instructions given in Step I of the next paragraph.

ASSEMBLY OF *PRESTOLITE* HYDRAULIC PUMP (Refer to Figure 29-4.)

1. To assemble pump motor and install on reservoir:
    a. Position motor frame on reservoir. Note aligning marks on frame and reservoir.
    b. Place thrust washers, of the same amount removed, on the drive end of the armature.
    c. Lubricate the entire length of the armature shaft, on the drive end, with light grease to protect 0-ring seal from damage. Insert end of shaft in reservoir.
    d. Saturate felt oiling pad around commutator end bearing with SAE 20 oil. Allow excess oil to drain off before assembling motor.
    e. Insert thrust ball in bearing of motor head. To hold ball in position, place a small amount of grease inside the bearing.
    f. Place head assembly on frame and allow brushes to extend over commutator. Remove the string securing the brushes in the holders. Push head assembly on frame and insure proper indexing of head and frame assemblies. Secure in place with thru bolts.
    g. Check freedom of rotation and end play (thrust) of the armature within the assembly. A minimum of 0.005 inch end play is permissible. Adjust to this tolerance if necessary by adding or removing thrust washers on drive end of armature shaft.

ASSEMBLY OF *PRESTOLITE* HYDRAULIC PUMP (continued)

2. Assemble valve and gear case to the reservoir as follows:
    a. If removed, place pump gears in valve and gear case and install cover. Install cover attaching bolts and secure.
    b. Lubricate reservoir seal ring with hydraulic fluid (MlL-H-5606A) and place in recess provided in case.
    c. Position reservoir on valve and gear case. Care should be taken when aligning the armature shaft with the pump gear. Do ***not run*** the motor to accomplish this.
    d. Ensure the seal ring is properly positioned, then install attaching screws. Tighten one screw to hold the assembly together. Connect motor to a 14 volt power supply. With an ammeter in the circuit, tighten the rest of the screws such that the current drawn does not exceed 12 amperes.
3. Attach the pump base to the pump as follows:
    a. With pump inverted, lubricate O-ring seals and install them in recesses provided in the valve and gear case.
    b. Install attaching bolts with washers and torque to 70 inch-pounds.
    c. Safety attaching bolts with MS20995-C32 wire.
4. Conduct motor operational check not to exceed 10 seconds running time.

TEST AND ADJUSTMENT OF *PRESTOLITE* HYDRAULIC PUMP (Refer to Figure 29-5.)

1. Test Equipment:
    a. Hydraulic pump and mounting base.
    b. Pressure gauge (0 - 1000 psi).
    c. Pressure gauge (0 - 3000 psi).
    d. Hoses with fittings to connect base and gauges.
    e. Power supply (14 Vdc).
    f. Ammeter (0 to 100 amps).
    g. Fuse or circuit protector (100 amps).
2. Test and Adjustment:

— NOTE —

Test gauges of known accuracy should be used when performing the following tests.

a. Connect the 0 to 1000 psi gauge to the low pressure port of the pump base.
b. Connect the 0 to 3000 psi gauge to the high pressure port of the pump base.
c. Connect black lead of pump motor to the negative terminal of the DC power supply.
d. Remove the filler plug located on the forward side of the pump. Loosen vent screw and add fluid, MIL-H-5606, through the filler hole until full. Reinstall the filler plug and tighten the vent screw.

NOTE

A small vent hole is located under the vent screw head. Retain 1/64 inch clearance between the screw head and the small vent hole.

e. Bleed air from the attached lines. (Lines may be bled by alternately connecting blue lead and green lead to the positive terminal of the power supply until all air is exhausted.)

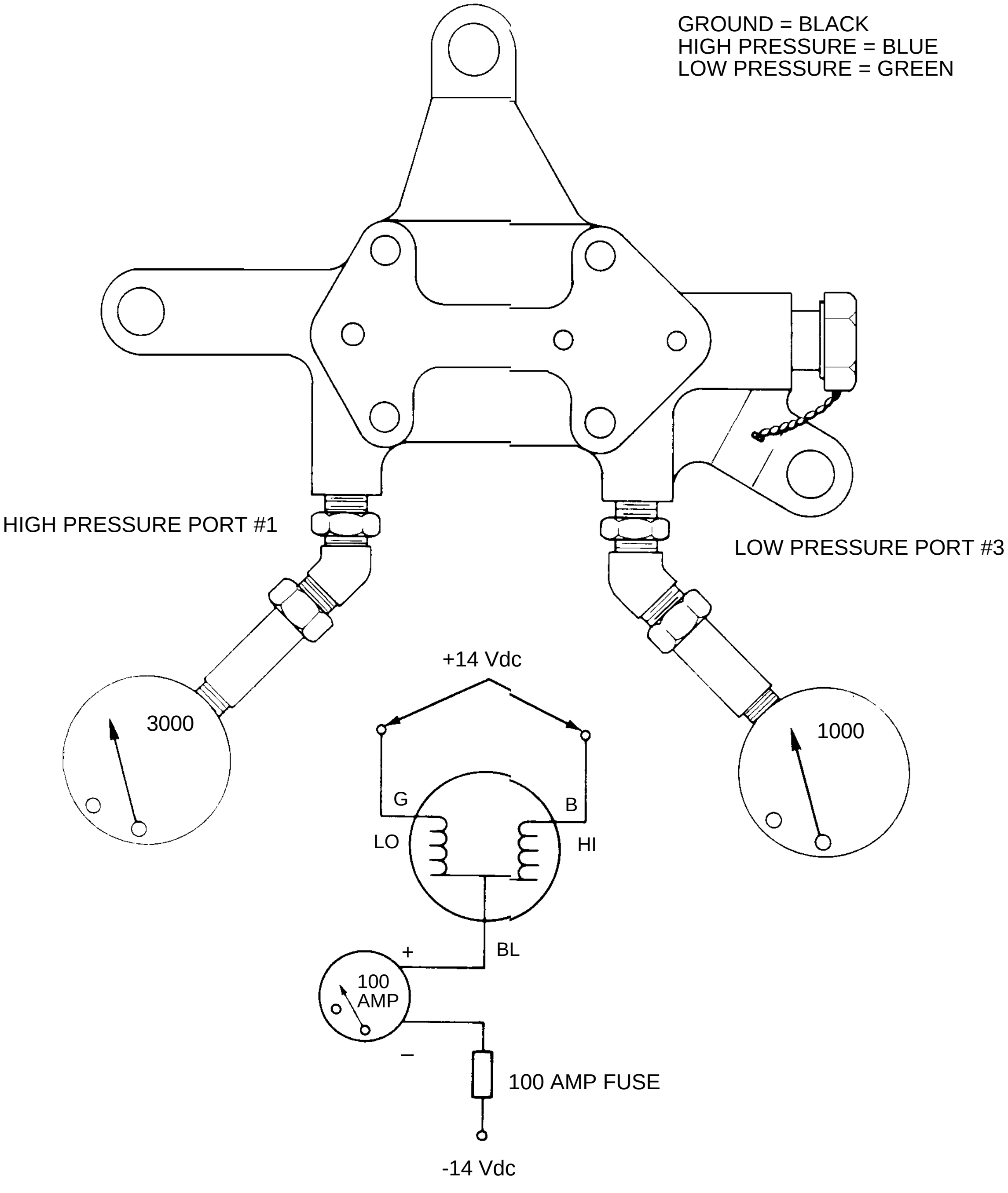


Figure 29-5. Test and Adjustments of Hydraulic Pump

TEST AND ADJUSTMENT OF *PRESTOLITE* HYDRAULIC PUMP (Refer to Figure 29-5.) (continued)

f. Connect blue lead to positive terminal of power supply. Pump should operate and the high pressure, gauge should indicate between 2000 and 2500 psi. (Should the gauge indicate a pressure below 2000 psi or over 2500 psi, adjust valve “A” Figure 29-4 accordingly to obtain the desired reading.)

— NOTE —

When increasing pressure, the pump running time must not exceed 12 seconds. There should be no external leakage while performing steps e through h.

g. Disconnect blue lead. The high pressure reading should not drop more than 300 psi in five minutes. High pressure may not be selected again for five minutes.
h. Connect green lead to positive terminal of power supply. Pump should operate in reverse, dropping reading on high pressure gauge to zero. The low pressure gauge should indicate 500 to 800 psi. (Should the gauge indicate a pressure below 500 psi or over 800 psi, adjust valve “B”, Figure 29-3 accordingly to obtain desired reading.) Disconnect green lead. Both pressure gauges should indicate zero psi.
i. Should it be necessary to check the pump motor, first connect the ammeter in the electrical circuit with the positive terminal of the meter to the black lead and negative terminal of the meter to the negative terminal of the DC power supply.
j. Connect the blue lead from the pump motor to the positive terminal of the power supply. With high pressure indication within 2000 to 2500 psi range on the pressure gauge, the ammeter should read 75 amperes maximum. Disconnect the blue lead.
k. Connect the green lead from the pump motor to the positive terminal of the power supply. With low pressure indication within the 500 to 800 psi range, the ammeter should read between 15 to 35 amperes.

— NOTE —

In the event any of the various tests do not perform satisfactorily, the pump assembly should be replaced

l. Disconnect the green lead from the power supply and permit the pressure to drop before disconnecting the hydraulic lines.

INSTALLATION OF *PRESTOLITE* HYDRAULIC PUMP (Refer to Figure 29-4)

1. Align three washers over each hole in shelf. Insert grommet through mounting holes in pump base. Insert bushing through hole in each grommet.
2. Position pump on washers. Insert bolt with top washer through bushing, bottom washers, shelf, and tighten.
3. Connect hydraulic lines to pump.
4. Connect pump electrical leads. Blue wire to outboard lower solenoid, green wire in inboard (upper) solenoid, and black wire to ground on bottom shelf.
5. Check fluid level in pump. (Refer to Chapter 12 for filling instructions.)
6. With aircraft on jacks, operate pump to purge hydraulic system of air, and check for leaks. After operation, recheck fluid level.

REMOVAL OF *OILDYNE* HYDRAULIC PUMP (Refer to Figure 29-6, Sheet 1 of 2)

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.

FIELD SERVICE OF *OILDYNE* HYDRAULIC PUMP

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 Aircraft, via the local Piper distributor, for servicing or repairs.

DISASSEMBLY OF *OILDYNE* HYDRAULIC PUMP FROM BRACKET (Refer to Figure 29-6, Sheet 1 of 2)

1. Remove safety wire securing two bolts that attach bracket to pump.
2. Remove the two bolts and washers.
3. Separate pump assembly from bracket.

DISASSEMBLY OF *OILDYNE* MOTOR ASSEMBLY FROM *OILDYNE* PUMP-ADAPTER ASSEMBLY (Refer to Figure 29-6, Sheet 2 of 2)

1. Remove two each mounting bolts on flange of motor assembly and separate the motor assembly from the pump.
2. Remove coupling and O-ring and discard.

— NOTE —

New O-ring and coupling are included in replacement motor assembly.

DISASSEMBLY OF *OILDYNE* RESERVOIR ASSEMBLY FROM *OILDYNE* PUMP-ADAPTER ASSEMBLY (Refer to Figure 29-6, Sheet 2 of 2))

— CAUTION —

DO NOT DISASSEMBLE PUMP ASSEMBLY FROM ADAPTER ASSEMBLY. DAMAGE TO VALVES AND PRESSURE SETTINGS, WHICH ARE NON-ADJUSTABLE, WILL OCCUR.

1. Remove screw and O-ring securing the reservoir to the adapter assembly.
2. Remove reservoir and reservoir seal.
3. 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.

1. MOTOR ASSEMBLY
2. BASIC PUMP-ADAPTER
3. RESERVOIR ASSEMBLY
4. BRACKET-MOUNTING
5. BASE-PUMP
6. RESTRICTOR ELBOW (PIPER P/N 01972-2)
7. 401 269 BOLT (3 REQUIRED)
8. 494 192 WASHER (3 REQUIRED)
9. 494 192 WASHER (9 REQUIRED)
10. DECK ASSEMBLY
11. PUMP BASE
12. 434 120 GROMMET (3 REQUIRED)
13. 65003-30 BUSHING (3REQUIRED)

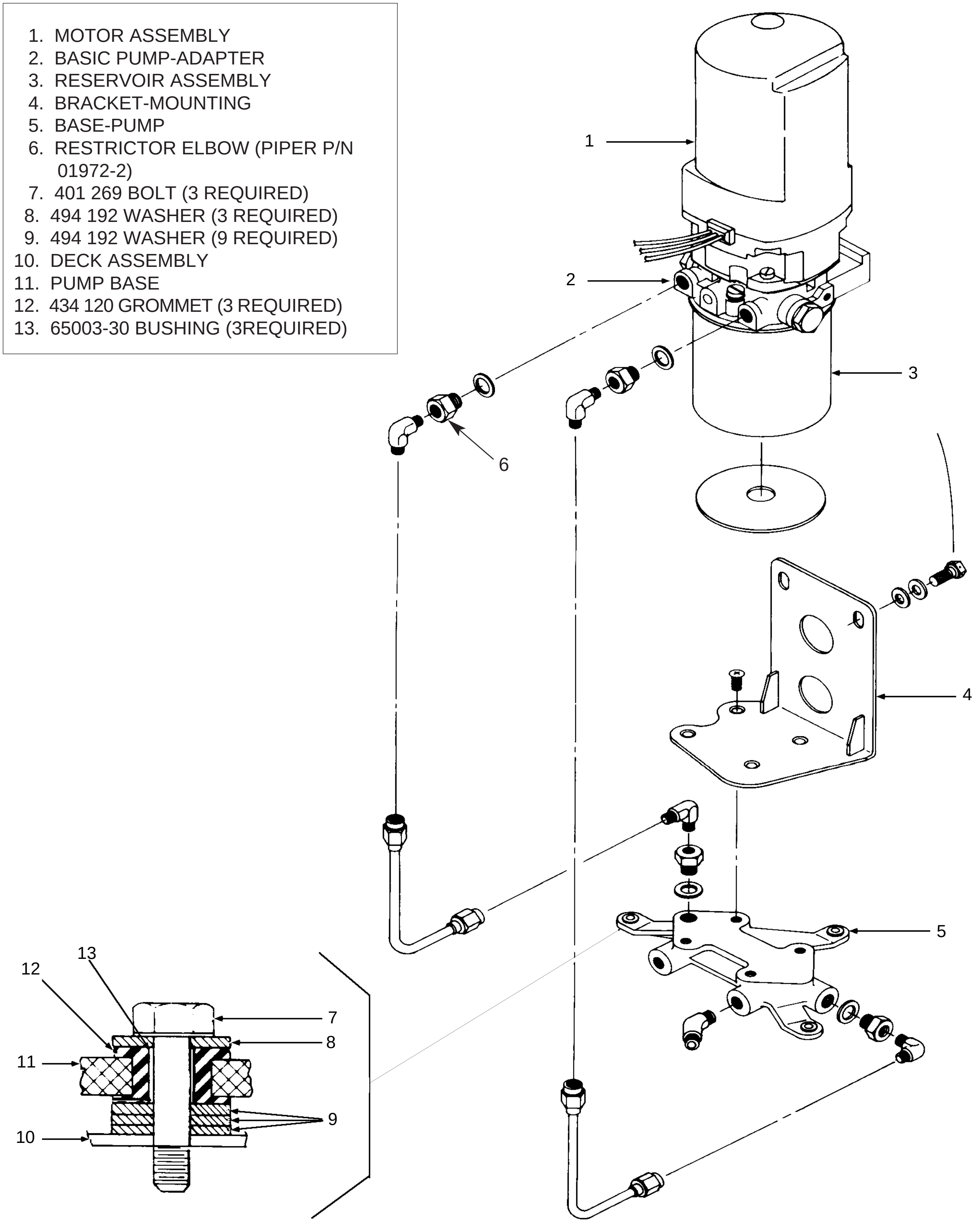
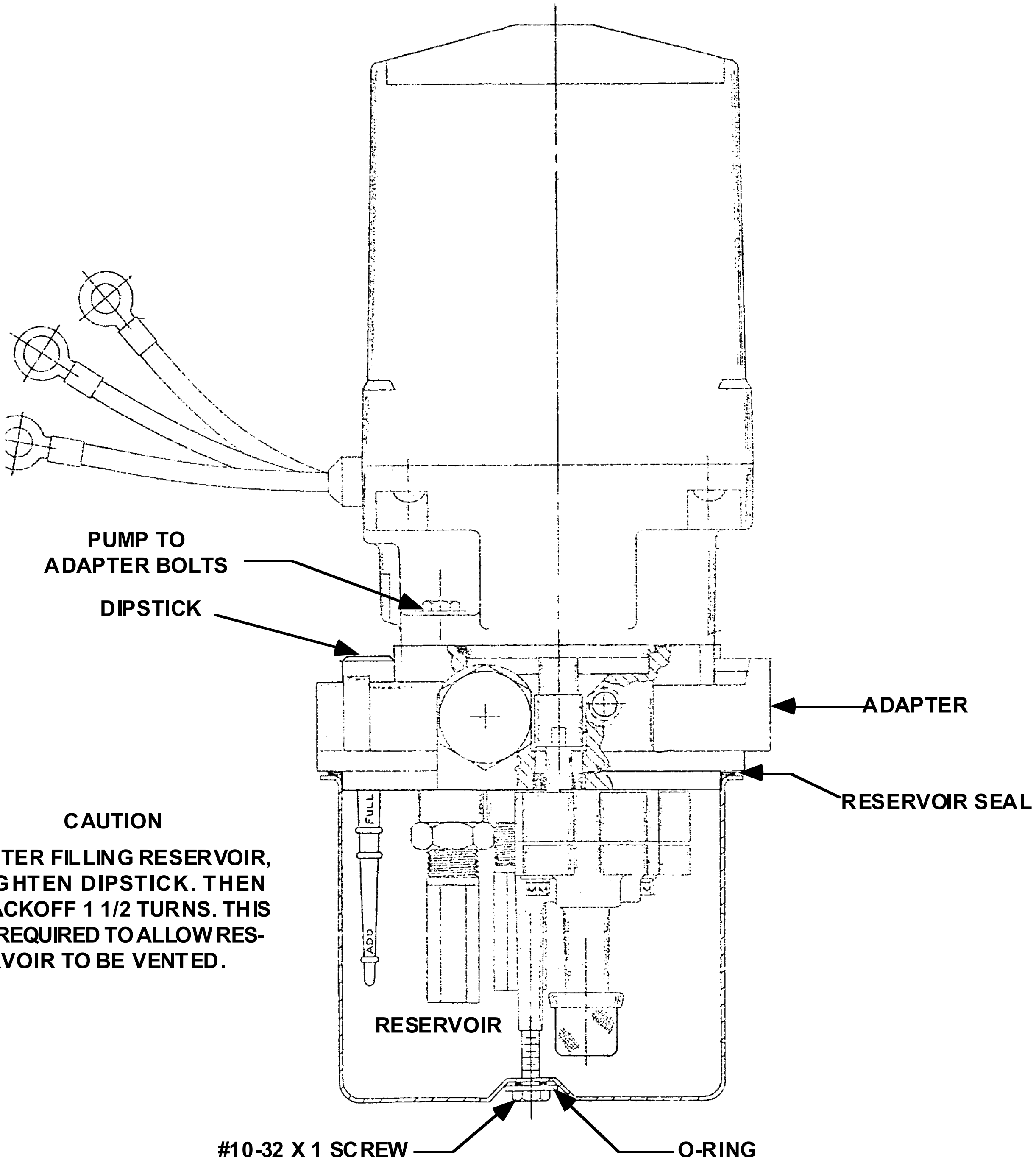


Figure 29-6 (Sheet 1 of 2) Oildyne Hydraulic Pump



CAUTION

AFTER FILLING RESERVOIR, TIGHTEN DIPSTICK. THEN BACKOFF 1 1/2 TURNS. THIS IS REQUIRED TO ALLOW RESERVOIR TO BE VENTED.

Figure 29-6 (Sheet 2 of 2) Oildyne Hydraulic Pump

ASSEMBLY OF RESERVOIR TO *OILDYNE* PUMP-ADAPTER ASSEMBLY (Refer to Figure 29-6, Sheet 2 of 2)

1. 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.
2. Position the reservoir seal between the reservoir and the adapter assembly.
3. Locate the O-ring and bolt that secures the reservoir to the pump-adapter assembly and apply a light coating of Titeseal No. 3 in back of first two bolt threads.
4. Position the O-ring on the bolt, and install it through the reservoir and into the pump-adapter securing the reservoir.
5. Tighten this bolt to a torque value of 40 - 50 inch pounds.

INSTALLATION OF MOTOR ASSEMBLY TO *OILDYNE* PUMP-ADAPTER ASSEMBLY (Refer to Figure 29-6, Sheet 2 of 2)

1. Locate the replacement O-ring and coupling.
2. Place the coupling and O-ring into position between the motor assembly and pump-adapter assembly.
3. Apply light coating of Titeseal No. 3 in back of the first two threads of mounting bolts.
4. Positioning the two units in place, install two each mounting bolts through the flange of the motor assembly and into the pump-assembly housing.
5. Torque bolts to 15 -20 inch pounds.

INSTALLATION OF PIPER BRACKET TO *OILDYNE* HYDRAULIC PUMP ASSEMBLY(Refer to Figure 29-6, Sheet 1 of 2)

1. If bracket was removed from was removed from pump mount, install bracket to Piper pump mount with four MS24693-S298 screws.

1. Position pump assembly on bracket so that tapped holes in oildyne adapter align with bolt holes on bracket.
2. Install two AN960-616 washers and two MS20074-06-05 bolts to secure pump assembly to bracket.
3. Safety bolts with MS20995-C41 wire.

INSTALLATION OF *OILDYNE* HYDRAULIC PUMP (Refer to Figure 29-6, Sheet 1 of 2)

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.

4. Install the “up” and “down” pressure hydraulic lines to pump mount.
5. Connect the three knife connectors that attach the black, blue, and green forward and reverse harness wires.
6. Install ante-splash cover (Piper P/N 96374-0) by installing the four attaching screws,
7. Install the ABS nose gear cover.

LANDING GEAR FREE-FALL VALVE ASSEMBLY

INSPECTION AND REPAIR OF FREE-FALL VALVE

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.

REMOVAL OF FREE-FALL VALVE ASSEMBLY (Refer to Figure 29-7)

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.

INSTALLATION OF FREE-FALL VALVE ASSEMBLY. (Refer to Figure 29-7.)

1. Apply Titeseal No. 3 in back of first two MALE threads of elbows and tees and insert fittings in valve. Apply Titeseal 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 Titeseal No. 3 in back of first two MALE threads of tees and connect hydraulic lines. Apply Titeseal 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.

1. CABLE
2. CLAMP
3. VALVE BODY
4. END FITTING
5. FRAME
6. PISTON SHAFT
7. BRACKET
8. ARM ASSEMBLY

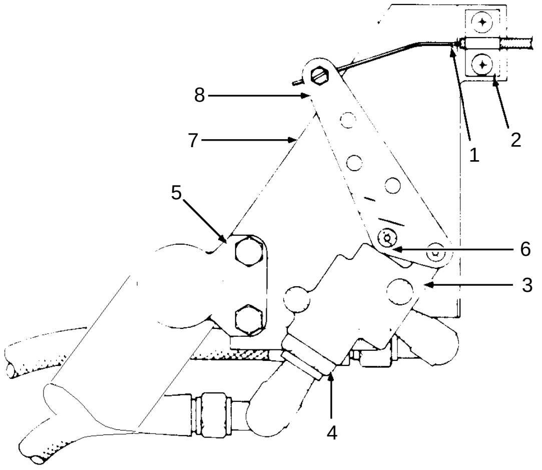


Figure 29-7. Free-Fall Valve Assembly

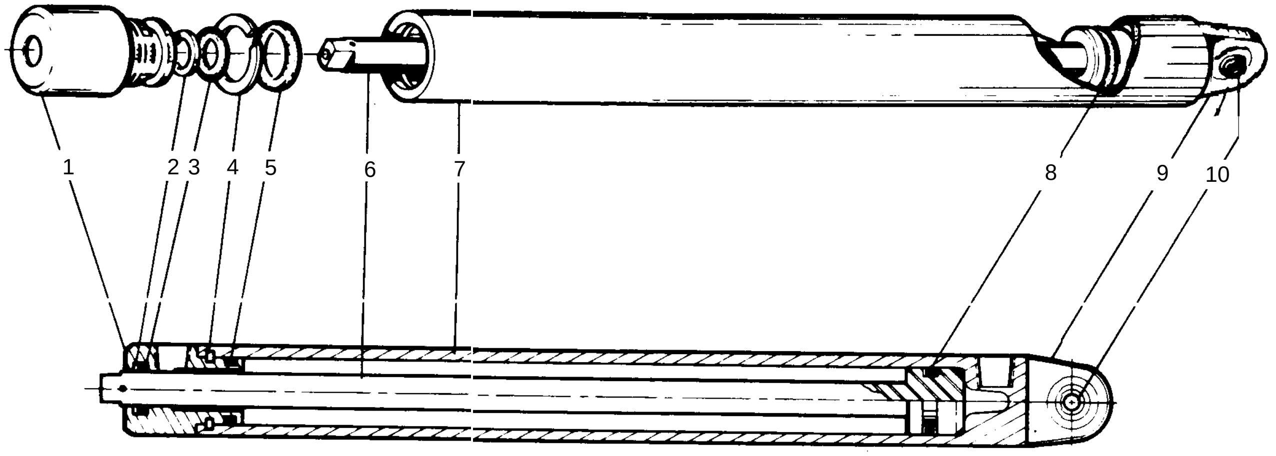
GEAR ACTUATING CYLINDER

REMOVAL OF NOSE GEAR ACTUATING CYLINDER

1. Place airplane on jacks. (Refer to Jacking, Chapter 7.)
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.

REMOVAL OF MAIN GEAR ACTUATING CYLINDER

1. Place airplane on jacks. (Refer to Jacking, Chapter 7.)
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.



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

Figure 29-8. Gear Actuating Cylinder

DISASSEMBLY OF ACTUATING CYLINDER (Refer to Figure 29-8)

— NOTE —

The following disassembly, cleaning, inspection, repair and assembly instructions apply to nose gear actuator and both main gear actuators.

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. (Refer to figure 29-9.)
4. Rotate end gland counterclockwise (with use of fitting) until end of retainer ring (Figure 29-9) 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.)

CLEANING, INSPECTION AND REPAIR OF GEAR ACTUATING CYLINDER

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.
3. Repairs to the cylinder are limited to polishing out small scratches, burrs, etc., and replacing components. (Refer to Seneca III Parts Catalog for replacement part numbers.)

ASSEMBLY OF GEAR ACTUATING CYLINDER (Refer to Figure 29-8)

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 29-9)
4. Align port in end gland and cylinder body. (Figure 29-9)
5. Check smoothness of operation of piston and static test unit to check for possible cut O-rings.
6. Clean nose cylinder orifices.

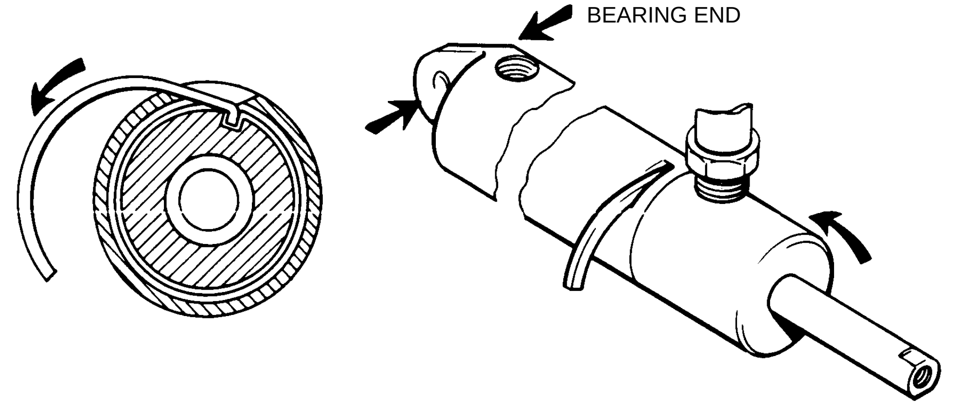
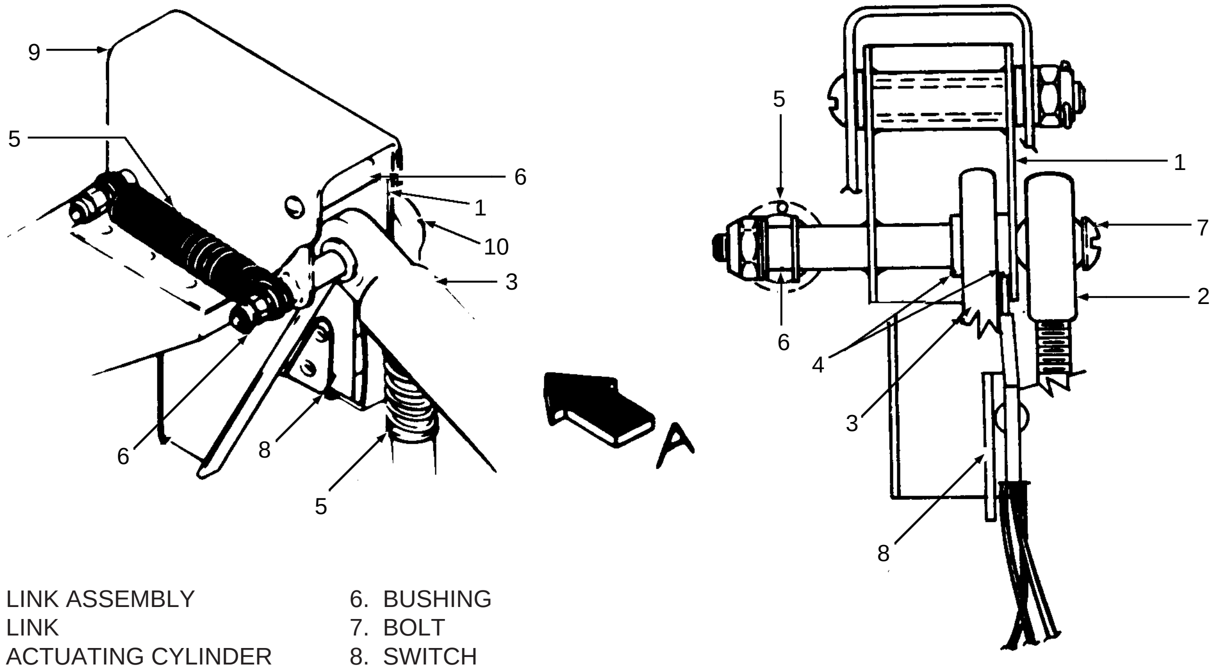


Figure 29-9. End Gland Locking Device



1. LINK ASSEMBLY
2. LINK
3. ACTUATING CYLINDER
4. WASHERS
5. SPRING
6. BUSHING
7. BOLT
8. SWITCH
9. MOUNT ASSEMBLY
10. ROD END BEARING

Figure 29-10. Nose Gear Actuating Cylinder Installation

INSTALLATION OF NOSE GEAR ACTUATING CYLINDER (Refer to Figure 29-10)

1. Refer to REMOVAL OF NOSE GEAR ACTUATING CYLINDER, step 4. Remove bolt far enough to position clevis end of actuating cylinder in the link assembly. Insert bolt with callouts arranged as illustrated in Figure 29-10.
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. (Refer to Adjustment of Nose Landing Gear, Chapter 32.)
5. Operate pump to purge system of air and check fluid level in reservoir.
6. Remove airplane from jacks.

INSTALLATION OF MAIN GEAR ACTUATING CYLINDER

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. (Refer to Adjustment of Main Landing Gear, Chapter 32.)
5. Operate pump and purge system of air. Check fluid level in reservoir.
6. Remove the airplane from jacks.

HYDRAULIC LINES

REMOVAL AND INSTALLATION OF HYDRAULIC LINES

Remove damaged hydraulic lines by disconnecting fittings at both ends and disconnecting where secured by brackets. Refer to Figure 6-2 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.

TESTING HYDRAULIC SYSTEM

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 (14 or 24 Vdc, as appropriate) in order to conserve the battery. (Refer to External Power Receptacle, chapters 12 and 24.)

— CAUTION —

TURN MASTER SWITCH OFF BEFORE INSERTING OR REMOVING EXTERNAL POWER SUPPLY PLUG.

1. Place airplane on jacks. (Refer to Jacking, Chapter 7.)
2. 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.
3. 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.
4. Recycle the landing gear to determine that it functions properly.
5. 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.

— 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.

SERVICING HYDRAULIC PUMP/RESERVOIR

The Prestolite combination pump and reservoir fluid level should be checked every 50 time-in-service hours by removing the filler plug located on the forward side of the pump and viewing the fluid through the filler plug hole Determine that fluid is visible up to the bottom of the filler plug hole.

Should fluid be below the bottom of the hole, add MIL-H-5606 petroleum base hydraulic fluid through the filler hole until full. Install filler plug and tighten. (Refer to Figure 29-4.)

— NOTE —

A small vent hole is located under the ***vent*** screw head. Retain 0.050 to 0.150 inch gap under ***vent*** screw head.

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. (Refer to Figure 29-6.)

GRIDS 2H8 THROUGH 2H11
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CHAPTER

30

ICE AND RAIN PROTECTION

CHAPTER 30- ICE AND RAIN PROTECTION

TABLE OF CONTENTS/EFFECTIVITY

CHAPTER 30- ICE AND RAIN PROTECTION

TABLE OF CONTENTS/EFFECTIVITY

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 (Figure 30-1); an electrical prop deice system (Figure 30-2); an electrically heated windshield panel (Figure 30-6, Section 30-40-00); heated pitot/ stall warning system((Figure 30-3); and an ice detection light installation. These systems can be installed individually or in any combination. On Seneca III models, except for the heated pitot/stall warning system, the systems are controlled from a control panel on the center instrument panel. The switch for pitot/stall warning system heat is located on the main switch panel On Seneca IV models, the switches for all installed ice protection systems are in a common group installed directly in the instrument panel directly above the throttle quadrant.

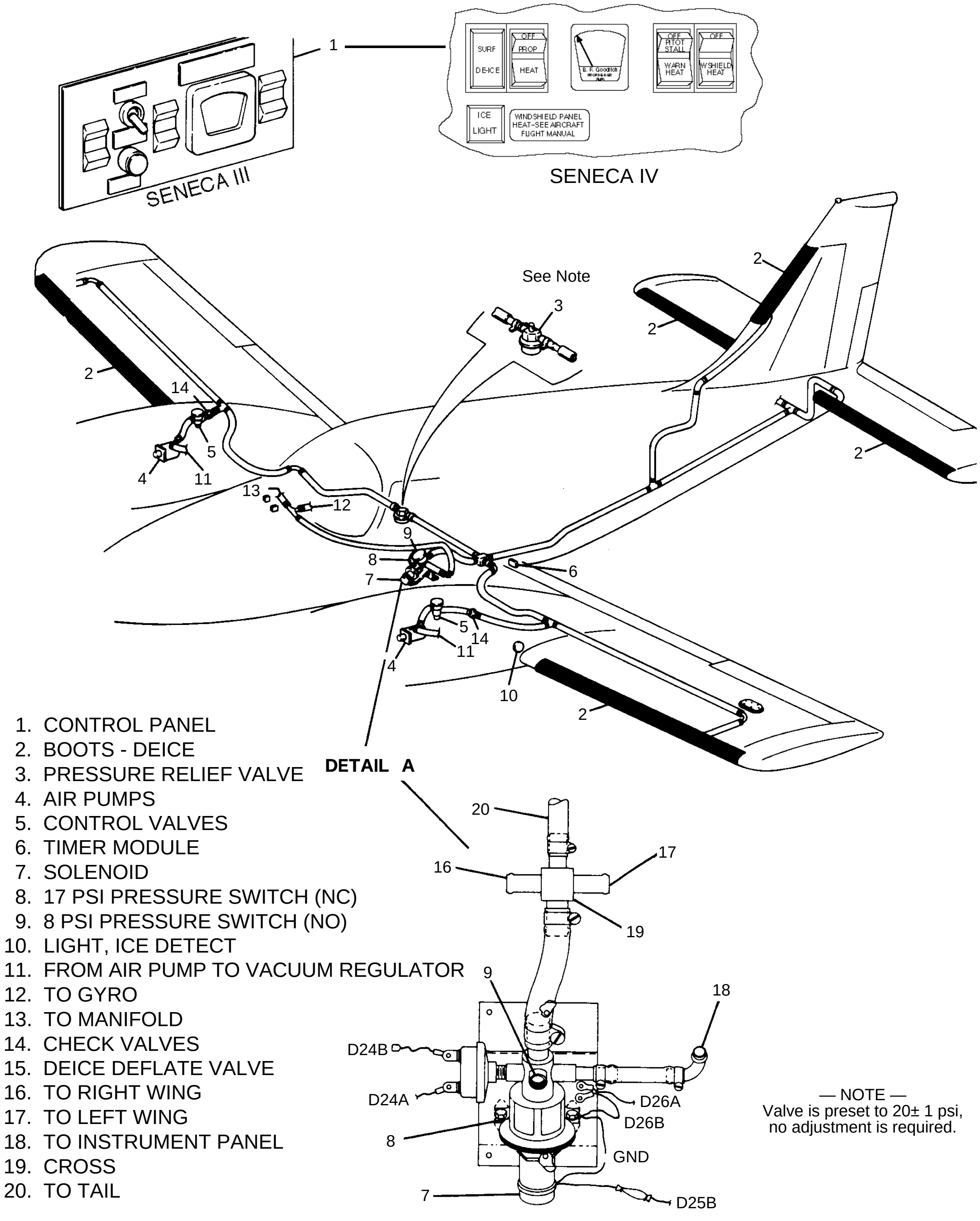
The pneumatic system, which utilizes boots to displace ice from the leading edges of the flight surfaces, necessitates replacing the standard air pumps with pumps of greater capacity. Along with the boots and related plumbing, the system also utilizes two control valves, two check valves, a deflate valve, 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 30-1.

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.

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) a slip ring assembly connected to the hub of each propeller; (3) modular brush assemblies; (4) a timer; a circuit breaker/ control switch located on the control panel; (5) an ammeter; and, (6) a shunt installation located on the left side if the fuselage on a longeron behind the side panel on the left side of the cockpit.



1. CONTROL PANEL
2. BOOTS - DEICE
3. PRESSURE RELIEF VALVE
4. AIR PUMPS
5. CONTROL VALVES
6. TIMER MODULE
7. SOLENOID
8. 17 PSI PRESSURE SWITCH (NC)
9. 8 PSI PRESSURE SWITCH (NO)
10. LIGHT, ICE DETECT
11. FROM AIR PUMP TO VACUUM REGULATOR
12. TO GYRO
13. TO MANIFOLD
14. CHECK VALVES
15. DEICE DEFLATE VALVE
16. TO RIGHT WING
17. TO LEFT WING
18. TO INSTRUMENT PANEL
19. CROSS
20. TO TAIL

— NOTE —
Valve is preset to 20± 1 psi, no adjustment is required.

Figure 30-1. Pneumatic Deice System Installation

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 l) 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. (Refer to Figure 30-9.) 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.

The McCauley 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.

When installed 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 in the switch cluster on the pilot's side of the instrument panel. 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. On Seneca III models, the light is controlled by a toggle switch located on the deice control panel. On Seneca IV models, 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) not found in this chapter refer to Chapter 91.

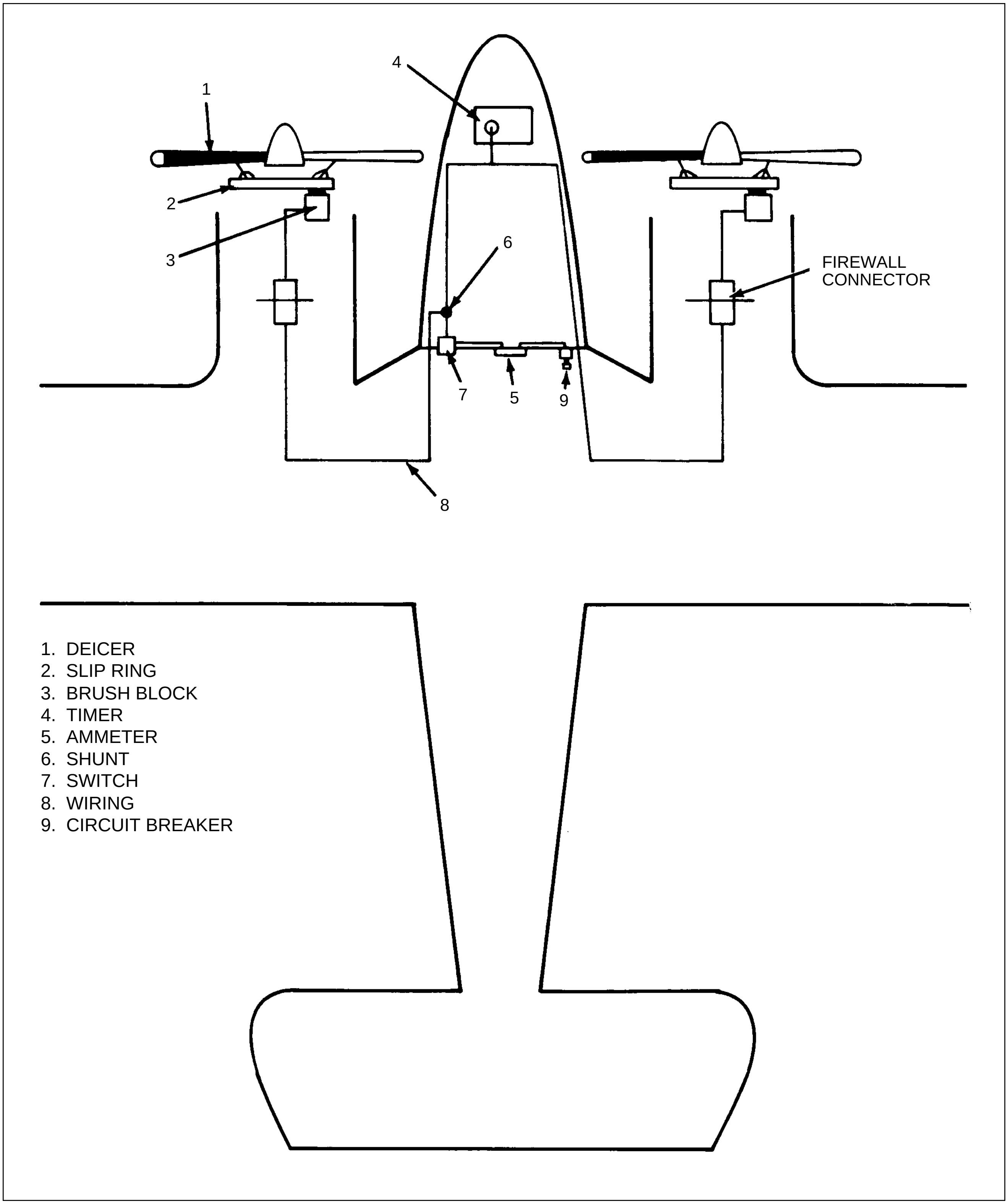


Figure 30-2. Electric Prop Deice System Installation

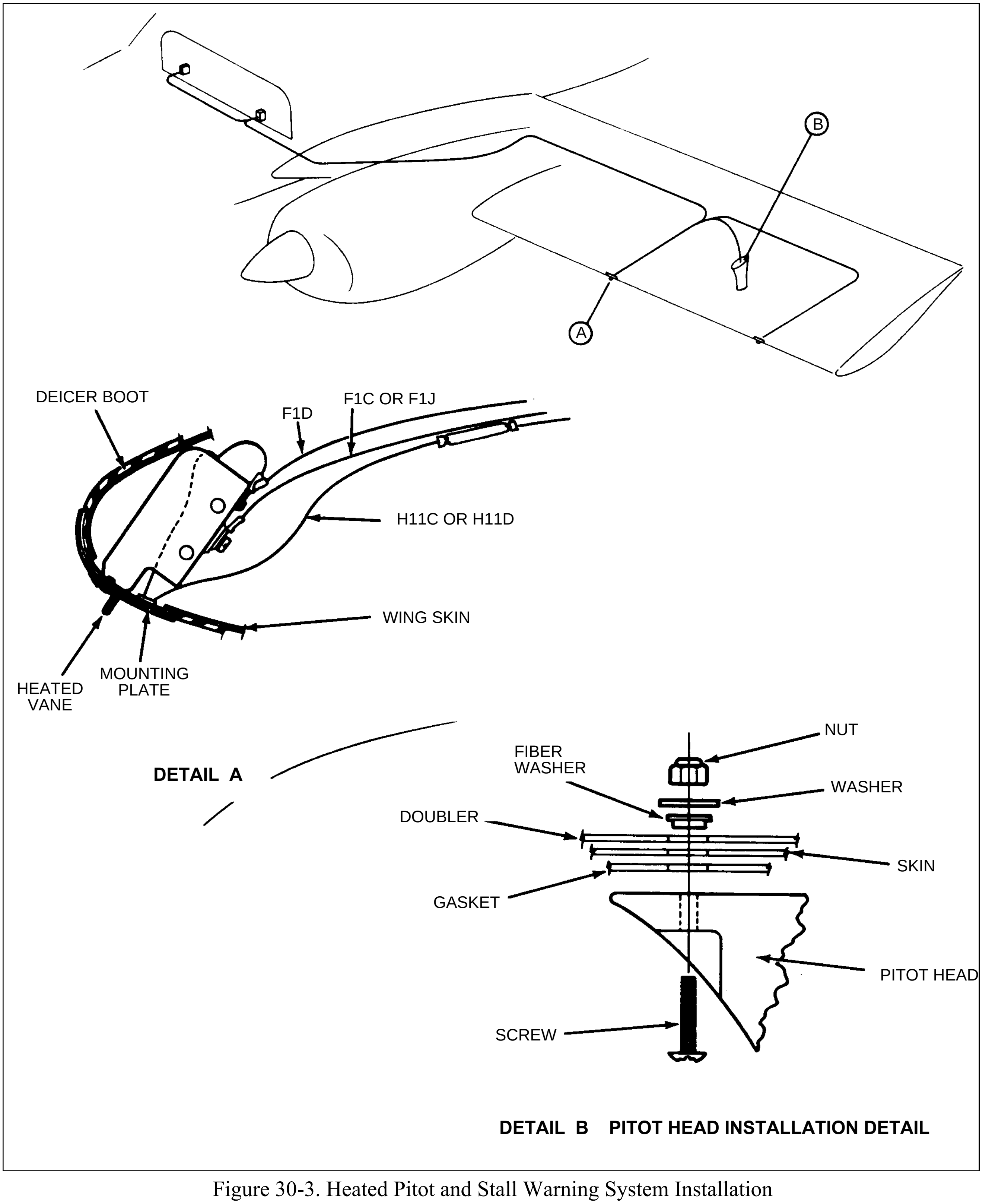


Figure 30-3. Heated Pitot and Stall Warning System Installation

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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.

For operational descriptions refer to Section 30-00-00,.Description and Operation

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.

CHART 3001. 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. air leakage test.
	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.

CHART 3001. TROUBLESHOOTING PNEUMATIC DEICE SYSTEM (continued)

Trouble	Cause	Remedy
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 Repair or replace 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.

INSPECTI0N

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, refer to Chart 3002 and the paragraph “Final Test and Adjustment of Pneumatic System” for operating pressure and check procedures .

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.

GROUND PROCEDURE (continued)

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.

100 HOUR INSPECTION

At each 100 hour inspection of the airplane, inspect and operate the deicer boots. Make checks as follows:

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.
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.

CHART 3002. OPERATING PRESSURES

Recommended Operating Pressure PSIG	Test Pressure in PSIG	
	MIN.	MAX.
15	13	17
18	16	20

— 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.

OPERATION CHECK (Refer to Figures 30-4 and 30-5)

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 on 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.

ELECTRICAL TESTS

1. With engines OFF turn ON-Master Switch.
2. TIMER: Activate the Deice System Switch. On Seneca III models, this switch is a momentary spring loaded center-off switch. On Seneca IV models, the switch is momentary push type. (Caution: Do not hold either type of Surface Deice Switch in ON position.)
   a. Check Timer operates immediately. (Refer. Figures 30-1.)
   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.
3. LEFT & 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.

ELECTRICAL TESTS (continued)

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:

TESTING FOR PRESSURE LEAKS

1. This test can be performed in either the left or right nacelles.
2. Cap the overboard ports of the control valve.
3. 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.

4. Remove test equipment, lubricate all threads, and replace all system components.

COMPONENT MAINTENANCE AND REPLACEMENT

FILTERS

Air supply for the system is supplied through the vacuum system. Refer to Chapter 37 for replacement of the appropriate filter(s).

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:

1. Remove nacelle hatch cover to gain access to the valve.

— CAUTION —

Do not lose steel hex actuator pin.

2. Remove electrical connector. Unscrew solenoid.
3. Remove valve poppet. It may be necessary to apply slim nose pliers to pin projection to pull poppet from valve.
4. Thoroughly clean valve bore and poppet with commercial hydrocarbon type solvent.
5. Assemble valve and solenoid.

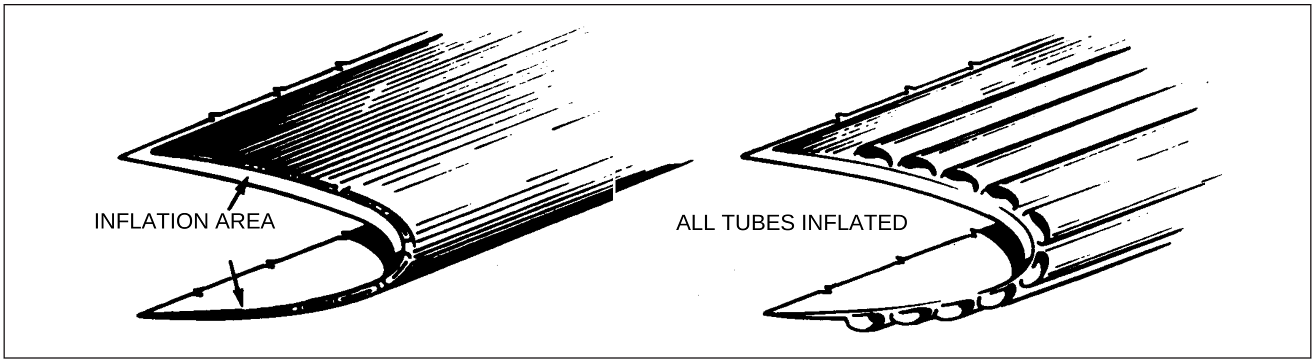

Figure 30-4. Pneumatic Deicer Boots Operation

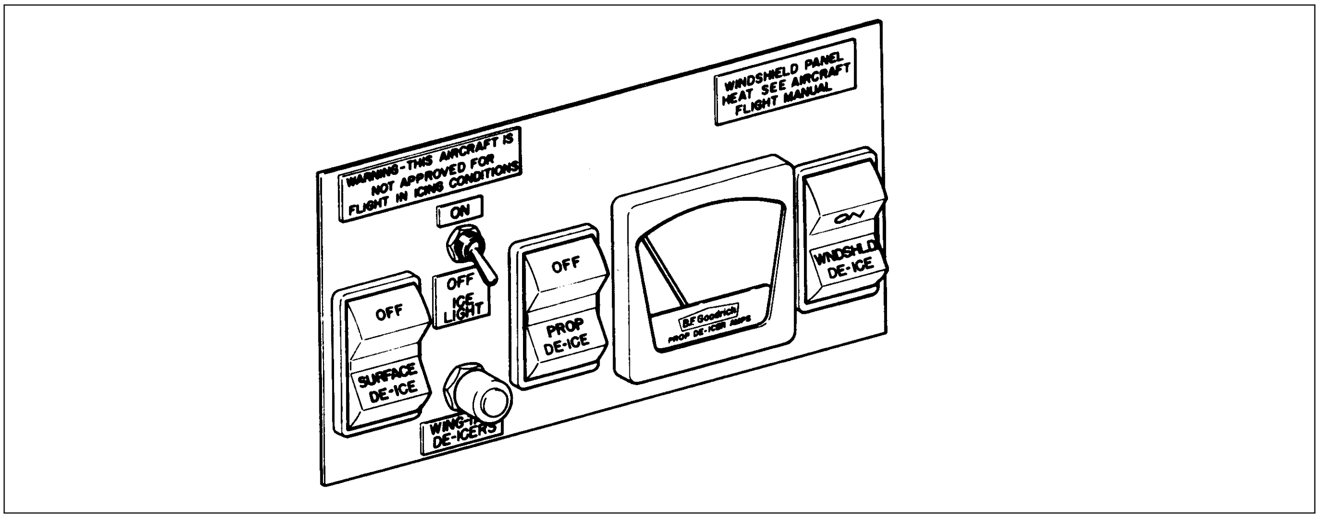

Figure 30-5. Seneca III Deicing Control Panel Installation (1 of 2)

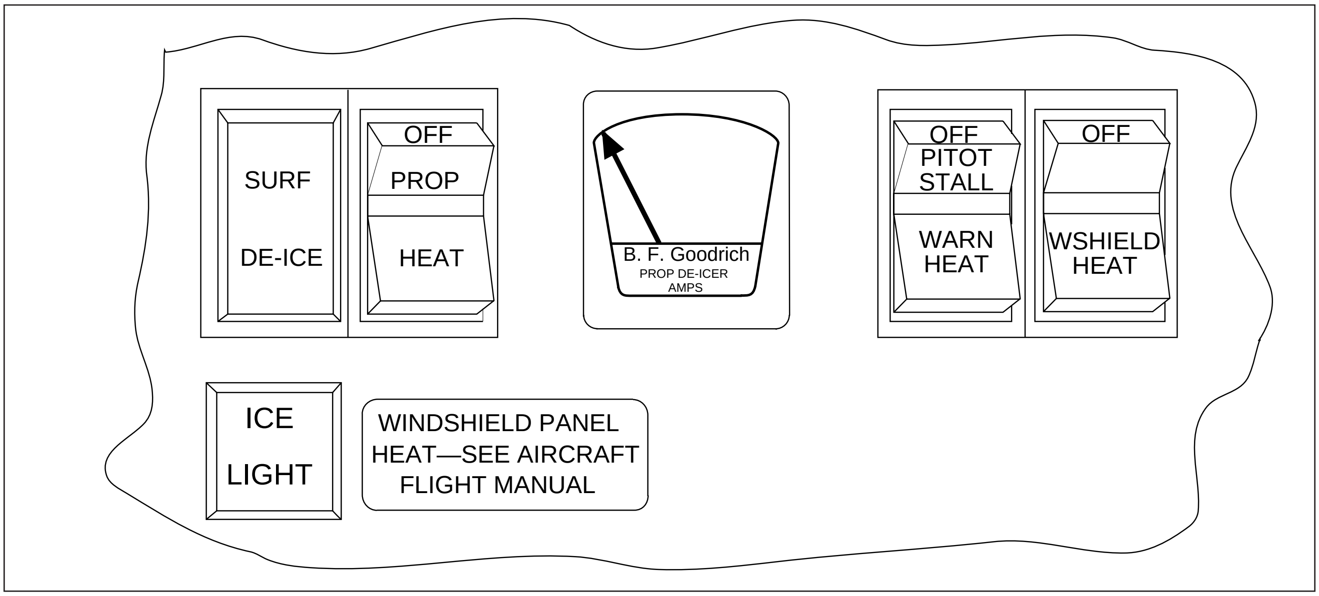

Figure 30-5. Seneca IV Deicing Control Panel Installation (2 of 2)

TIMER

No field maintenance is recommended. For repair or replacement, contact your B. F. Goodrich dealer or distributor.

PNEUMATIC BOOTS

REMOVAL OF BOOTS

– WARNING –

CEMENT AND SOLVENT VAPORS ARE TOXIC AND EXTREMELY FLAMMABLE. USE APPROPRIATE CAUTIONS WHEN USING THEM

– NOTE –

For additional information, refer to the latest revision of B. F. Goodrich Installation and Removal of Pneumatic 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 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).

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. (Refer to the appropriate paragraph for vulcanized repairs.)

COLD REPAIR

The materials and supplies for making cold repairs are listed in Chart 3003.

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.

2. Tube Area Damage

   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.

— 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

   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.

COLD REPAIR (continued)

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.

CHART 3003. 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 Spiicing 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)

COLD REPAIR (continued)

CHART 3003. MATERIAL AND SUPPLIES FOR COLD REPAIR (continued)

Part No.	Quantity	Description
The following materials may be obtained from local supply:		
		Toluol
	As required	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 or 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.

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.

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.

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.

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.

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.)

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.

– 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.

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.

– 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.

– CAUTION –

Tighten each clamp with a pair of slip joint pliers. Do not squeeze the clamp so tight that the hose is damaged.

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.

MOUNTING BOOT ON LEADING EDGE (continued)

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.
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 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.

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.

– CAUTION –

Avoid twisting or sharp bending of the deicer

13. If the deicer should attach incorrectly, use MEK to remove and reposition properly.
14. Rubber roll, apply pressure over entire surface of the deicer.

– NOTE –

All rolling should be done parallel to the inflatable tubes. Roll trailing edges with a narrow stitcher-roller.

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.

MOUNTING BOOT ON LEADING EDGE (continued)

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

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.

CLEANING DEICER BOOTS

— CAUTION —

Avoid the use of petroleum products as cleaning agents

1. Wash deicers with a mild soap and water solution.
2. Rinse with clean water.

– NOTE –

The temperature of the soap solution and rinse water should by exceed 140°F (60°C)

CLEANING DEICER BOOTS (continued)

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.

– NOTE –

If cleaning compound MIL-C-25769 is used to clean the airplane, thoroughly rinse off the deicers with clean water.

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.

ICEX 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.

Before applying Icex, 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.

Apply Icex 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

Follow the application by rubbing the entire surface with a soft, dry cloth until a smooth gloss is achieved.

Reapply Icex every 150 hours

Icex is not a cure-all for icing problems. Icex will not prevent or remove ice formations. Its only function is to keep ice from initially getting a strong foothold, thus making removal easier.

One quart can of Icex will cover appproximately 500 square feet.

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.

RESURFACING CONDUCTIVE CEMENT (continued)

The following materials are required to remove and replace the old, damaged coating:

1. Fine grit sandpaper.
2. Two inch paint brush.
3. One inch masking tape.
4. Conductive neoprene cement, No. A-56-B, B.F. Goodrich Company.
5. Isopropyl Acetate, Federal Specification TT-1-721, as cleaning or thinning solvent.
6. 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.

2Clean deicer thoroughly with Isopropyl Acetate.

1. Roughen entire surface of boot, using a fine grit sandpaper.
2. Clean surface again with clean, lint-free cloth moistened with cleaning solvent.
3. Apply masking tape beyond upper and lower trailing edges, leaving a 1/4 inch gap of bare metal.
4. Mask off any legible deicer brands.
5. 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.

FINAL TEST AND ADJUSTMENT OF PNEUMATIC SYSTEM

1. Remove the hatch covers on each nacelle and disconnect the line between the control valve and check valve.
2. 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.
3. Perform the following procedure with just the left engine operating and then just the right engine operating.
    a. Start the specific engine. Allow the engine to warm up and bring up the power to 2400 rpm.

b. 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.

c. 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.

d. 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.

e. 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 on the pilot's side of the instrument panel. If both systems are not installed, the pitot system, however, 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, and heated lift detectors. The units for these installations are installed on the left wing. Refer to Chapters 27 and 34 for removal and installation procedures. For wiring diagrams (schematics) refer to Chapter 91.

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WINDOWS AND WINDSHIELD

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. On Seneca III models, the heated panel is operated by a circuit breaker type switch located in the deice control panel above and to the right of the throttle quadrant. On Seneca IV models, 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.

REMOVAL AND INSTALLATION OF HEATED PANEL

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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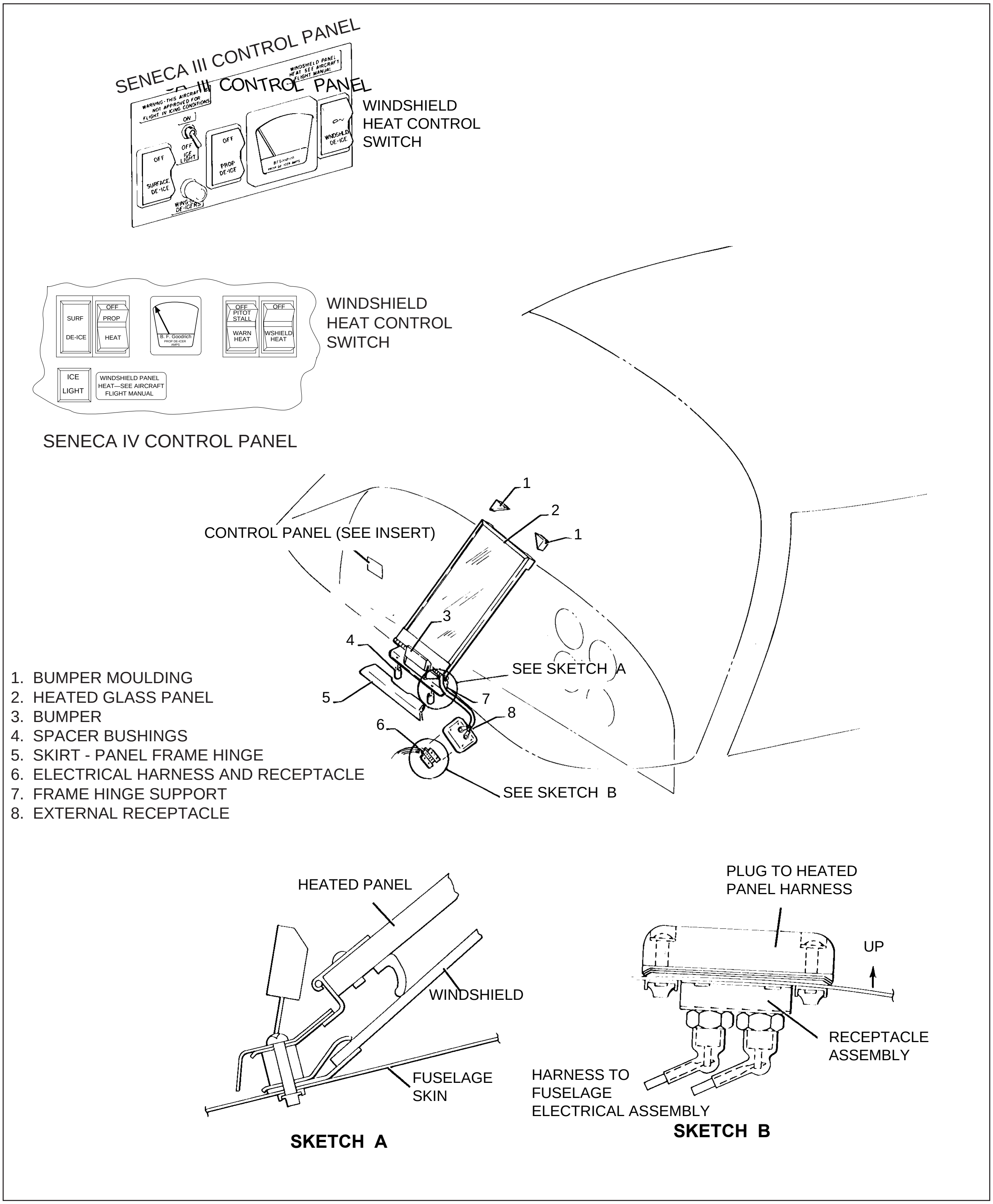

Figure 30-6. Windshield Heat)

PROPELLERS

The deice system for the propeller installations, as described in the GENERAL section, makes use of 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.

Two bladed and three bladed propeller installations have different types of boot electrical installations. Two bladed propellers have two heating elements incorporated in each boot, while three bladed propellers use boots incorporating a single heating element.

Dual element deicers 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.

Single element deicers have only two leads; one input and one ground.

Both installations make use of slip rings and modular brush assemblies to transfer the electrical current to the rotating deicers. The modular brush assemblies are mounted to the front of each engine, and transfer the current through their brushes to their slip rings. These slip rings are connected through a harness to each of their respective boots.

A 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.

On Seneca III models, the ammeter for either the 2 bladed or 3 bladed system is incorporated in the ice protection control panel. On Seneca IV models, it is located among the deice switches installed directly in the instrument panel above the throttle quadrant. Designed for the particular system installed (14 Vdc or 28 Vdc), it is important that, if replacement is necessary, the correct replacement ammeter (by part number) be 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 and/or power is supplied by a 14 Vdc or 28 Vdc system.

With the exception of a minor difference in how the control switch is labeled, Seneca III and Seneca IV propeller deice systems are the same

TROUBLESHOOTING

CHART 3004. TROUBLESHOOTING PROPELLER DEICER 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. No power from airplane.	Locate and correct short before setting circuit breaker If no voltage into switch, locate and correct open.

CHART 3004. TROUBLESHOOTING PROPELLER DEICER SYSTEM (continued)

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.) (continued)	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 and 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

CHART 3004. TROUBLESHOOTING PROPELLER DEICER SYSTEM (continued)

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.

CHART 3004. TROUBLESHOOTING PROPELLER DEICER SYSTEM (continued)

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 is 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.

CHART 3004. TROUBLESHOOTING PROPELLER DEICER SYSTEM (continued)

Trouble	Cause	Remedy
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.
	Timer cycles erratically.	Test timer.
Radio noise or interference with deicers on.	Brushes “arcing.”	Check brush alignment as shown in Figures 30-14 and 30-15. 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 equip ment.

CHART 3004. TROUBLESHOOTING PROPELLER DEICER SYSTEM (continued)

Trouble	Cause	Remedy
Cycling sequence not correct.	Crossed connections.	Check system wiring circuit diagram for improper connections. (Refer to Figure 30-8.)
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 30-10.

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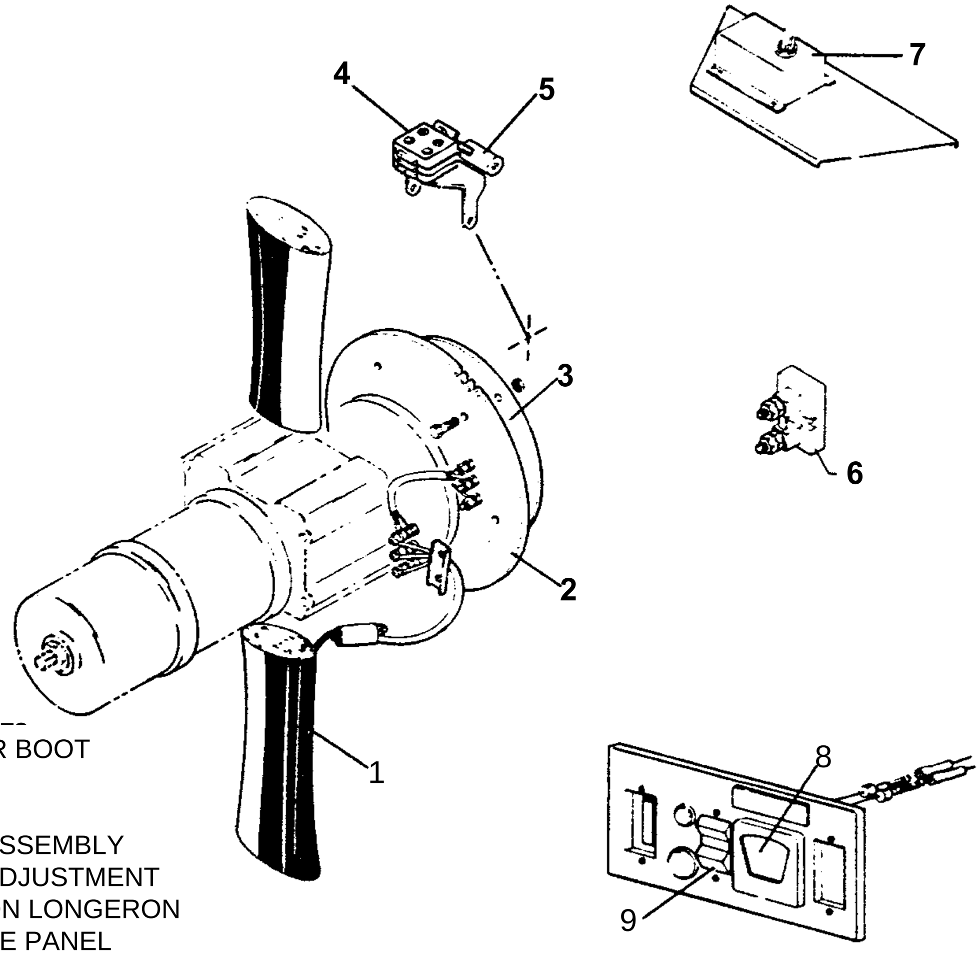
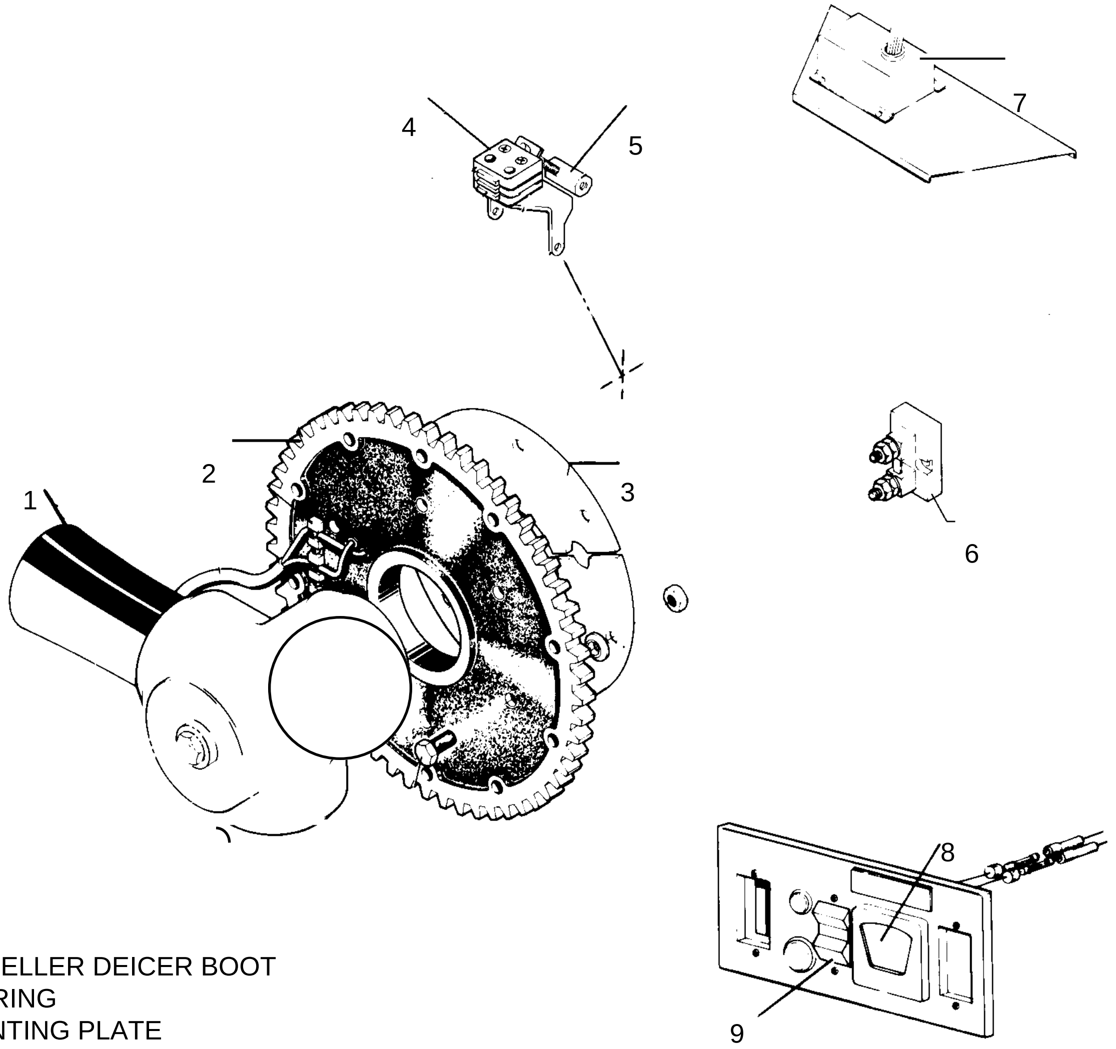


1. PROPELLER DEICER BOOT
2. SLIP RING
3. MOUNTING PLATE
4. MODULAR BRUSH ASSEMBLY
5. MODULAR BRUSH ADJUSTMENT
6. SHUNT (LOCATED ON LONGERON
   BEHIND PILOT'S SIDE PANEL
7. TIMER
8. AMMETER
9. PROP DEICE SWITCH

TWO-BLADED INSTALLATION
(SENECA III DEICE CONTROL DISPLAYED.
SWITCH AND METER SAME RELATIVE
LOCATION ON SENECA IV DEICE CONTROLS)

Figure 30-7. Propeller Deicer Installation



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

THREE-BLADED INSTALLATION
(SENECA III DEICE CONTROL DISPLAYED. SWITCH AND METER SAME RELATIVE LOCATION ON SENECA IV DEICE CONTROLS)

Figure 30-7. Propeller Deicer Installation (continued)

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 circuit diagram, Figure 30-8 for assistance to check voltages or continuity.

HELPFUL TIPS

1. 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.

INSPECTION

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. 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.

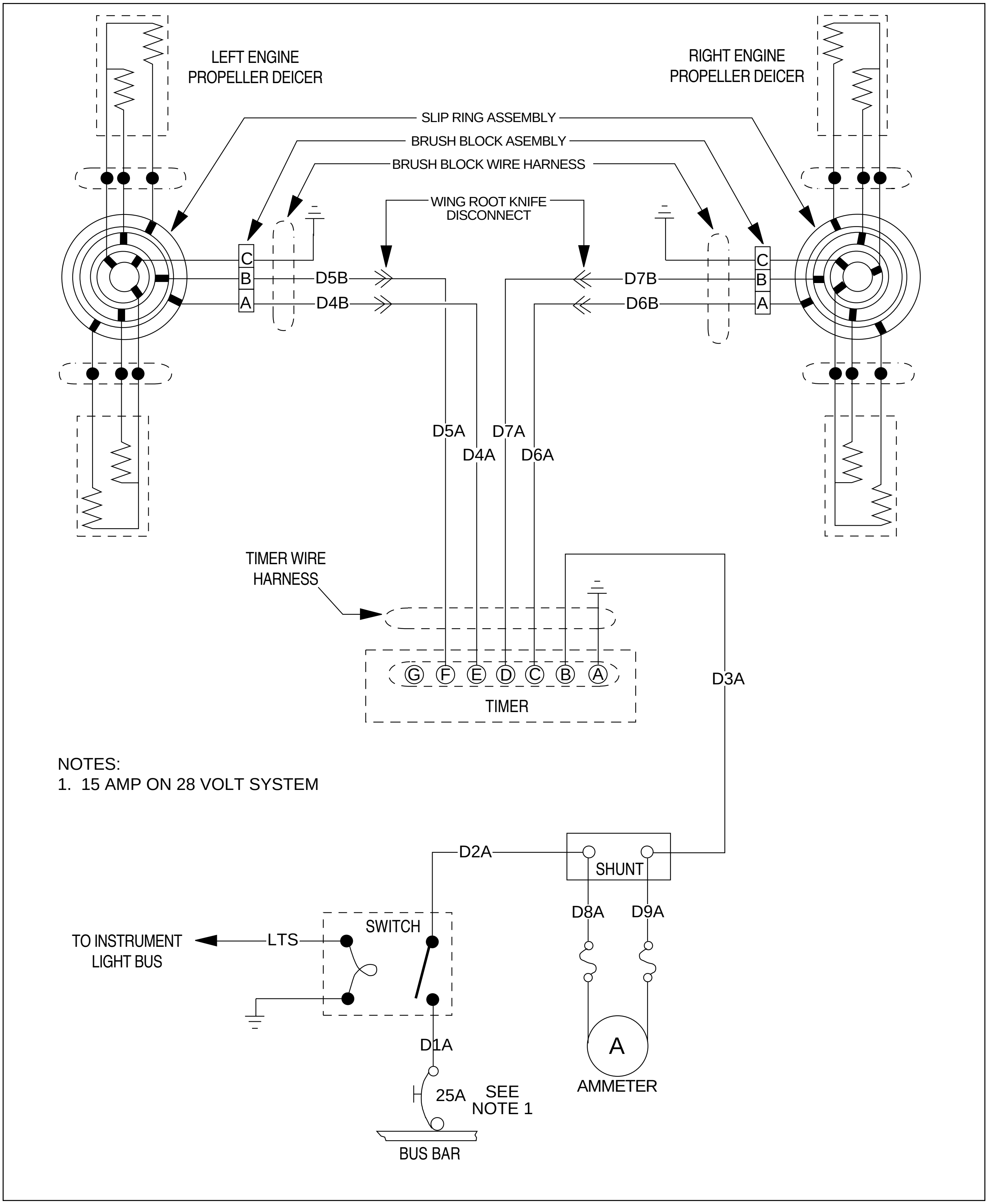
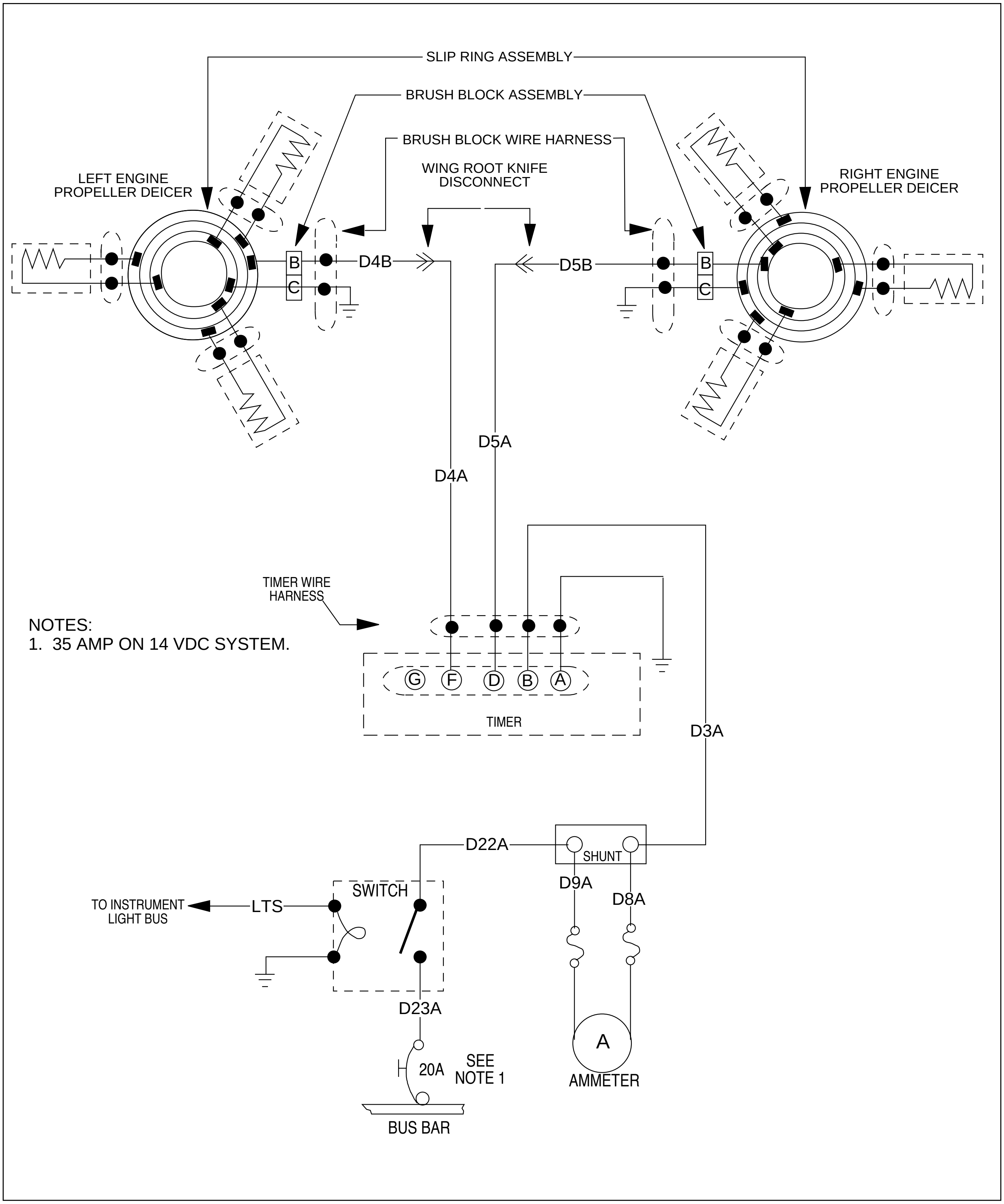
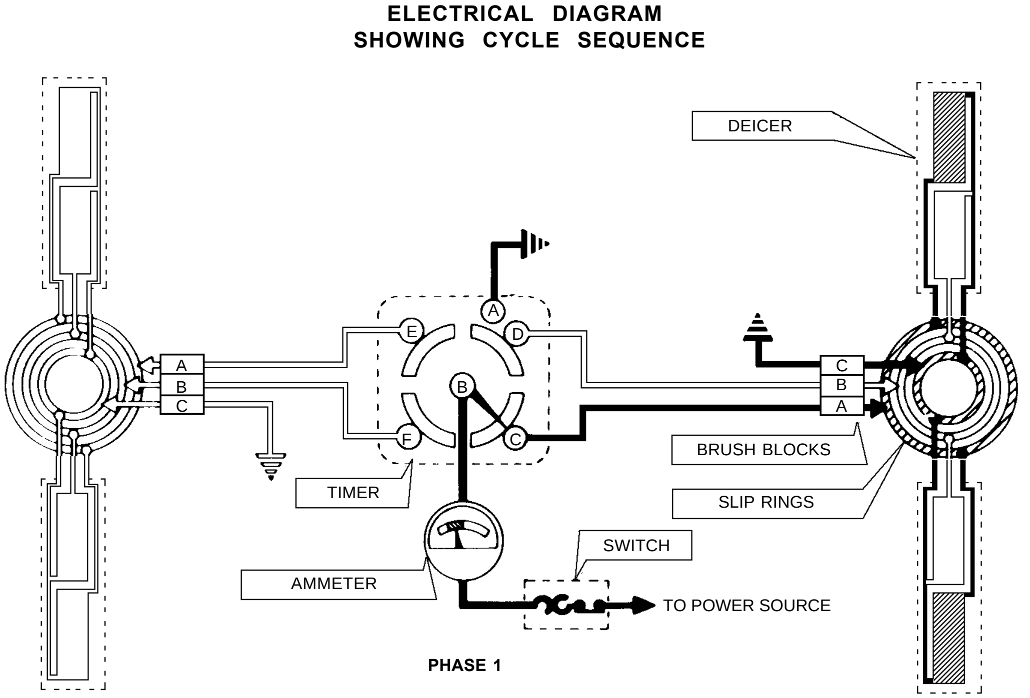


Figure 30-8. Wiring Diagram - Electrical Prop Deicing System (Two Blade)

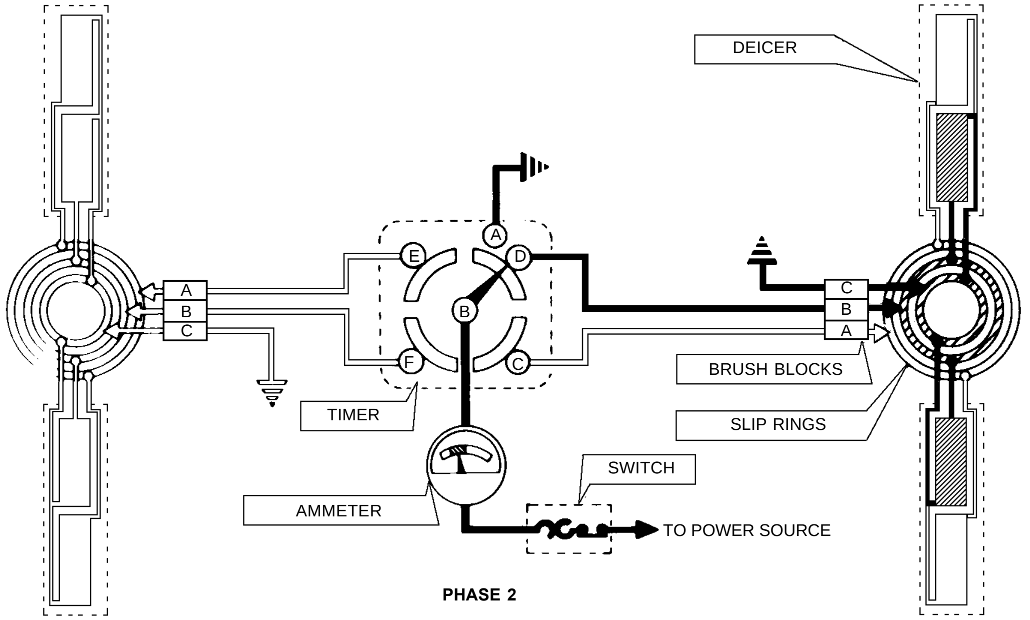


NOTES:
1. 35 AMP ON 14 VDC SYSTEM.

Figure 30-9. Wiring Diagram - Electrical Prop Deicing System (Three Blade)



PHASE 1



PHASE 2

Figure 30-10. Cycling Sequence Two Blade (Phase 1 & 2) – (Sheet 1 of 3)

ELECTRICAL DIAGRAM
SHOWING CYCLE SEQUENCE

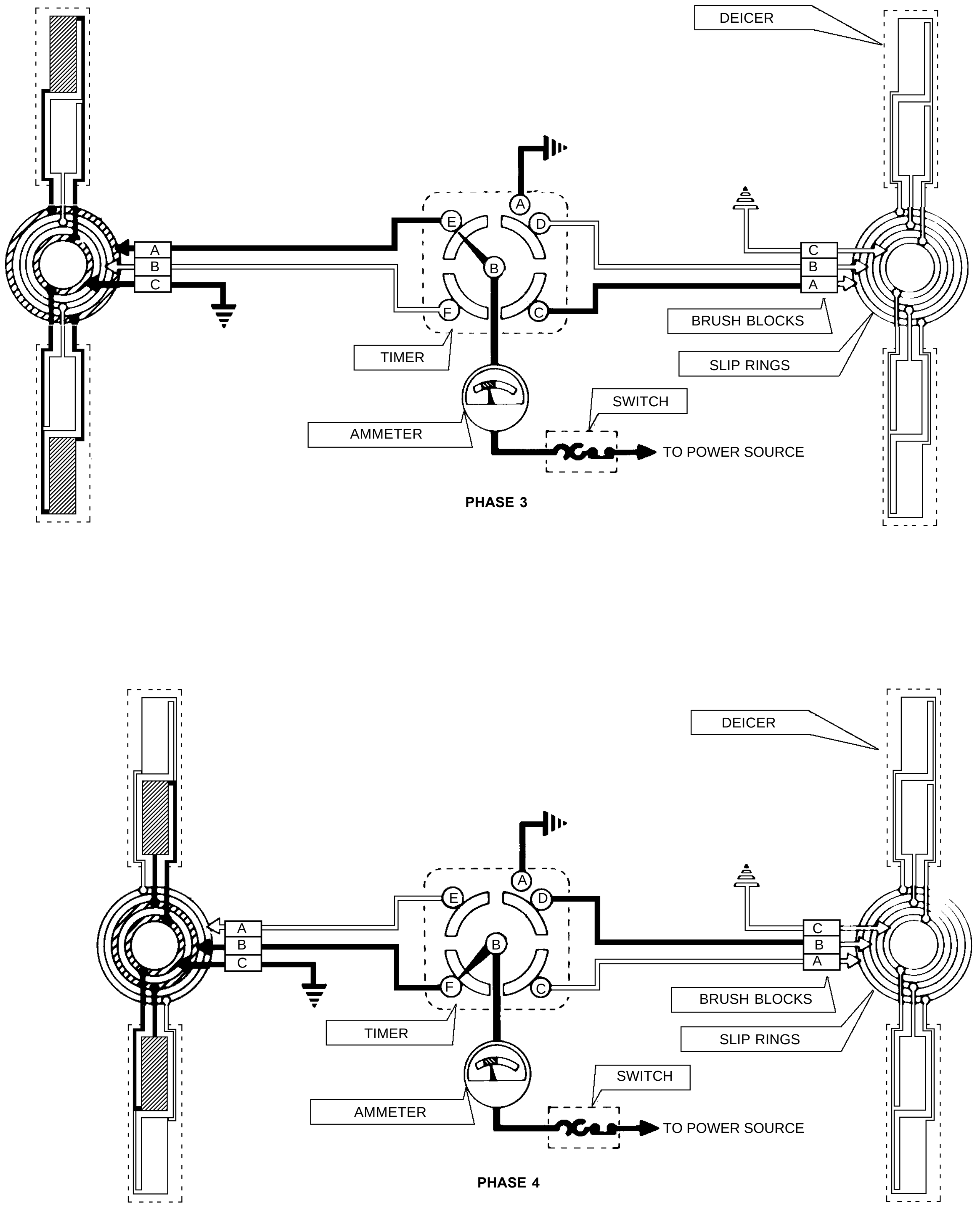
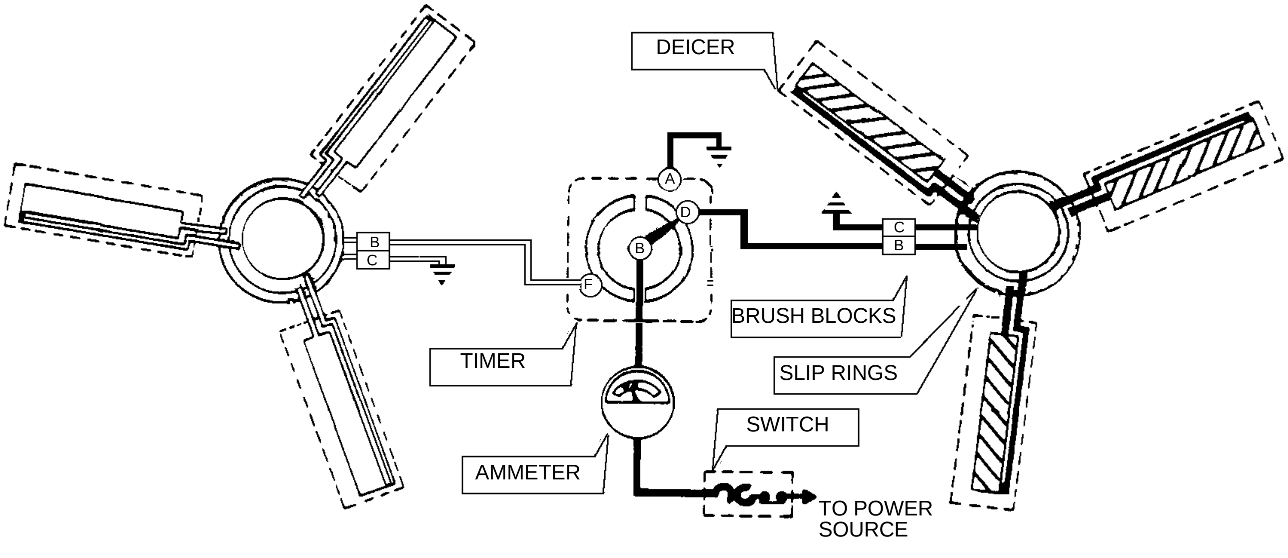
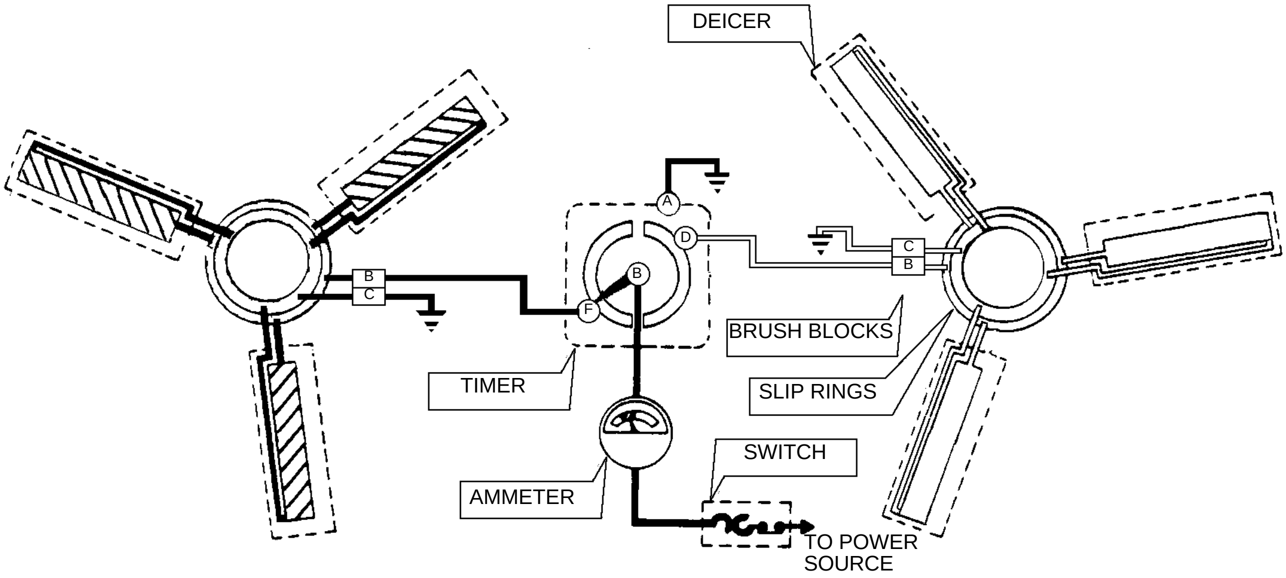


Figure 30-10. Cycling Sequence Two Blade (Phase 3 & 4) – (Sheet 2 of 3)

ELECTRICAL DIAGRAM
SHOWING CYCLE SEQUENCE



PHASE 1



PHASE 2

Figure 30-10. Cycling Sequence Three Blade (Phase 1 & 2) – (Sheet 3 of 3)

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. (Refer to Figure 30-7.)

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 30-11 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 30-16 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 30-15. If not correct, loosen mounting screws and move in elongated holes to correct block position before tightening securely.
   c. Visually check brush block for approximately 2° angle Of attack. (Refer to Figure 30-15.) If not, loosen mounting screws and twist block. but be sure to hold clearance limits shown when tightening.

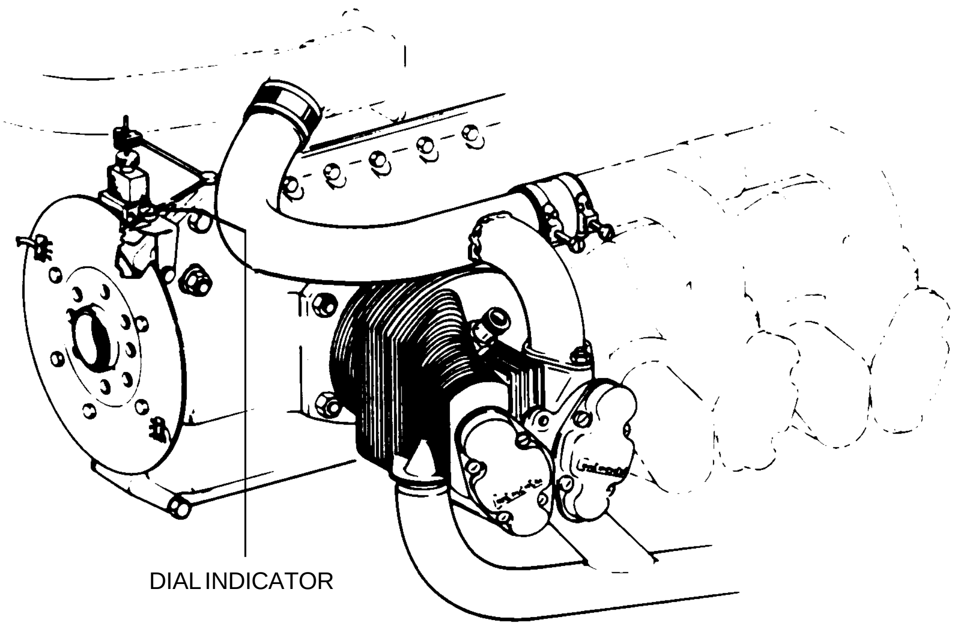
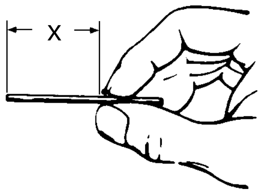
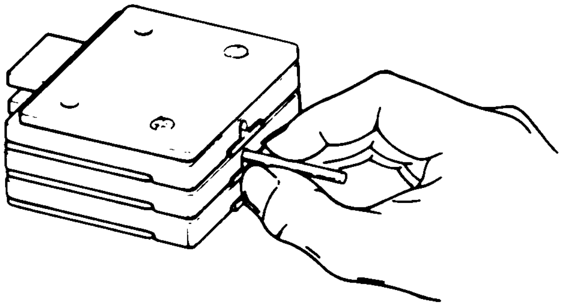


Figure 30-11. Use of Dial Indicator



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 the normal position of the brush when installed on the aircraft.



	X DIMENSION
BRUSH BLOCK ASSEMBLY	MUST REPLACE
3E-2042-1	
BRUSHES WITH RODS	17/64
BRUSHES WITHOUT RODS	1-7/64

Figure 30-12. Measuring Brush Assemblies

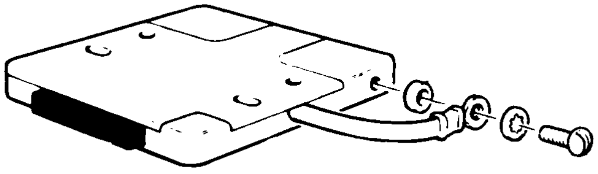


Figure 30-13. Brush Module Assembly 3E2011

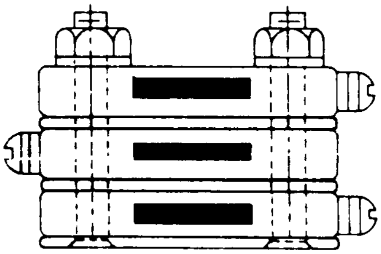


Figure 30-14. Alternate Module Stacking Arrangement

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 diagram in Figure 30-8 & 9 to trace circuitry.

BRUSH ASSEMBLIES

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 30-12. Replace brush modules as follows:

— NOTE —

Brushes arc 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.

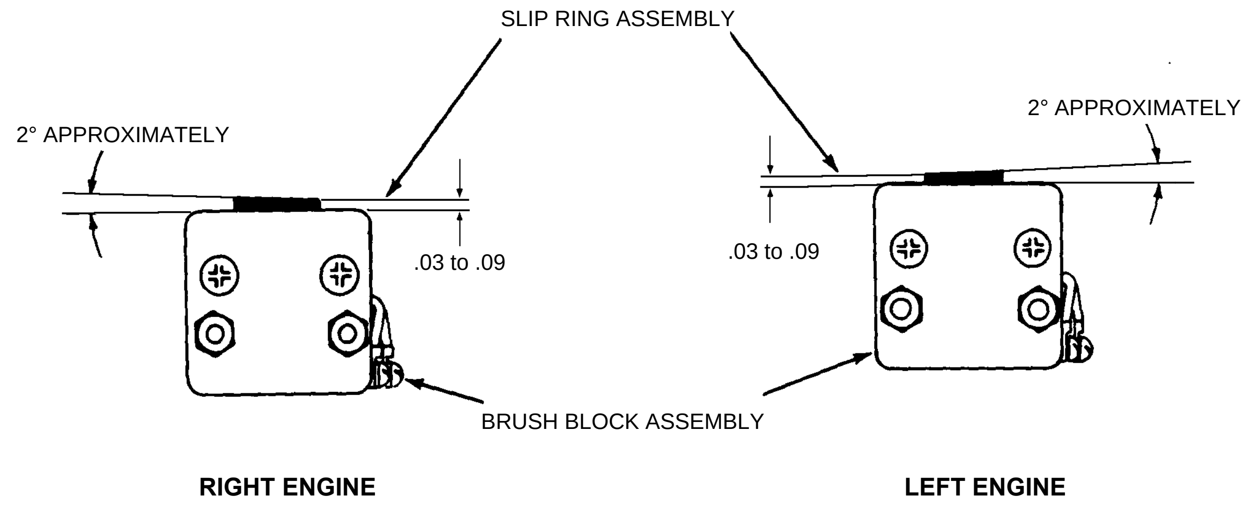


Figure 30-15. Tolerances for Brush Assemblies

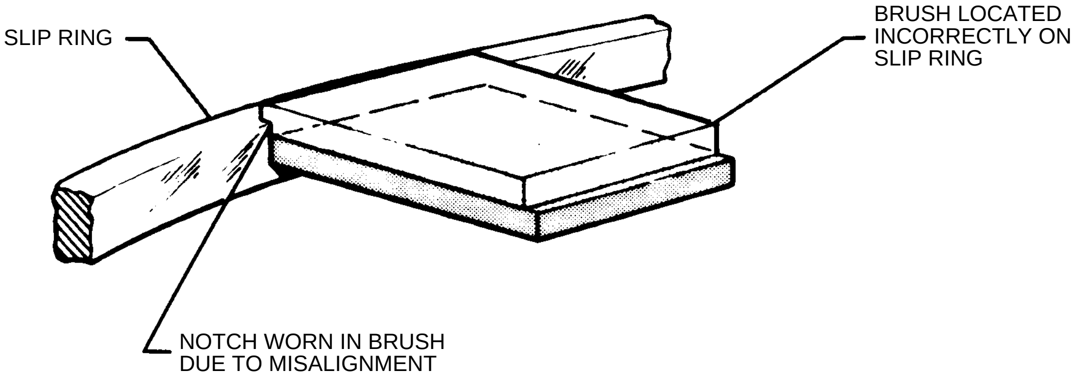


Figure 30-16. Centering of Brushes on Slip Rings

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 30-15 or Figure 30-16. If there is interference between adjacent ring terminals, reorient center module as shown in Figure 30-14.

— NOTE —

Ascertain flat washer is positioned between star washer and housing.

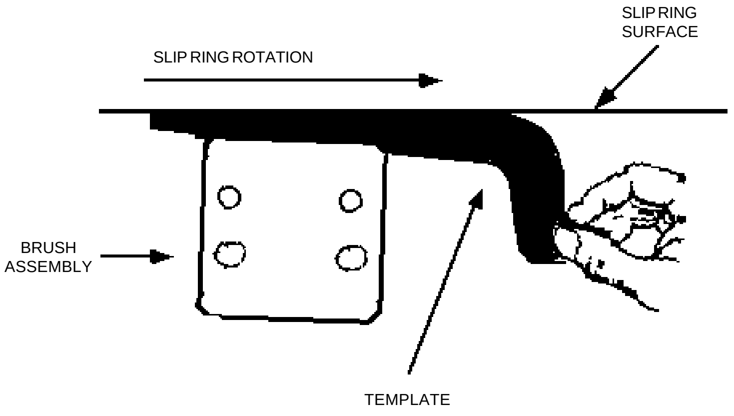
4. Reconnect aircraft wire harness and ensure adjacent ring terminals are not touching.
5. Install assembly on aircraft and check adjustment.

ALIGNMENT OF NEW BRUSHES

Any time the brush block assembly is dismounted, the alignment at reinstallation must be checked as described in step 7 under “100 Hour Inspection.”

BRUSH BLOCK ALIGNMENT

A brush alignment template is available for adjusting brush alignment. Refer to Miscellaneous Section of the Parts Catalog under Special Tools.



1. NOTE DIRECTION OF SLIP RING ROTATION
2. PLACE TEMPLATE AGAINST FACE OF BRUSH ASSEMBLY
3. SLIDE BRUSH ASSEMBLY FORWARD UNTIL TEMPLATE MEETS SLIP RINGS
4. TIGHTEN BRUSH ASSEMBLY AND REMOVE TEMPLATE

Figure 30-17. Brush Block Alignment.

SLIP RINGS

ALIGNMENT OF SLIP RING ASSEMBLIES

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 30-11.) Rotate the propeller slowly noting the run-out indicated on the gauge. The total run-out must not exceed 0.005 inch ± 0.0025 inch and 0.002 inch in any 4 inch interval of slip ring travel.

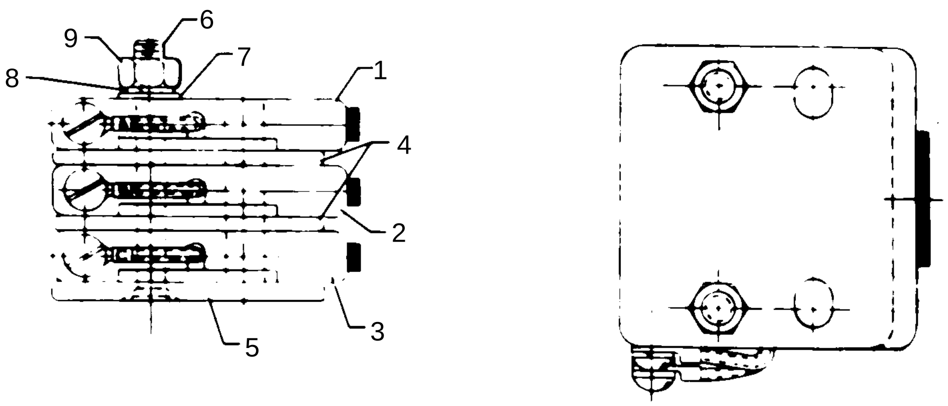
— NOTE —

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.

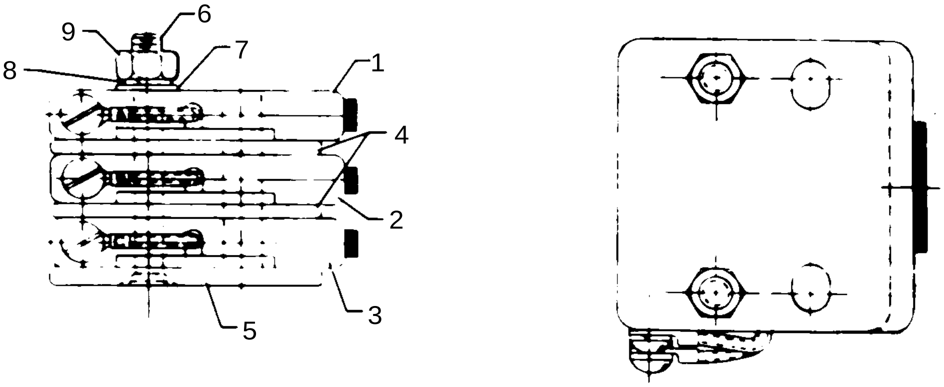
REPLACEMENT OF SLIP RING ASSEMBLIES

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.



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

Figure 30-18. Modular Brush Assembly 3E2042-1 (2 Bladed Prop)



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

Figure 30-19. Modular Brush Assembly 3E2062-2 (3 Bladed Prop)

DEICER BOOTS

RESISTANCE CHECK OF DEICER BOOTS

To determine incorrect resistance, short or open at the brush-to-slip ring contact, disconnect harness at the timer and use low range ohmmeter to read resistance from each deicer circuit lead (Pins C, D, E and F of harness plug) to ground; it should read .47 to .58. If this reading is not obtained, disconnect the deicer lead harness to measure heater resistances individually. Individual heater should be 0.95 to 1.15. If first check is off limits but second check is satisfactory, trouble is probably in the brush-to-slip ring area; if the second check is off limits, the deicer is damaged and must be replaced.

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.

REMOVAL OF BOOTS

1. Disconnect terminals of propeller deicer from studs on the spinner bulkhead.
2. Use MEK or Toluol to soften the adhesion line between the deicer and the propeller blade.

— CAUTION —

DO NOT ALLOW SOLVENTS TO LEAK INTO PROPELLER HUBS AND CAUSE DAMAGE TO SEALS.

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.

BLADE PREPARATION

1. Mark and cut from masking tape a pattern the size of the propeller deicer. (Refer to Figure 30-20.)
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 below), center the pattern on this mark and stick the pattern to the leading edge. Mark the position of the deicer harness.

— NOTE —

All deicers on a single propeller must be located at same distance from the hub for rotational balance.

3. Remove the pattern and remove any paint in the marked off area. Clean down to bare metal. Next, clean the 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.

— CAUTION —

CLEANLINESS OF METAL AND RUBBER PARTS CANNOT BE TOO HIGH STRESSED. ONLY PERFECTLY CLEAN SURFACES WILL ASSURE MAXIMUM ADHESION.

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.

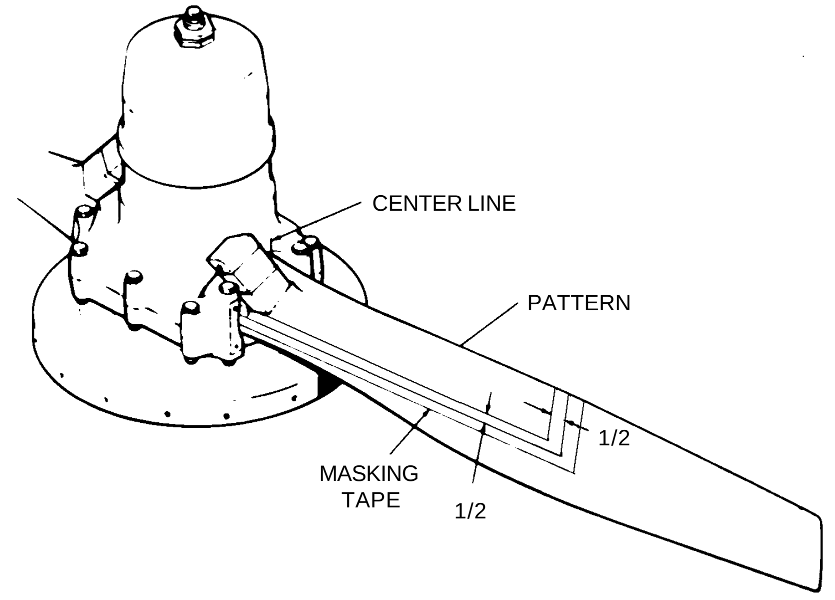


Figure 30-20. Installation of Deicer Boot

CHART 3005. 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 Hou r) *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
I 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.

CEMENT APPLLCATION

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.

INSTALLATION OF DEICER AND REQUIRED MATERIALS

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. (Refer to Figure 30-20.)
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 30-21.)
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.
8. Roll the tapered edges, especially inboard edge of the deicer with the metal stitcher.

— 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.

PREPARATION AND APPLICATION OF SEALER

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 the filler, sealer, or paint thoroughly and in the proper proportions by weight, as given in chart.
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. (Refer to Figure 30-22.) 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. (Refer to Figures 30-20 and 30-22.) 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.

WRINKLED DEICERS (Refer to Figure 30-21**)**

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.

ELECTRICAL CHECK

1. Check the electrical resistance of each of the two elements within the deicer. (Refer to Schematic, Figure 30-8 & 9 and Resistance Readings.) (Refer to Chart 3007.)
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. Minimum and maximum ohms between common ground and either of the other terminals is 0.095 to 1.15.

— NOTE —

These resistances apply only to deicers that are not connected to terminal studs..

CHART 3006. 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

CHART 3007. ELECTRICAL RESISTANCE

Resistance Check	Min.	Max.
(14 Vdc System) – Twop Bladed Propeller		
1 Blade each Element	0.95	1.15
2 Blades in Parallel	0.47	0.58
(28 Vdc System) – Two Bladed Propeller		
1 Blade each Element	4.58	5.26
2 Blades in Parallel	2.29	2.63
(28 Vdc System) – Three Bladed Propeller		
1 Blade each Element	4.74	4.90
3 Blades in Parallel	1.58	1.63

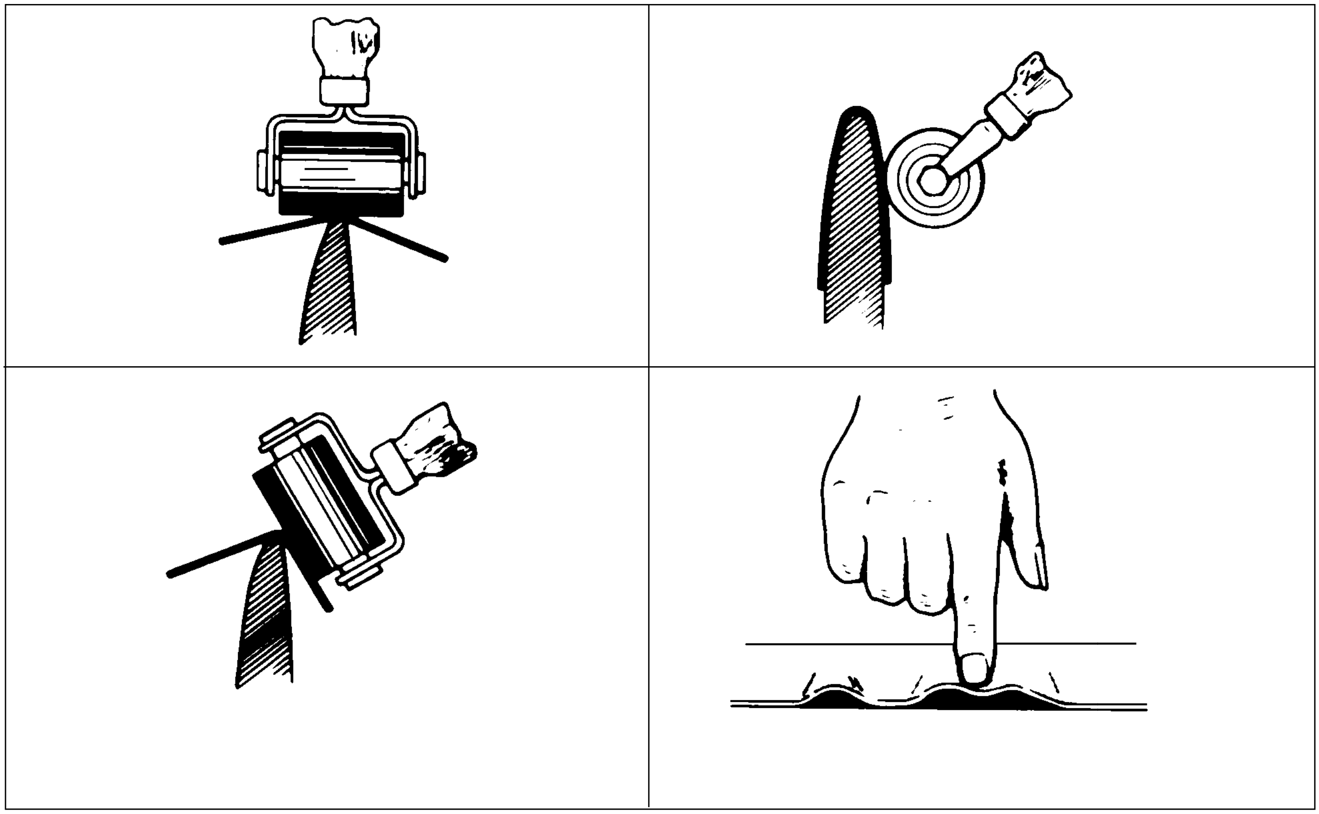


Figure 30-21. Wrinkled Deicers

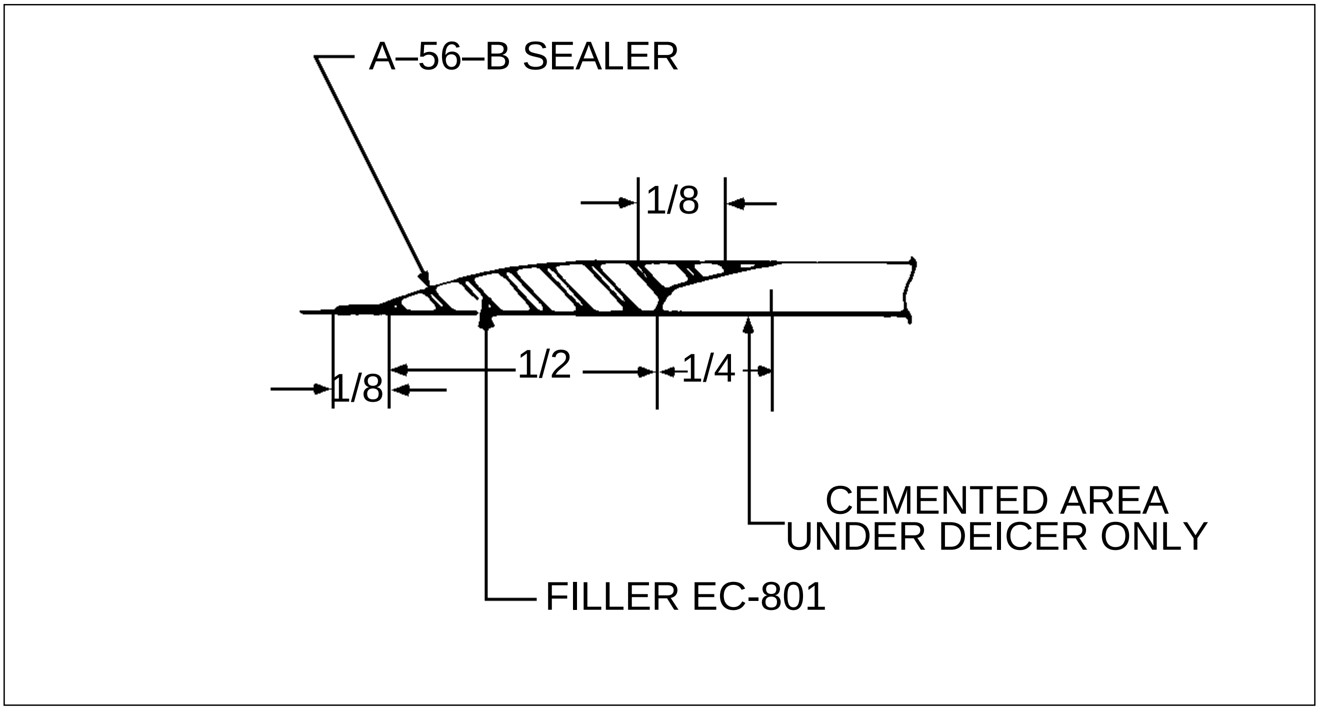


Figure 30-22. Sealer Application (Boot)

INSTALLATION OF DEICER WIRING HARNESS – TWO BLADED PROPELLERS (Refer to Figure 30-23)

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 MS3367-1-9 strap ***between*** leads along length of plug. Do ***not tighten***.
3. Refer to view A. Install two MS3367-2-9 straps ***under*** MS3367-1-9 and around counterweight Do ***not tighten.***
4. Install 5/8 inch I.D. tubing over deicer wire harness.
5. Route the wire harness and protective tubing under both MS3367-2-9 straps. Tighten both tie straps.
6. Tighten MS3367-1-9 strap around plug.
7. Install deicer harness wire terminals to screws on spinner bulkhead. (Refer to view B.).
8. Install lead clip over harness.

INSTALLATION OF DEICER WIRING HARNESS – THREE BLADED PROPELLERS (Refer to Figure 30-24)

1. If necessary, install 3E2087 connector mounting bracket to propeller hub using appropriate number of AN502-10-8 screws and AN960C10 washers.
2. Join connector plug on end of harness to connector plug extending from propeller deicer boot. Secure connection by installing a MS3367-2-9 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 3E2087 connector mounting bracket using two MS3367-1-9 straps. (Refer to views A and B.) Route straps under MS3367-2-9 strap. Note position of strap buckles in Figure 30-24.
4. Using two MS3367-1-9 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 TA1720 SS4T clamp and 1 each MS51957-30 screw, AN960-C6, and MS210454-06 nut. Clamp must be positioned 90° to radial line as shown in Figure 30-24. Ensure clamp is installed in correct mounting hole with respect to propeller rotation.
6. Connect harness to 1E1150-3 terminal strip.

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.

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 Chart 3007.

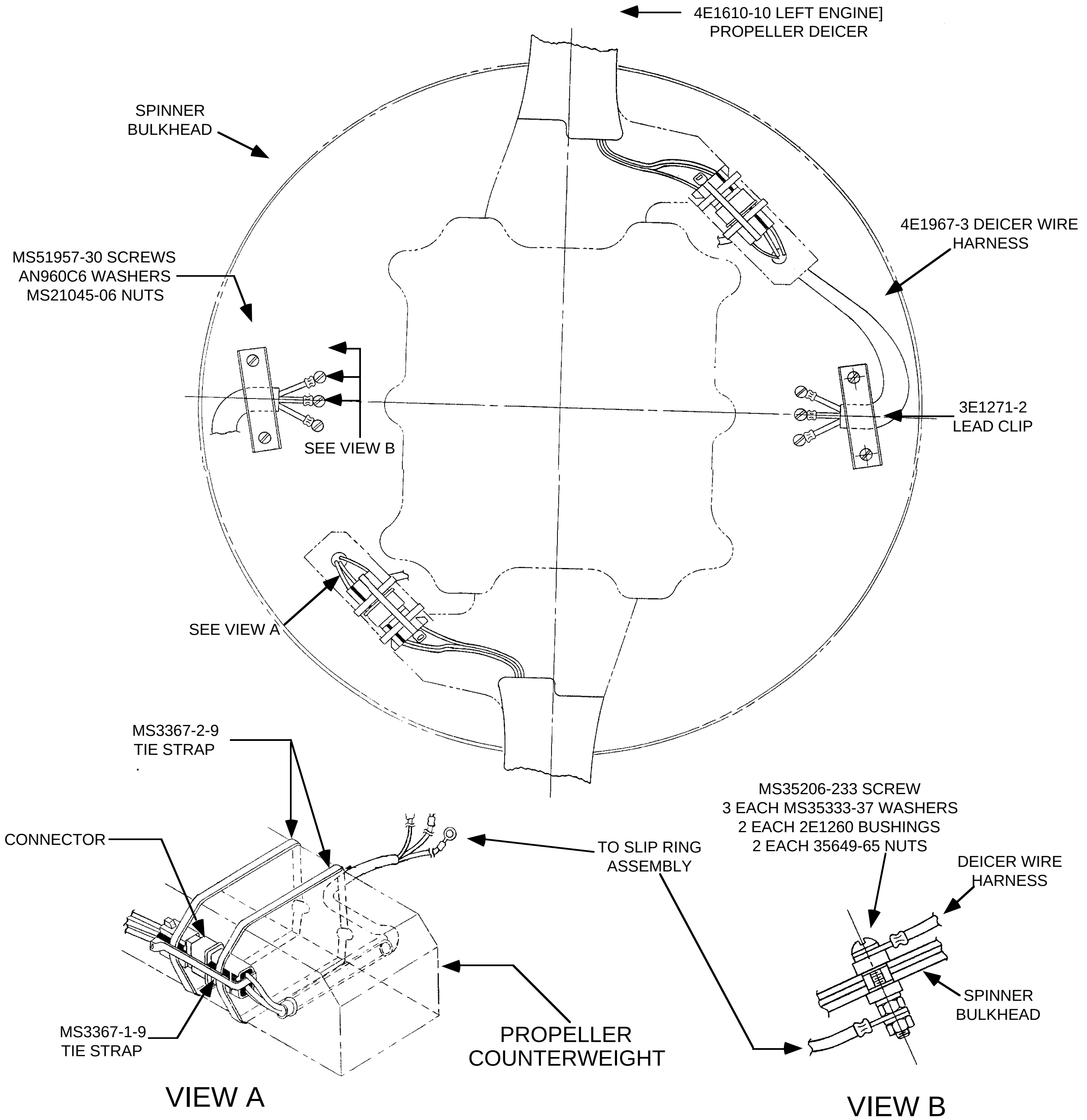


Figure 30-23 Two Bladed Propeller Deicer Harness Installation

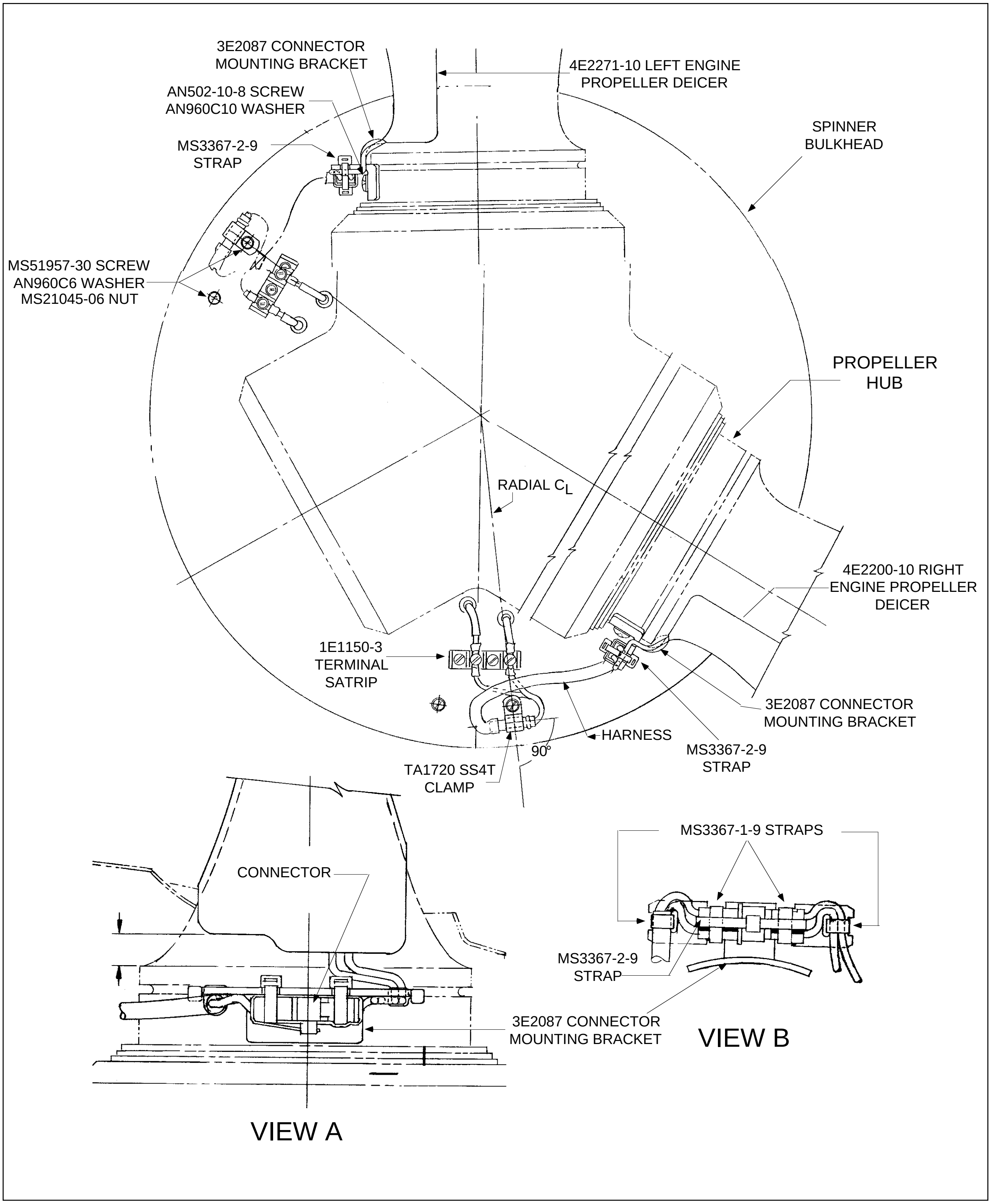


Figure 30-24 Three Bladed Propeller Deicer Harness Installation

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 Coporate Woods Park, Uniontown, Ohio 44685.

TIMER TEST

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.

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, 12 or 24 volt unit. On Seneca III airplanes, the light is controlled from a toggle type switch mounted on the deice switch panel. On Seneca IV airplanes, 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.

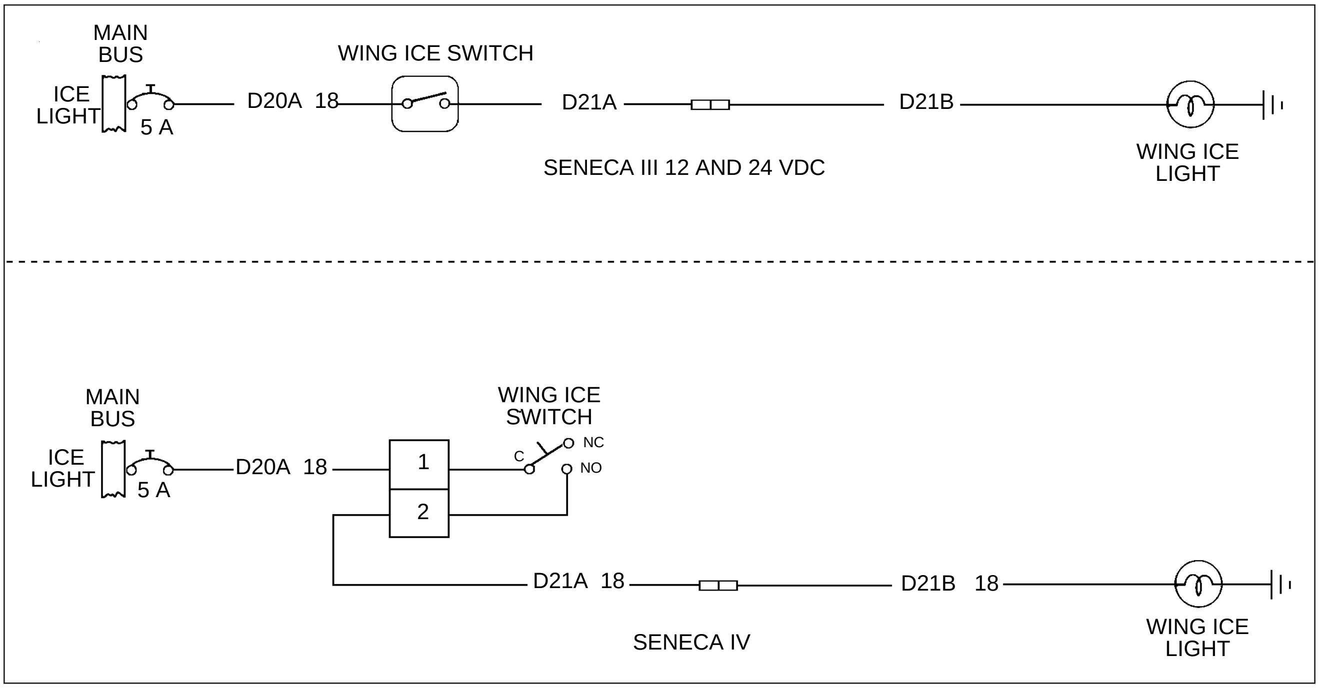


Figure 30-25. Ice Detection Light Schematic

SERVICING

The only service required of this unit is the replacement of a burned out lamp with a new R-12 style bulb.

1. Use Piper P/N 472 172 to replace 14 Vdc lamps.
2. Use Piper P/N 472 125 to replace 28 Vdc lamps.

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.

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.

GRID 2K3
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**GRIDS 2K4 THRU 2L24
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AIRPLANE MAINTENANCE MANUAL

CARD 3 OF 5

PA-34-220T

SENECA III
(ALL)

SENECA IV
(S/N's 3448038 THRU 3448079)

PIPER AIRCRAFT CORPORATION

PART NUMBER 761-751 APRIL 17, 2007

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AEROFICHE REVISION STATUS

Revisions to this Maintenance Manual (P/N 761-751) originally issued December 19, 1980, and completely reissued November 29, 1993, are as follows:

Revision	Publication Date	Aerofiche Card Effectivity
ORG801219	December 19, 1980	1, 2 and 3
CR891220	December 20, 1989	1, 2, 3 and 4
CR931129	November 29, 1993	1, 2, 3, 4 and 5
IR970205	February 5, 1997	1 and 3
PR070417 *	April 17, 2007	1, 3, and 5

* PARTIAL REVISION OF MAINTENANCE MANUAL 761-751

Revisions appear only in Aerofiche Cards 1, 3, and 5. Accordingly, discard your existing Aerofiche Cards 1, 3, and 5, and replace them with these dated April 17, 2007.

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

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GO TO GRID 1A5 FOR THE COMPLETE INTRODUCTION

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12. CHAPTER/SECTION INDEX GUIDE

NOTE: The following GAMA Specification No. 2 standard chapters are not included in this Maintenance Manual: 31, 36, 38, 49, 53, 54, 60, 72, 78, 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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LIST OF ILLUSTRATIONS

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LIST OF CHARTS

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CHAPTER

32

LANDING GEAR

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CHAPTER 32 - LANDING GEAR

TABLE OF CONTENTS/EFFECTIVITY

CHAPTER 32 - LANDING GEAR

TABLE OF CONTENTS/EFFECTIVITY (cont.)

CHAPTER 32 - LANDING GEAR

TABLE OF CONTENTS/EFFECTIVITY (cont.)

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GENERAL

This section contains instructions for overhauling, inspecting and adjusting the various components of the PA-34-220T landing gear and brake system. Also included are adjustments for the electrical limit, safety and warning switches. Other than functional test, this section does not address the hydraulic components of the landing gear extension and retraction system. That information is in 29-10-00.

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.

Airplane serial numbers 34-8133001 through 34-863303 and 3433001 through 3433169 were equipped with Prestolite hydraulic pumps. Serial numbers 3433170 and up, and 3448001 and up are equipped with Oildyne hydraulic pumps. Prestolite pumps may be replaced with the Oildyne pump by purchasing adapter parts from Piper Aircraft Corporation. Refer to the Parts Catalog for appropriate part numbers.

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. On Seneca III airplanes, the green lights will dim when the navigation lights are turned ON. On the Seneca IV, 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 be 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.

2. TROUBLESHOOTING

Mechanical and electrical troubles peculiar to the landing gear system are listed in Chart 3201. When troubleshooting, first eliminate hydraulic malfunctions as listed in Chapter 29. Then proceed to switch malfunctions and last to the mechanical operation of the gear itself, both of which are included in this section.

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.

CHART 3201. TROUBLESHOOTING LANDING GEAR (Sheet 1 of 3)

Trouble	Cause	Remedy
(Seneca III airplanes only) Green gear down lights dim although position light switch is off and gear is down and locked.	Failed instrument panel light control switch. (Lights grounding through dimming resistor instead of through position light switch.)	Replace switch.
Green gear down lights fail to go out with gear in transit or retracted.	Gear down limit switch failed.	Replace switch.
(Seneca III airplanes only) Green gear down lights will go out and not dim when position light switch is turn on although gear is down and locked.	Green light ground dimming resistor open.	Replace resistor.
(Seneca IV airplanes only) 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.
(Seneca IV airplanes only) 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.

CHART 3201. TROUBLESHOOTING LANDING GEAR (Sheet 2 of 3)

Trouble	Cause	Remedy
(Seneca III airplanes only) Green down lock lights operate normally with position lights off but do not operate at all with position lights on.	Green lights dimming resistor open.	Replace resistor.
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.
Nose landing gear shimmies 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.	Refer to previous remedy for correction.
Nose gear fails to steer properly.	Oleo cylinder binding in strut housing.	Lubricate strut housing (Refer to Lubrication Chart.)
		Chart and/or strut housing bushings damaged.
	One brake dragging.	Determine cause and correct.

CHART 3201. TROUBLESHOOTING LANDING GEAR (Sheet 3 of 3)

Trouble	Cause	Remedy
Nose gear fails to steer properly. (continued)	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 or extends.	Steering arm roller sheared at top of strut.	Replace defective roller.
	Incorrect rigging of nose gear steering.	Check nose gear steering adjustment.
	Damaged tiller track.	Replace track.
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.

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MAIN GEAR AND DOORS

1. MAIN GEAR OLEO

A. INSPECTION

NOTE: Disassemble as required.

(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.

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. It is recommended oil be used for aircraft kept in a highly corrosive environment. When oil is used it must be followed by scheduled lubrication.

B. DISASSEMBLY (Refer to Figure 32-1.)

The main gear oleo assembly may be removed and disassembled from the oleo housing with the gear removed from or installed in the airplane. The following instructions assume the gear is still installed.

(1) Refer to 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.

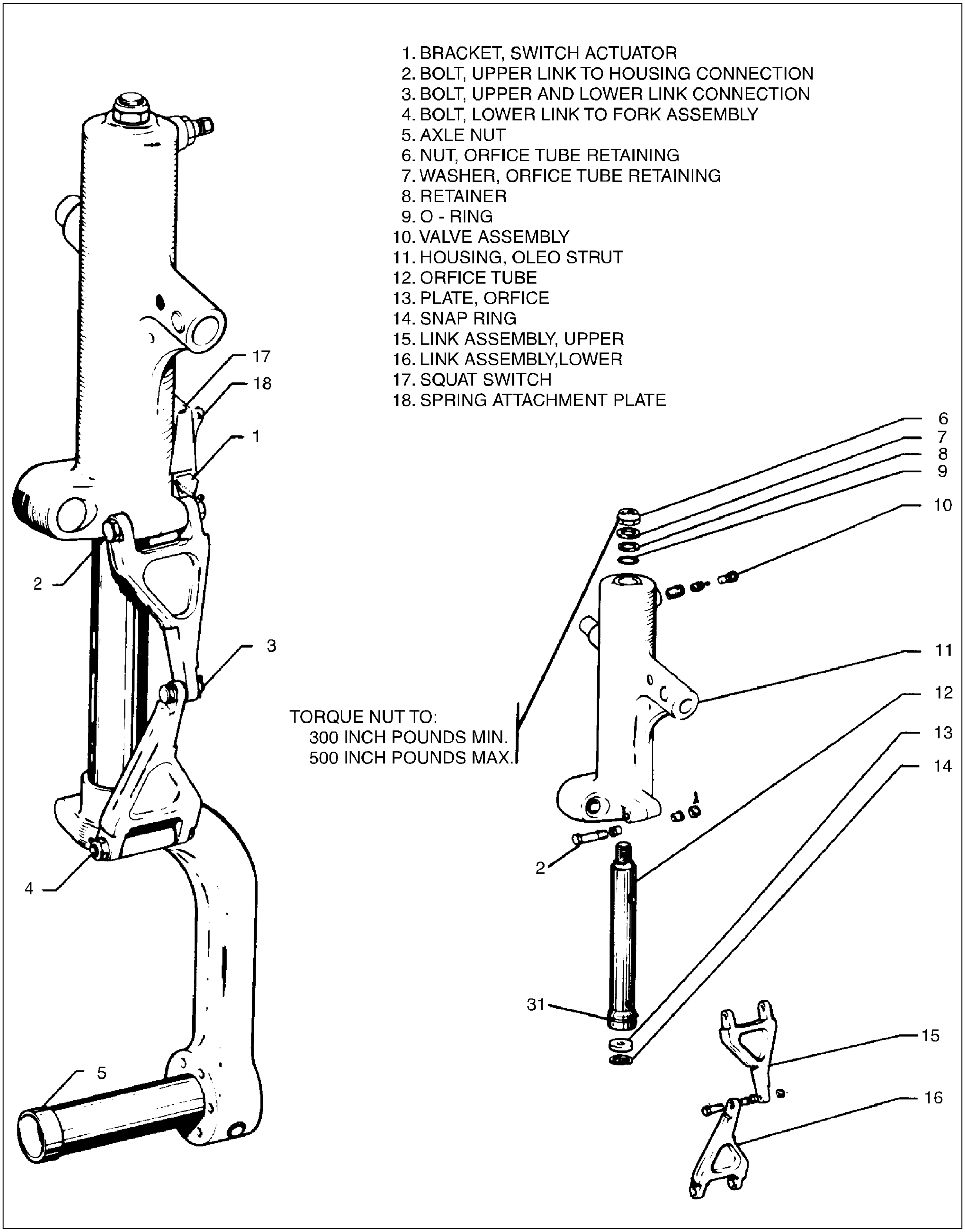
(6) Compress the piston tube slightly, to take off any load on the bearing assembly and make sure it is held in its position.

(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.

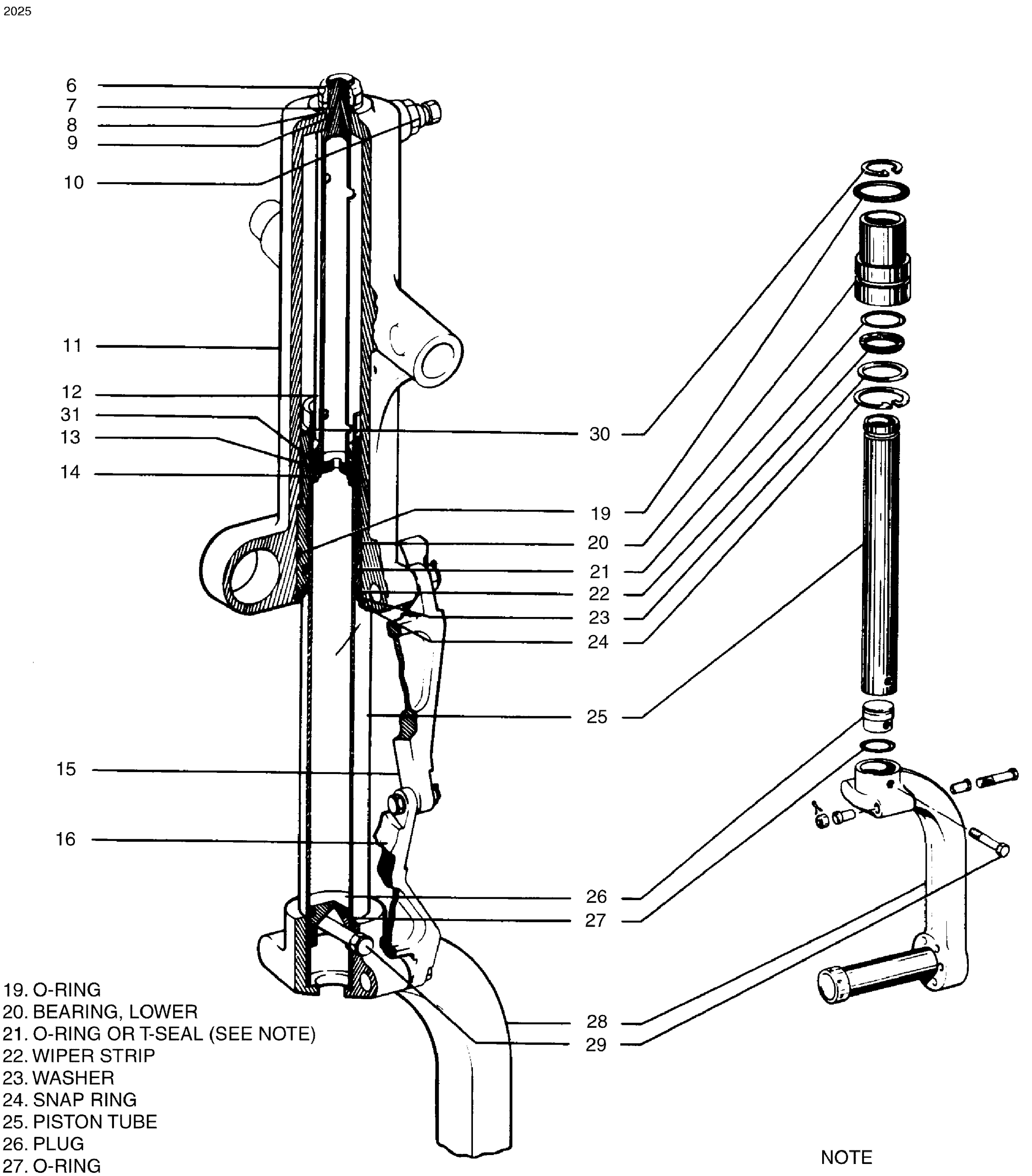
(10) The orifice tube is secured to the strut housing by a locknut where the tube extends through the top of the housing. Remove the locknut and washer.



1. BRACKET, SWITCH ACTUATOR
2. BOLT, UPPER LINK TO HOUSING CONNECTION
3. BOLT, UPPER AND LOWER LINK CONNECTION
4. BOLT, LOWER LINK TO FORK ASSEMBLY
5. AXLE NUT
6. NUT, ORFICE TUBE RETAINING
7. WASHER, ORFICE TUBE RETAINING
8. RETAINER
9. O - RING
10. VALVE ASSEMBLY
11. HOUSING, OLEO STRUT
12. ORFICE TUBE
13. PLATE, ORFICE
14. SNAP RING
15. LINK ASSEMBLY, UPPER
16. LINK ASSEMBLY,LOWER
17. SQUAT SWITCH
18. SPRING ATTACHMENT PLATE

TORQUE NUT TO:
300 INCH POUNDS MIN.
500 INCH POUNDS MAX.

Figure 32-1. Main Gear Oleo Strut Assembly (Sheet 1 of 2)



19. O-RING
20. BEARING, LOWER
21. O-RING OR T-SEAL (SEE NOTE)
22. WIPER STRIP
23. WASHER
24. SNAP RING
25. PISTON TUBE
26. PLUG
27. O-RING
28. FORK ASSEMBLY
29. BOLT ASSEMBLY
30. PISTON TUBE RETAINING RING
31. LUBERIZED BUTT JOINT RING, ORFICE TUBE

NOTE

OVERLAP OF BACK - UP RING MUST BE APPROXIMATLY 180° APART. (REFER TO PARTS CATALOG)

Figure 32-1. Main Gear Oleo Strut Assembly (Sheet 2 of 2)

(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: Separating the piston tube (strut) and fork is not recommended due to shrink fit tolerance built in when manufactured.

C. ASSEMBLY (Refer to Figure 32-1.)

(1) Make sure all parts are cleaned and inspected as described in Inspection, above.

(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.
- (d) Torque the orifice tube locknut per Figure 32-1.

(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. (Refer to 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 squat switch assembly on the left gear 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.

(7) Reconnect the brake hose clamps and the fitting to the actuating cylinder. Bleed as described for brakes in 32-40-00.

(8) Lubricate gear assembly as described in 12-20-00.

(9) Service oleo strut with fluid and air as described in 12-20-00.

(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 per 32-30-00.

(11) Remove aircraft from jacks.

D. REPAIR

Repair of the oleo is limited to smoothing out minor scratches, nicks and dents and replacement of parts.

2. MAIN LANDING GEAR

A. INSPECTION

(1) General

NOTE: Disassemble as required.

(a) Clean all parts with a suitable dry type cleaning solvent.

(b) Inspect the gear components for the following unfavorable conditions:

1 Bolts, bearing and bushings for excess wear, corrosion and damage.

2 Gear housing, truss links, torque links and attachment plates for cracks, bends or misalignment.

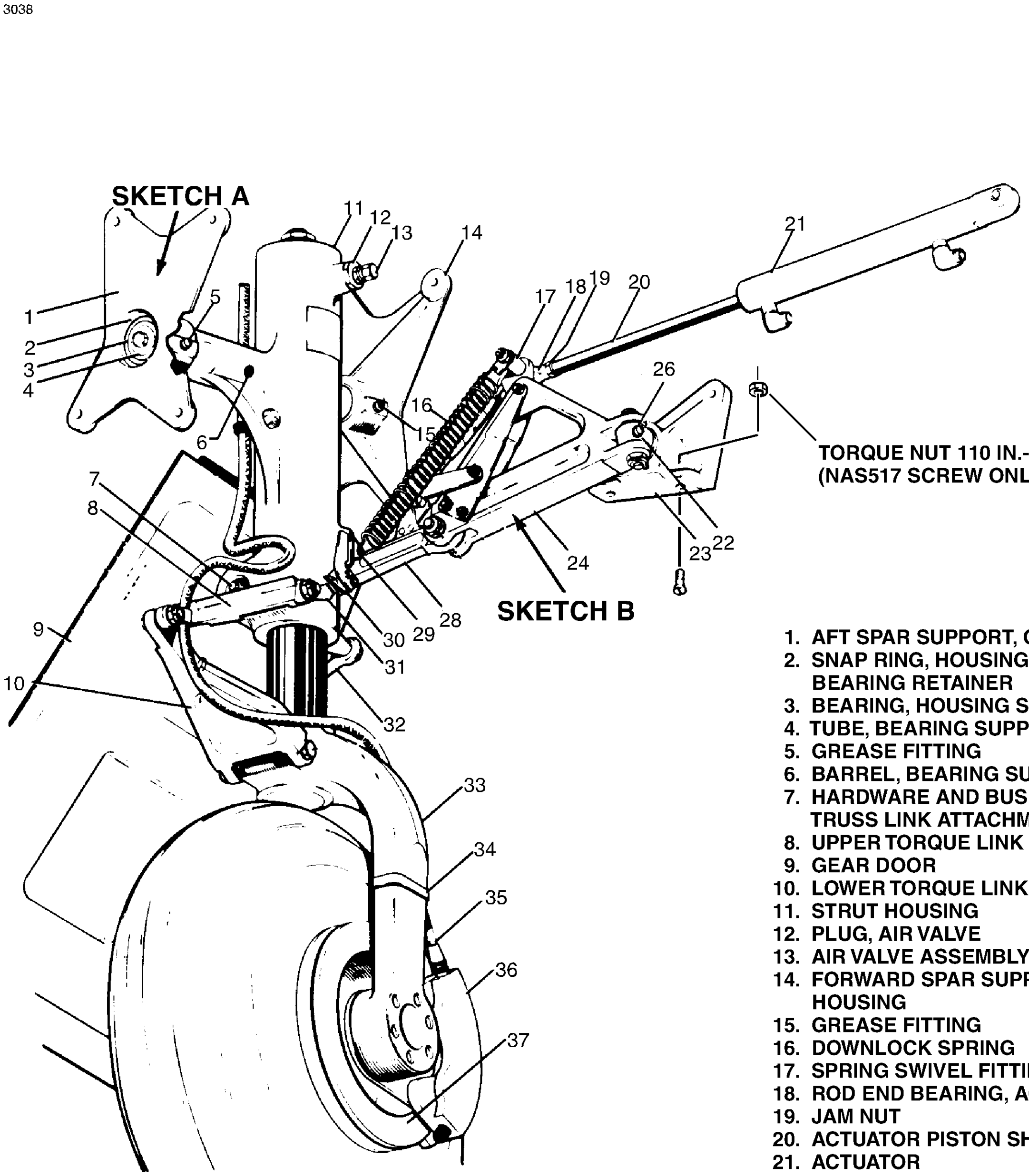
(c) Inspect the gear down lock spring for the following:

1 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.

2 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.

(d) Check the general condition of each limit switch and its actuator and wiring for fraying, poor connections or conditions that may lead to failures.

(e) 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.



1. AFT SPAR SUPPORT, GEAR HOUSING
2. SNAP RING, HOUSING SUPPORT BEARING RETAINER
3. BEARING, HOUSING SUPPORT
4. TUBE, BEARING SUPPORT
5. GREASE FITTING
6. BARREL, BEARING SUPPORT
7. HARDWARE AND BUSHINGS, LOWER TRUSS LINK ATTACHMENT
8. UPPER TORQUE LINK
9. GEAR DOOR
10. LOWER TORQUE LINK
11. STRUT HOUSING
12. PLUG, AIR VALVE
13. AIR VALVE ASSEMBLY
14. FORWARD SPAR SUPPORT, GEAR HOUSING
15. GREASE FITTING
16. DOWNLOCK SPRING
17. SPRING SWIVEL FITTING
18. ROD END BEARING, ACTUATOR SHAFT
19. JAM NUT
20. ACTUATOR PISTON SHAFT
21. ACTUATOR
22. STUD BEARING, TRUSS SPAR SUPPORT
23. SPAR SUPPORT FOR TRUSS ASSEMBLY
24. UPPER LINK, TRUSS ASSEMBLY
25. MOUNTING PAD, DOWN LIMIT SWITCH
26. GREASE FITTING
27. ACTUATING PLATE, DOWN LIMIT MICRO SWITCH
28. LOWER LINK, TRUSS ASSEMBLY
29. BRACKET, DOWN LOCK SPRING
30. SQUAT SWITCH
31. ACTUATOR, SQUAT SWITCH
32. ROD, GEAR DOOR CONNECTING
33. STRUT ASSEMBLY
34. CLAMP SUPPORT FOR BRAKE LINE
35. BRAKE LINE
36. BRAKE ACTUATING CYLINDER

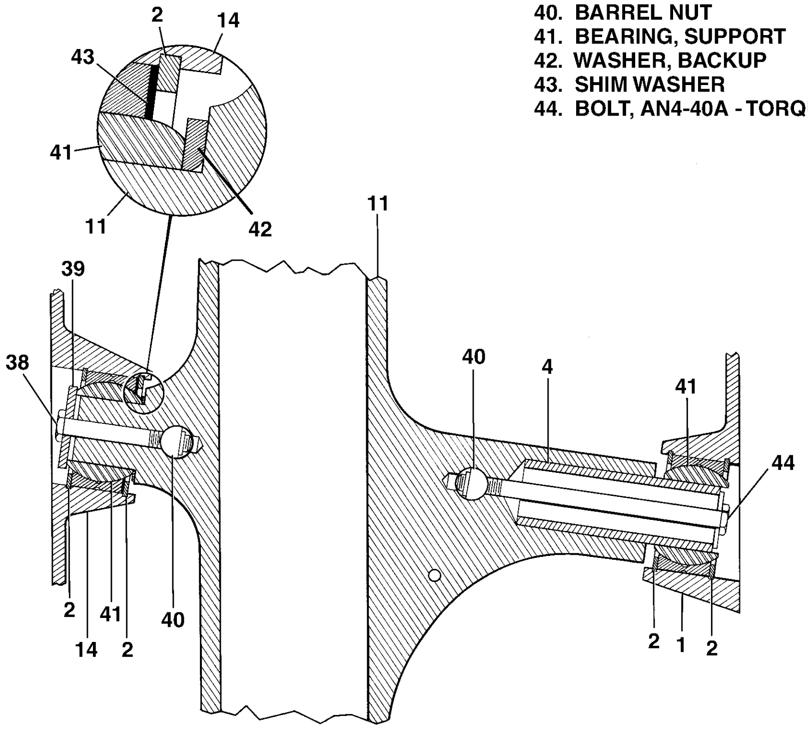
NOTE

DURING ASSEMBLY IT MAY HAVE BEEN NECESSARY TO USE OVERSIZE HARDWARE TO MEET MANUFACTURING TOLERANCES. SPECIAL ATTENTION SHOULD THEREFORE BE GIVEN WHEN REMOVING HARDWARE TO INSURE THAT THE SAME HARDWARE (DIAMETER, ETC.) IS USED AT REASSEMBLY. STANDARD AN 4 OR AN 5 BOLTS ARE REPLACED BY ALTERNATE OVERSIZED BOLTS NAS 3004 OR NAS 3005 RESPECTIVLY, AND STANDARD FLUSH HEAD BOLTS MS 24694-505 ARE REPLACED BY NAS1604-9R BOLTS WHEN OVERSIZED HARDWARE IS REQUIRED.

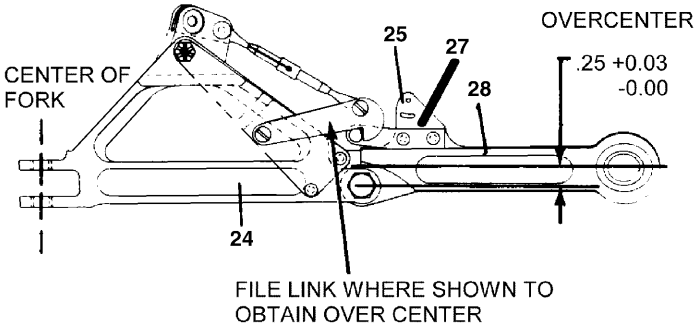
Figure 32-2. Main Landing Gear Installation (Sheet 1 of 2)

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



SKETCH B



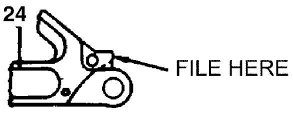


Figure 32-2. Main Landing Gear Installation (Sheet 2 of 2)

CAUTION: MAIN GEAR TRUNNION ASSEMBLIES OTHER THAN P/N'S 39486-014 (LEFT) AND 39486-015 (RIGHT) (EACH EMBOSSED WITH FORGING NUMBER 02599-2) MUST BE REPLACED UPON ACCUMULATING 2500 HOURS TIME-IN-SERVICE.

CAUTION: IF TIME-IN-SERVICE FOR MAIN GEAR TRUNNION ASSEMBLIES OTHER THAN P/N'S 39486-014 (LEFT) AND 39486-015 (RIGHT) (EACH EMBOSSED WITH FORGING NUMBER 02599-2) CANNOT BE DETERMINED, THEN THOSE MAIN GEAR TRUNNION ASSEMBLIES MUST BE REPLACED BEFORE FURTHER FLIGHT.

(2) Trunnion Assembly Dye-Penetrant Inspection

In all Seneca III's and Seneca IV's S/N's 3448038 and 3448039, for airplanes which have not installed new main gear trunnion assemblies P/N's 39486-014 (Left) and 39486-015 (Right) (each embossed with forging number 02599-2) per Piper Service Bulletin No. 787C; and, have accumulated 500 hours time-in-service on one or both of the installed main gear trunnion assemblies; perform the following inspection each 100 hours between 500 and 2000 hours time-in-service, and each ten (10) hours between 2000 and 2500 hours time-in-service:

NOTE: Installation of main gear trunnion assemblies P/N's 39486-014 (Left) and 39486-015 (Right) (each embossed with forging number 02599-2) at any time eliminates these repetitive inspection requirements.

(a) Carefully clean the trunnion housing of dirt and paint in the affected area.

NOTE: Upon reaching 2000 hours time-in-service, permanently remove paint and maintain an alodined surface in the area of inspection to facilitate the ten hour repetitive inspection.

(b) Inspect the housing for cracks with a suitable dye-penetrant inspection method at the lower end of the fillet (see Figure 32-2A).

(c) Replace the trunnion if cracks are detected.

(d) If no cracks are detected, repaint the trunnion (500 thru 2000 hours time-in-service only) and return to service.

(e) Make an appropriate logbook entry documenting this inspection.

B. REMOVAL (Refer to Figure 32-2.)

(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.

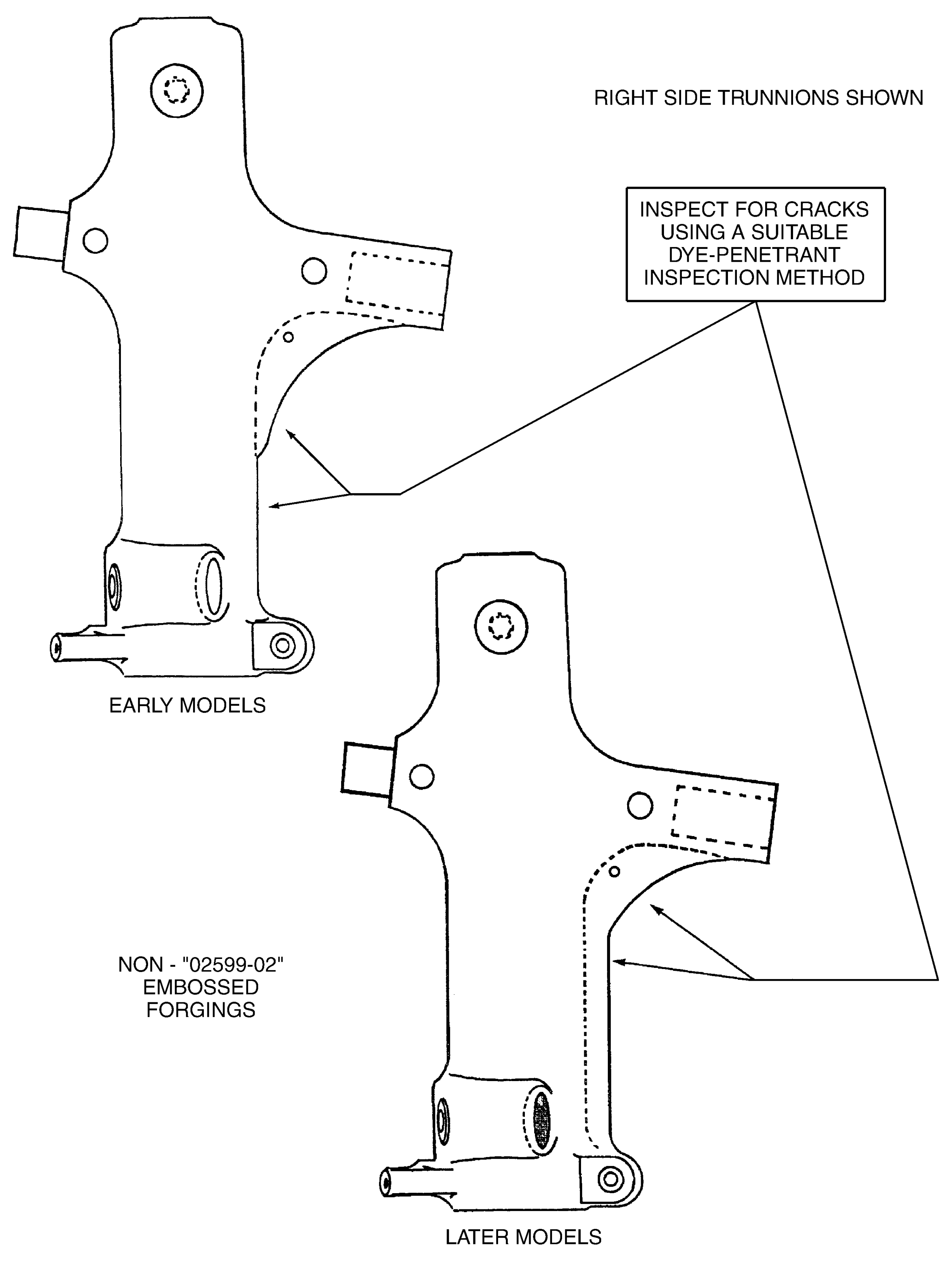


Figure 32-2A. Main Gear Trunnion Inspection

(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.

C. INSTALLATION (Refer to Figure 32-2.)

CAUTION: REFER TO PIPER S. B. NO. 956 BEFORE INSTALLING MAIN LANDING GEAR.

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 62833-044) as necessary. Refer to Sketch A, Figure 32-2.

(3) Referring to Figure 32-2, 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 bolt (Item 38) and install the retaining bolt in the arm with the torque specified in Figure 32-2. 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 it properly installed in the long (aft) arm of the housing and slide the specific backup washer (P/N 67502-0) over the retaining bolt (Item 44).

(j) Reaching through the access hole under the wing, install the retaining bolt and backup washer with the torque specified in Figure 32-2.

(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 factory. 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. See Figure 32-2 and Chart 9102 for torque values.

(b) If necessary, assemble the upper and lower truss links and check the over center travel as described in Inspection, above.

(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 below.

(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 (Refer to Figure 32-3.)

(1) Place a straightedge no less than twelve feet long across the front of both main landing gear wheels. Butt 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: A carpenter's square is recommended 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.

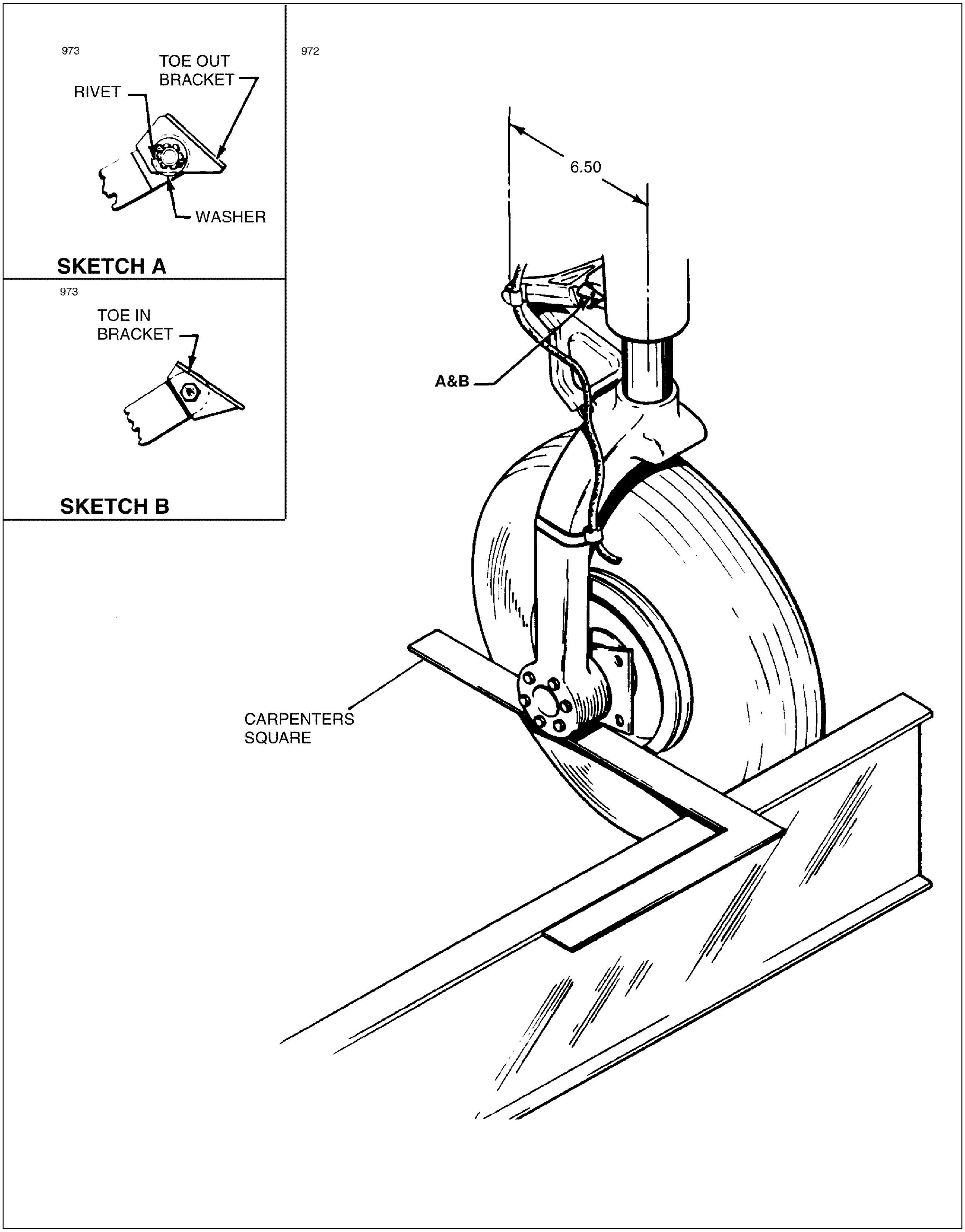


Figure 32-3. Aligning Main Gear

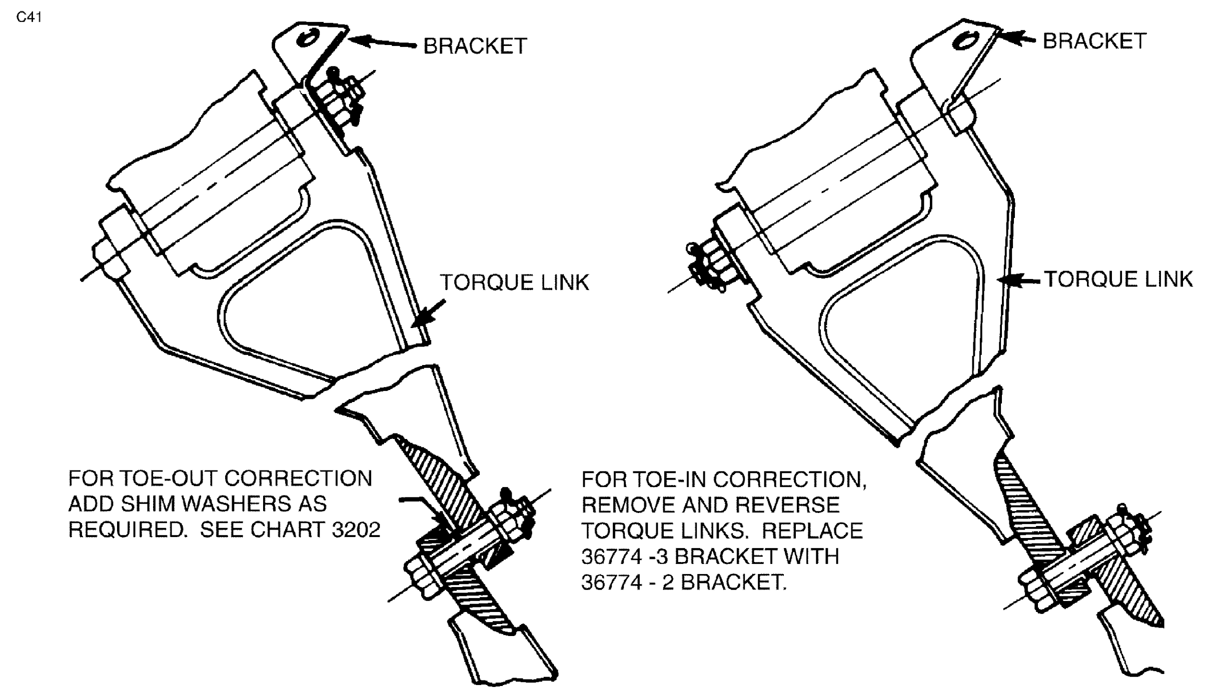


Figure 32-4. Toe-In/Toe-Out Adjustment

CHART 3202. 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		

(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. Refer to Chart 3202.

(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. (Refer to Figure 32-4.) 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.

(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).

E. REPAIR

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.

3. MAIN GEAR DOORS

A. INSPECTION

(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.

B. 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.

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.

(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. Overtightening 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.

E. REPAIR

Repairs to a door are limited to replacement of hinge, repair of fiberglass and painting.

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NOSE GEAR AND DOORS

1. NOSE GEAR OLEO

A. INSPECTION

(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.

B. REMOVAL (FROM TRUNNION) (Refer to Figure 32-5.)

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.

C. INSTALLATION (IN TRUNNION) (Refer to Figure 32-5.)

(1) Assemble the components of the oleo strut as instructed in steps (1) through (8), in Assembly, below, 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.

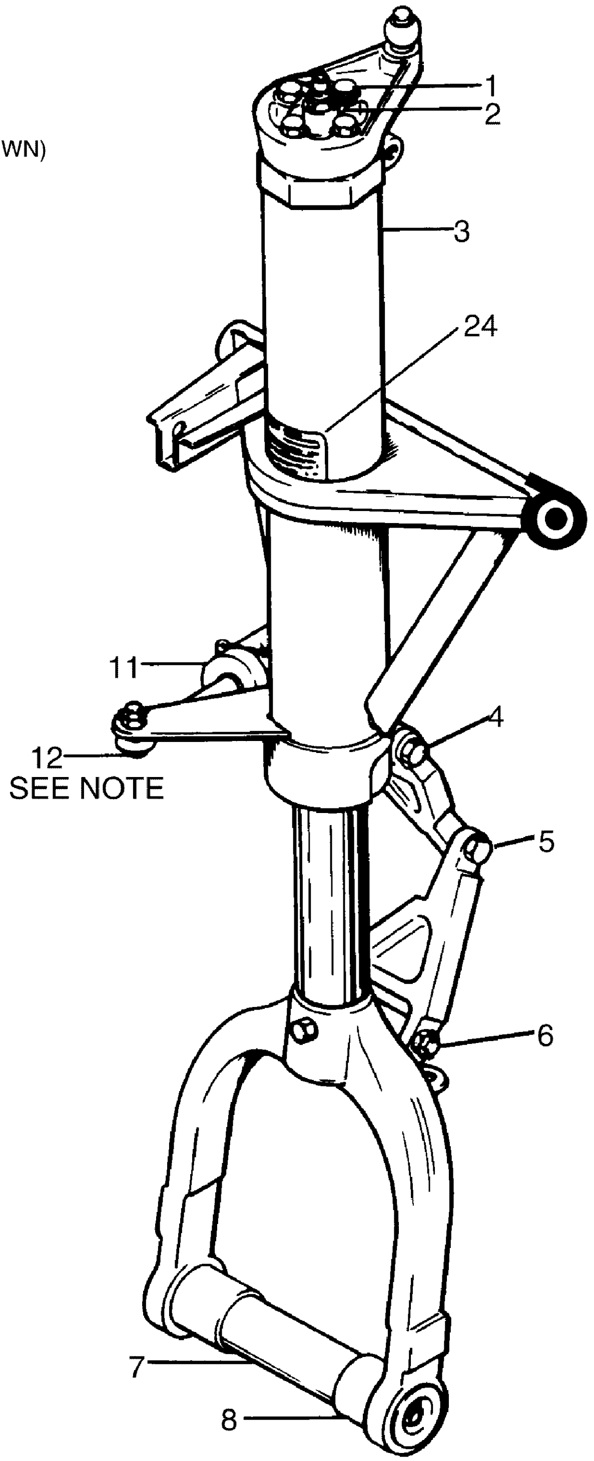
(3) Coat the bearing surfaces of the lower shoulder bushing with the appropriate grease (refer to 12-20-00) and slide the bushing down the oleo cylinder until it bottoms above the upper torque link mount.

(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.

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.

Figure 32-5. Nose Gear Oleo Strut Assembly (Sheet 1 of 2)

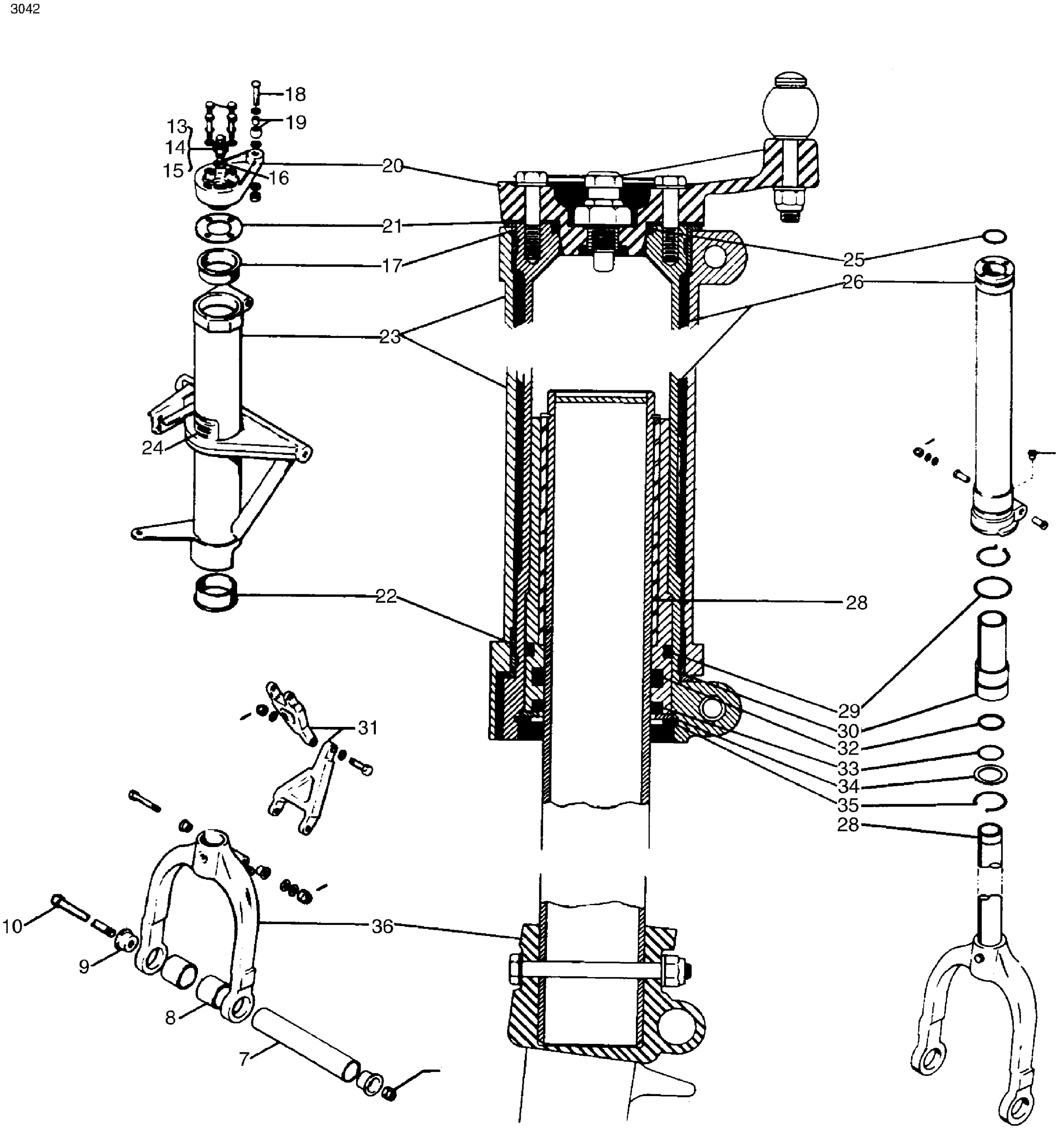


Figure 32-5. Nose Gear Oleo Strut Assembly (Sheet 2 of 2)

(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 12-20-00.

(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.

(10) Refer to Figure 32-5, 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.

NOTE: The hardware used in connecting the centering spring rod end to the trunnion arm must be installed as shown in Figure 32-5.

(11) Lubricate the gear assembly per 12-20-00.

(12) Fill the oleo housing with 21 ± 1 ozs. 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.

D. DISASSEMBLY (Refer to Figure 32-5.)

(1) If not already accomplished, release the air pressure and remove the hydraulic fluid as described in steps 2 and 3 in Removal, above.

(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.

E. ASSEMBLY (Refer to Figure 32-5.)

(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. (Refer to 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 ± .25 inches visible strut extension.

F. REPAIR

Repair of the oleo is limited to smoothing out minor scratches, nicks and dents, and replacement of parts.

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 2005-13-16.

(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.

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.

(4) Turn Limit Indicator

A Turn Limit Indicator was added to the Seneca V in 1998 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.

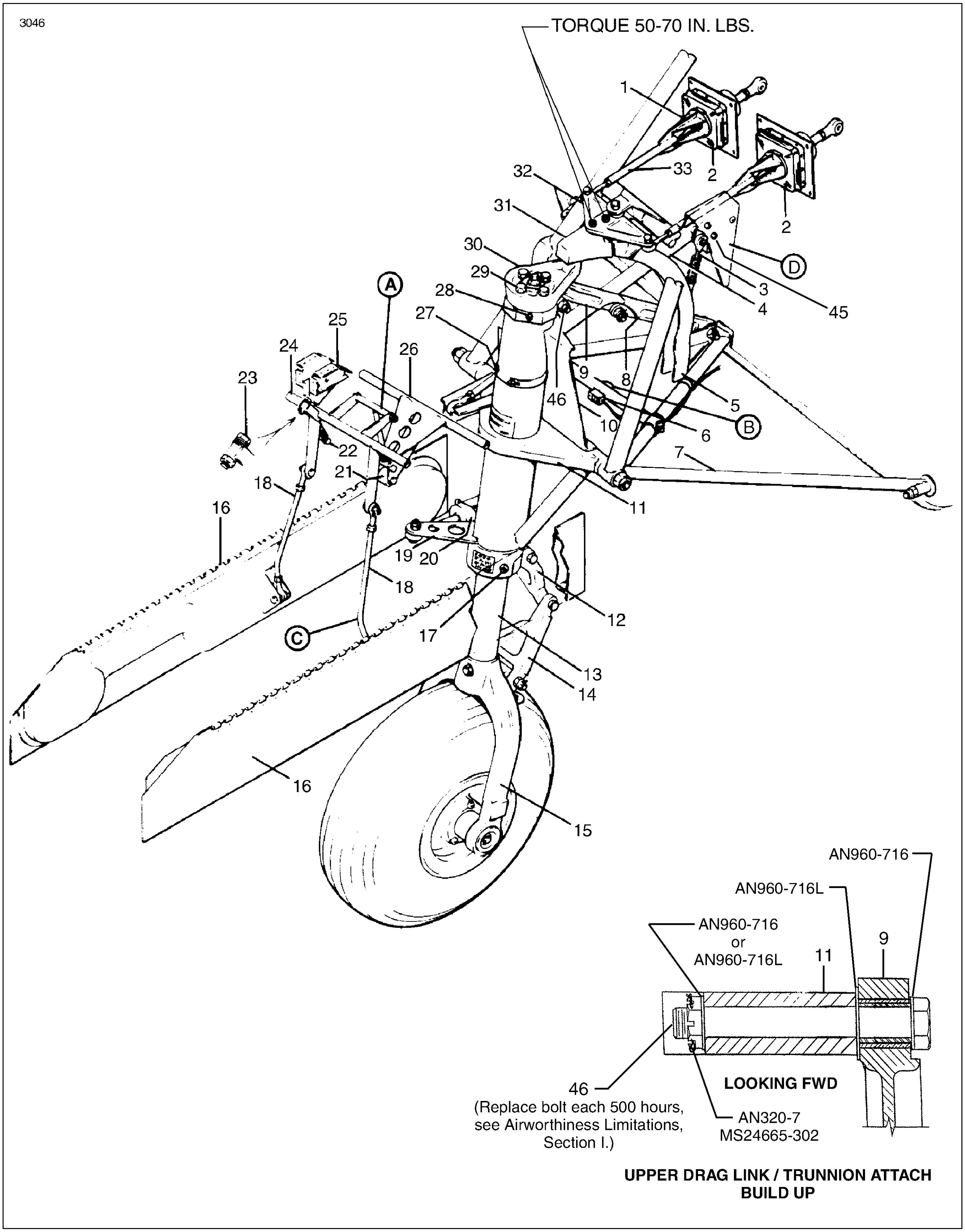
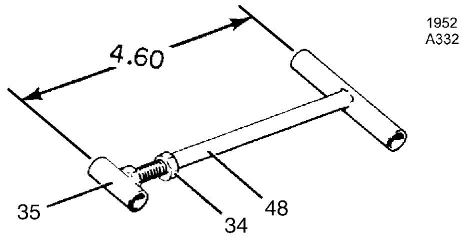


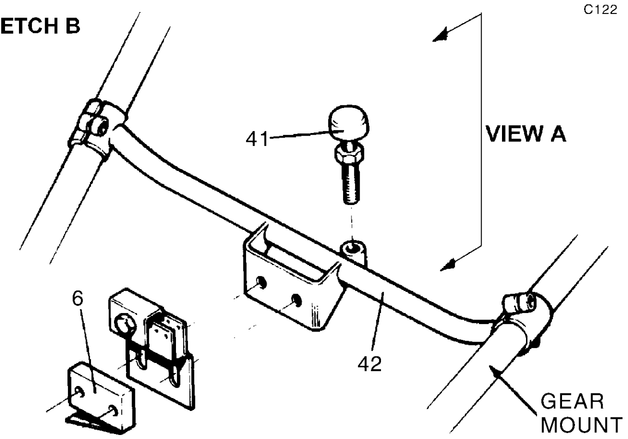
Figure 32-6. Nose Gear Installation (Sheet 1 of 2)

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. TRUNNION 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. TRUNNION ARM, SHIMMY DAMPENER ATTACHMENT
20. SHIMMY DAMPENER SPRING ASSEMBLY
21. ROLLER
22. SPRING, DOWN RETURN
23. BOLT, WASHERS (4 OR AS REQ.), NUT
24. TORQUE TUBE ASSEMBLY, DOORS
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. LINK ASSY., DOORS, LOWER
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)
48. LINK ASSY., DOORS, UPPER

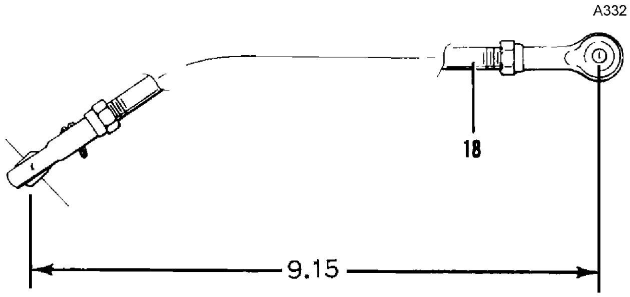
SKETCH A



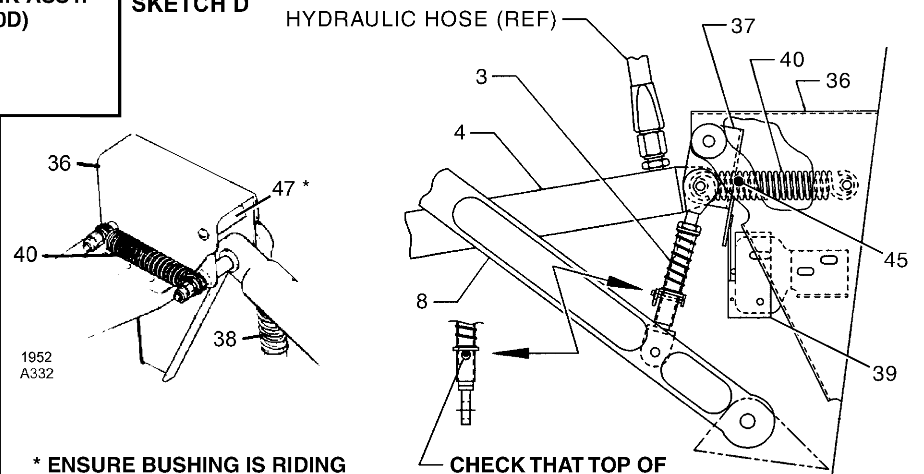
SKETCH B



SKETCH C

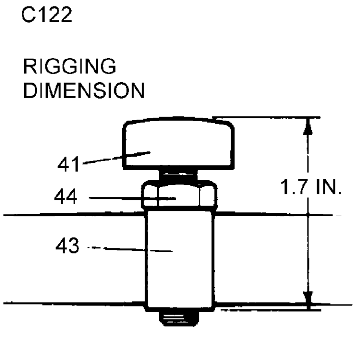


SKETCH D



* ENSURE BUSHING IS RIDING IN .250 HOLES OF ACTUATOR MOUNT BRACKET BEFORE TIGHTENING BOLT.

CHECK THAT TOP OF .191 HOLE IN SLEEVE HAS NOT BEEN ELONGATED, DISTORTED, OR CRUSHED BY THE .125 PIN.



VIEW A

Figure 32-6. Nose Gear Installation (Sheet 2 of 2)

B. INSPECTION

(1) General

(a) Clean all parts with a suitable dry type cleaning solvent.

(b) Inspect gear components for the following unfavorable conditions:

1 Bolts, bearings and bushings for excessive wear, corrosion and damage.

2 Gear strut and cylinder, drag links and down lock link assembly for cracks, dents, bends or misalignment.

3 Down lock link assembly for damaged threads and bearing.

4 Roller assembly for freedom of movement and excessive wobble.

(c) 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.

(d) 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.

(e) Check general condition of limit switches and actuators, wiring for fraying and poor connections or conditions which could lead to failures.

(2) Service Wear Limits

Use the wear limits in Figure 32-8 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.

(3) 100 Hour Actuator Mount Bracket Inspection

Each 100 hours time-in-service, visually inspect the actuator mount bracket (Item 36, Figure 32-6, Sketch D) for wear, cracks, loose mounting rivets, and elongation of the .250 diameter holes (Item 8, Figure 32-8) where the retraction link and the P/N 95061-089 bushing (Item 47, Figure 32-6, Sketch D) attach. See Figure 32-8 for wear limits.

(4) 100 Hour Tunnel Bracket Installation Inspection (See Figure 32-9.)

Inspect the rivets shown in Figure 32-9 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 32-9.)

(a) 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.

(b) 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.

(c) Inspect the bracket attachment flange for cracks in the flange radius as shown in Figure 32-9.

(5) 100 Hour Upper Drag Link Bolt Inspection

(a) 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 32-6, and with a 10X magnifier visually inspect for straightness, cracking or thread wear.

(b) 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.

(6) 100 Hour Nose Gear Drag Link Inspection (See Figure 32-7.)

The drag links function to lock and retain the gear in its down position by traveling to a specific overcenter locked position. The "overcenter 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.

(a) Jack up the airplane per 7-10-00.

(b) 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.

(c) Clean the gear with an appropriate cleaner and make sure the overcenter stops are unobstructed and hinge points are clean.

(d) See 12-20-00 and lubricate the gear.

(e) With reference to Figure 32-7, continue as follows for overcenter 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.

1 Unbolt the down lock link assembly (3) from the lower drag link (8) 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.

2 Without removing the bolts, remove the cotter pins from the three drag link bolts (upper, center, and lower) and loosen the nuts enough to withdraw them about 1/4 of an inch.

3 Lay a "true" straightedge across the exposed grips of the upper and lower drag link bolts.

4 Apply pressure to the top of the drag links to keep the overcenter stops in solid contact and measure the perpendicular distance between the top surface of the center bolt grip and the bottom of the straightedge.

5 The measured distance must be 0.250 of an inch or greater. If the measured distance is less than 0.250 of an inch, replace drag links.

(7) 1000 Hour Nose Gear Trunnion Inspection (See Figure 32-10.)

Beginning at 2000 hours and each 1000 hours thereafter, visually inspect the nose gear trunnion (P/N 95723-005/-006) for cracks in the areas shown in Figure 32-10. Use supplemental lighting and a 10X magnifier.

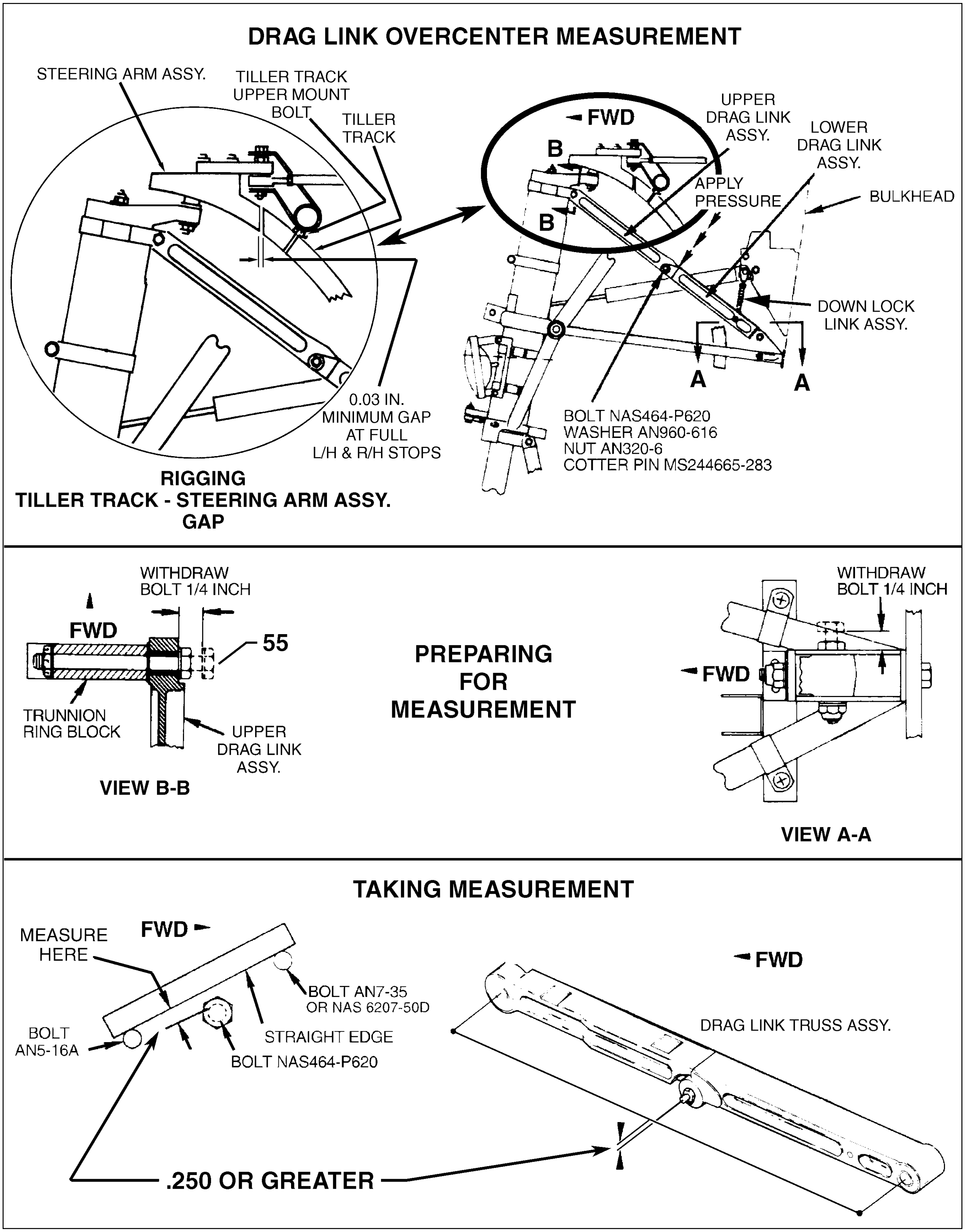
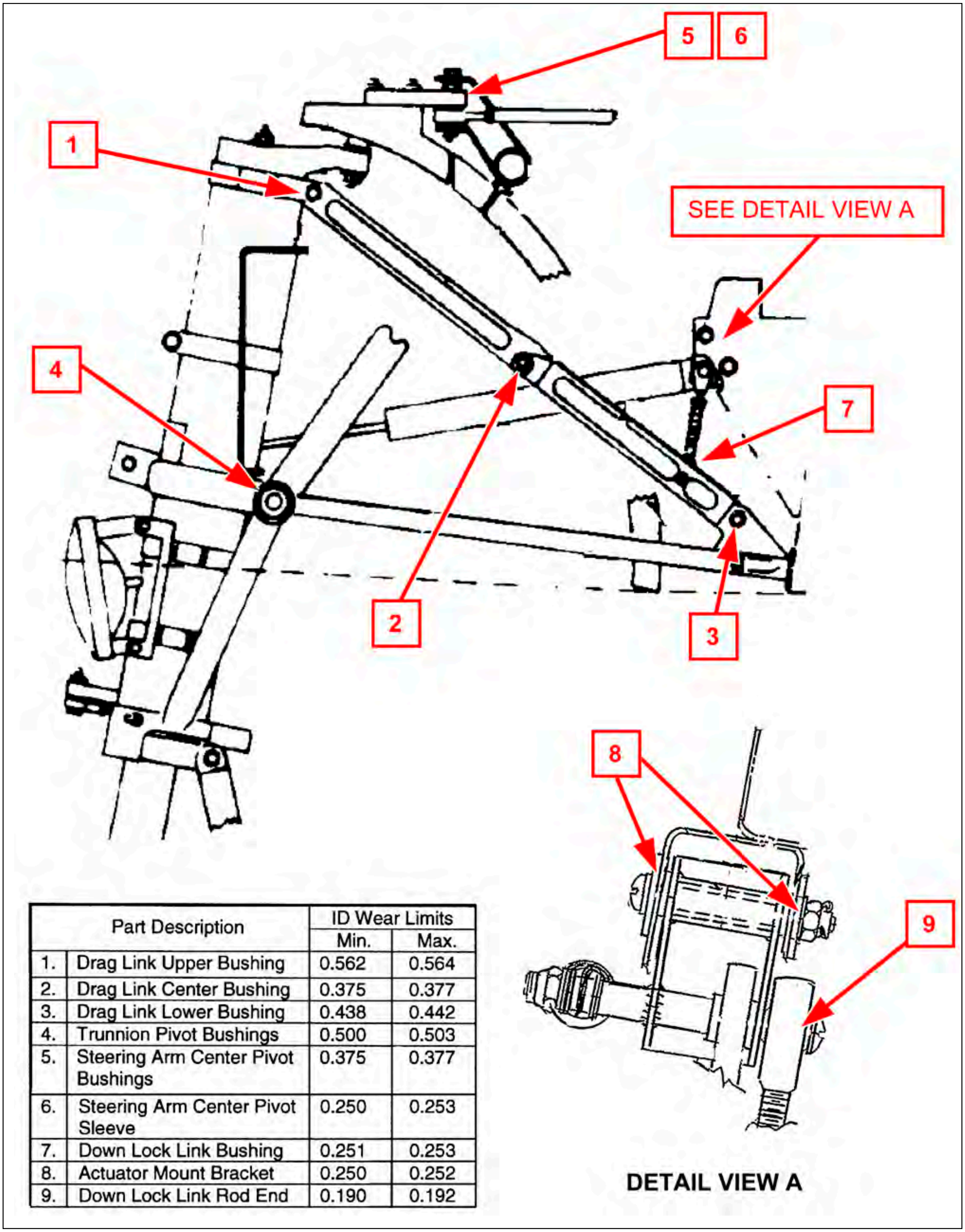


Figure 32-7. Drag Link Installation and Adjustment



Part Description		ID Wear Limits	
		Min.	Max.
1.	Drag Link Upper Bushing	0.562	0.564
2.	Drag Link Center Bushing	0.375	0.377
3.	Drag Link Lower Bushing	0.438	0.442
4.	Trunnion Pivot Bushings	0.500	0.503
5.	Steering Arm Center Pivot Bushings	0.375	0.377
6.	Steering Arm Center Pivot Sleeve	0.250	0.253
7.	Down Lock Link Bushing	0.251	0.253
8.	Actuator Mount Bracket	0.250	0.252
9.	Down Lock Link Rod End	0.190	0.192

Figure 32-8. Service Wear Limits

C. REMOVAL (See Figure 32-6.)

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.

D. INSTALLATION AND RIGGING (See Figures 32-6 and 32-7.)

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 over 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 32-6). 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 D, Figure 32-6), 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 32-6) 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 32-6, Sketch B 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.

(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 32-7.)

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.

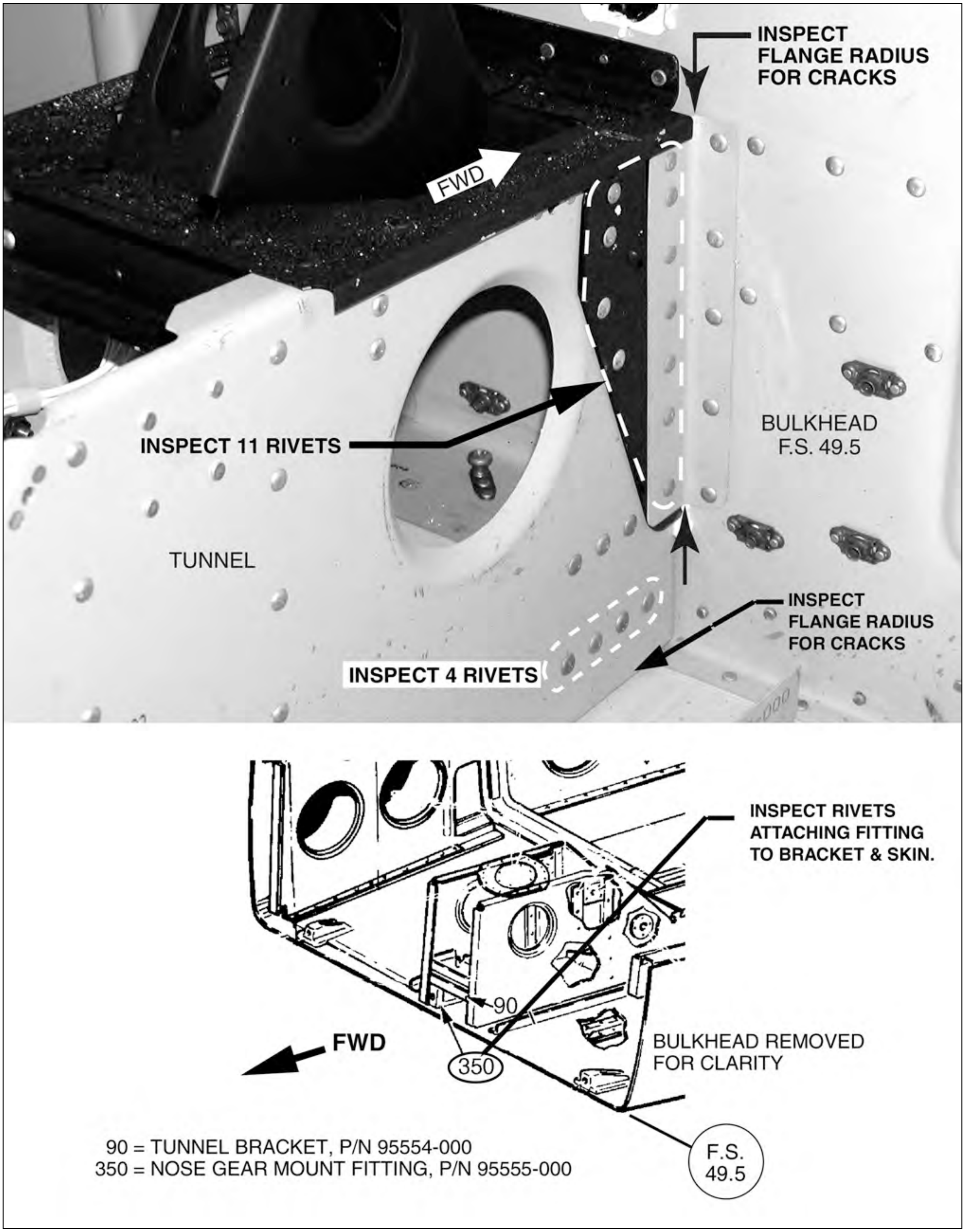


Figure 32-9. Tunnel Bracket Installation Inspection

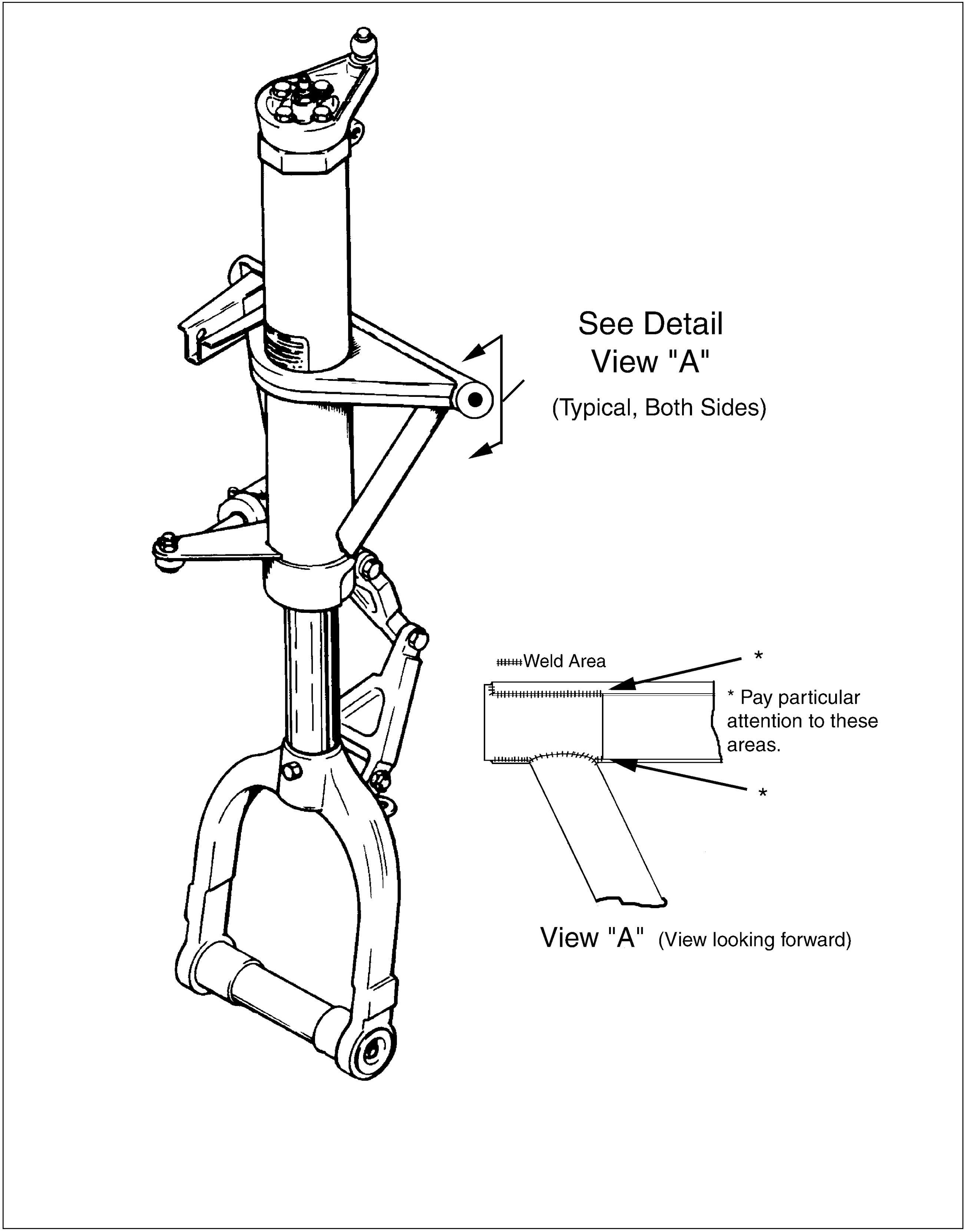


Figure 32-10. Nose Gear Trunnion Inspection

E. 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 and 8-10-00.)

(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 32-11.)

(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 32-12, 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.

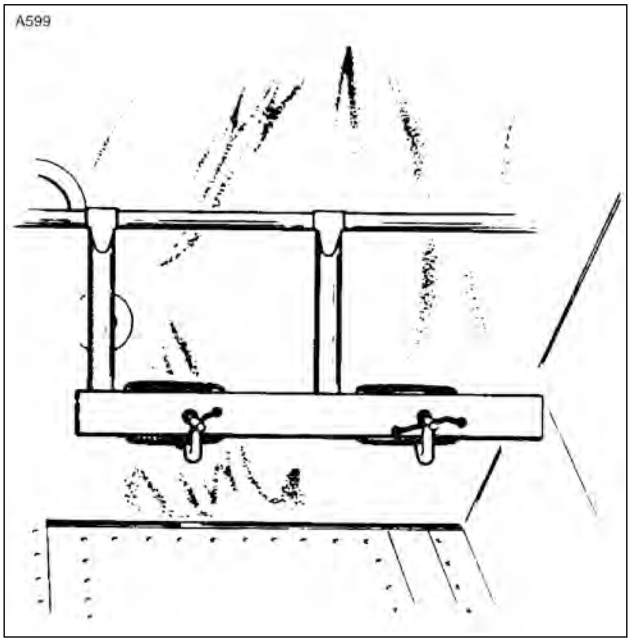


Figure 32-11. Clamping Rudder Pedals in Neutral Position

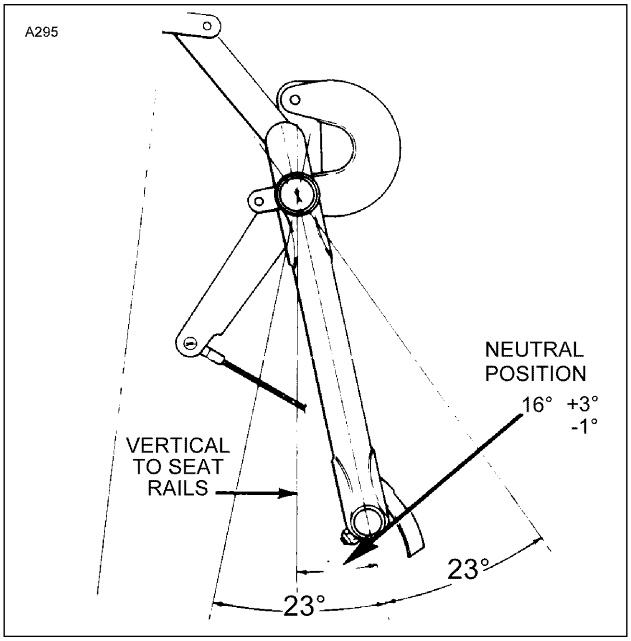


Figure 32-12. Rudder Pedals at Neutral Angle

(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.

F. REPAIR

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.

3. NOSE GEAR DOOR

A. INSPECTION

(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.

B. REMOVAL (Refer to Figure 32-6.)

(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.

C. INSTALLATION (Refer to Figure 32-6.)

(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. (Refer to Sketch A.)

(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. (Refer to Figure 32-6.)

(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. (Refer to Figure 32-6.)

(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.

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 32-6). 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.

E. REPAIR

(1) Repairs to doors are limited to replacing hinges and brackets.

(2) Repairs to the retraction mechanism are limited to painting and replacement of component parts.

EXTENSION AND RETRACTION

LANDING GEAR RETRACTION SYSTEM

FUNCTIONAL TEST

Before proceeding with this test, ensure that:

(1) Tires and struts are properly inflated per 12-20-00.

(2) The nose gear, main gear, limit switches and nose gear steering are properly adjusted (refer to the respective sections in this chapter).

CAUTION: TO PREVENT ACCIDENTAL ACTIVATION, PULL THE FOLLOWING CIRCUIT BREAKERS: W/T DEICE AND PROPS DEICE, PITOT HEAT, AND STALL WRN (14 VDC MODELS); SURFACE AND PROP DEICE, WSHLD HEAT, AND PITOT HEAT (28VDC MODELS)

(3) The BATT switch and all other electrical switches are OFF and remain OFF throughout the test.

(4) Raise the aircraft on jacks per 7-10-00.

(5) Connect a 50-ampere minimum power source of the correct voltage (14 or 28 Vdc) to the aircraft's electrical system through the external power supply.

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 following steps.

(6) During all tests, add MIL-H-5606 hydraulic fluid to hydraulic reservoir as necessary to keep:
   (a) Fluid level, on Prestolite pumps, 1/2 inch below top of filler hole.
   (b) Reservoir filled on Oildyne pumps. Tighten dipstick, then back off 1 1/2 turns

(7) Place the gear selector in the DOWN position.

(8) Place the throttles in a closed position.

(9) Ensure that the PUMP LANDING (14 Vdc models) or GEAR PUMP (28 Vdc models) circuit breaker is IN. Check:
   (a) Three green gear safe lights – ON.
   (b) Red GEAR UNSAFE (14 Vdc models) or GEAR WARN (28 Vdc models) annunciator is OFF.
   (c) Gear warning horn does NOT sound.
   (d) Hydraulic pump does NOT operate.

(10) Place gear selector switch in the UP position. Check:

- (a) Three green gear safe lights – OFF.
- (b) Red GEAR UNSAFE (14 Vdc models) or GEAR WARN (28 Vdc models) annunciator is ON.
- (c) Gear warning horn SOUNDS.
- (d) All gears retract fully and nose gear doors close.
- (e) Hydraulic pump STOPS operating

(11) Move left throttle to its mid-travel position. Check warning horn continues to sound and red GEAR UNSAFE (14 Vdc models) or GEAR WARN (28 Vdc models) remains ON.

(12) Close left throttle. Move the right throttle to its mid-travel position. Check warning horn continues to sound and red GEAR UNSAFE (14 Vdc models) or GEAR WARN (28 Vdc models) remains ON.

(13) Move both throttles to their mid-level position. Check warning horn STOPS sounding and red GEAR UNSAFE (14 Vdc models) or GEAR WARN (28 Vdc models) go OUT.

(14) 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 UNSAFE (14 Vdc models) or GEAR WARN (28 Vdc models) is NOT ON and there is no repeated pump operation for a subsequent fifteen minute period.

(15) Pull the PUMP LANDING (14 Vdc models) or GEAR PUMP (28 Vdc models) circuit breaker OUT

(16) Pull the gear free fall knob. Check all gears return to the down and locked position, with the down latches engaged.

(17) Place the gear selector switch in the DOWN position. Push the free fall knob in. Push the PUMP LANDING (14 Vdc models) or GEAR PUMP (28 Vdc models) circuit breaker IN. Check:

- (a) Three green gear safe lights – ON.
- (b) Red GEAR UNSAFE (14 Vdc models) or GEAR WARN (28 Vdc models) annunciator is OFF.
- (c) Gear warning horn does NOT sound.

(18) 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:

- (a) Insert a suitable wedge under the squat switch leaf.
- (b) Remove torque link connecting bolt and rotate upper half so the switch tang is free.
- (c) Loosen squat switch adjustment screws and rotate switch until tang is free.
- (d) Partially compress the left main gear shock absorber so that squat switch operating tang is free.

(19) Move throttles to closed position.

(20) Place the gear selector switch in the UP position. Check that the:

- (a) Hydraulic pump does NOT run.
- (b) Three green safe lights remain ON.
- (c) Red GEAR UNSAFE (14 Vdc models) or GEAR WARN (28 Vdc models) annunciator is ON.
- (d) Gear warning horn SOUNDS.

(21) Move throttles to mid travel position. Check the the:

- (a) Red GEAR UNSAFE (14 Vdc models) or GEAR WARN (28 Vdc models) annunciator remains ON.
- (b) Gear warning horn does NOT sound.

(22) Place the gear selector switch down. Check to ensure that the:

- (a) Red GEAR UNSAFE (14 Vdc models) or GEAR WARN (28 Vdc models) annunciator is OFF.
- (b) The gear warning horn does NOT sound.

(23) Return the squat switch to the IN–FLIGHT position.

(24) Manually “break” the left main gear down lock. Check that the:

- (a) Hydraulic pump motor RUNS.
- (b) Correct green safe light is OUT.
- (c) Red Red GEAR UNSAFE (14 Vdc models) or GEAR WARN (28 Vdc models) annunciator remains ON.
- (d) The horn does NOT sound.

(25) Repeat step 23 for the right main gear.

(26) Move the gear selector switch to its UP position and turn the landing light switches ON. Check that:

- (a) The hydraulic pump motor operates.
- (b) The three green safe lights are OUT.
- (c) The Red GEAR UNSAFE (14 Vdc models) or GEAR WARN (28 Vdc models) annunciator remain ON until all gear are UP; then OFF.
- (d) All gear retract fully in less than 10 seconds.
- (e) The pump motor stops operating after the gear is up.
- (f) The warning horn does not sound.
- (g) The landing light is OFF when the gears are in the fully retracted position.

(27) Place the gear selector switch in the DOWN position. Check that:

- (a) The hydraulic pump motor OPERATES.
- (b) All gears return to the down and locked position.
- (c) The hydraulic pump motor stops operating after all the gears are down and locked.
- (d) The three green safe lights are ON.
- (e) The Red GEAR UNSAFE (14 Vdc models) or GEAR WARN (28 Vdc models) annunciator is OFF.
- (f) 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.

(28) Seneca III only:

- (a) Turn the navigation light switch ON. Check that the three green safe lights remain on but become dim.
- (b) Turn navigation light switch OFF.

(29) Seneca IV only:

- (a) Place annunciator panel DAY/NIGHT switch to NIGHT position. Check that the three green safe lights remain on but become dim.
- (b) Place annunciator panel DAY/NIGHT switch to DAY position.

(30) Disconnect auxiliary power source from the aircraft's electrical system.

(31) Remove aircraft from jacks.

WHEELS AND BRAKES

1. WHEELS

A. NOSE WHEEL

(1) Inspection

(a) Visually check all parts for cracks, distortion, defects and excess wear.

(b) Check wheel bolts for stripped or damaged threads.

(c) Check internal diameter of felt grease seals. Replace the felt grease seal if surface is hard or gritty.

(d) Check tire for cuts, internal bruises and deterioration.

(e) Check bearing cones and cups for wear and pitting and relubricate.

(f) Replace any wheel casting having visible cracks.

(2) Removal and Disassembly (Refer to Figure 32-13.)

(a) Jack the airplane enough to raise the nose wheel clear of the ground.

(b) To remove the nose wheel, first remove the nut from one end of the axle rod and slide out the rod and axle plugs.

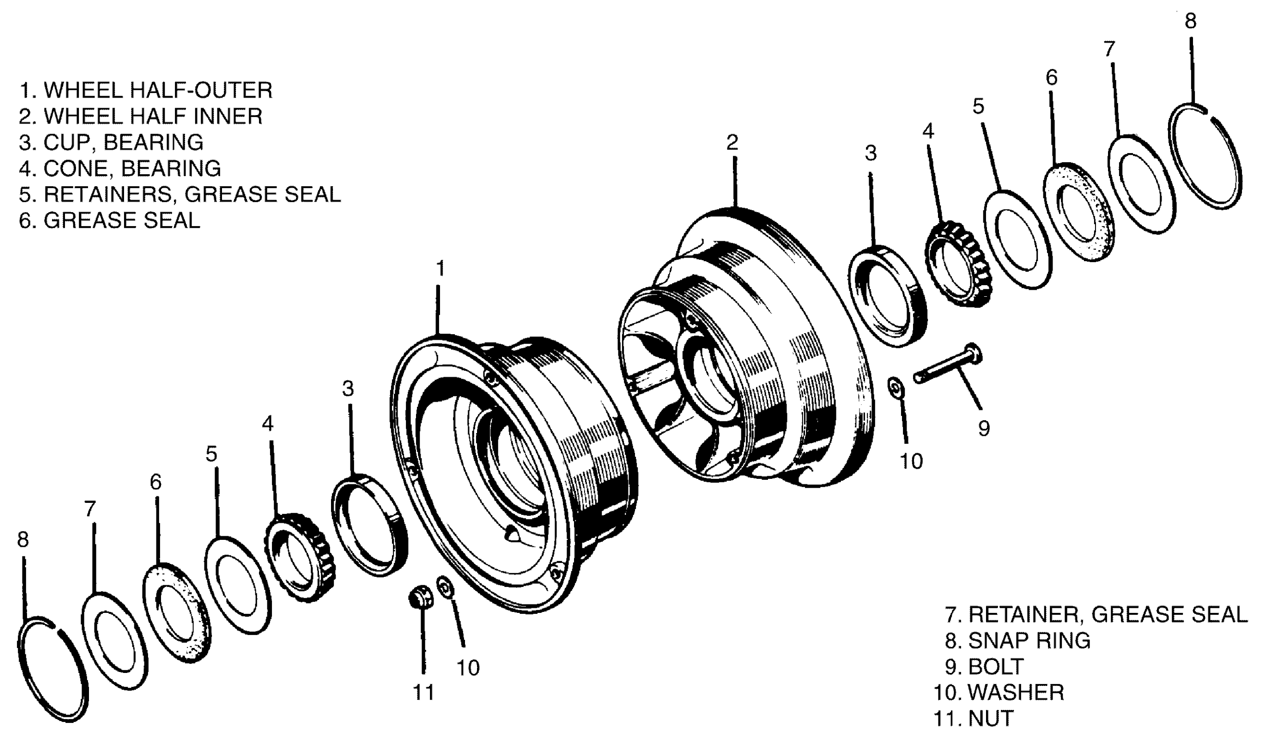


Figure 32-13. Nose Wheel Assembly (Typical)

(c) Lightly tap the axle tube out from the center of the wheel assembly by use of an object of near equal diameter.

NOTE: Exercise care to avoid damaging axle tube ends. This will make removal and installation extremely difficult.

(d) Remove spacer tubes and wheel assembly.

(e) 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.

(f) Remove snap ring, grease seal, seal retainers and bearing cones. Remove bearing cup by tapping evenly from the inside.

(3) Assembly and Installation (Refer to Figure 32-13.)

(a) Carefully install bearing cups into each wheel half per Bearing Cup Replacement, below.

(b) 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.

(c) Install the tire and tube on the wheel half with the valve stem hole, inserting the valve stem through the valve hole.

(d) 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.

(e) Lubricate bearing cones and install cones, inner seal retainers and grease seals. Secure outer seal retainer with three snap rings.

(f) 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.

B. MAIN WHEELS

(1) Inspection

(a) Visually check all parts for cracks, distortion, defects and excess wear.

(b) Check wheel bolts for stripped or damaged threads.

(c) Check internal diameter of felt grease seals. Replace the felt grease seal if surface is hard or gritty.

(d) Check tire for cuts, internal bruises and deterioration.

(e) Check bearing cones and cups for wear and pitting and relubricate.

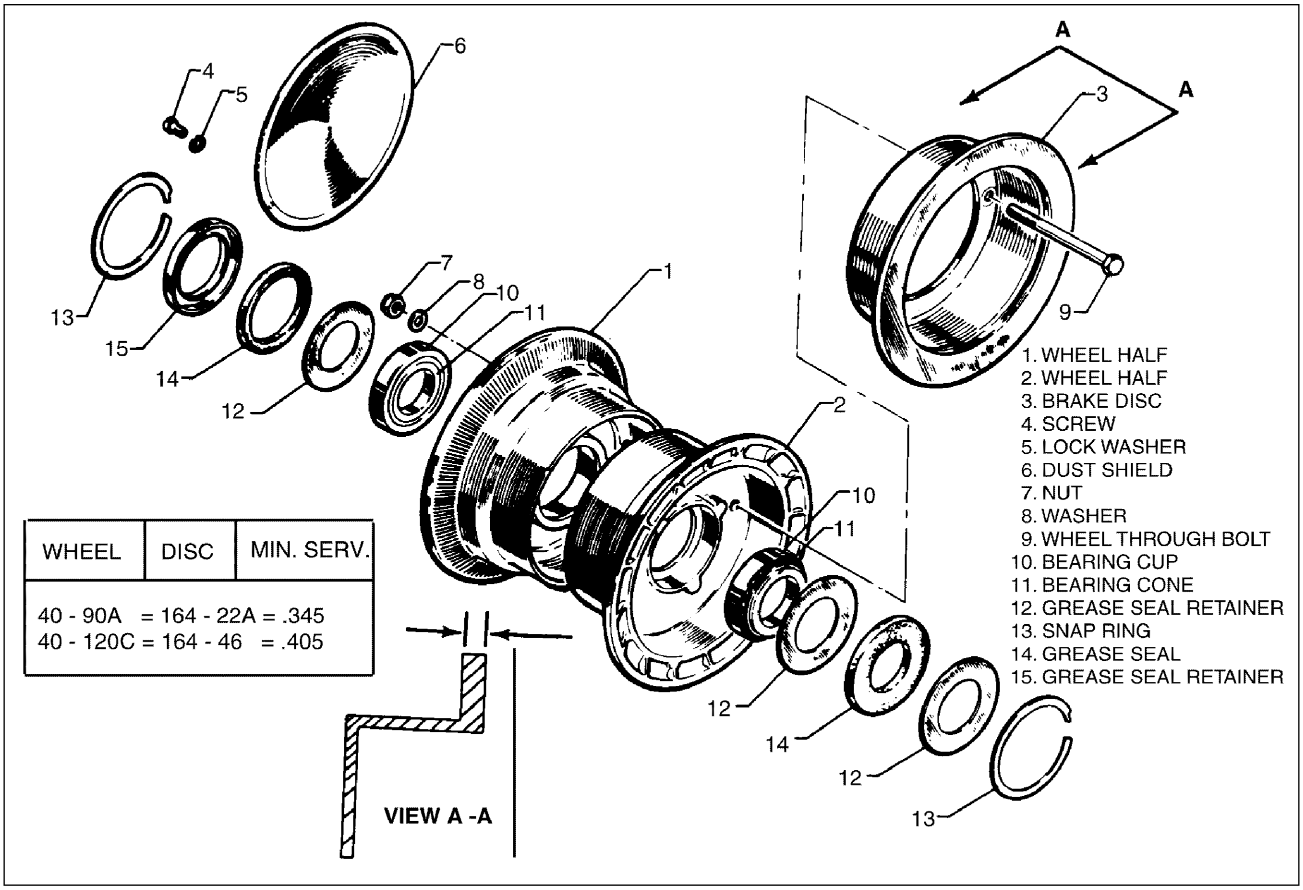
(f) Replace any wheel casting having visible cracks.

(2) Removal and Disassembly (Refer to Figure 32-14.)

(a) Place airplane on jacks.

(b) 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.

(c) Remove the dust cover and cotter pin that safeties axle nut; remove axle nut and bushing and slide wheel from the axle.



WHEEL	DISC	MIN. SERV.
40 - 90A	= 164 - 22A	= .345
40 - 120C	= 164 - 46	= .405

Figure 32-14. Main Wheel Assembly

(d) 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.

(e) 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.

(3) Assembly and Installation (Refer to Figure 32-14.)

(a) Determine that the bearing cup is properly installed in each wheel half per Bearing Cup Replacement, below.

(b) 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.

(c) Install the tire and tube on the wheel half with the valve stem hole, inserting the valve stem through the valve hole.

(d) 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.

(e) Lubricate bearing cones and install cones, felt grease seals and grease seal rings. Secure with snap rings.

(f) 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.

(g) 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.

C. 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.

2. BRAKES

A. WHEEL BRAKE ASSEMBLY

Adjustment of brake lining clearance is unnecessary since they are self-adjusting. Inspection of the lining is necessary and may be inspected visually while installed on the airplane. The linings are of riveted type and should be replaced if the thickness of any one segment becomes worn below .099 of an inch or if signs of uneven wear are evident.

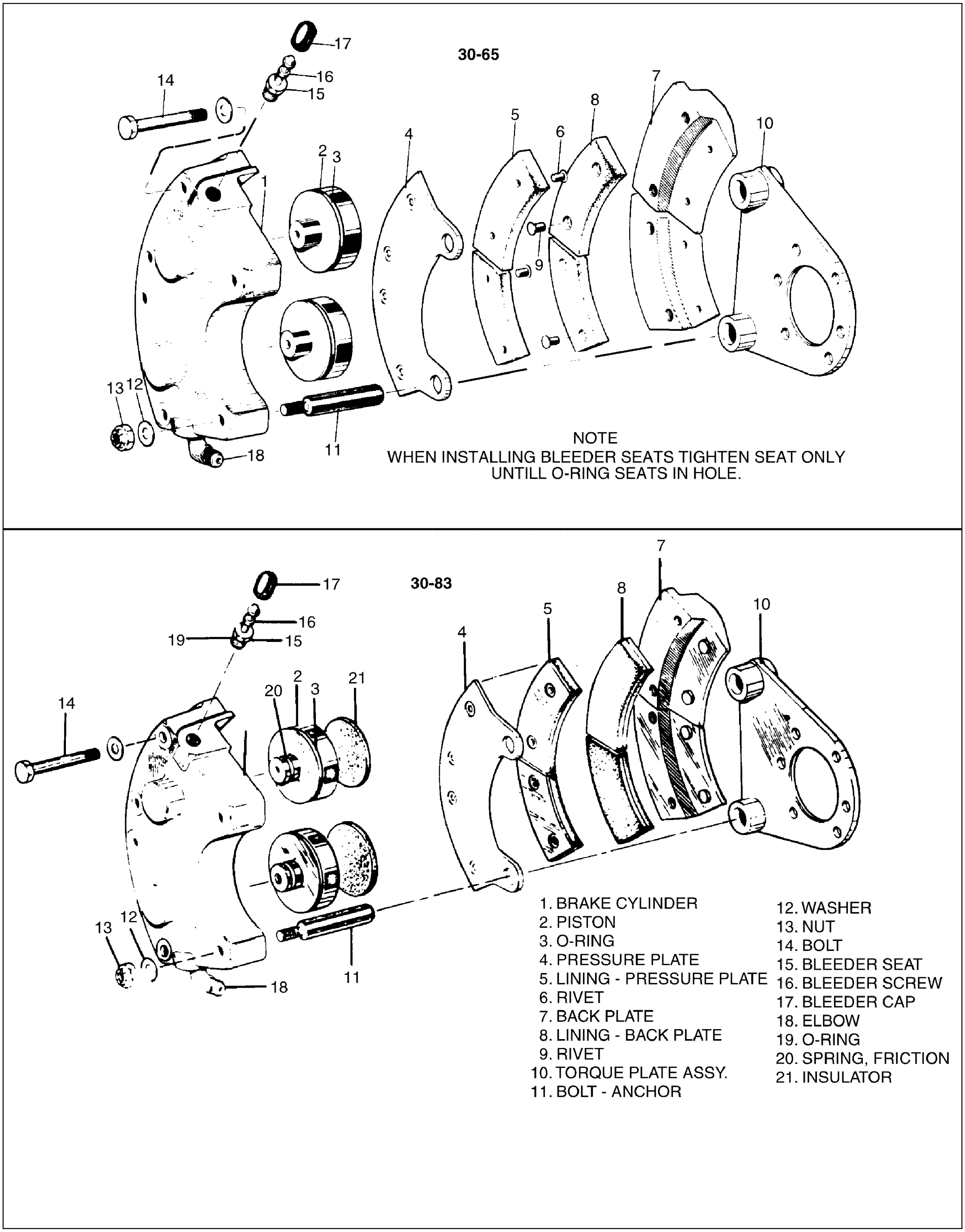
NOTE: A heavy duty brake and wheel assembly is optional. Heavy duty wheel assemblies (40-120) and brake discs (164-46) may be easily identified by six bolt hole pattern. Standard wheel assemblies (40-90A) and disc brakes (164-22A) have a three bolt hole pattern.

(1) Inspection

(a) Clean the assembly with a suitable solvent and dry thoroughly.

(b) Check the wall of the cylinder housing and piston for scratches, burrs, corrosion, etc, that may damage O-rings.

(c) Check the general condition of the brake bleeder screw and lines.



NOTE
WHEN INSTALLING BLEEDER SEATS TIGHTEN SEAT ONLY UNTILL O-RING SEATS IN HOLE.

1. BRAKE CYLINDER
2. PISTON
3. O-RING
4. PRESSURE PLATE
5. LINING - PRESSURE PLATE
6. RIVET
7. BACK PLATE
8. LINING - BACK PLATE
9. RIVET
10. TORQUE PLATE ASSY.
11. BOLT - ANCHOR
12. WASHER
13. NUT
14. BOLT
15. BLEEDER SEAT
16. BLEEDER SCREW
17. BLEEDER CAP
18. ELBOW
19. O-RING
20. SPRING, FRICTION
21. INSULATOR

Figure 32-15. Wheel Brake Assemblies – 30-65 and 30-83

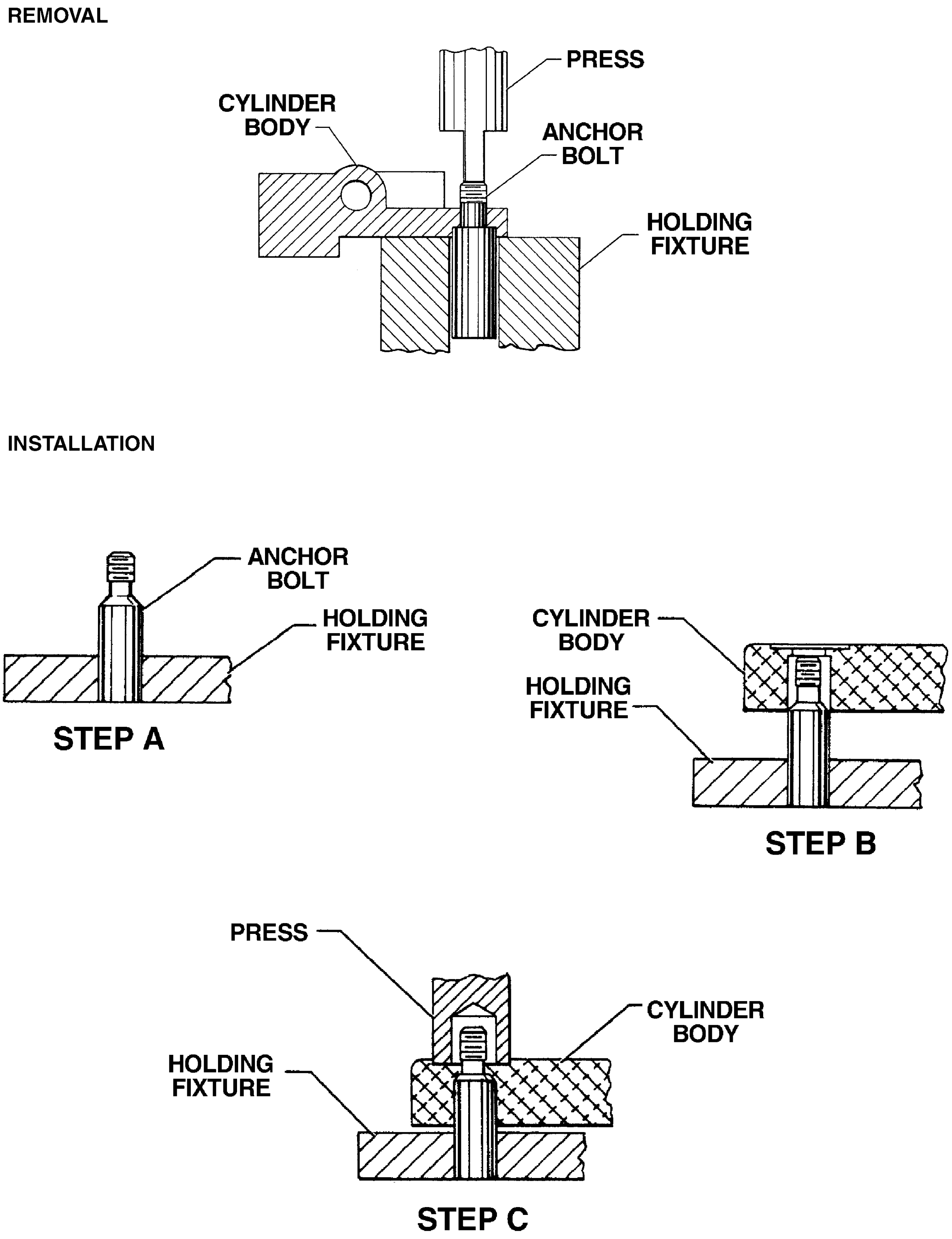


Figure 32-16. Removal and Installation of Anchor Bolts

(d) Check the brake disc for wear, grooves, scratches, or pits. Minimum disc service thickness is shown in Figure 21-14. 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, refer to Main Wheels, Removal and Disassembly, above.

(e) 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.

(f) 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 brake linings on Cleveland 30-65 brakes, perform a minimum of six light braking applications with time left between stops to allow them to cool.

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.

(2) Removal and Dismantling (Refer to Figure 32-15.)

(a) To remove brake assembly, first disconnect brake line from brake cylinder at the elbow.

(b) Remove bolts joining brake cylinder housing and back plate assembly. Remove back plate from between brake disc and wheel.

(c) Slide brake cylinder housing from torque plate.

(d) Remove pressure plate by sliding it off the anchor bolts of brake cylinder housing.

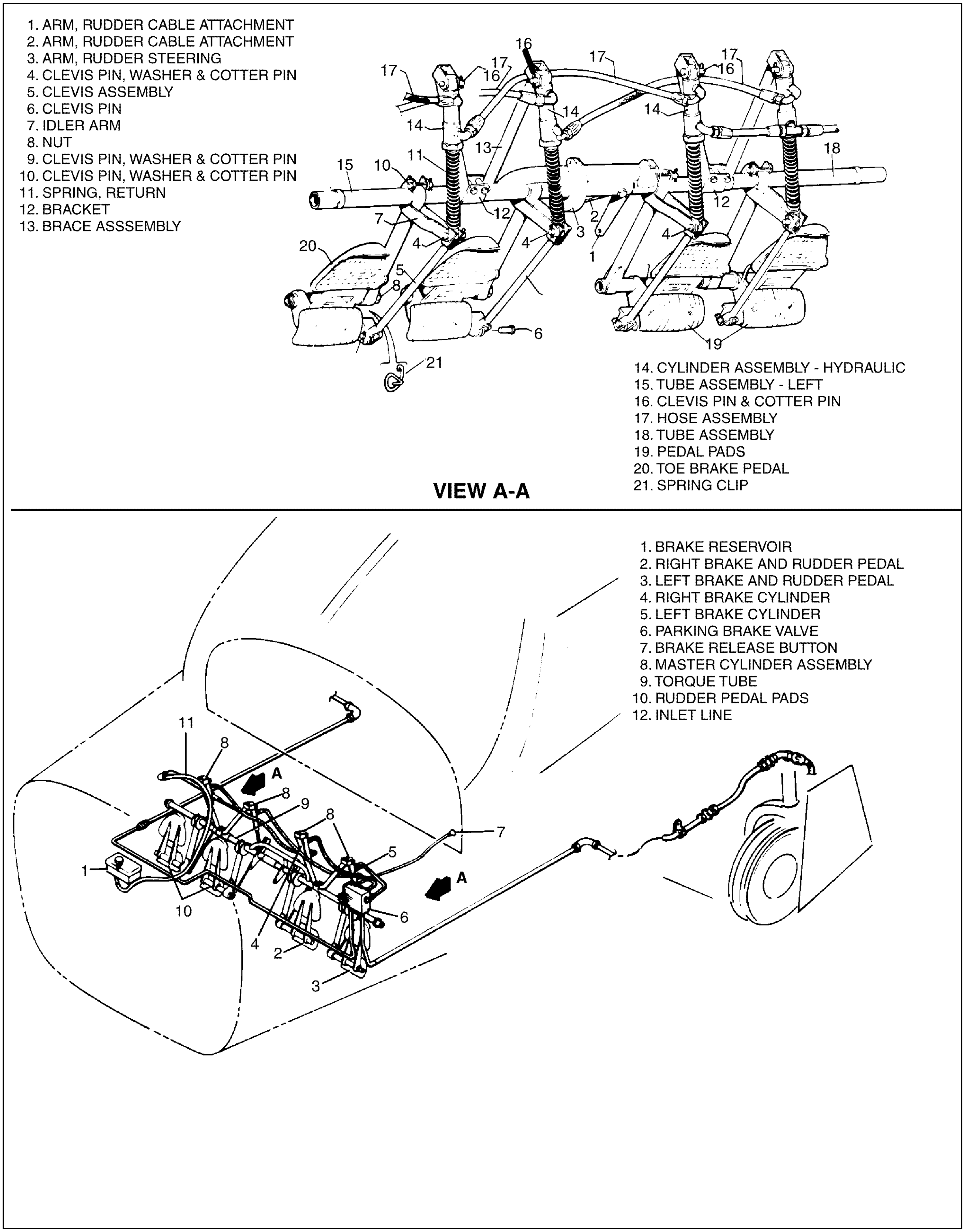
(e) The pistons may be removed by injecting low air pressure in the cylinder fluid inlet, forcing the pistons from the housing.

(f) Check anchor bolts for wear.

(g) The following procedure should be used when removing anchor bolts:

1 Position cylinder assembly on a holding fixture. (Refer to Figure 32-16.)

2 Use a suitable arbor press and remove the anchor bolt from the cylinder body.



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 ASSSEMBLY
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

VIEW A-A

1. BRAKE RESERVOIR
2. RIGHT BRAKE AND RUDDER PEDAL
3. LEFT BRAKE AND RUDDER PEDAL
4. RIGHT BRAKE CYLINDER
5. LEFT BRAKE CYLINDER
6. PARKING BRAKE VALVE
7. BRAKE RELEASE BUTTON
8. MASTER CYLINDER ASSEMBLY
9. TORQUE TUBE
10. RUDDER PEDAL PADS
12. INLET LINE

Figure 32-17. Brake Installation

(3) Rebuilding and Installation (Refer to Figure 32-16.)

(a) If anchor bolts have been removed, they should be reinstalled as follows:

1 Support anchor bolt in a holding fixture. (Refer to Figure 32-16, Step A.)

2 Align cylinder body over anchor bolt. (Refer to Figure 32-16, Step B.)

3 Using a suitable arbor press, apply pressure on the spot face directly over the anchor bolt. (Refer to Figure 32-16, Step C.)

(b) 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.

(c) Slide pressure plate onto anchor bolts of housing.

(d) Slide cylinder housing on torque plate.

(e) Position back plate between wheel and brake disc. Install bolts and torque to 40 inch-pounds to secure the assembly.

(f) Connect brake line to cylinder housing and bleed brake system as described below.

B. PARKING BRAKE VALVE

(1) Inspection

(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.

(2) Removal (Refer to Figure 32-17.)

(a) Disconnect the parking brake cable from the valve actuating arm.

(b) Disconnect the fluid lines from the valve.

(c) Remove the screws that attach the valve to its mounting bracket.

(d) Place a protective material over the line openings to prevent contamination of the system.

(3) Installation

(a) Attach the valve to the bulkhead mounting bracket with screws.

(b) Connect the fluid lines to the valve.

(c) 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.

(4) Disassembly (Refer to Figure 32-18.)

(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.

(5) Assembly (Refer to Figure 32-18.)

(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.

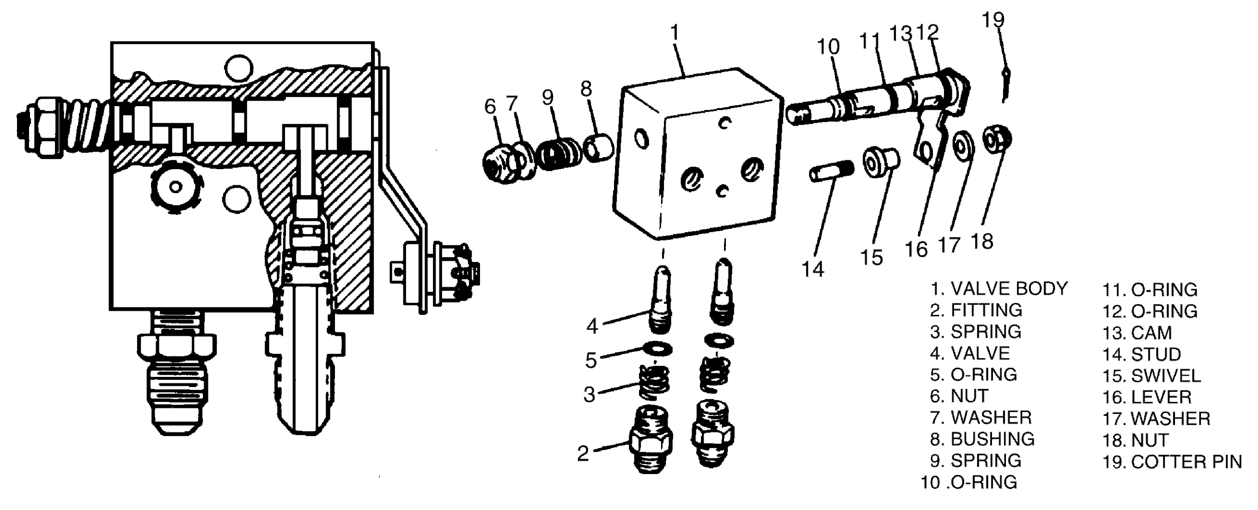


Figure 32-18. Parking Brake Valve Assembly

(6) Repair

Repairs are limited to smoothing burred or scratched surfaces and replacing O-rings.

C. TOE BRAKE CYLINDER

(1) Inspection

(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.

(2) Removal (Refer to Figure 32-17.)

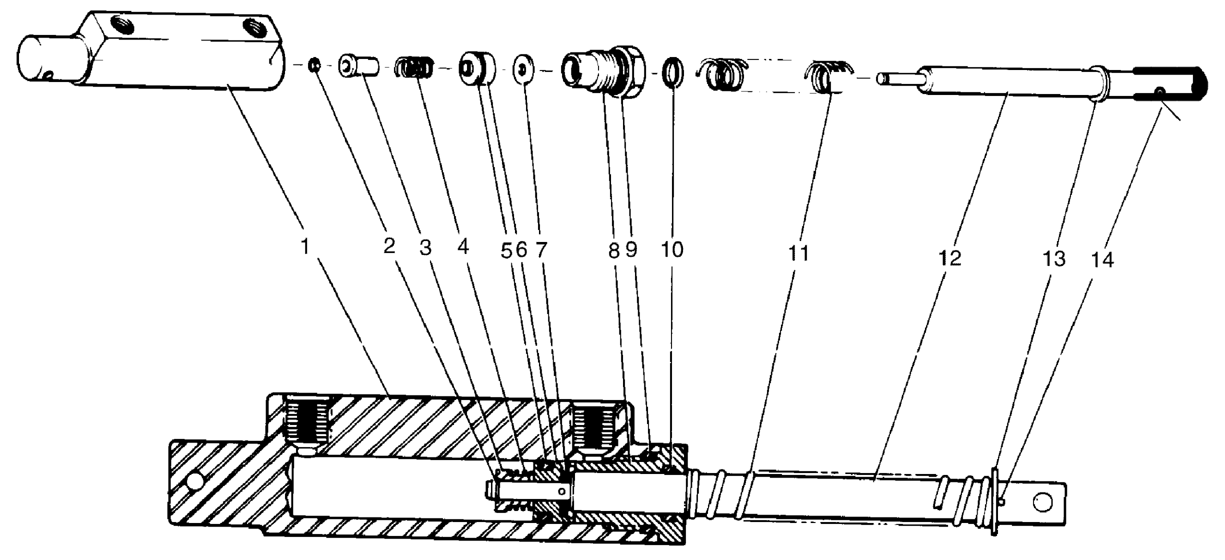
(a) Disconnect upper and lower lines from the cylinder being removed. Cap lines to prevent fluid leakage or drain fluid from brake reservoir and master cylinder.

(b) Remove cotter pins and clevis pins securing brake cylinder in position; then remove brake cylinder.

(3) Installation (Refer to Figure 32-17.)

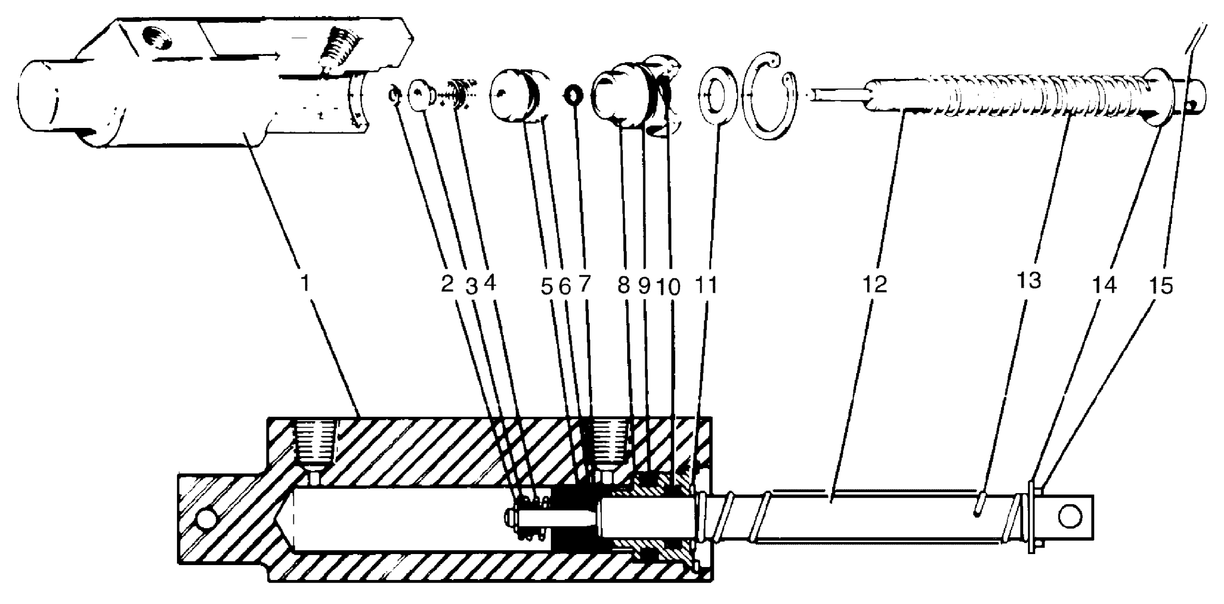
(a) Position brake cylinder at its mounting points and secure in position with clevis pin. Safety clevis pins with cotter pins.

(b) Connect brake lines to cylinder fittings. Bleed brakes as explained below.



1. HOUSING
2. RETAINING RING
3. SLEEVE
4. SPRING
5. O-RING
6. PISTON
7. SEAL
8. FITTING
9. O-RING
10. O-RING
11. SPRING
12. PISTON ROD
13. WASHER
14. ROLL PIN

Figure 32-19. Gar-Kenyon 17000 Toe Brake Cylinder



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

Figure 32-20. Cleveland 10-30 Toe Brake Cylinder

(4) Disassembly

(a) Gar-Kenyon cylinder number 17000. (Refer to Figure 32-19.)

1 Remove the cylinder.

2 To disassemble the cylinder, first remove the piston rod assembly by unscrewing the fitting from the cylinder.

3 The piston rod assembly may be disassembled by first removing the retaining ring securing the sleeve and then removing the spring, piston, seal, fitting, and, if desired, the large return spring.

4 Remove the O-rings from the piston and fitting.

(b) Cleveland cylinder number 10-30. (Refer to Figure 32-20.)

1 Remove the cylinder.

2 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.

3 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.

4 Remove the O-rings from the piston and packing gland.

(5) Assembly (Refer to Figures 32-19 and 32-20.)

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) Gar-Kenyon cylinder number 17000. (Refer to Figure 32-19.)

1 Install new O-rings on the inside and outside of the fitting and on the outside of the piston.

2 To assemble the piston rod assembly, install on the rod, in order, the roll pin, return spring retainer washer, return spring, fitting with O-rings, seal, piston with O-rings, spring and sleeve. Secure these pieces with the retaining ring on the end of the rod.

3 Insert the piston rod assembly in the cylinder and secure fitting.

4 Install the cylinder.

(b) Cleveland cylinder number 10-30. (Refer to Figure 32-20.)

1 Install new O-rings on the inside and outside of the packing gland and on the outside of the piston.

2 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.

3 Insert the piston rod assembly in the cylinder and secure with the retaining plug.

4 Install the cylinder.

(6) Repair

Repairs are limited to polishing out small scratches and burrs on the cylinder or piston and replacing the seal and O-rings.

D. BRAKE BLEEDING PROCEDURE

(1) Gravity

(a) 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.

(b) Fill the brake reservoir on the firewall with hydraulic fluid, MIL-H-5606.

(c) Disconnect the toe brake cylinders from the pedal connection by removing clevis pin, washer and cotter pin.

(d) Invert toe brake cylinder to aid in releasing trapped air in the top of the cylinder.

(e) Check toe brake pedals in the cockpit to ensure pedals are pulled full aft.

(f) 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.

(g) Tighten both wheel bleeders.

(h) Pull hand brake until a firm handle is maintained.

(2) Pressure (Refer to Figures 32-21 and 32-22)

(a) 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.

(b) 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.

(c) 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.

(d) 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.

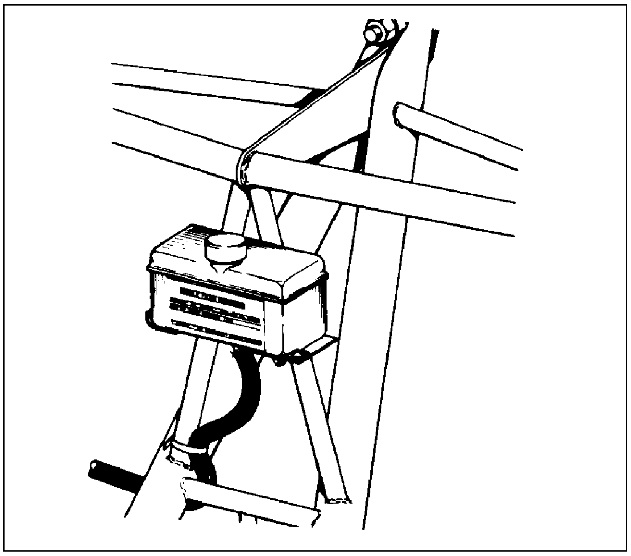


Figure 32-21. Brake Reservoir Bleeding

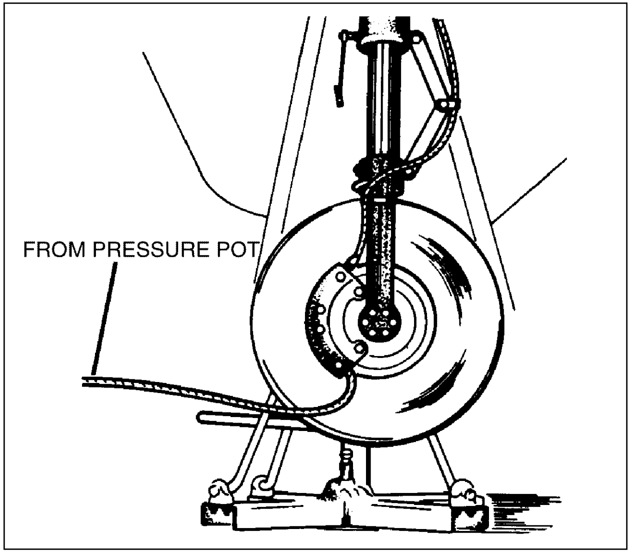


Figure 32-22. Bleeding Brake

(e) Repeat this procedure, if necessary, on the other gear.

(f) Drain excess fluid from the reservoir to fluid level line with a syringe.

E. BRAKE SYSTEM LEAK CHECK

(1) Pull firmly on the hand brake until resistance has built up and actuate the locking mechanism.

(2) After the system has stood for approximately 10 minutes, the handle should be checked for the same resistance.

(3) 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.

POSITION AND WARNING

1. 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. ADJUSTMENT OF NOSE GEAR UP LIMIT SWITCH

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. (Refer to Figure 32-6.)

(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. ADJUSTMENT OF NOSE GEAR DOWN LIMIT SWITCH (Refer to Figure 32-23.)

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.

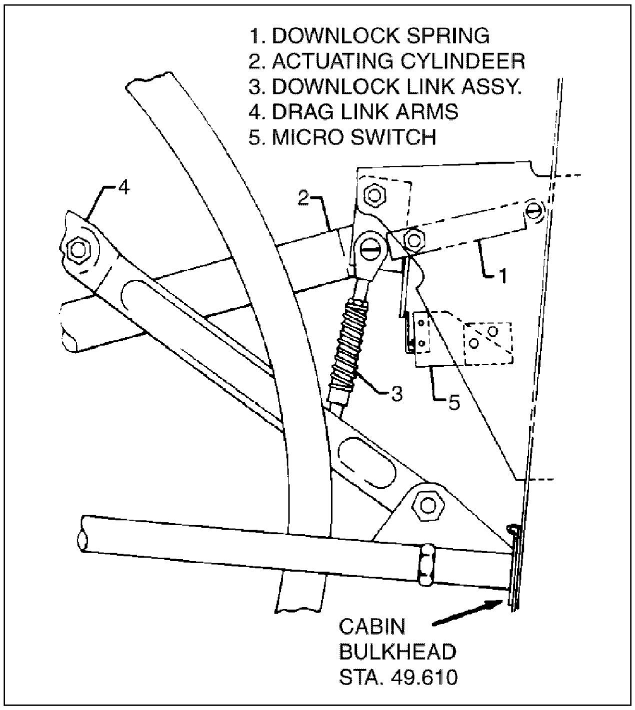


Figure 32-23. Adjust Nose Gear Down Limit Switch

C. ADJUSTMENT OF MAIN GEAR UP LIMIT SWITCHES

Up limit switches are mounted in the outboard interior of each wheel well. Included in the right side installation is 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 21-40-00.

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.

D. ADJUSTMENT OF MAIN GEAR DOWN LIMIT SWITCH (Refer to Figure 32-24.)

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.

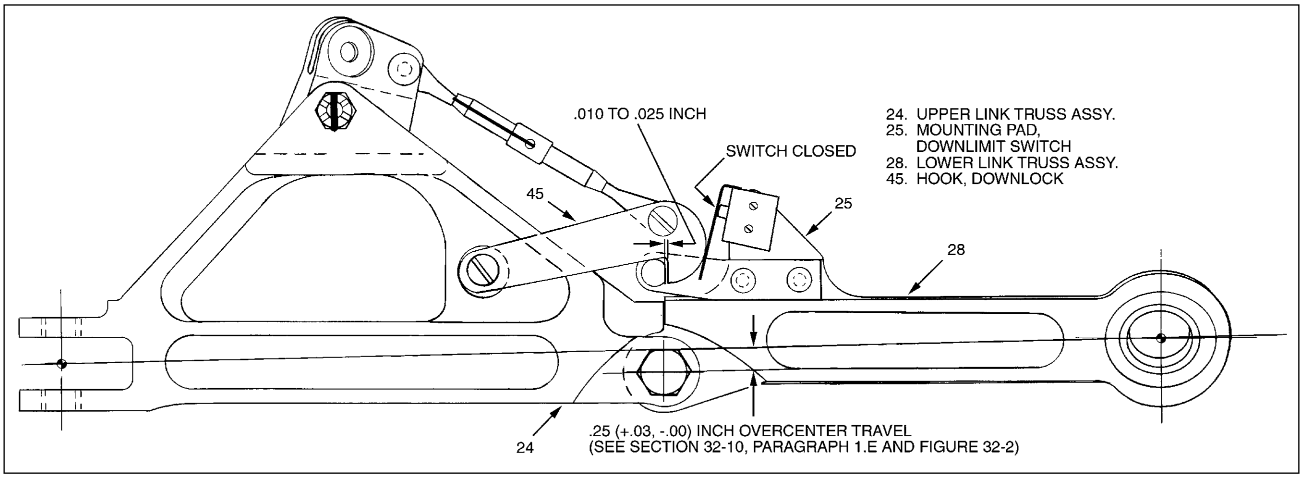


Figure 32-24. Adjust Main GearDown Limit Switch

E. ADJUSTMENT OF MAIN GEAR SQUAT SWITCHES

CAUTION: ENSURE THAT THE LATEST REVISION OF PIPER S. B. NO. 938 HAS BEEN COMPLIED WITH.

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 (refer to Chapter 91 for Electrical Schematic).

Adjust the squat switches as follows:

(1) 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.

(2) Adjust the switches on their mounting bracket to actuate at this point.

(3) Extend and compress gear to ensure proper operation

2. GEAR WARNING THROTTLE SWITCH (Refer to Figure 32-25.)

The throttle switch activates 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 Chapter 91.

A. 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

(1) 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.

(2) Place the airplane on jacks and retract the landing gear.

(3) Reposition the throttle levers at the location which gave the 14 ± 2 inches of manifold pressure per step 1.

(4) 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

(5) 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.

(6) Flight test the airplane to ensure proper operation of the gear warning horn with the gear up and power reduced below 14 ± 2 inches of manifold pressure.

B. REPLACEMENT (Refer to Figure 32-25.)

(1) Determine and take note of how many washers are between the microswitch and the bracket.

(2) Disconnect electrical wires and mark microswitch position.

(3) Remove screws and install new switch in same position making sure to use same amount of washers.

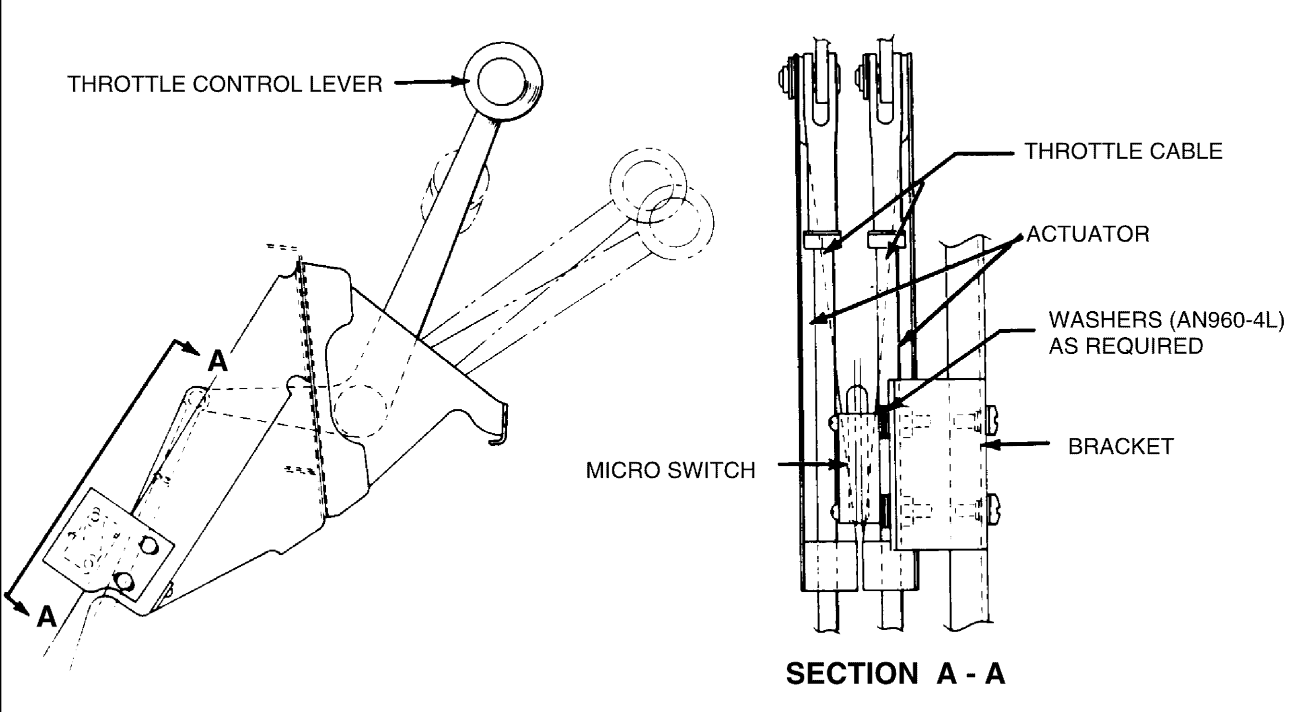


Figure 32-25. Throttle Warning Switch

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CHAPTER

33

LIGHTS

CHAPTER 33 - LIGHTS

TABLE OF CONTENTS/EFFECTIVITY

CHAPTER 33 - LIGHTS

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

— WARNING —

IT IS THE USER'S RESPONSIBILITY TO REFER TO THE APPLICABLE PUBLICATIONS WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT.

— CAUTION —

ENSURE THAT ALL REPLACEMENT ELECTRICAL COMPONENTS TO BE INSTALLED ON SENECA III, 28 VDC SYSTEMS ARE RATED AT 28 DC VOLTS AND ARE COMPATIBLE TO THE 28 DC VOLT SYSTEM.

This chapter functions to provide information on the location, identification, and maintenance of lighting equipment used in the Seneca III, 14 Vdc, Seneca III, 28 Vdc, and Seneca IV airplanes.

For wiring diagrams and schematics refer to Chapter 91.

DESCRIPTION AND OPERATION

Lighting systems available are covered in four sections of this chapter as shown in the chapter table of contents.

FLIGHT COMPARTMENT

Seneca III, 14 Vdc and 28 Vdc airplanes are equipped with overhead flood lights, overhead instrument panel lights, glareshield lights and left and right side lights. Of these lights, the overhead instrument panel, left and right side, and glareshield lights are controlled by a dimmer in the instrument panel located just to the left of the engine instruments.

Seneca IV airplanes are 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 on-off/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 on-off/dimmer control switch incorporated in the light fixture.

Both Seneca III and Seneca IV models are equipped with annunciator lights, incorporating a press-to-test switch, located on the upper right side of the pilot’s instrument panel.

The annunciator panel on the Seneca IV also incorporates and day-night toggle switch to dim the lights for night operations

PASSENGER COMPARTMENT

Seneca III, 14 Vdc and 28 Vdc airplanes have available four optional reading lights installed in the overhead panel, one for each of the third through sixth passengers. Also available are two optional courtesy lights with one installed above forward entrance door and the second installed in the position of the left rear reading lights. All of these lights are activated by individual switches.

The three reading lights and both the forward and aft courtesy lights are standard equipment on Seneca IV airplanes. The are each operated by individual switches.

The courtesy lights on both the Seneca III and Seneca IV are wired directly to the battery so that they may be turned ON with the BATT switch OFF.

CARGO AND SERVICE COMPARTMENTS

Seneca III, 14 Vdc and 28 Vdc airplanes have available an optional lighting system (automatic and mechanical) for the forward baggage compartment consisting of a single light mounted in the top of the baggage compartment just forward of the door opening. The system may be installed with either a manual switch or an automatic switch. The manual system uses a switch on the light assembly. The automatic system uses a door switch which is activated by the door as soon as thee door latch is released.

NOTE

When equipped with the automatic switch, the light will be ON with the door closed, if the door latch is not engaged, resulting in battery depletion.

The forward baggage compartment lighting system is standard equipment on the Seneca IV. The light is activated automatically when the door is unlatched.

NOTE

When equipped with the automatic switch, the light will be ON with the door closed, if the door latch is not engaged, resulting in battery depletion.

The forward baggage compartment light on both the Seneca III and Seneca IV is wired directly to the battery so that it will be activated with the BATT switch OFF.

EXTERIOR LIGHTS

Exterior lighting on both the Seneca III and Seneca IV airplanes consist 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 panel located:

1. On Seneca III models on lower left side of instrument panel.
2. On Seneca IV models on lower center right side instrument panel beneath the copilot’s avionics panel.

On both the Seneca III models the wing ice light switch is located on the deice control panel. The Seneca IV wing ice light switch is located among the deice switch group located on the instrument panel above the throttle quadrant.

TROUBLESHOOTING

When checking any of the light systems, other than the courtesy lights or forward baggage compartment light, the BATT switch must be ON in order to operate the lights. Ensure that the circuit breaker of the affected system is activated.

FLIGHT COMPARTMENT

SENECA III OVERHEAD FLOOD AND OVERHEAD PANEL LIGHTS

The overhead lights are mounted in the overhead forward fresh air vent. The overhead flood assembly(s) uses a dimmer just above the light control while the overhead panel lights are controlled by a dimmer control just below the control column on the instrument panel.

MAINTENANCE TO SENECA III OVERHEAD FLOOD LIGHTS

1. Remove screws retaining lens cover to housing.
2. The light bulb is of a bayonet type and removed accordingly.
3. Replace the bulb and ensure correct operation.
4. 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.
5. Clean lens cover as necessary and install.

MAINTENANCE OF SENECA III OVERHEAD PANEL LIGHTS

The overhead panel lights are installed in the fresh air duct above the pilot's and copilot's seats. The overhead duct contains the panel light assemblies, audio speaker, and fresh air ducting. Remove the small PK screws that secure it within the support channels of the ceiling fresh air ducting. Allow the panel to hand in place by using a piece of safety wire and securing it to the ceiling support channel. Replace faulty panel lights with bulbs of same voltage rating.

SENECA III INSTRUMENT AND PANEL LIGHTS

The Seneca III instrument and panel lights involve four groups: pilot's and copilot's glareshield lights, right and left side panel lights, overhead panel lights, and overhead flood lights. All lights are powered through dimmer controls by a 5 amp circuit breaker.

On Seneca III, 14 Vdc models, all instrument and panel lights, except the overhead floods, are controlled by a transistorized dimmer assembly located under the pilot's control column. Two control knobs extend from the dimmer, the upper knob for controlling the radio lights and the lower for controlling the aforementioned lights.

On Seneca III, 28 Vdc models, the lights are controlled by two dimmer potentiometers, installed on the instrument panel, which operate independent dimmer control boxes located forward of the instrument panel.

REMOVAL OF SENECA III DIMMER CONTROL ASSEMBLY

1. Access to the Dimmer Control Assembly is from beneath the instrument panel.
2. Disconnect the electrical connection from the assembly.
3. Remove the two screws securing the assembly to the instrument panel.
4. Remove assembly from the airplane.

INSTALLATION OF SENECA III DIMMER CONTROL ASSEMBLY

1. Position the assembly in the instrument panel with the control knobs inserted into their appropriate slots.
2. Secure the assembly to the instrument panel with the two screws previously removed.
3. Connect the electrical connection to the assembly.
4. Check operation of Dimmer Control Assembly.

SENECA IV DOME PANEL FLOOD/MAP LIGHTS

Two overhead instrument panel/map lights are mounted in the overhead forward fresh air vent panel adjacent to the avionics 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 located adjacent to the light unit.

MAINTENANCE TO DOME PANEL FLOOD/MAP LIGHTS

To Replace Bulb

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.
3. Replace the bulb. Engage (push IN) FLOOD circuit breaker. Ensure correct operation of light.
4. 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 switch/dimmer operation.
5. Clean lens as necessary.
6. Install light fixture and secure with three screws previously removed.

To Replace Switch/Rheostat

1. Ensure BATT switch is off. Disengage (pull OUT) FLOOD and SPKR AMP circuit breakers.
2. Loosen allen nut and remove switch knob.
3. Loosen (do not remove) nut securing switch 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 switch. Do not permit panel to hang by elelctrical wires.
5. Remove nut from switch. Remove switch from panel. Remove wire from switch.
6. Install wire on new switch. Install switch in panel. Install security nut and finger tighten.
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 switch to panel
9. Install switch knob and tighten allen nut.
10 Engage (push IN) FLOOD and SPKR AMP circuit breakers.

SENECA IV INSTRUMENT POST LIGHTS

The primary means of illuminating flight and engine instruments is with post lights.

To Replace Bulb:

1. Ensure BATT and NAV LIGHT switches are 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.

To Remove Socket:

1. Ensure BATT and NAV LIGHT switches are OFF and INST. PNL. circuit breaker is disengaged (pulled OUT).
2. Gain access to back of instrument panel in vicinity of socket to be replaced.
3 Unscrew wire from machine threaded brass extension on rear of socket.
4. Remove small copper nut and lock washer from threaded brass extension on rear of socket.
5. Remove socket from mounting hole through front of instrument panel panel
6. Engage (push IN) INST. PNL. circuit breaker in.

To Install Socket:

1. Ensure BATT and NAV LIGHT switches are OFF and INST. PNL. circuit breaker is disengaged (pulled OUT).
2. Inserting end with threaded brass extension through hole in panel
3. Securing with copper lock washer and nut.
4. Snug nut just enough to flatten lock washer against panel to ensure proper ground.
5. Install wire by screwing onto end of threaded brass extension.
6. Engage (push IN) INST. PNL. circuit breaker in.

SENECA IV 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 ARE PULLED *OUT.*

To Replace Bulb(s):

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.

To Replace Bulb(s): (continued)

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.

To Replace Switch:

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 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.

SENECA IV DIMMER CONTROLS

The Seneca IV has 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.

To 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.

NOTE

Check that potentiometer control is turned fully counterclockwise.

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.

ANNUNCIATOR (Refer to Chapter 91 for the appropriate schematics.)

An annunciator panel light cluster is mounted in the top of the instrument panel just above the pilot's altimeter. This unit provides a distinct visual indication of a specific system malfunction by illuminating the particular system's warning light. On Seneca III models, a PUSH TO TEST switch, located on the left side of the annunciator panel, is used to illuminate the entire display. The PUSH TO TEST switch on the Seneca IV is located on the right side of the annunciator panel. Should some lights be displayed and others not, pushing the test button should activate those not lit.

A DAY - NIGHT toggle switch, located on the left side of the Seneca IV panel, operates the dimmer control box, enabling the pilot to dim the annunciator lights during night flight. The dimmer control box, which is powered through the PUSH TO TEST switch, is located under the floor board on the right side of the fuselage near the flap torque tube brackets.

The following annunciator lights should be illuminated when the engines are stopped: GYRO AIR (Seneca III, 14 Vdc), LEFT or RIGHT VACUUM LOW (Seneca III, 28 Vdc), or LEFT or RIGHT VACUUM INOP (Seneca IV); ALT OUT (Seneca III, 14 Vdc) or ALTERNATOR (Seneca III, 28 Vdc and Seneca IV); OIL (Seneca III, 14 Vdc); OIL PRESSURE (Seneca III, 28 Vdc); OIL PRESS) Seneca IV): and LOW BUS VOLTAGE (Seneca IV option).

Seneca III – 14 Vdc

The annunciator system involves two units: the annunciator panel (previously described), and the annunciator control box. The control box is mounted to the water line stringer 47.45 on the left side of the aircraft, just forward of Fuselage Station 81.00. Power is supplied to this unit through a five amp fuse located behind the circuit breaker panel. Certain of the annunciated systems however, operate their lights directly from their systems, others work on a “ground apply” principle through the annunciator control box.

The lighted cluster consists of twelve lights. These twelve lights are: OVER BOOST (2 each), AUX FUEL ON (2 each), OIL PRESS, GYRO AIR (2 each), HEATER OVERHEAT, A/C DOOR OPEN, ALT OUT, DECISION HEIGHT (s/n’s 34-8133001 thru 34-8233215) or BAGGAGE DOOR (s/n’s 34-8333001 thru 34-8633031, and 3433001 and up),and GEAR UNSAFE.

CHART 3301. SENECA III ANNUNCIATOR PANEL FUNCTION DESCRIPTIONS (14 Volt System)

Nomenclature	Color	Cause of Illumination
OVER BOOST	AMBER	Illuminates when engine’s manifold pressure exceeds 39.5 to 40 inches of mercury.
OIL	AMBER	Illuminates when engine’s oil pressure has decreases to 15 psi.
HEATER OVERHEAT	RED	Illuminates when overheat switch has deactivated the heater unit.

Seneca III – 14 Vdc (continued)

CHART 3301. SENECA III ANNUNCIATOR PANEL FUNCTION DESCRIPTIONS (14 Volt System)
(continued)

Nomenclature	Color	Cause of Illumination
ALT OUT	RED	Illuminates when one or both alternator circuits have failed. This circuit is tied into the diode assembly located at FS 53.6.
GEAR UNSAFE	RED	Illuminates when gear is in transit or is not fully up/down and locked.
AUX FUEL ON	AMBER	Illuminates when "HI" auxiliary fuel pump is on.
GYRO AIR	AMBER	Illuminates when either vacuum switch is activated. The vacuum switches are attached to regulators, set to close at 4 ± 0.25 psi vacuum.
AC 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.
DECISION HEIGHT S/N'S 34-8133001 thru 34-8233215)	AMBER	Illuminates when airplane arrives at height above ground level selected on radio altimeter
BAGGAGE DOOR (S/N's 34-8333001 thru S/N's 34-8333031 and 3433001 and up.)	AMBER	Illuminates when nose baggage door is open.

— NOTE —

The DECISION HEIGHT (s/n's 34-8133001 thru 34-8233215) or BAGGAGE DOOR (s/n's 34-8333001 thru 34-8633031, and 3433001 and up), GYRO AIR, OIL PRESS, OVER BOOST and A/C DOOR OPEN lights operate off a ground apply principle receiving power from the annunciator box. The others work off of power from their own systems.

SENECA III - 28 VDC

Power is supplied to the annunciator panel through a five amp circuit breaker located on the main electrical bus circuit breaker panel. Certain of the annunciated systems operate their lights directly from their systems, while others work on a “ground apply” principle.

The lighted cluster consists of fifteen spaces incorporating twelve to fifteen lights, depending on options included on the airplane. The twelve primary and three optional lights are: LEFT OVERBOOST, LEFT AUX. FUEL ON, OIL PRESSURE, GEAR WARN, L. VACUUM LOW, FLAPS, ALTERNATOR, LOW BUS VOLTAGE (optional), BAGGAGE DOOR, HEATER OVERHEAT, R. VACUUM LOW, STARTER ENGAGE (optional), RIGHT OVERBOOST, RIGHT AUX. FUEL ON, and AIR COND DOOR OPEN (optional).

CHART 3302. SENECA III ANNUNCIATOR PANEL FUNCTION DESCRIPTIONS (28 Volt System)

Nomenclature	Color	Cause of Illumination
LEFT or RIGHT OVERBOOST	AMBER	Illuminates when engine’s 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 output exceeds 32 Vdc and the alternator control unit(s), located forward of the bottom of the bulkhead separating the cabin section from the nose section, takes an alternator off line,or alternator is selected OFF.
LEFT or RIGHT AUX FUEL ON	AMBER	Illuminates when HI auxiliary fuel pump is on.
L or R VACUUM LOW	AMBER	Illuminates when either vacuum switch is activated. The vacuum switches are attached to regulators, set to close at 4 ± 0.25 psi 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.
OIL PRESSURE	AMBER	Illuminates when engine’s oil pressure has decreases to 15 psi.
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.
STARTER ENGAGE	AMBER	Illuminates when starter is activated.

SENECA III - 28 VDC (continued)

CHART 3302. SENECA III ANNUNCIATOR PANEL FUNCTION DESCRIPTIONS (28 Volt System)
(continued)

Nomenclature	Color	Cause of Illumination
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.

— NOTE —

The L an R VACUUM LOW, OIL PRESSURE, L or R OVER BOOST and A/C DOOR OPEN lights operate off a ground apply principle receiving power from the annunciator box, while the others work off of power from their own systems.

SENECA IV

Power is supplied to the annunciator panel through a five amp circuit breaker located on the main electrical bus circuit breaker panel. Certain of the annunciated systems operate their lights directly from their systems, while others work on a "ground apply" principle.

Although provisions are made for eighteen annunciators, the lighted cluster incorporates fifteen to seventeen lights, depending on options included on the airplane. The fifteen primary and two optional lights are: LEFT OVERBOOST, LEFT AUX FUEL ON, OIL PRESS, GEAR WARN, L. VACUUM INOP, L. START ENGAGE, ALTERNATOR, LOW BUS VOLTAGE (optional), FLAPS, WING-TAIL DEICE, BAGGAGE DOOR, HEATER OVERHEAT, R. VACUUM LOW, R START ENGAGE , RIGHT OVERBOOST, RIGHT AUX. FUEL ON, and AIR COND DOOR OPEN (optional).

CHART 3303. SENECA IV ANNUNCIATOR PANEL FUNCTION DESCRIPTIONS

Nomenclature	Color	Cause of Illumination
LEFT or RIGHT OVERBOOST	AMBER	Illuminates when engine's 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."
LEFT or RIGHT AUX FUEL ON	AMBER	Illuminates when "HI" auxiliary fuel pump is on.
L or R VACUUM LOW	AMBER	Illuminates when either vacuum switch is activated. The vacuum switches are attached to regulators, set to close at 4 ± .25 psi vacuum.

SENECA IV (continued)

CHART 3303. SENECA IV ANNUNCIATOR PANEL FUNCTION DESCRIPTIONS (continued)

Nomenclature	Color	Cause of Illumination
LOW BUS VOLTAGE	RED	Illuminates when the electrical system drops from bus voltage to battery voltage. Fuse overload protection is provided to voltage monitor.
OIL PRESSURE	AMBER	Illuminates when engine's oil pressure has decreases to 15 psi.
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 STARTER ENGAGE	RED	Illuminates when left engine starter is activated.
R STARTER ENGAGE	RED	Illuminates when 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 (less than 14.5 Vdc)
WING-TAIL DEICE	GREEN	Illuminates when wing or tail deice boots inflate to 8.0 psi.

— NOTE —

The L an R VACUUM LOW, OIL PRESSURE, L or R OVER BOOST, A/C DOOR OPEN, WING-TAIL DEICE, BAGGAGE DOOR and LOW BUS VOLTAGE lights operate off a ground apply principle receiving power from the annunciator box, while the others work off of power from their own systems.

TROUBLESHOOTING ANNUNCIATOR

Chart 3304 gives information on those problems most commonly experienced. For further information contact the service representative at Vero Beach, Florida.

TROUBLESHOOTING ANNUNCIATOR (continued)

CHART 3304. ANNUNCIATOR PANEL TROUBLESHOOTING

Trouble	Cause	Remedy
(Seneca III, 14 Vdc Model) "Ground Applied" warning lights fail to operate.	Blown annunciator box fuse.	Replace the 5 amp fuse behind instrument panel.
(Seneca III, 28 Vdc and Seneca IV Models) "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.	**(Seneca III Models)** Check all wire segments, connections, and the receptacle at the side of the annunciator panel. **(Seneca IV Models)** Check all wire segments and connections at connectors on annunciator light assembly.
All the warning lights fail to extinguish after engine is running.	**(Seneca III Models)** Test switch grounded out.	Check terminals and replace switch if necessary.
	(Seneca IV Models) 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 light fails to operate.	Lamp burned out.	Replace.
	Sensor activates at too low a setting.	Replace.
	Defective Sensor	Replace.

CHART 3101. ANNUNCIATOR PANEL TROUBLESHOOTING (continued)

Trouble	Cause	Remedy
Overboost warning light fails to extinguish.	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.	Lamp burned out.	Replace.
	Defective sensor switches.	Replace.
Alternator warning light fails to operate.	Lamp burned out.	Replace.
(Seneca III, 14 Vdc Model) Alternator warning light fails to extinguish.	Blown fuse or fuses.	Replace one or both 5 amp fuses.
	Defective alternator output circuit.	Check and repair.
(Seneca III, 28 Vdc and Seneca IV Models) 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.

ANNUNCIATOR LIGHT TESTS

The annunciator lights may be tested as follows:

— NOTE —

The sequence of the test may be varied at the option of the mechanic.

1. Press the annunciator test button to ensure that the annunciators illuminate.
2. Start the right engine and observe that the right GYRO AIR (Seneca III, 14 Vdc), RIGHT VACUUM LOW (Seneca III, 28 Vdc), RIGHT VACUUM INOP (Seneca IV) light extinguishes as the engine starts.
3. Operate the engine at approximately 700-1000 rpm. Note that oil pressure, air pressure or vacuum, and alterrnator output are normal.

ANNUNCIATOR LIGHT TESTS (continued)

4. Start the left engine and observe that the left GYRO AIR (Seneca III, 14 Vdc), LEFT VACUUM LOW (Seneca III, 28 Vdc), LEFT VACUUM INOP (Seneca IV) light extinguishes as the engine starts. See that the oil pressure, air pressure or vacuum, and alternator output is normal.
5. 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.

6. 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 OUT (Seneca III, 14 Vdc), or ALTERNATOR (Seneca III, 28 Vdc or Seneca IV) annunciator to illuminate.
7. After ensuring that the propellers and propeller blast will not do any damage, run the engines up, one at a time, to check that each OVER BOOST (Seneca III, 14 Vdc), L OVERFBOOST or R OVERBOOST (Seneca III, 28 Vdc or Seneca IV) annunciator comes on at 39.5 + .5 inches of mercury manifold pressure.
8. If the optional air conditioning system is installed, check that the A/C DOOR OPEN (Seneca III, 14 Vdc), AIR COND DOOR OPEN (Seneca III, 28 Vdc or Seneca IV) 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 placed in the off position.
9. Shut down the right engine and check that the right GYRO AIR (Seneca III, 14 Vdc), RIGHT VACUUM LOW (Seneca III, 28 Vdc), RIGHT VACUUM INOP (Seneca IV) light illuminates just as the engine slows to approximately 300 rpm. Check that the other annunciator lights are on.
10. Repeat step 8 for the left engine, ensuring that the left GYRO AIR (Seneca III, 14 Vdc), LEFT VACUUM LOW (Seneca III, 28 Vdc), LEFT VACUUM INOP (Seneca IV)light illuminates.
11. 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.
12. Refer to Chapter 32, Landing Gear, for the functional test for the gear unsafe light.

GLARESHIELD LIGHTS (Seneca III)

The glareshield lights are made up of eight (five, pilot; three, copilot) lights involving two assemblies. The lights are situated under the lip of the glareshield and clipped to individual mounts. If any of these lights become inoperative, replace the affected bulb and operate the system to ensure no other problems exist.

The bulbs are of the bayonet type and covered with a filter which should be placed on the new bulb.

If the bulb still does not light up after replacement, unclip the socket from its bracket and ensure the leads are properly attached and there is continuity through the socket. Replace the socket if necessary.

Should the lights not operate properly connect a voltmeter and check for 12 or 24 volts at socket assembly on left or right side of instrument panel. Should no voltage be present then check dimmer assembly.

RIGHT AND LEFT SIDE LIGHTS (Seneca III)

The right and left side panel lights are controlled by instrument panel lights dimmer control. The right and left side lights are located in the cockpit area on the right and left side lights.

REMOVAL OF LAMP RIGHT SIDE (LEFT TYPICAL) (Seneca III)

1. Remove four screws from side panel.
2. Remove panel light bulb.

INSTALLATION OF LAMP RIGHT SIDE (LEFT TYPICAL) (Seneca III)

1. Insert light bulb in light assembly receptacle.
2. Position panel secure with appropriate screws.

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PASSENGER COMPARTMENT

COURTESY AND READING LIGHTS (Refer to Figure 33-1.)

Courtesy lights are designed to light up each of the entrances. They are optional on Seneca III models and standard on the Seneca IV. 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.

When installed on Seneca III, 14 Vdc models, both courtesy lights receive power from the battery side of the master solenoid. When installed on Seneca III, 28 Vdc models, both courtesy lights receive power from the battery bus. The courtesy lights on Seneca IV models are also powered off the battery bus. This enables illumination of both lights when the battery switch is off. In all models, the circuit is protected by a 5 amp fuse

The aft courtesy on Seneca III models is also operated by a switch located on the light assembly. The aft courtesy light on Seneca IV models is operated by a switch on the left rear entrance door.

The reading lights installed on Seneca III airplanes are individually controlled with switches on each bezel. Seneca IV reading lights are controlled by rocker type switches located in each seat's armrest.

Seneca III airplanes have four reading lights installed in the passenger cabin. When the courtesy light package is installed, the fourth reading light serves as the aft courtesy light. The three or four reading lights are powered through a ten amp CABIN circuit breaker.

In addition to the aft courtesy light, Seneca IV airplanes have three reading lights 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

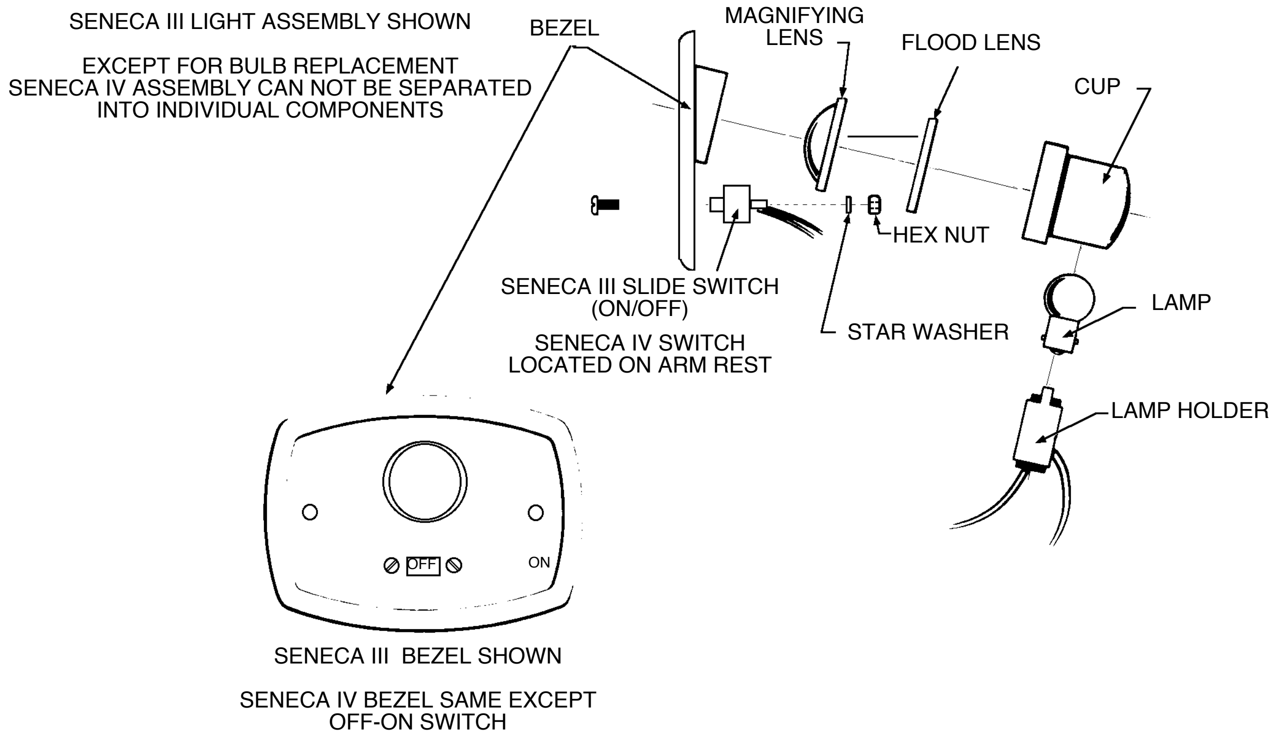

Figure 33-1. Reading and Courtesy Light Assembly (Whelen)

MAINTENANCE OF COURTESY AND READING LIGHTS

To change aft courtesy or reading light bulb:

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.
5. Install light unit.

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CARGO AND SERVICE COMPARTMENTS

Two types of optional forward baggage compartment lighting systems are available on the Seneca III models; automatic and manual. The automatically operated forward baggage compartment lighting system is standard on Seneca IV models.

The manually operated switch (Seneca III models) is located on the light assembly. The automatic system (Seneca III and IV) 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

When equipped with the automatic switch, the light will be ON with the door closed, if the forward door latch pin is not engaged, resulting in battery depletion.

Both the Seneca III optional systems, and the Seneca IV system, use a similar lighting assembly and a five amp fuse located near the master solenoid in the nose of the aircraft.

Refer to Chapter 91 for electrical schematics.

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.

1. Remove the lens cover by removing the three attaching screws.
2. Remove bayonet type bulb.
3. Install new bulb and ensure its operation.
4. Install lens cover by installing the three attaching screws.

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EXTERIOR

NAVIGATION LIGHTS

REMOVAL OF WING NAVIGATION LIGHT BULB

1. Remove screw securing the lens retainer.
2. Remove lens and bulb.

— NOTE —

The wing tip must be removed in order to remove the complete lamp assembly.

INSTALLATION OF WING NAVIGATION LIGHT

1. Install bulb, lens and lens retainer.
2. Secure with appropriate screws.

ANTI-COLLISION STROBE LIGHTS

REMOVAL OF LAMP IN ANTI-COLLISION WING TIP STROBE LIGHT

The lights are located in both wing tips next to the navigational lights.

1. Remove the screw securing the navigational light cover and remove cover.
2. Remove the three screws securing navigational light bracket assembly and remove light assembly.
3. Remove the strobe lamp by cutting the wires on the lamp beneath the mounting bracket.
4. Remove the defective lamp.
5. Remove and discard the plug with the cut wires from the electrical socket.

INSTALLATION OF LAMP IN ANTI-COLLISION WING TIP STROBE LIGHT

1. Route the wires from the new lamp down through the hole in the navigational light bracket.
2. Insert the wire terminals in the plastic plug supplied with the new lamp. Wire according to Figure 33-2 and the appropriate schematic in Chapter 91.
3. Position strobe lamp on navigational light bracket.
4. Secure navigational light assembly and bracket with appropriate screws.
5. Install navigational light cover and secure with appropriate screws.

REMOVAL OF LAMP IN VERTICAL STABILIZER ANTI-COLLISION LIGHT

The light is located on the upper section of the vertical stabilizer.

1. Loosen the screw in the clamp securing the light cover.
2. Remove the light cover.
3. Remove the defective lamp from the socket.

INSTALLATION OF LAMP IN VERTICAL STABILIZER ANTI-COLLISION LIGHT

1. Plug in new lamp using correct number.
2. Replace light cover.
3. Tighten screw in clamp to secure light cover.

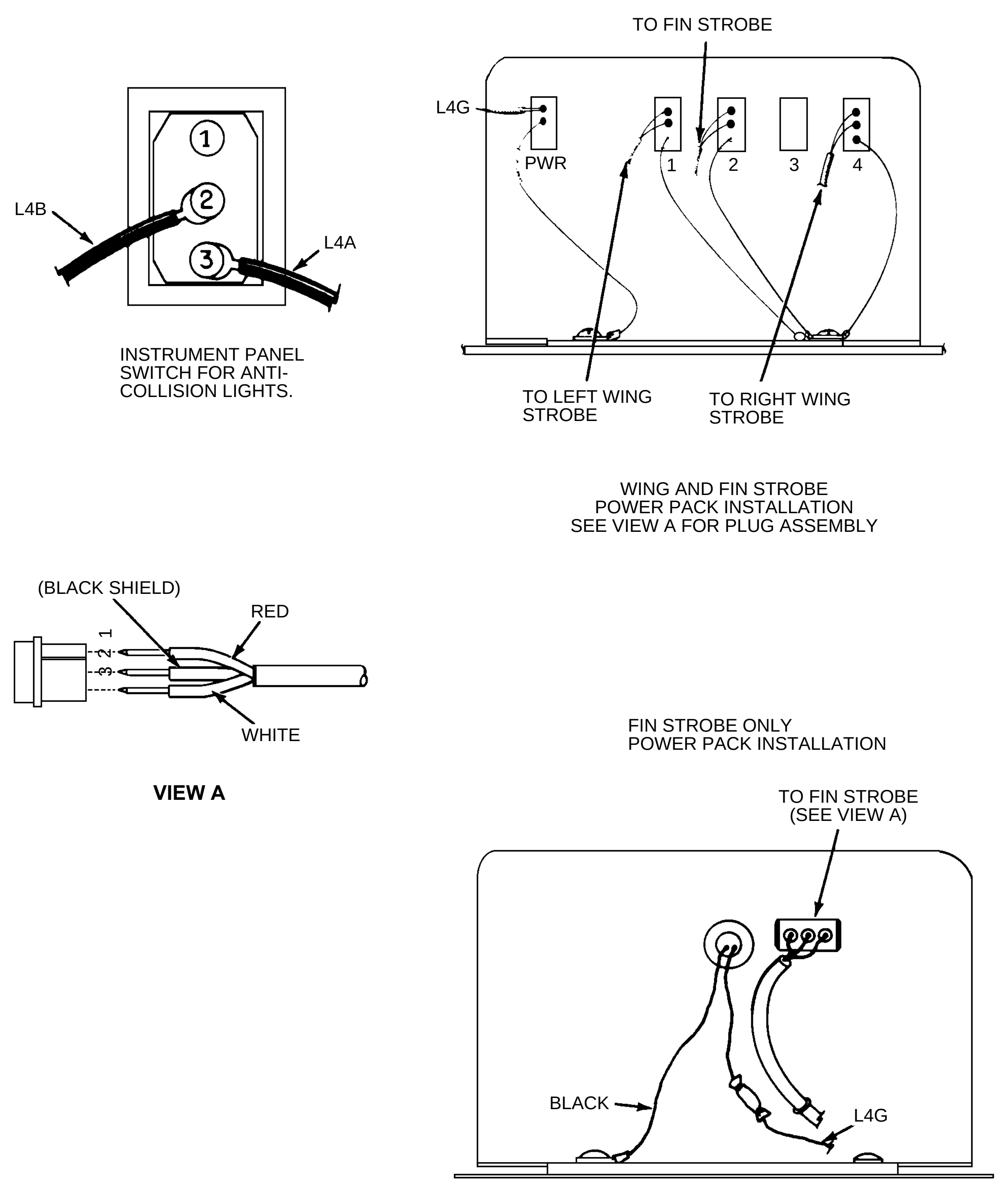

Figure 33-2. Strobe Installation Connections - Seneca III (Sheet 1 of 2)

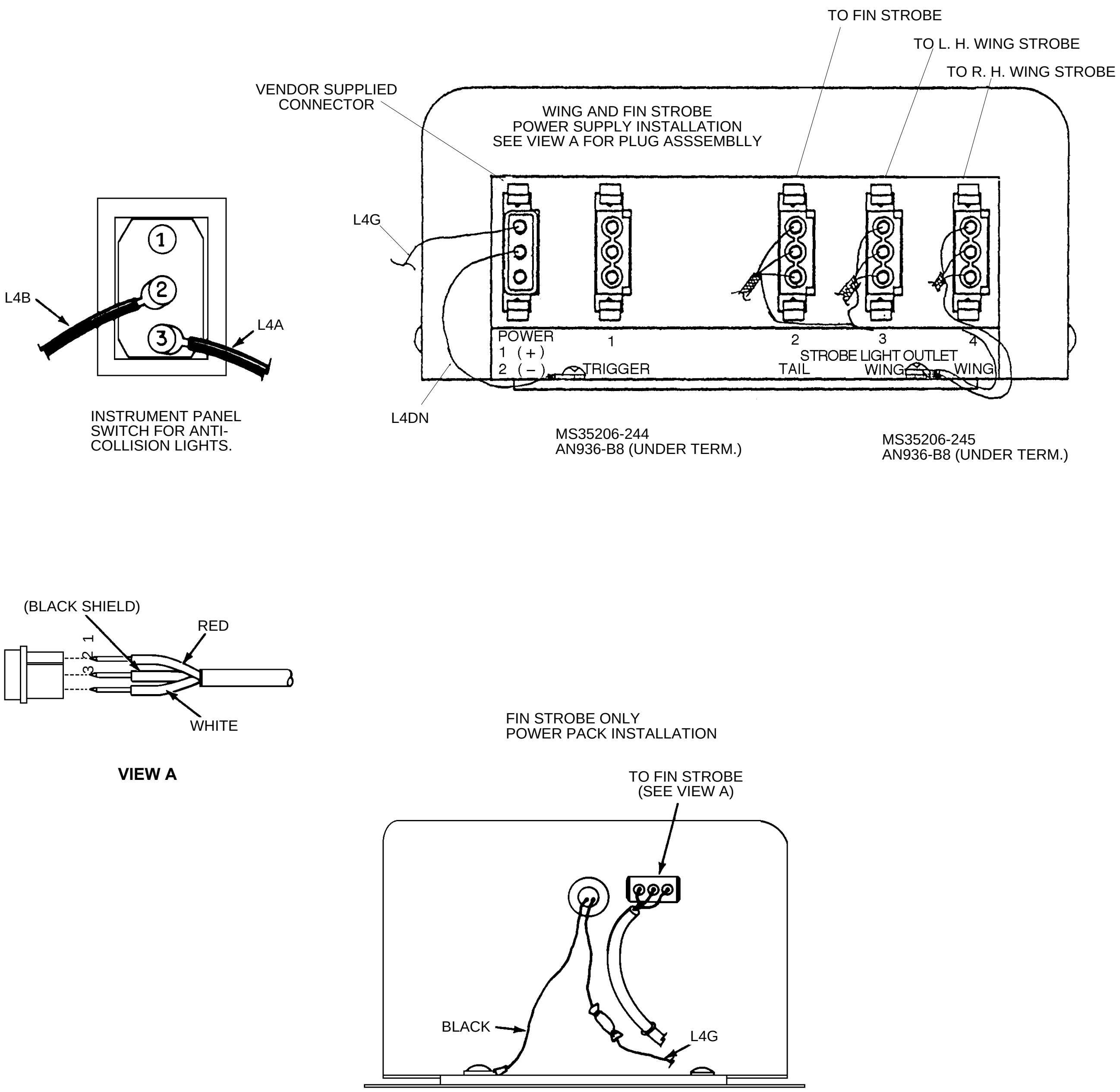

Figure 33-2. Strobe Installation Connections - Seneca IV (Sheet 2 of 2)

TROUBLESHOOTING PROCEDURE FOR ANTI-COLLISION AND WING TIP STROBE LIGHT SYSTEMS

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 33-2 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 14 or 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.

— CAUTION —

WHEN DISCONNECTING THE POWER SUPPLY, ALLOW FIVE MINUTES OF BLEED DOWN TIME PRIOR TO HANDLING THE UNIT.

3. Check interconnecting cables for shorts.
    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. Check the light tube socket assembly for shorts.
    a. Disconnect the tube socket assembly of the anti-collision light from the interconnecting cable.
    c. Using an ohmmeter, check for continuity between pin 1 of AMP connector to pin 1 of tube socket; pin 2 of AMP connector to pins 6 and 7 of tube socket; and pin 3 of AMP connector to pin 4 of tube socket. If no continuity exists, the tube socket assembly is broken and should be replaced.
5. Engage (push IN) all appropriate circuit breakers.

RECOGNITION LIGHTS

Recognition lights are installed in the leading edge of both wing tips. The installation is optional on Seneca III models and standard on Seneca IV models. Be sure Seneca III replacement parts are compatible with the 14 Vdc or 28 Vdc electrical system, as appropriate.

REPLACEMENT OF RECOGNITION LIGHT LAMP

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) FLOOD/RECOG 10 amp circuit breaker (Seneca III, 14 Vdc models) or RECOG 7.5 amp circuit breaker (Seneca III, 28 Vdc models and Seneca IV)
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.

LANDING AND TAXI LIGHTS

These lights consist of two 250 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 Chapter 39.) 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.

REMOVAL OF LANDING AND TAXI LIGHTS (Refer to Figure 33-3.)

1. 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.

2. 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.
3. Disconnect the electrical leads from the lamp being removed.
4. 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.

INSTALLATION OF LANDING AND TAXI LIGHTS (Refer to Figure 33-3.)

1. To install the landing lamps, attach the electrical leads to the lamp or lamps.
2. 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.

3. 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. (Refer to Figure 33-3.)
4. Align the bracket longitudinally and secure in place with clamps.
5. The light beam angle may be adjusted by the adjustment screws at the sides of the bracket and tilting the mounting fixture as desired.

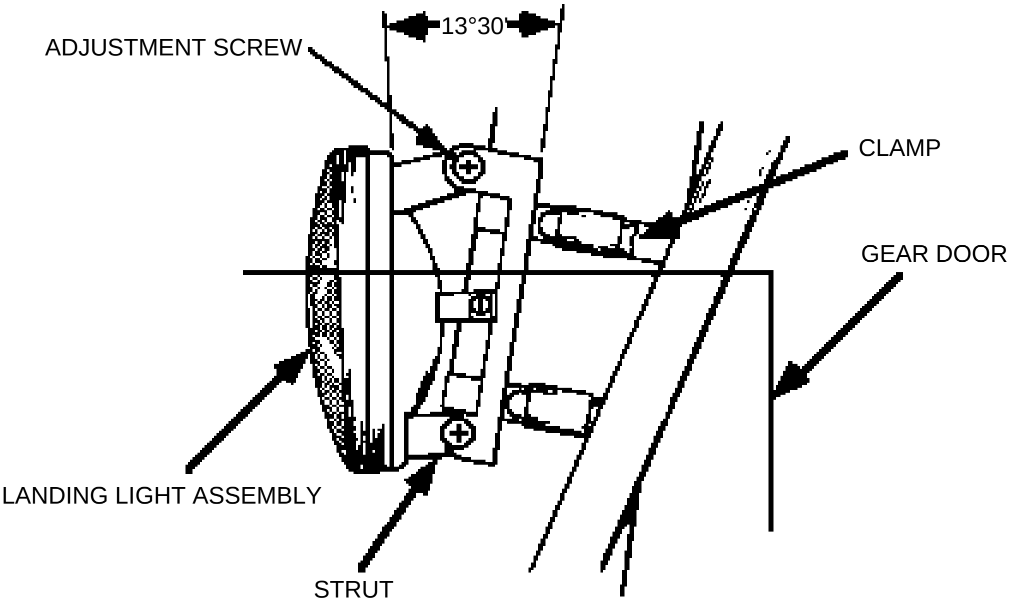

Figure 33-3. Landing Light Adjustment

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CHAPTER

34

NAVIGATION AND PITOT/ STATIC

CHAPTER 34 - NAVIGATION AND PITOT STATIC

TABLE OF CONTENTS/EFFECTIVITY

CHAPTER 34 - NAVIGATION AND PITOT STATIC

TABLE OF CONTENTS/EFFECTIVITY

— WARNING —

IT IS THE USER'S RESPONSIBILITY TO REFER TO THE APPLICABLE VENDOR PUBLICATIONS WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT.

GENERAL

The flight environment data and pitot static instruments systems consists of:

1. Pitot and static air sources which supplies both pitot and static air pressure for the airspeed indicator, and static air pressure for the altimeter and vertical speed indicator.
2. The vacuum system (optional on Seneca III models, standard on Seneca IV models) consists of a vacuum pump installed on each engine to supply negative pressure to operate the:
   a. Attitude Deviation Indicator (ADI) (Attitude Gyro).
   b. Gyroscopic Heading Indicator (Directional Gyro) or Horizontal Situation Indicator (HSI).
3. A magnetic compass
4. An electrically operated Turn and Slip (Turn and Bank) indicator.

A Mitchell Horizontal Situation Indicator (HSI) was available as an option on Seneca III–14 Vdc models. When installed, the self contained gyro is vacuum operated, while the navigation input is electrical. King HSI’s, installed on Seneca III–28Vdc models as an option, is operated by a remote gyroscopic compass system, installed as part of the Flight Director System (FDS). The King HSI is standard on the Seneca IV.

Attitude Indicators installed on all Seneca models, whether part of an FDS or not, have self contained vacumm operated gyros.

Both the ADI and vacuum operated HSI’s require 4.8 to 5.2 psi negative pressure for proper rotor speed. An annunciator illuminates should the neagative pressure decrease to 4.0 psi.

All of these instruments are face mounted.

DESCRIPTION AND OPERATION (Refer to Figure 34-1)

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. 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 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 in front of the pilot. 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. Pitot and static lines can be drained through separate drain valves located on the left lower side of the fuselage interior.

Refer to Chapter 37 for a description of the vacuum system.

REMOVAL AND REPLACEMENT OF FACE MOUNTED INSTRUMENTS.

Since all instruments are mounted in a similar manner, a description of a typical removal and installation is provided as a guide for the removal and installation of the instruments. Special care should be taken when any operation pertaining to the instruments is performed.

— NOTE —

Tag instrument connections for ease of installation.

1. The mounting screws for the individual instruments are exposed. Remove the connections to the instrument prior to removing the mounting screws of the instrument to be removed. Use care not to scratch the finish on the instrument panel.
2. Installation of the instruments will be completed by reversing the removal instructions. After the installation is completed, check all components for security and clearance from the flight controls.

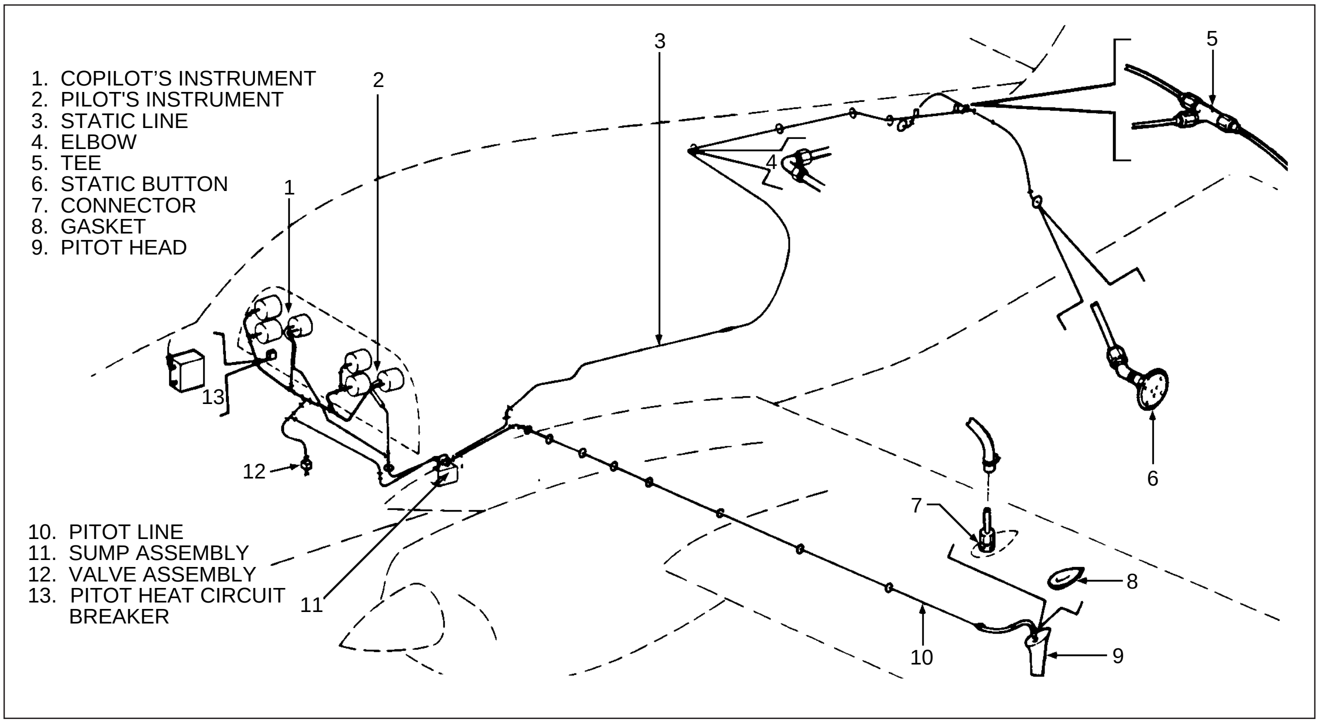

Figure 34-1. Pitot-Static System

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FLIGHT ENVIRONMENT DATA AND PITOT STATIC

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.

TROUBLESHOOTING VERTICAL SPEED INDICATOR

— NOTE —

The instrument panel vacuum gauge does not have sufficient accuracy for use in adjusting the vacuum regulators. If it becomes necessary to adjust the vacuum, temporarily install an accurate vacuum gauge before adjusting the regulators.

— NOTE —

When any connections in the static system are opened for checking, system must be checked per FAR 23.1325.

CHART 3401. 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 to 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.

CHART 3401. TROUBLESHOOTING VERTICAL SPEED INDICATOR (continued)

Trouble	Cause	Remedy
Pointer indicates a descent when airplane is "slipped"	Static vent on side opposite slip is blocked.	Disconnect static line at aft "T" connection (Fig. 34-1, item 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.

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 sensative 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 available as an option on Seneca III models. Altitude encoding altimeters are standard on the Seneca IV.

TROUBLESHOOTING ALTIMETER

— NOTE —

When any connections in the static system are opened for checking, system must be checked per FAR 23.1325.

CHART 3402. 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.

TROUBLESHOOTING ALTIMETER (continued)

CHART 3402. TROUBLESHOOTING ALTIMETER (continued)

Trouble	Cause	Remedy
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.
Barometric scale and reference markers out of synchronism with pointers.	Drift in mechanism.	Reset pointers per AC 43.13-1, Ch. 7 dated June 12, 1969.
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.

RADAR ALTIMETER

Either the Bonzer MK10X or the King KRA-10-A radar altimeter system may installed in the Seneca III, 14 Vdc models. Only the King KRA-10-A radar altimeter system is installed in the Seneca III, 28 Vdc and Seneca IV models. Each system makes use of an indicator, on/off switch, transmitter, and antenna. King units installed in the Seneca III, 14 Vdc models also require a 14 Vdc to 28 Vdc converter. Both systems function to provide above ground level (AGL) altitude information from 40 feet with the Bonzer and 20 feet with the King, up to a maximum of 2500 feet. Seneca III, 14 Vdc models, s/n ’s 34-8133001 thru 34-8233215 also included a decision height interconnect with the annunciator panel.

— 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 King Radio Corporation. Seneca III, 14 Vdc models also require a KA-133 14 Vdc to 28 Vdc converter

The receivers of both systems, as well as the converter (when required) for the King system, are 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 for both systems 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.

For any repair work to the Bonzer system, contact Bonzer.

REMOVAL AND INSTALLATION OF RADAR ALTIMETER INDICATOR

The indicator is mounted in the pilot's side of the instrument panel.

1. Remove the screws securing the instrument to the instrument panel and remove the instrument.
2. Remove the electrical connector from the back of the instrument.
3. Installation of the instrument will be in the reverse of removal.

REMOVAL OF KING KA-131 ANTENNA (Refer to Figure 34-2.)

1. Support the antenna and remove the eight screws securing it to the belly of the aircraft.
2. 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.
3. Remove the safety wire and plug.

INSTALLATION OF KING KA-131 ANTENNA (Refer to Figure 34-2.)

1. Install gasket in place on antenna ensuring metal portions of gasket will contact airframe for good bonding.
2. Install antenna cable finger tight and secure with safety wire.
3. With the cable attachment facing aft, position the antenna on the fuselage and install the eight screws.

REMOVAL OF KING KRA-10-A RECEIVER/TRANSMITTER (R/T) UNIT (Refer to Figure 34-2.)

— CAUTION —

BEFORE ENTERING THE AFT FUSELAGE SECTION, MAKE CERTAIN THE AIRCRAFT IS SUPPORTED AT THE TAIL SKID.

1. Remove the close-out panel at the rear of the baggage compartment.
2. Remove the safety wire and unscrew the antenna cable from the KRA-10-A R/T unit.
3. Remove the screw securing the P1001 connector assembly to the KRA-10-A R/T and remove the connector assembly from the R/T unit.
4. Loosen the screw on the spring loaded R/T retainer and lift the R/T unit from the mounting rack.

INSTALLATION OF KING KRA-10-A RECEIVER/TRANSMITTER (R/T) UNIT (Refer to Figure 34-2.)

1. Position the R/T unit on the mounting rack and secure by tightening the screw on the spring loaded R/T retainer.
2. Attach the P1001 connector to the R/T unit and secure with screw.
3. Install antenna cable finger tight and secure with safety wire.
4. After checking security of installation, reinstall baggage compartment close-out panel.

REMOVAL OF KING KA-133 CONVERTER (Refer to Figure 34-2.)

1. Remove the close-out panel at the rear of the baggage compartment.
2. Remove electrical connector from converter.
3. Remove the four screws securing the converter to the mounting bracket and remove the converter.

INSTALLATION OF KING KA-133 CONVERTER (Refer to Figure 34-2.)

1. Position the converter on the mounting bracket and secure with four screws.
2. Attach the electrical connector to the converter.
3. After checking security of installation, reinstall baggage compartment close-out panel.

REMOVAL OF BONZER RADAR ALTIMETER ANTENNA (Refer to Figure 34-3.)

1. Remove the eight screws securing the antenna to the airframe and remove the antenna.
2. Disconnect the cable. Take note of the position of the connection relative to the aircraft.

INSTALLATION OF BONZER RADAR ALTIMETER ANTENNA (Refer to Figure 34-3.)

1. Position the gasket on the antenna and install the cable.
2. Position the antenna in the belly of the fuselage in the position at which the old was removed.
3. Install the screws to mount the antenna to the belly.

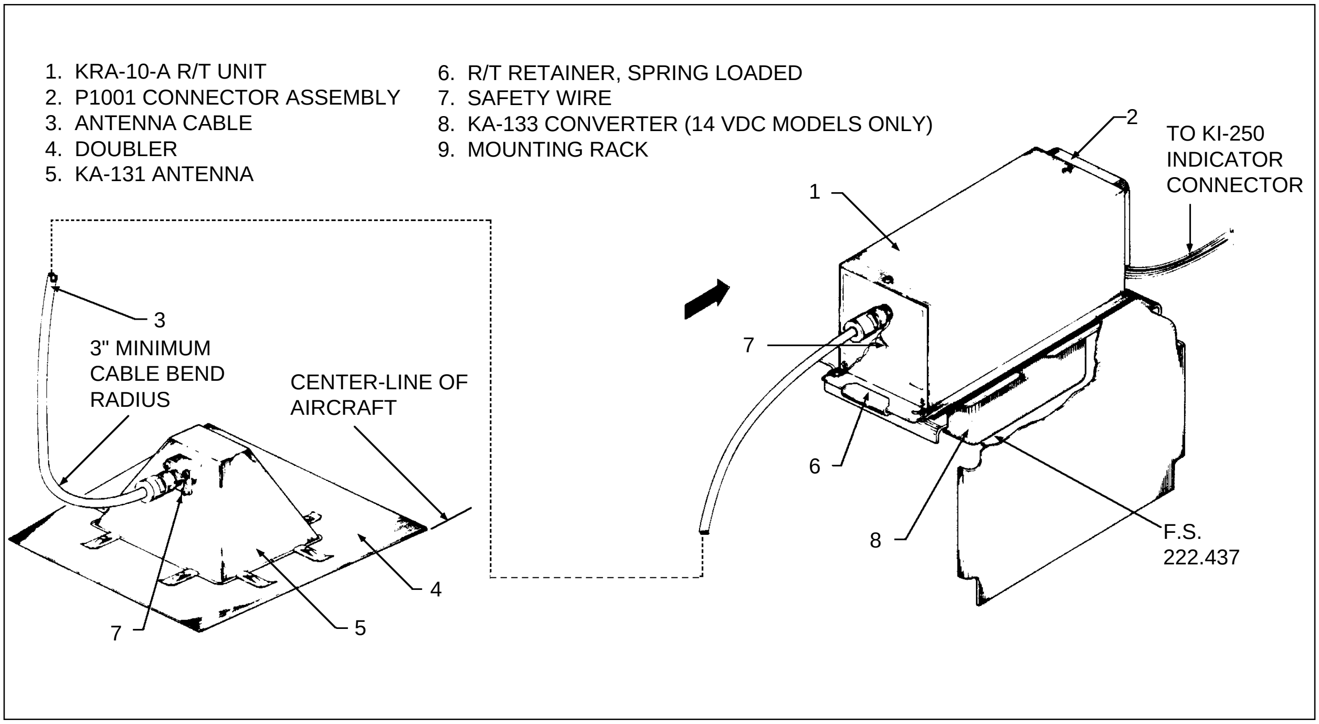

Figure 34-2. King Radar Altimeter Installation

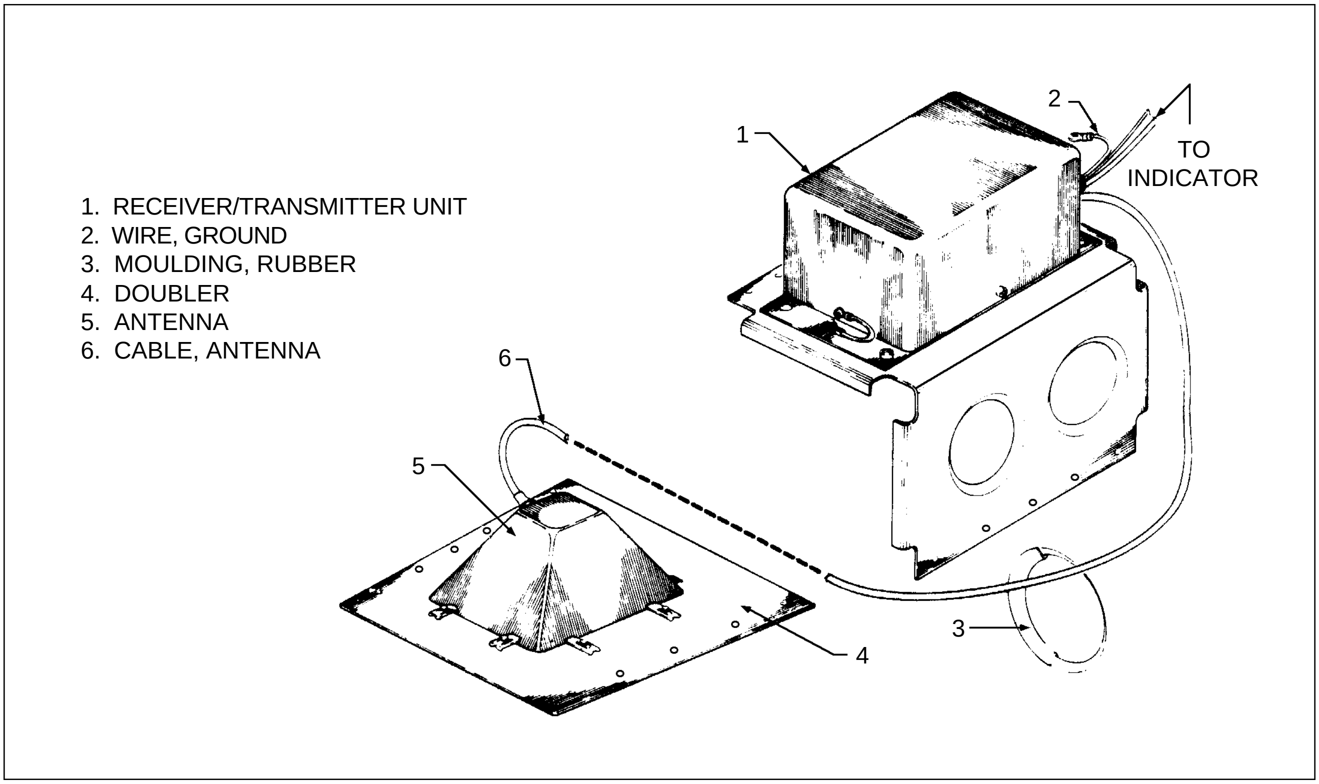

Figure 34-3. Bonzer Radar Altimeter Installation

REMOVAL OF BONZER RECEIVER/TRANSMITTER (R/T) UNIT (Refer to Figure 34-3.)

— CAUTION —

BEFORE ENTERING THE AFT SECTION OF THE FUSELAGE, MAKE CERTAIN THE AIRCRAFT IS SUPPORTED AT THE TAIL SKID.

1. Remove the close-out panel at the rear of the baggage compartment.
2. Remove the antenna cable from the R/T unit.
3. Remove the mounting screw and nut securing the ground wire to the mounting bracket.
4. Remove the electrical connector from the R/T unit.
5. Remove the remaining three mounting screws and nuts and remove the R/T unit from the aircraft.

INSTALLATION OF BONZER RECEIVER/TRANSMITTER (R/T) UNIT (Refer to Figure 34-3.)

1. Place the R/T unit in place on the mounting bracket and secure with three mounting screws and nuts.
2. Attach the electrical connector to the R/T unit.
3. Secure the ground wire to the mounting bracket with the remaining screw and nut.
4. Attach the antenna cable to the R/T unit and tighten finger tight.
5. After checking the security of the installation, reinstall the baggage compartment and close-out panel.

AIRSPEED INDICATOR

The airspeed indicator provides a means of indicating the speed of the airplane passing through the air. The airspeed indication is the differential pressure reading between pitot air to pressure and static air pressure. 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.

TROUBLESHOOTING AIRSPEED INDICATOR

— NOTE —

When any connections in static system are opened for checking, system must be checked per FAR 23.1325.

CHART 3403. 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.

CHART 3403. TROUBLESHOOTING AIRSPEED TUBES AND INDICATOR (continued)

Trouble	Cause	Remedy
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.	Remove lines from static instruments and blow out lines from cockpit to pitot head.

OUTSIDE AIR TEMPERATURE GAUGE (OAT)

Unlit OAT's were installed on Seneca III airplanes, s/n's 34-8133001 through 34-8633031, and 3433001 through 3433088. These instruments may be replaced with lit OAT's by installing Piper Service Kit 755 129 Seneca III models. s/n 3433001 through 3433179, and 3448001 through 3448037, as well as Seneca IV models, s/n's 3448038 and up, are equipped with internally lit OAT's. The only maintenance required is replacing a a faulty instrument or a bad light bulb . The gauge must be removed to replace the light bulb.

REMOVING AND INSTALLING OUTSIDE TEMPERATURE GAUGE

– CAUTION –

During installation of all OAT's, only finger tighten gauge and external threaded hex tube (sunshield). Over torquing will damage instrument.

Unlit Instruments

1. Remove external sunshield.
2. Unscrew instrument from support bushing. Note position of any washers or spacers.
3. Install new gauge in reverse sequence. Check gauge position before tightening sunshield

Illuminated Instruments - Seneca III

1. Remove pilot's side panel and window close out panel.
2. Disconnect ground and power wires.
3. Remove external sunshield.
4. Unscrew instrument from support bushing. Note position of any washers or spacers.
5. Install new gauge in reverse sequence. Check gauge position before tightening sunshield
6. Install pilot's side panel and window close out panel.

Illuminated Instruments - Seneca IV

1. Remove pilot's window close out panel.
2. Disconnect power wire.
3. Remove external sunshield.
4. Unscrew instrument from support bushing. Note position of any washers or spacers.
5. Install new gauge in reverse sequence. Check gauge position before tightening sunshield
6. Install pilot's window close out panel.

ATTITUDE AND DIRECTION

A. MAINTENANCE OF GYRO INSTRUMENTS – GENERAL

Do not attempt to repair any faulty gyro instrument in the field. Faulty instruments should be forwarded to a certified instrument repair shop for repairs.

B. GYRO FITTING INSTALLATION PROCEDURES (EDO-AIRE)

The use of teflon tape on the tapered pipe threads is recommended and should be installed as follows:

— CAUTION —

Permit no oil, grease, pipe compound or any foreign material to enter parts prior to installation of fittings. Make sure that all air lines are clean and free of foreign particles and/or residue before connecting lines to gyro. Do not use thread lube on fittings or in ports. The use of thread lube can cause contamination shortening the life of the gyro and can cause premature failure. Any evidence of the use of thread lube will create a warranty void condition.

1. Carefully lay teflon tape on the fitting threads allowing one thread to be visible from the end of the fitting. Hold in place and wrap in the direction of the threads so tape will remain tight when the fitting is installed.
2. Apply sufficient tension while winding to assure that tape forms into thread grooves (one full wrap plus 1/2 inch overlap is sufficient).
3. After wrap is complete, maintain tension and tear tape by pulling in direction of wrap. The resulting ragged end is the key to the tape staying in place.
4. Press tape well into threads.
5. Screw fitting into port being careful not to exceed torque requirements as noted on decal located on cover of gyro. (Refer to Chapter 91, List of Consumable Materials.)

C. ATTITUDE DEVIATION INDICATORS (ADI) - (GYRO HORIZON)

1. General

The ADI is essentially an air driven gyroscope rotating in a horizontal plane and is operated by the same principle as the directional gyro. On some Seneca III, 28 Vdc installations, and Seneca IV installations, 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 gyroscopic rotates 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 difference degrees of bank.

2. Troubleshooting

CHART 3404. TROUBLESHOOTING ATTITUDE DEVIATION INDICATOR

0Trouble	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.
Bar fails to respond (continued).	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.

D. AIR DRIVEN HEADING INDICATOR (DIRECTIONAL GYRO)

1. General

Air driven heading indicators are standard equipment in Seneca III, 14 Vdc models, and are offered as an option for installation on the copilot's instrument panel on Seneca III, 28 Vdc models and the Seneca IV.

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 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, prececession 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.

2. Troublshooting

CHART 3405. TROUBLESHOOTING HEADING (DIRECTIONAL GYRO) INDICATOR

Trouble	Cause	Remedy
Excess 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.	a. Adjust.
	b. Incorrect gauge reading.	b. Replace gauge.
	c. Pump failure.	c. Repair or replace.
	d. Vacuum line kinked or leaking.	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.

E. HORIZONTAL SITUATION INDICATOR (HSI)

The King KCS 55A Horizontal Situation Indicator (HSI) is installed in the Seneca III, 28 Vdc and Seneca IV model airplanes as standard equippment on the pilot’s instrument panel. When the optional King EHI-40 Flight Director is installed, the King ED-461 HSI is used.

Both the KCS 55A and ED-461 HSI’s receive heading information from a remote electrically operated KG 102A gyro installed in the tail section of the airplane. When operating normally, the gyro is slaved to the Earth’s magnetic field by the KMT 112 Magnetic Slaving Transmitter installed in the left wing tip. Thus, the remote KG 102A 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 KMT 112, the KG 102A 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.

F. MAGNETIC COMPASS

1. General

The magnetic compass is a self-contained instrument. The compass card is mounted on two magnets, which tend to align themselves with the Earth’s magnetic field, permitting the compass to use Earth’s magnetic north as a reference. Due to magnetic attractions created by nearby metal surfaces and the airplanes’s electrical equipment, the compass magnets are frequently “pulled” away from magnetic north. Much of this error (not all) can be removed by a procedure called swinging the compass (see Adjustment of Magnetic Compass). This involves placing the airplane on a magnetic compass rose, and, using a brass screwdriver to adjust compensators incorporated in the instrument, removing as much of the error as possible while on headings of north, south, east and west. The remaining error is then noted on a compass correction (deviation) card for each 30° of heading. The completed correction card is then placed in receptacle mounted on the instrument. The compass should be swung whenever instruments or radios are changed and at least once a year. For night operations, the instrument is internally lit. The light is powered by the airplanes’s instrument lighting circuit.

2. Troubleshooting

CHART 3406. TROUBLESHOOTING MAGNETIC COMPASS (SHEET 1 OF 2)

Trouble	Cause	Remedy
Excessive card error.	Compass not properly compensated. External magnetic interference.	Compensate instrument. Locate magnetic interference and eliminate if possible.
Excessive card oscillation.	Insufficient liquid.	Replace instrument.
Card sluggish.	Weak card magnet. Excessive pivot friction or broken jewel.	Replace instrument. Replace instrument.

CHART 3406. TROUBLESHOOTING MAGNETIC COMPASS (SHEET 2 OF 2)

Trouble	Cause	Remedy
Card sluggish. (continued)	Excessive pivot friction or broken jewel.	Replace instrument.
Liquid leakage.	Loose bezel screws. Broken cover glass. Defective sealing gaskets.	Replace instrument. Replace instrument. Replace instrument.
Discolored markings.	Age.	Replace instrument.
Defective light.	Burned out lamp or broken circuit.	Check lamp or continuity of wiring.
Card sticks.	Altitude compensating diaphragm collapsed.	Replace instrument.
Card does not move compensating screws are turned.	The gears that turn compensating magnets are stripped.	Replace instrument.
Compass swings erratically when radio transmitter is keyed.	Normal.	

3. Adjustment of Magnetic Compass

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. Place airplane on a magnetic compass rose designed and intended for adjusting magnetic compasses.
b. 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.
c. Align airplane with magnetic North heading on the compass rose. Adjust N-S adjustment screw until compass reads exactly North.
d. Align airplane with magnetic East heading on the compass rose. Adjust E-W adjusting screw until compass reads exactly East.
e. Align airplane with magnetic South heading and note error. Adjust N-S adjusting screw until one-half of the error has been removed.

f. Align airplane with magnetic West heading and note error. Adjust E-W adjusting screw until one-half of the error has been removed.
g. Align airplane with magnetic north. Note heading being indicated on magnetic compass (may not be North) and enter on compass deviation (correction) card.
h. Align airplane with successive magnetic 30° headings, i. e., 030°, 060°, 090°, 120°, etc. Enter actual compass reading on each heading on compass deviation (correction) card.
i. If deviations (difference between actual magnetic heading and what compass indicates on that particular heading) exceeds ± 10° on any heading:
    (1) 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.
j. When satisfied that errors in excess of 10° is fault of the instrument, replace instrument.
k. After installing new instrument, repeat steps 1 through 8.

G. TURN INDICATORS

1. General

Seneca III and Seneca IV airplanes are equipped with either turn and slip indicator(s) or turn coordinator(s). The gyro in either one is electrically operated. The turn portion of both indicators is a gyroscope, while a ball sealed in a curved glass tube filled with dampening fluid is used to maintain coordinated flight. Both types work on the precession principle.

The gyro in the turn and slip indicator, which is the older style, is installed so that the needle responds only to ***rate*** of yaw or ***rate*** turn. It has a vertical needle in the center of the dial mechanically linked to the gyro. Unless the aircraft is turning or yawing, the needle will not move regardless of roll ***rate***. The greater the ***rate*** of ***turn*** (degree of heading change per second), the more the gyro is precessed, resulting in greater needle deflection in the direction of turn.

The gyro in the turn coordinator is installed so that the indicator, mechanically linked to the gyro, responds to both the ***rate*** of yaw or turn, and ***rate*** (not degree) of roll. With this indicator, if the aircraft is rolled right and left rapidly, the indicator will move while the airplane is ***rolling,*** indicating the ***rate*** (degrees per second) of roll. If the aircraft is then held in at a constant bank angle, and rudder is applied to maintain heading (such as when “slipping”), the indicator will come back to zero rate, indicating no roll or turn. Should the airplane be permitted to turn once a desired bank angle is established, the indicator will remain deflected in the direction of the roll/turn, now indicating ***rate*** of turn. Thus, by using the flight controls to keep the indicator on the appropriate turn index, will result in the airplane becoming established in a coordinated, standard rate (3° per second) turn.

2. Trobleshooting

CHART 3407. TROUBLESHOOTING TURN INDICATOR

Trouble	Cause	Remedy
Pointer fails to respond.	Foreign matter lodged in instrument.	Replace instrument.
Incorrect sensitivity.	Out of calibration.	Replace instrument.

CHART 3407. TROUBLESHOOTING TURN INDICATOR (continued)

Trouble	Cause	Remedy
Incorrect turn rate	Out of calibration. Aircraft not in coordinated turn. (Turn and slip indictor)	Replace instrument. Center ball in turn.
Ball sticky.	Flap spot on ball.	Replace instrument.
Ball not in center when aircraft is correctly trimmed.	Instrument not level in panel.	Level instrument.
Instrument will not	No power to instrument. Instrument malfunction.	Check circuit and repair. Replace instrument.

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CHAPTER

35

OXYGEN

CHAPTER 35 - OXYGEN

TABLE OF CONTENTS/EFFECTIVITY

CHAPTER 35 - OXYGEN

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

The purpose of the following information is to provide supplemental information for the servicing of the oxygen systems. Major repairs to the oxygen systems 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.).

DESCRIPTION AND OPERATION

Fixed or portable oxygen systems are available for the Seneca III. Only a fixed oxygen system is available for the Seneca IV. The major components for the fixed or portable oxygen systems are manufactured by Scott Aviation. It is therefore recommended that Scott Aviation, as well as Piper Customer Services, be contacted for any required information not covered herein.

The fixed oxygen system uses a 3AA1800, 63 cu. ft. cylinder. The cylinder is installed in the aft section of Seneca III airplanes, s/n’s 34-8133001 thru 34-8333129, 34-8433003 thru 34-8433009, 34-8433011, 34-8433014 thru 34-8433024. The cylinder is connected to an external fill valve mounted to the left side of the fuselage, aft of the fuselage Bulkhead Station 222.437. The manifold for the outlets is arranged with the tank feed line attached to a tee fitting on the right rear passenger's outlet, and from where the other outlets are fed. See Figure 35-1 (Sheet 1 of 3). ON-OFF push-pull control is provided by a knob on the overhead panel, to the left of the fresh air duct control. A gauge for displaying tank pressure is mounted in the overhead duct behind the passengers, and is illuminated by post light.

The fixed oxygen system cylinder on Seneca III models, s/n’s 34-8433001, 34-8433002, 34-8433010, 34-8433012, 34-8433013, 34-8433025 and up, and 3448001 thru 3448037, and Seneca IV airplanes, s/n’s 3448038 and up, is installed in the left side nose section aft of the closeout panel at station 31.04. On Seneca III models, an ON-OFF push-pull control knob, and a gauge for displaying tank pressure, is mounted on the copilots instrument panel above the glove box or flight instruments. See Figure 35-1 (Sheet 2 of 3).

The ON-OFF push-pull control knob and pressure gauge on Seneca IV models are installed on the pilot’s instrument panel below, and slightly to the right of, the control wheel. See Figure 35-1 (Sheet 3 of 3).

On both the Seneca III models with cylinders installed in the nose section, and on Seneca IV models, 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 35-1 (Sheet 2of 3 and Sheet 3 of 3).

The portable oxygen system, available only on Seneca III models, is made up of two Scott units each having a 22 cu. ft. capacity 3AA1800 cylinder. Each tank is incorporated in a case which utilizes a dual manifold, permitting four masks to be used (per unit) with dual connectors at each outlet.

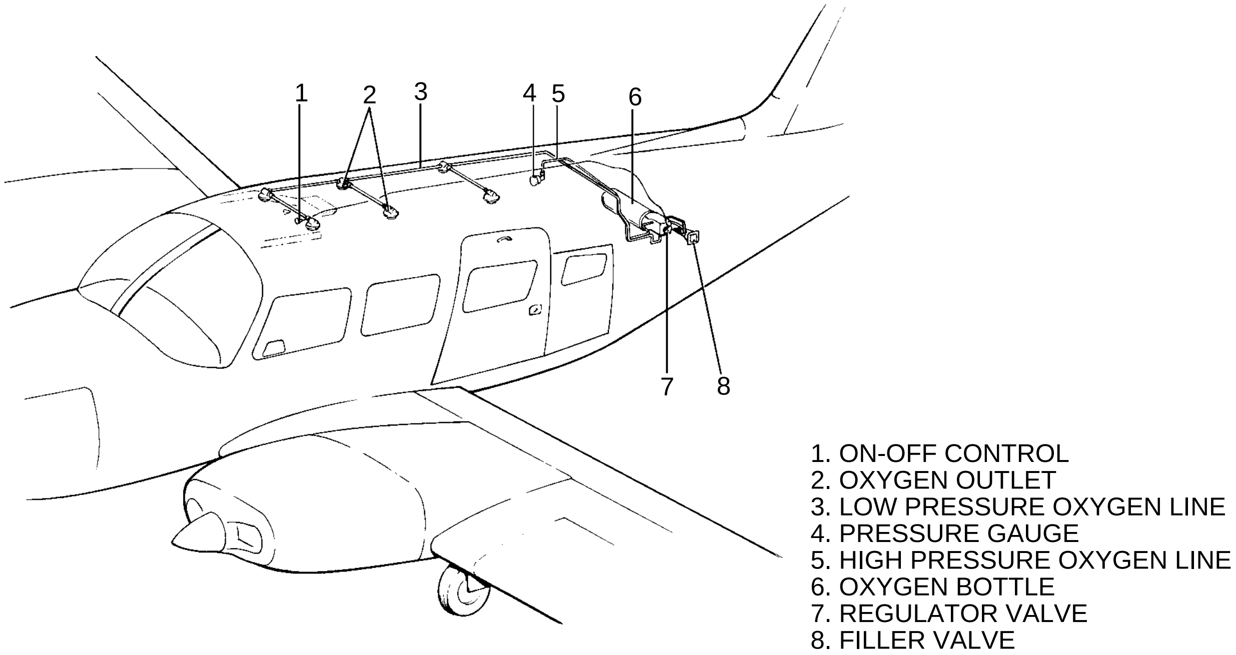
— WARNING —

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.

DESCRIPTION AND OPERATION (continued)

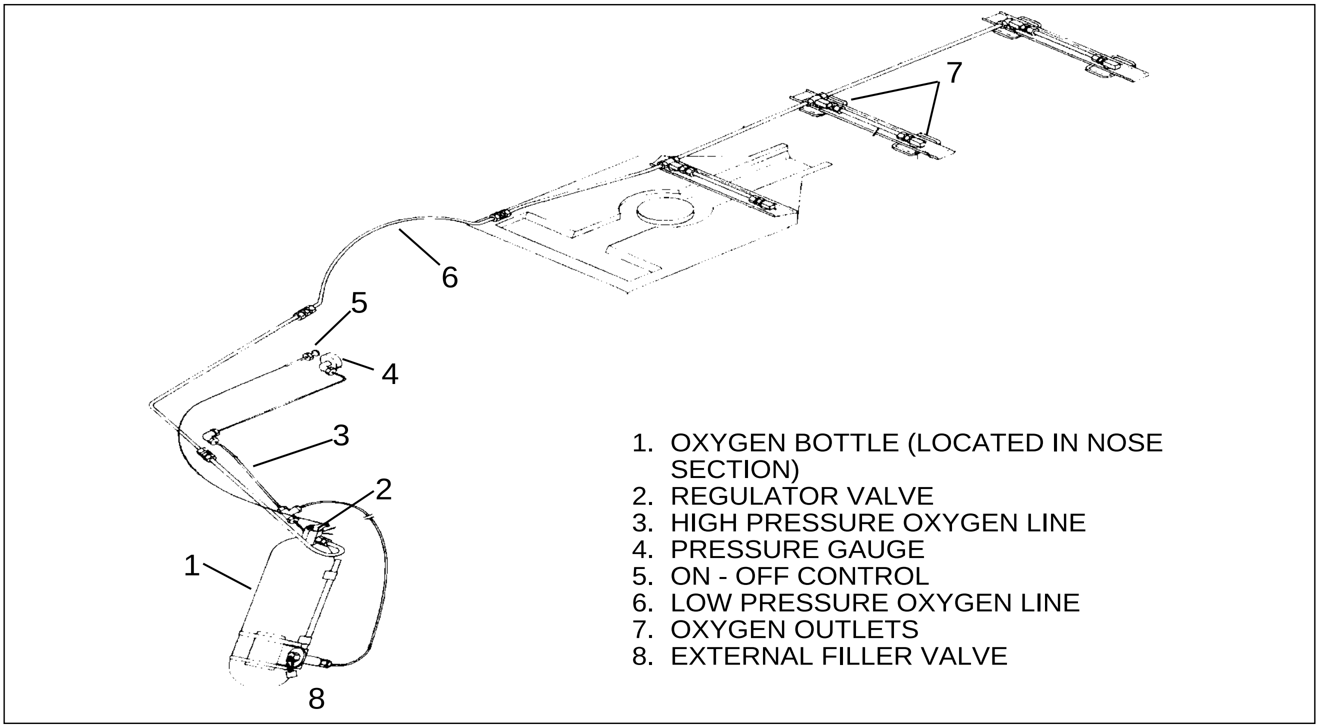
— NOTE —

Oxygen cylinders are identified by the ICC or DOT identification stamped on the cylinder. The standard weight cylinder (ICC or DOT 3AA1800) must be hydrostatically tested every 5 years. The month and year of the last test is stamped beneath the ICC/DOT identification.



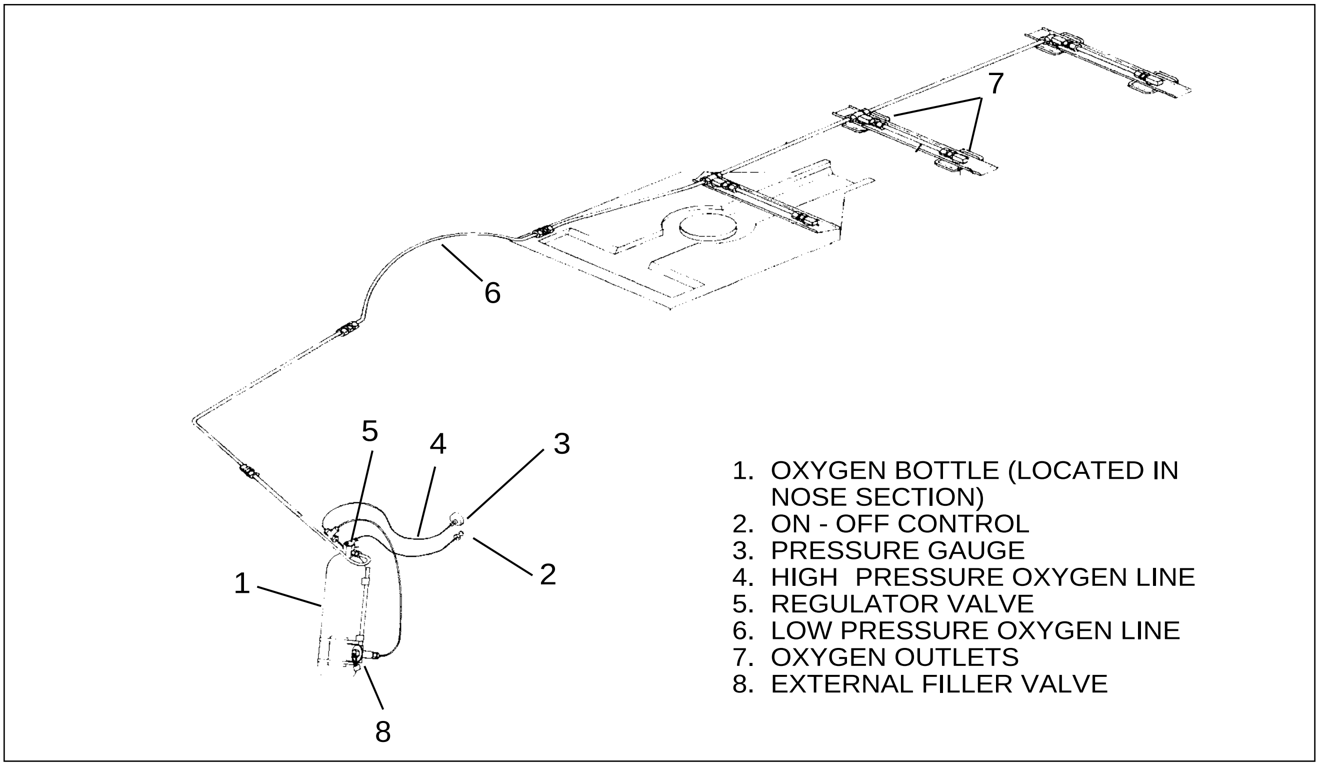
1. ON-OFF CONTROL
2. OXYGEN OUTLET
3. LOW PRESSURE OXYGEN LINE
4. PRESSURE GAUGE
5. HIGH PRESSURE OXYGEN LINE
6. OXYGEN BOTTLE
7. REGULATOR VALVE
8. FILLER VALVE

Figure 35-1. Fixed Oxygen System Installation (Sheet 1 of 3)
S/N's 34-8133001 thru 34-8333129, 34-8433003 thru 34-8433009, 34-8433011, 34-8433014 thru 34-8433024



1. OXYGEN BOTTLE (LOCATED IN NOSE SECTION)
2. REGULATOR VALVE
3. HIGH PRESSURE OXYGEN LINE
4. PRESSURE GAUGE
5. ON - OFF CONTROL
6. LOW PRESSURE OXYGEN LINE
7. OXYGEN OUTLETS
8. EXTERNAL FILLER VALVE

Figure 35-1. Fixed Oxygen System Installation (Sheet 2 of 3)
S/N's 34-8433001, 34-8433002, 34-8433010, 34-8433012, 34-8433013, 34-8433025 and up, and 3448001 thru 3448037



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

Figure 35-1. Fixed Oxygen System Installation (Sheet 3 of 3)
S/N's 3448038 and up

TROUBLESHOOTING OXYGEN SYSTEM

CHART 3501. TROUBLESHOOTING OXYGEN SYSTEM

Trouble	Cause	Remedy
No indication of pressure on pressure gauge.	Cylinder empty or leak in system has exhausted pressure.	Charge system and check for leak. [1] Purge, charge, and check system for leaks. [2]
	Pressure gauge or regulator defective.	Return unit to manufacturer or take to approved shop. [1] Replace gauge. [2]
Pressure indication normal but no oxygen flowing.	Oxygen cylinder regulator assembly defective.	Return unit to manufacturer or take to approved shop. [1] Remove tank and have regulator removed. [2]
Offensive odors in oxygen.	Cylinder pressure below 50 psi. Foreign matter has entered the system during previous servicing.	Purge the oxygen system.

NOTES:

[1] Portable system only.

[2] Fixed system only.

CREW/PASSENGER SYSTEMS

— 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.

FIXED OXYGEN SYSTEM

INSPECTION AND MAINTENANCE

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.

INSPECTION AND MAINTENANCE (continued)

— NOTE —

Oxygen cylinders are identified by the ICC or DOT identification stamped on the cylinder. The standard cylinder weight (ICC or DOT 3AA1800) must be hydrostatically tested at the end of each 5 year period. Lightweight cylinders (ICC or DOT 3HT 1850) must be tested every 3 years and be replaced after 4380 refills or 24 years, whichever comes first. The month and year of the last test should be stamped on the cylinder beneath the ICC, DOT identification.

1. 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.
2. 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.
3. 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.
4. An operational check of the regulator can be accomplished as follows: (Refer to Figure 35-2.)
   a. 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.
   b. 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.
   c. 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.
   d. There should be no external leakage anywhere on the regulator when it is turned off. All fittings should be leak free.
5. Check airframe logbook for last maintenance on oxygen system and perform as required per Chart 3502.
6. 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.
7. 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.

8. Check plumbing for kinking, cracks, gouges, dents, deep scratches, or other damage. Replace as necessary.

INSPECTION AND MAINTENANCE (continued)

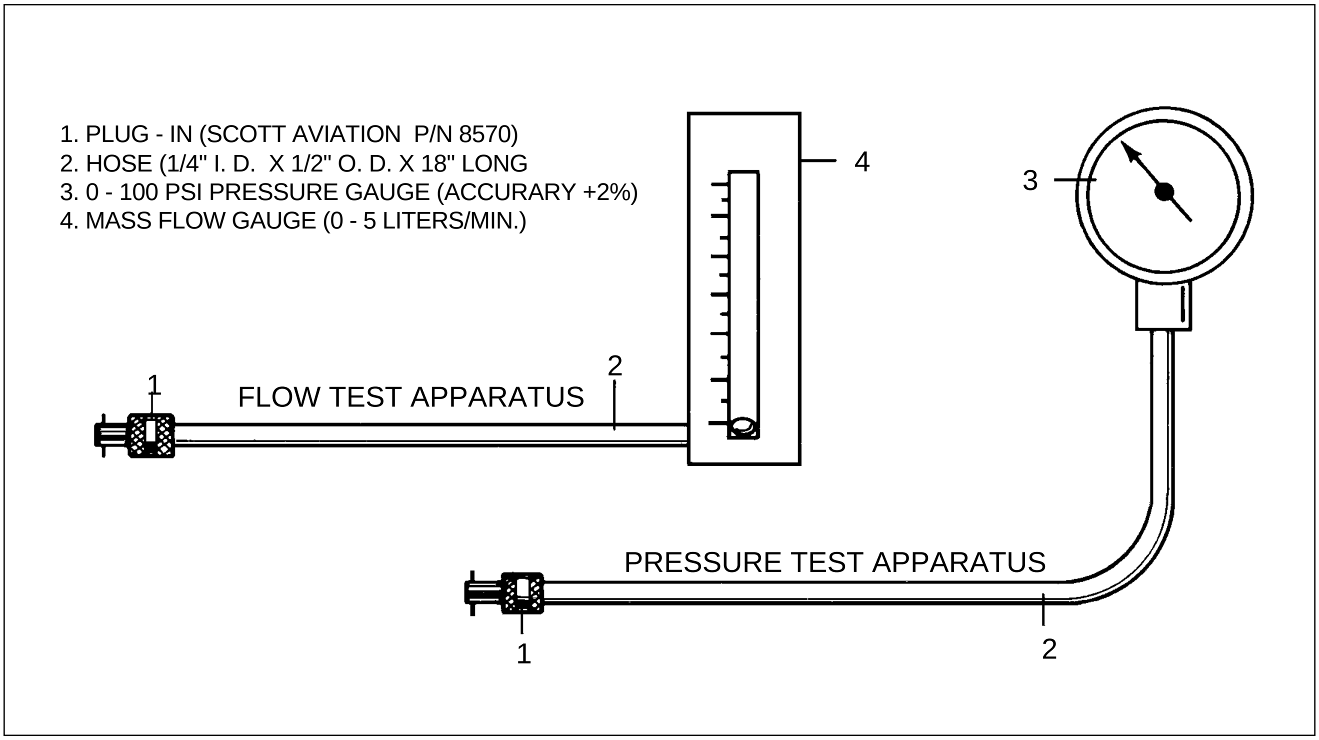


Figure 35-2. Test Apparatus For Testing Oxygen System

9. Make sure to check the oxygen lines for proper clearance as follows: (Refer to Figure 35-3.)
   a. 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.
   b. At least 1/2 inch minimum between oxygen tubes and all rigid moving parts of the aircraft such as levers and rigid control rods.
   c. Six inch minimum separation between oxygen tubes and hydraulic, fuel and electrical system lines and components.
      (1) 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.
   d. A minimum of 1/8 inch between tubing and structure adjoining the supporting clamp as shown in Figure 35-3, Sketch A.
   e. 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 35-3, Sketch D.
   f. 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. (Refer to Figure 35-3, Sketch B.)

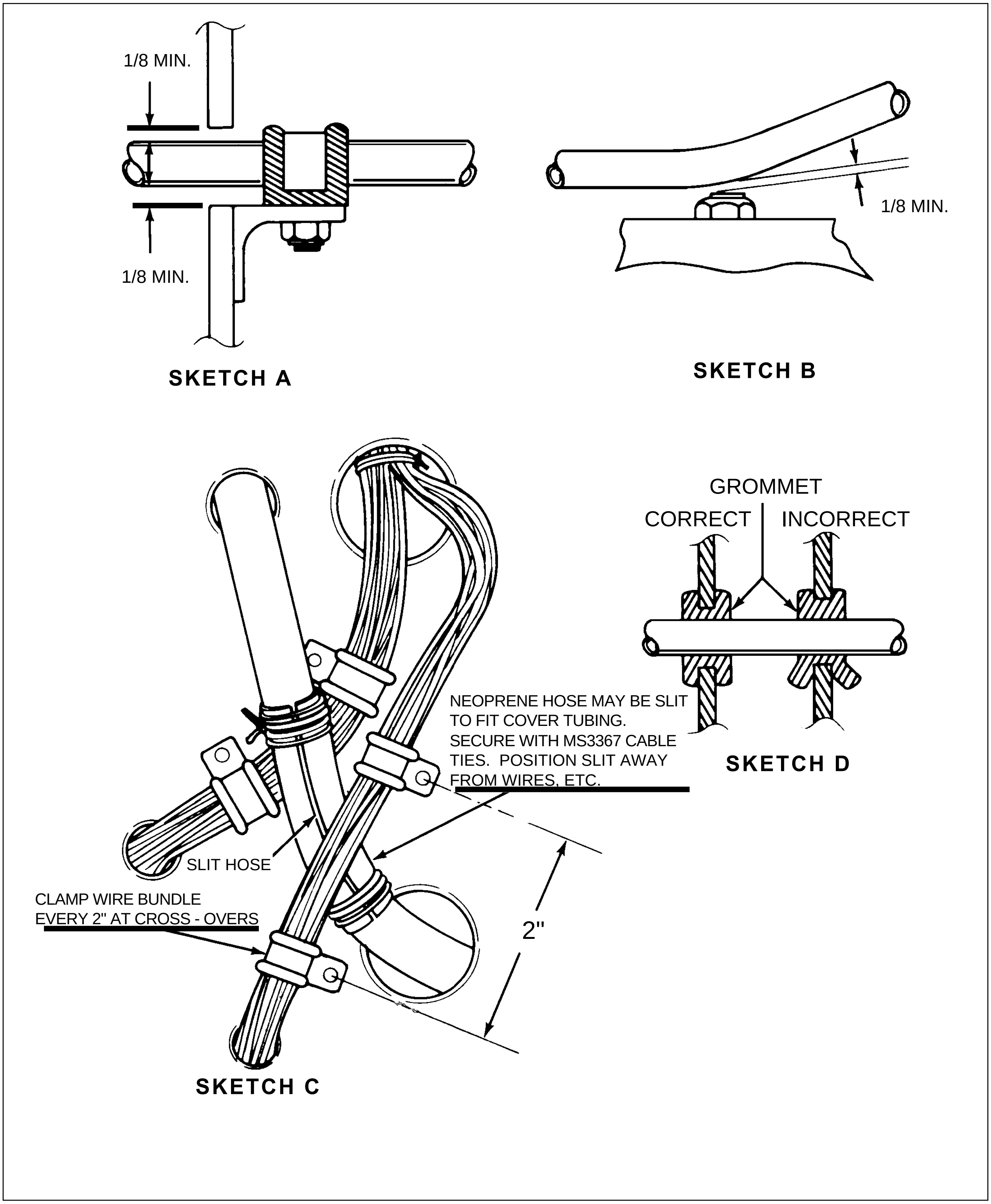


Figure 35-3. Oxygen Tubing Installation

INSPECTION AND MAINTENANCE (continued)

10. Perform any other required maintenance as directed in AC43.13-1A, Chapter 8.
11. Clean components as necessary per the following subject-paragraph.

CLEANING AND PURGING OF OXYGEN SYSTEM COMPONENTS.

— 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.

CLEANING AND PURGING OF OXYGEN SYSTEM COMPONENTS. (continued)

— CAUTION —

DO NOT USE ADHESIVE TAPE FOR ATTACHING OR SECURING PROTECTIVE COVERINGS ON OXYGEN COMPONENTS. USE WAXED LACING TWINE OR TIE RAPS.

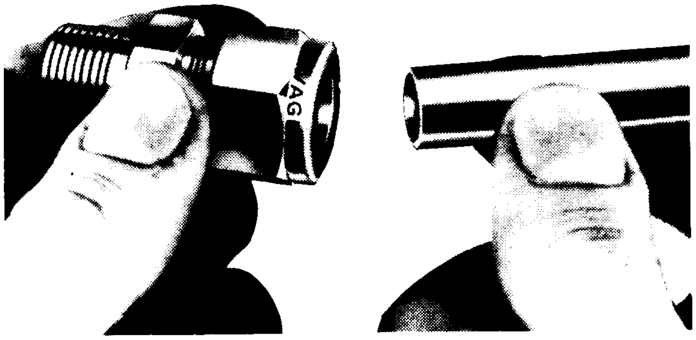
4. After cleaning, all tubing must be protected by caps, plugs and/or plastic bags.
5. Before installation, make sure fitting, tube, and fixture threads are in good condition and that the cones do not exhibit pitting or disfigurement.

SWAGELOC FITTING INSTALLATION. (Refer to Figure 35-4)

— 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.

1. For swageloc fittings not preswaged or for in-aircraft installation, proceed as follows:
   a. Turn the fitting nut onto the fitting finger tight and insert the tube until it bottoms firmly on the shoulder in the fitting.
   b. Tighten the nut with a wrench until the tube will not turn by hand.
   c. Mark the nut at the six o'clock position.
   d. Hold the fitting body steady with a backup wrench and tighten as follows:
      (1) On tubing with a diameter bigger than 3/16 inch, tighten 1 1/4 turns (to the nine o'clock position).
      (2) On tubing of 1/16, 1/8, and 3/16 inch diameter, tighten only 3/4 turn.
   e. 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.
2. Preswaged swageloc fittings are fabricated and installed as follows:
   a. 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.
   b. Tighten the nut on the fitting just enough that the tube within the fitting will not turn by hand.
   c. With a wrench, tighten the nut as follows:
      (1) On tubing with diameters over 3/16 inch, tighten 1 1/4 turns.
      (2) On tubing with 1/16, 1/8, or 3/16 inch diameter, tighten 3/4 of a turn.
   d. Unscrew the nut to release the ferrule-tube assembly from the tool.
   e. The assembly is installed on the fitting as follows:
      (1) Slide tube in fitting until it bottoms, turn nut to finger tight position and tighten one quarter turn with wrench.
      (2) Snug slightly with wrench.

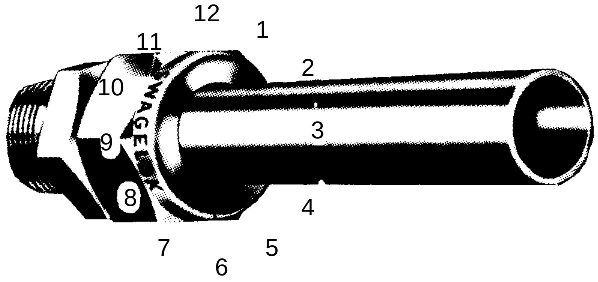


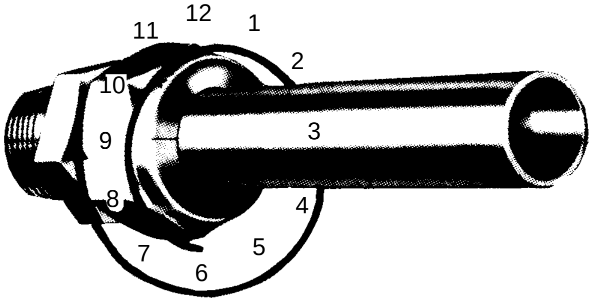
STEP 1

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.

Figure 35-4. Installation of Swageloc Fittings

APPLICATION OF 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.

1. 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.
2. 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.

CHART 3502. FIXED OXYGEN SYSTEM COMPONENT LIMITS

Parts	Inspection	Overhaul
Regulator	300 Flight Hours	5 Years
Pressure Gauge	300 Flight Hours	Replace on Condition
High Pressure Lines	300 Flight Hours	Replace on Condition
Low Pressure Lines	300 Flight Hours	Replace on Condition
Outlets	300 Flight Hours	Every 5 Years [1]
External Recharge Valve	Each Use	Every 5 Years [2]
Masks	Each Use	Replace as Necessary

[1] On condition, replace the rubber components in the assembly or replace assembly.

[2] If the screen in front of valve is dirty, replace valve. Valve replacement is recommended for every 5 years.

LEAK TESTS.

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.

1. 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.

2. Apply the leak detector solution to the test surface and watch for indication of leakage.
3. Large leaks will produce bubbles immediately, but small leaks will form a white foam in 5 to 60 seconds.
4. 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 35-2.
5. Adjust the regulator on the dry nitrogen cylinder for 100 psi and check for leakage at the outlets.
6. Correct any leaks and wipe off excess leak detector solution.
7. Close the valve on the nitrogen gas tank and insert a Scott plug-in to relieve system pressure.
8. Disconnect test gauge, plug-in, and nitrogen tank.
9. 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.

OXYGEN SYSTEM COMPONENT HANDLING

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.

REMOVAL OF OXYGEN CYLINDER (S/N' 34-8133001 thru 34-8333129, 34-8433003 thru 34-8433009, 34-8433011, 34-8433014 thru 34-8433024) (Refer to Figure 35-5.)

— NOTE —

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.

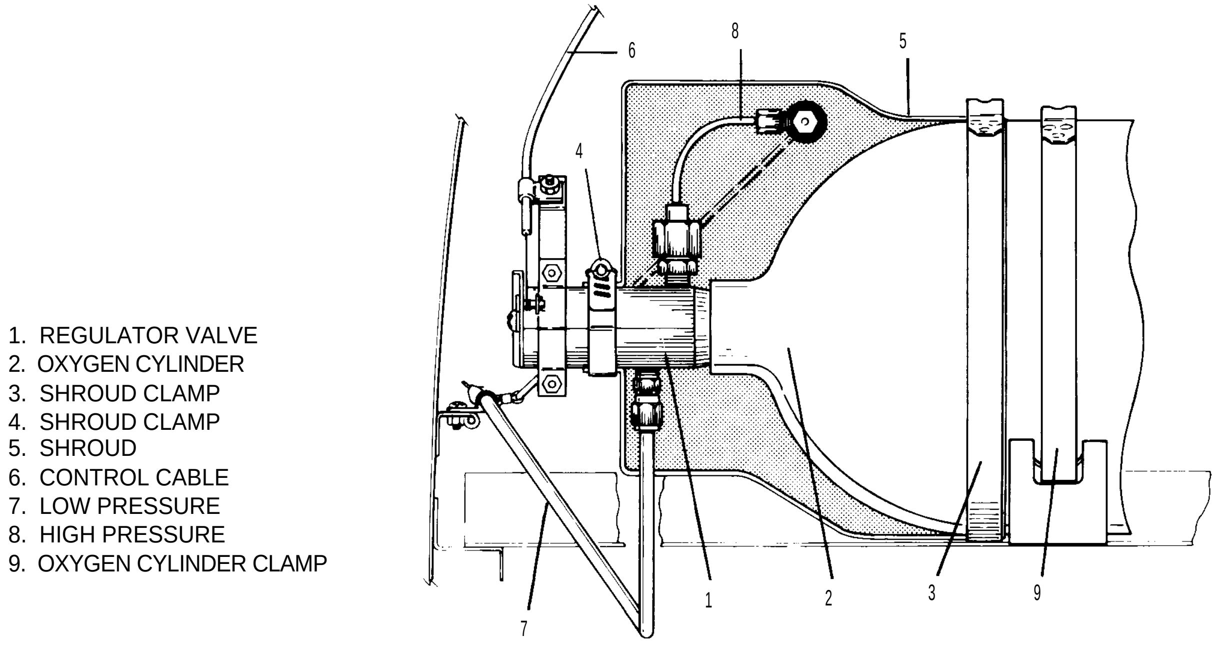
The oxygen bottle, located behind the finished bulkhead in the baggage compartment, is secured to a removable shelf mounted to each side of the fuselage. The tank is mounted such that the regulator-control valve is on the left side of the aircraft, the same side as the recharge valve. A shroud covers the regulator end of the bottle to prevent leaks, should any develop, from filling the aircraft with oxygen. With this in mind, a vent tube interconnects the shroud with the recharge valve fixture permitting any oxygen to vent overboard.

1. Remove the screws attaching the finished bulkhead to the fuselage bulkhead and remove the finished bulkhead.
2. It is recommended that when working in the rear of the aircraft, an appropriate tail stand be properly attached to the tail.
3. With the immediate area clear of flammables (grease, hydraulic fluid, fuel), and oxygen system off, connect a mask of tube to an outlet to exhaust any pressure in the system.
4. Remove the screws and loosen the clamps securing the shroud to the cylinder and regulator-control valve.
5. Remove the spring clamp securing the vent tube to the cylinder shroud and disconnect the tube.
6. Carefully separate the shroud along the high pressure lines.
7. The high pressure fitting on the regulator-control valve incorporates a valve that opens only when a line is connected with it. With this in mind, carefully unscrew the high pressure line until the pressure decreases, and then remove the line. Disconnect low pressure lines as well.
8. Loosen and open the clamps securing the bottle to the shelf. Carefully move the bottle in such a way that fair access can be made to control mechanism.
9. Disconnect the control cable. Be careful not to kink the cable.
10. Remove the tank from aircraft being careful not to damage the regulator-control valve.

REMOVAL OF OXYGEN CYLINDER (Seneca III models, s/n's 34-8433001, 34-8433002, 34-8433010, 34-8433012, 34-8433013, 34-8433025 and up, and 3448001 thru 3448037, and Seneca IV airplanes, s/n's 3448038) (Refer to Figure 35-6.)

— NOTE —

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.



1. REGULATOR VALVE
2. OXYGEN CYLINDER
3. SHROUD CLAMP
4. SHROUD CLAMP
5. SHROUD
6. CONTROL CABLE
7. LOW PRESSURE
8. HIGH PRESSURE
9. OXYGEN CYLINDER CLAMP

Figure 35-5. Oxygen Cylinder and Regulator Assembly
(S/N's 34-8133001 thru 34-8333129, 34-8433003 thru 34-8433009, 34-8433011, 34-8433014 thru 34-8433024)

REMOVAL OF OXYGEN CYLINDER (Seneca III models, s/n's 34-8433001, 34-8433002, 34-8433010, 34-8433012, 34-8433013, 34-8433025 and up, and 3448001 thru 3448037, and Seneca IV airplanes, s/n's 3448038) (Refer to Figure 35-6.) (continued)

1. From inside of of forward baggage compartment:
   a. Remove hydraulic reservoir cover located in rear top center of compartment by removing four attachment screws.
   b. Remove left rear closeout panel by removing 11 remaining attachment screws.
2. 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.

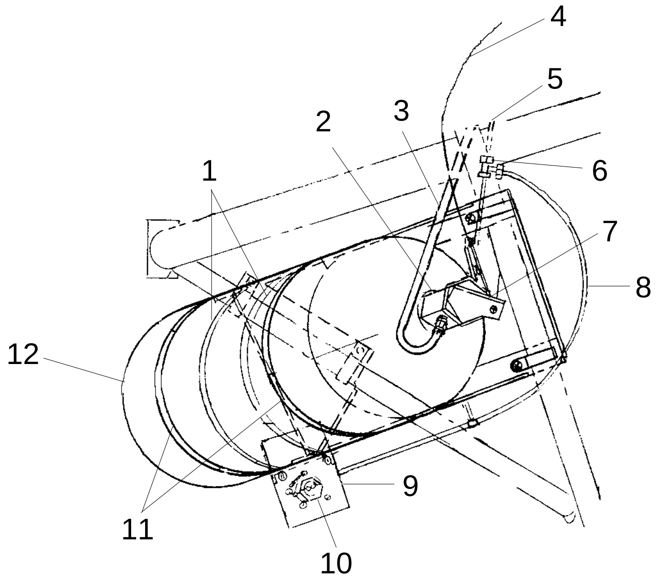
3. Safety valve on cylinder in the OFF position.
4. Disconnect low pressure line from cylinder. Cap line immediately after removal.

— 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.

REMOVAL OF OXYGEN CYLINDER (Seneca III models, s/n’s 34-8433001, 34-8433002, 34-8433010, 34-8433012, 34-8433013, 34-8433025 and up, and 3448001 thru 3448037, and Seneca IV airplanes, s/n’s 3448038) (Refer to Figure 35-6.) (continued)

5. Disconnect high pressure fitting at the cylinder valve. Cap line immediately after removal.
6. Remove two filler valve clamps and two cylinder hold down clamps.
7. Remove cylinder from airplane.



1. FILLER VALVE BRACKETS
2. REGULATOR VALVE
3. LOW PRESSURE LINE
4. ON – OFF VALVE CABLE
5. HIGH PRESSURE LINE (TO GAU GE)
6. FILLER LINE/GAUGE LINE “T”
7. ON – OFF LEVER
8. FILLER LINE
9. FILLER VALVE MOUNTING BRACKET
10. FILLER VALVE
11. CYLINDER SUPPORT BRACKETS
12. OXYGEN CYLINDER

Figure 35-6 Oxygen Cylinder and Regulator Valve
(Seneca III models, s/n’s 34-8433001, 34-8433002, 34-8433010, 34-8433012, 34-8433013, 34-8433025 and up, and 3448001 thru 3448037, and Seneca IV airplanes, s/n’s 3448038 and up.)

REMOVAL OF RECHARGE VALVE (S/N’s 34-8133001 thru 34-8333129, 34-8433003 thru 34-8433009, 34-8433011, 34-8433014 thru 34-8433024) (Refer to Figure 35-7.)

The recharge valve is located on the left rear side of the aircraft and is covered by its own access door. The valve is interconnected with the gauge line as well as the regulator-control valve and is constantly under cylinder pressure as long as the high pressure line is attached to the regulator.

— NOTE —

The recommended service life for the recharge valve is 5 years and the oxygen cylinder must be hydrostatically tested every 5 years. With these circumstances in mind it is recommended that the recharge valve be removed and replaced when the cylinder is removed for service.

1. Due to the location of the recharge valve it is necessary to remove the oxygen cylinder. For ease of removal it is recommended that the cylinder shelf also be removed.

REMOVAL OF RECHARGE VALVE (S/N's 34-8133001 thru 34-8333129, 34-8433003 thru 34-8433009, 34-8433011, 34-8433014 thru 34-8433024) (Refer to Figure 35-7.) (continued)

2. Remove the screws that secure the recharge valve protective shroud to the valve mounting dish and slide the shroud back over the high pressure line.
3. Unscrew the high pressure line fitting from the recharge valve and with somebody turning the screw from outside the aircraft, backup the nut to remove the valve.

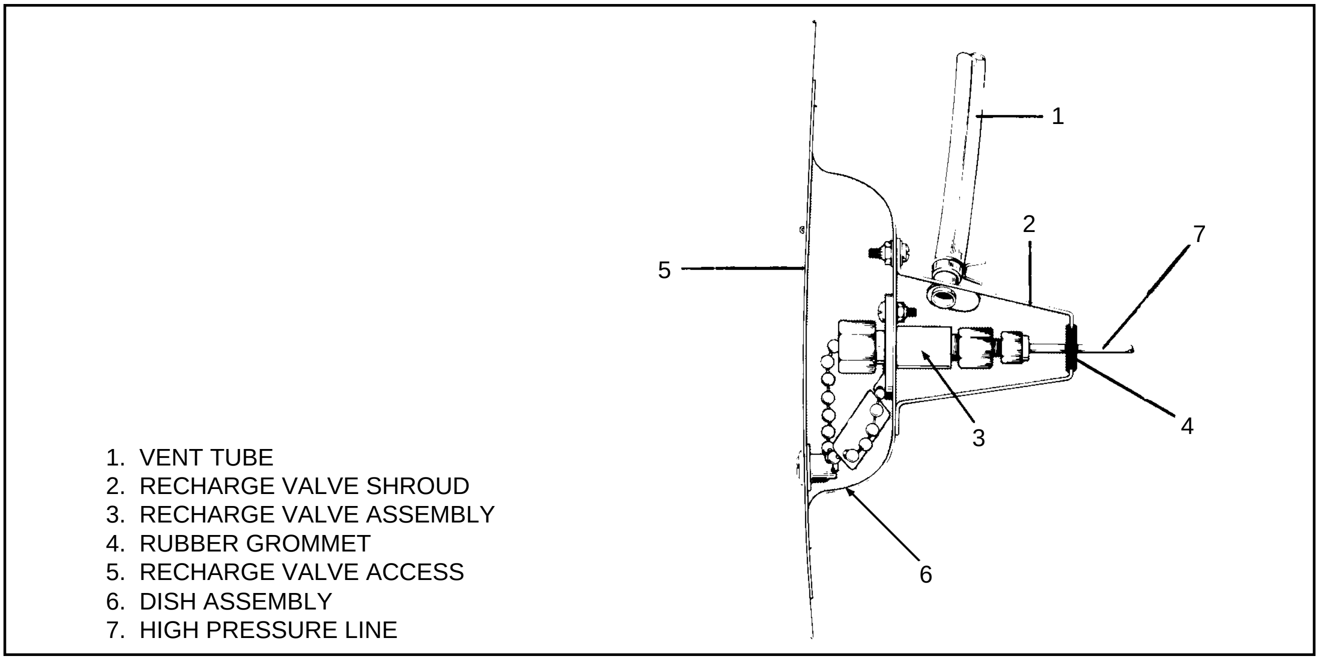


Figure 35-7. Oxygen System Recharge Valve Installation
(S/N's 34-8133001 thru 34-8333129, 34-8433003 thru 34-8433009, 34-8433011, 34-8433014 thru 34-8433024

REMOVAL OF RECHARGE VALVE (Seneca III models, s/n's 34-8433001, 34-8433002, 34-8433010, 34-8433012, 34-8433013, 34-8433025 and up, and 3448001 thru 3448037, and Seneca IV airplanes, s/n's 3448038) (Refer to Figure 35-8)

1. From inside of of forward baggage compartment:
   a. Remove hydraulic reservoir cover located in rear top center of compartment by removing four attachment screws.
   b. Remove left rear closeout panel by removing 11 remaining attachment screws.

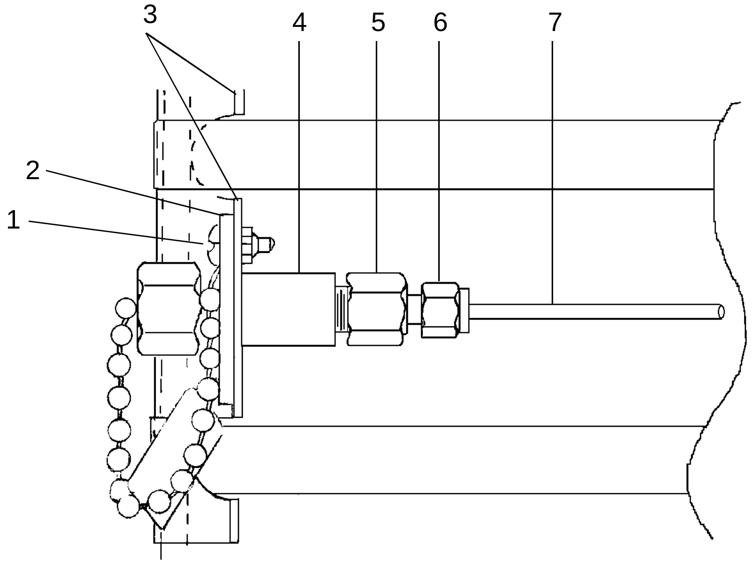
— NOTE —

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.

2. Disconnect the high pressure fitting at the tank valve. Cap the line immediately after removal.

REMOVAL OF RECHARGE VALVE (Seneca III models, s/n's 34-8433001, 34-8433002, 34-8433010, 34-8433012, 34-8433013, 34-8433025 and up, and 3448001 thru 3448037, and Seneca IV airplanes, s/n's 3448038) (Refer to Figure 35-8) (continued)

3. Disconnect high pressure line fitting from recharge valve. Cap line immediately after removal.
4. Remove three screws from refill valve mounting plate.
5. Remove valve from airplane.



1. MOUNTING PLATE ATTACHMENT SCREWS
2. MOUNTING PLATE
3. MOUNTING BRACKET
4. CHARGING VALVE ASSEMBLY
5. FEMALE CONNECTOR (UNION)
6. HIGH PRESSURE LINE CONNECTION
7. HIGH PRESSURE LINE TO CYLINDER/ PRESURE GAUGE "T" CONNECTOR

Figure 35-8. Oxygen System Recharge Valve Installation
(Seneca III models, s/n's 34-8433001, 34-8433002, 34-8433010, 34-8433012, 34-8433013, 34-8433025 and up, and 3448001 thru 3448037, and Seneca IV airplanes, s/n's 3448038)

INSTALLATION OF RECHARGE VALVE (34-8133001 thru 34-8333129, 34-8433003 thru 34-8433009, 34-8433011, 34-8433014 thru 34-8433024).

1. Insert the valve through the aperture in the mounting cup and align the bolt holes.
2. With the safety chain and information plate mounting washer aligned at one of the holes, install the mounting bolts.
3. Apply teflon tape to male threads as explained earlier in this section.
4. Reconnect the high pressure line to the valve and torque the fitting 30 to 50 inch-pounds.
5. Install the valve protective shroud.

INSTALLATION OF RECHARGE VALVE Seneca III models, s/n's 34-8433001, 34-8433002, 34-8433010, 34-8433012, 34-8433013, 34-8433025 and up, and 3448001 thru 3448037, and Seneca IV airplanes, s/n's 3448038) (Refer to Figure 35-8)

— NOTE —

Apply teflon tape to all tapered male threads as cautioned on page 1 of this section.

1. Insert valve assembly into mounting bracket.
2. Align screw holes in valve mounting plate with those in mounting bracket.
3. 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.

4. Connect high pressure line to **valve.**
5. Connect high pressure to **cylinder**. Torque fitting 30 to 50 inch-pounds.
6. Check all connections that had been separated for leaks.
7. Install close out panels.

INSTALLATION OF OXYGEN CYLINDER (34-8133001 thru 34-8333129, 34-8433003 thru 34-8433009, 34-8433011, 34-8433014 thru 34-8433024)

1. Before mounting the cylinder to the shelf, connect the control cable to the control valve-regulator. If the shelf has been removed reinstall it before continuing. Install teflon tape per prior instructions in this chapter.
2. Position cylinder on shelf and install the pressure lines. 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.
3. Install the cylinder protective shroud and tighten the clamps securing it to the tank and valve.
4. Secure the cylinder to the shelf by connecting and tightening the clamps.
5. If vent tube has been disconnected from the shroud make sure it is firmly attached to both the cylinder and valve shrouds.
6. Make sure all seals are properly in place in the cylinder shroud. Make sure the MS35489-35 seal is in the bottom of the shroud where the low pressure line comes through. The two seals where the high pressure lines go into the shroud are MS35489-2 grommet seals.
7. Check pressure and refill bottle as necessary.
8. Inspect for leaks, especially at fittings that have been separated.

INSTALLATION OF OXYGEN CYLINDER (Seneca III models, s/n's 34-8433001, 34-8433002, 34-8433010, 34-8433012, 34-8433013, 34-8433025 and up, and 3448001 thru 3448037, and Seneca IV airplanes, s/n's 3448038) (Refer to Figure 35-6.)

1. Position cylinder in airplane as shown in Figure 35-6. Check to be sure that regulator and valve are free to move and do not contact surrounding area.
2. Install two cylinder hold down clamps.
3. Install two filler valve hold down brackets clamps.

INSTALLATION OF OXYGEN CYLINDER (Seneca III models, s/n's 34-8433001, 34-8433002, 34-8433010, 34-8433012, 34-8433013, 34-8433025 and up, and 3448001 thru 3448037, and Seneca IV airplanes, s/n's 3448038) (Refer to Figure 35-6.) (continued)

4. 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.
5. 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.
6. Unsafety valve on cylinder. Check that valve remains in OFF position.
7. Connect ON-OFF cable to cylinder valve. Secure with a new cotter pin.
8. Position and attach cable support bracket.
7. Check pressure and refill bottle as necessary.
8. Inspect for leaks, especially at fittings that have been separated.
9. Install forward baggage compartment left rear closeout panel. Secure by installing 13 of the 15 attachment screws.
10. Insure of cylinder and cylinder valve ON-OFF control are clear of headliner and floor panel.
11. Install hydraulic reservoir cover and secure with four screws. Note that two of these screws also secure closeout panel.
12. Close and secure forward baggage door.

REMOVAL AND INSTALLATION OF PRESSURE GAUGE (Seneca III models 34-8133001 thru 34-8333129, 34-8433003 thru 34-8433009, 34-8433011, 34-8433014 thru 34-8433024) (Refer to Figure 35-9.)

1. The pressure gauge is tied into the same high pressure line as the recharge valve, through a tee fitting at the tank regulator-control valve. The high pressure line connects into the valve such that it activates a check valve permitting pressure to the line. Disconnect the high pressure fitting at the tank valve . Cap the line immediately after removal.
2. Remove the overhead vent panel and remove instrument from bracket as follows:
   a. Disconnect the tube from the fitting at the rear of the instrument.
   b. Immediately cap the oxygen line.
   c. Snap off the clip securing the instrument in its bracket.
   d. If the fitting on the rear of the instrument is to be reused, remove, clean threads, and using teflon tape, install fitting on new gauge. Refer to appropriate section in this chapter.
3. Install gauge as follows:
   a. With fitting installed on rear of instrument install gauge in bracket. Make sure clip is properly secured.
   b. Remove cap from oxygen line and with teflon tape properly installed, connect the oxygen line to the fitting.
   c. Install fitting in tank.

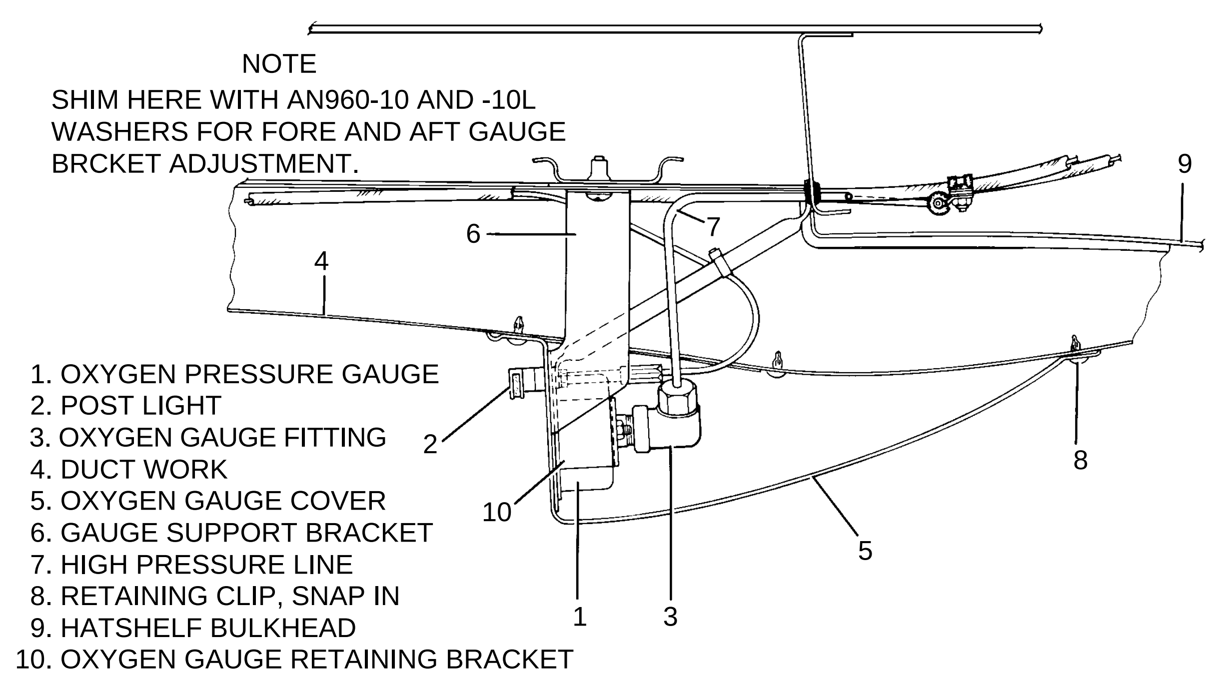


Figure 35-9. Oxygen Pressure Gauge Installation
(Seneca III models 34-8133001 thru 34-8333129, 34-8433003 thru 34-8433009, 34-8433011, 34-8433014 thru 34-8433024)

REMOVAL AND INSTALLATION OF PRESSURE GAUGE (Seneca III models, s/n's 34-8433001, 34-8433002, 34-8433010, 34-8433012, 34-8433013, 34-8433025 and up, and 3448001 thru 3448037)

The oxygen pressure gauge and ON-OFF control knob is installed in the top left side of the copilot's instrument panel above the glove compartment. Access to either one is obtained through the top of the glove compartment. If flight instruments are installed in the copilot's instrument panel, remove as many as necessary to gain access to the oxygen pressure gauge.

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.

To remove oxygen pressure gauge:

1. From inside of of forward baggage compartment:
   a. Remove hydraulic reservoir cover located in rear top center of compartment by removing four attachment screws.
   b. Remove left rear closeout panel by removing the 13 remaining attachment screws.
2. Disconnect ***high*** pressure fitting at the **cylinder valve**. Cap line immediately after removal.
3. Disconnect high pressure line from gauge and cap immediately.
4. Remove two nuts from brass studs securing gauge to bracket.
5. Remove gauge through pilot side of instrument panel.

REMOVAL AND INSTALLATION OF PRESSURE GAUGE (Seneca III models, s/n's 34-8433001, 34-8433002, 34-8433010, 34-8433012, 34-8433013, 34-8433025 and up, and 3448001 thru 3448037) (continued)

To install pressure gauge:

1. Insert pressure gauge into instrument panel.
2. 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.
3. Connect high pressure line to gauge.
4. Connect high pressure fitting to cylinder valve.
5. Inspect fittings that have been separated for leaks.
6. Install forward baggage compartment left rear closeout panel. Secure by installing 13 of the 15 attachment screws.
7. Insure closeout panel is clear of cylinder and cylinder valve ON-OFF control.
8. Install hydraulic reservoir cover and secure with four screws. Note that two of these screws also secure closeout panel.
9. Close and secure forward baggage door.

REMOVAL AND INSTALLATION OF PRESSURE GAUGE Seneca IV models, s/n's 3448038 and up)

The oxygen pressure gauge and 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 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.

To remove oxygen pressure gauge:

1. From inside of of forward baggage compartment:
   a. Remove hydraulic reservoir cover located in rear top center of compartment by removing four attachment screws.
   b. Remove left rear closeout panel by removing the 13 remaining attachment screws.
2. Disconnect ***high*** pressure fitting at the **cylinder valve**. Cap line immediately after removal.
3. Disconnect high pressure line from gauge and cap immediately.
4. Remove two nuts from brass studs securing gauge to bracket.
5. Remove gauge through pilot side of instrument panel.

To install pressure gauge:

1. Insert pressure gauge into instrument panel.
2. 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.
3. Connect high pressure line to gauge.
4. Connect high pressure fitting to cylinder valve.
5. Inspect fittings that have been separated for leaks.
6. Install forward baggage compartment left rear closeout panel. Secure by installing 13 of the 15 attachment screws.

REMOVAL AND INSTALLATION OF PRESSURE GAUGE (Seneca IV models, s/n's 3448038 and up) (continued)

7. Insure is clear of cylinder and cylinder valve ON-OFF control are clear headliner and floor panel.
8. Install hydraulic reservoir cover and secure with four screws. Note that two of these screws also secure closeout panel.
9. Close and secure forward baggage door.

REMOVAL OF OUTLETS (Seneca III models 34-8133001 thru 34-8333129, 34-8433003 thru 34-8433009, 34-8433011, 34-8433014 thru 34-8433024)

1. Check that the oxygen system is completely turned off. Insert an oxygen mask to release pressure and ensure the system is off.
2. With a suitable spanner wrench, remove the outer half of the outlet.
3. Remove the trim panel by removing the retaining screws.
4. Disconnect outlet from the low pressure line(s). Cap line(s) immediately after disconnection.

REMOVAL OF OUTLETS (Seneca III models, s/n's 34-8433001, 34-8433002, 34-8433010, 34-8433012, 34-8433013, 34-8433025 and up, and 3448001 thru 3448037, and Seneca IV airplanes, s/n's 3448038)

1. Check that the oxygen system is completely turned off. Insert an oxygen mask to release pressure and ensure the system is off.
2. With a suitable spanner wrench, remove the outer half of the outlet.
3. If removing one or more of the four aft cabin outlets, also remove two sheet metal screws from bezel
4. Remove or drop overhead panel sufficiently to gain access to low pressure line connections.
5. 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.
6. If removing left side outlet(s), disconnect one union connected to oxygen supply line form right side outlet
7. Remove outlet from airplane.

INSTALLATION OF OUTLETS (Seneca III models 34-8133001 thru 34-8333129, 34-8433003 thru 34-8433009, 34-8433011, 34-8433014 thru 34-8433024)

1. Apply teflon tape to male threads of the fitting. Refer to appropriate procedure in this chapter.
2. Connect the outlet to the low pressure line.
3. Position the trim panel and secure with screws.
4. Position and secure the outer half of the outlet with a suitable spanner wrench.
5. Torque the fittings onto the outlets to approximately 30 inch-pounds. Do not over torque.

INSTALLATION OF OUTLETS (Seneca III models, s/n's 34-8433001, 34-8433002, 34-8433010, 34-8433012, 34-8433013, 34-8433025 and up, and 3448001 thru 3448037, and Seneca IV airplanes, s/n's 3448038)

1. Position outlet in airplane.
2. If installing left side outlet, connect union to oxygen supply line form right side outlet
3. 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.

INSTALLATION OF OUTLETS (Seneca III models, s/n's 34-8433001, 34-8433002, 34-8433010, 34-8433012, 34-8433013, 34-8433025 and up, and 3448001 thru 3448037, and Seneca IV airplanes, s/n's 3448038) (continued)

4. Inspect fittings that have been separated for leaks.
5. Replace overhead paneling and secure in place.
6. 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.
7. 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***.

REMOVAL AND INSTALLATION OF OXYGEN ON/OFF CONTROL (Seneca III models 34-8133001 thru 34-8333129, 34-8433003 thru 34-8433009, 34-8433011, 34-8433014 thru 34-8433024)

(Refer to Figure 35-1, Sheet 1 of 3.)

1. The on/off control is mounted in the overhead vent panel. To remove control, drop the overhead panel and ducting and remove the retaining nut from the rear of the control cable fitting.
2. Gain access to the bottle and disconnect cable from the regulator-control mechanism.
3. Cut the tie-raps securing the cable and pull cable from aircraft.
4. When installing a new cable, make sure new cable shield is cut to 113.5 inches (288.29 cm) long and that the core has sufficient material to make a twin loop, two inches from the end of the shield. Install as follows:
    a. Route cable through the hole in the overhead duct end as shown in Figure 35-1. Tie-rap the cable as before.
    b. Make sure the cable properly reaches the valve and reinstall vent and panels. Reconnect cable to regulator-control mechanism.

REMOVAL AND INSTALLATION OF OXYGEN ON/OFF CONTROL (Seneca III models, s/n's 34-8433001, 34-8433002, 34-8433010, 34-8433012, 34-8433013, 34-8433025 and up, and 3448001 thru 3448037)

The ON-OFF control knob is installed in the top left side of the copilot's instrument panel above the glove compartment. It is connected to the ON-OFF control on the oxygen bottle by a push-pull cable. Access to the knob is obtained through the top of the glove compartment. If flight instruments are installed in the copilot's instrument panel, remove as many as necessary to gain access to the oxygen control knob.

To remove ON-OFF control knob and cable:

1. From inside of of forward baggage compartment:
    a. Remove hydraulic reservoir cover located in rear top center of compartment by removing four attachment screws.
    b. Remove left rear closeout panel by removing the 13 remaining attachment screws.
    c. Remove right rear closeout panel.
2. Disconnect cable from regulator-control mechanism on cylinder by removing cotter pin and washer.
3. Release cable from butterfly clamp and cut the five tie wraps securing cable to high pressure oxygen line. Note position of tie wraps for installation.

REMOVAL AND INSTALLATION OF OXYGEN ON/OFF CONTROL (Seneca III models, s/n's 34-8433001, 34-8433002, 34-8433010, 34-8433012, 34-8433013, 34-8433025 and up, and 3448001 thru 3448037) (continued)

4. Remove retaining nut from rear of control knob.
5. Cut loop off end of cable core. Pull cable from airplane through instrument panel. When cable has cleared grommet in right side of station 44.5 bulkhead, slide retainer nut off cable.

To install new control knob and cable:

1. Trim cable shield to 44.0 inches (111.76 cm) long. Trim core to allow sufficient material to make a two turn loop, two inches (5.08 cm) from the end of the shield.
2. Place instruction plate (supplied by Scott) under knob mounting flange before installing cable.
3. Insert cable through instrument panel. Slide retainer nut onto cable and secure control knob to instrument panel.
4. Route cable through grommet in station 44.5 bulkhead and along high pressure line to cylinder.
5. Secure cable to high pressure line with five MS3367-1-9 tie wraps (Piper p/n 488 702) and CR-2M ring connectors (Piper p/n 555 411) installed at same location as those cut to remove cable.
6. Bend core wire end for 1 1/2 to 2 turns with 0.188 inch (0.478 cm) inside diameter.
7. Place loop over pin on regulator lever and secure with washer and cotter pin provided by Scott.
8. Secure cable to butterfly clamp. Check operation before installing closeout panels.
9. Install closeout panels and hydraulic reservoir cover.
10. Close and secure nose baggage compartment door.
11. Install all flight instruments removed to gain access to cable.

REMOVAL AND INSTALLATION OF OXYGEN ON/OFF CONTROL (Seneca IV models, s/n's 3448038 and up)

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.

To remove ON-OFF control knob and cable:

1. From inside of of forward baggage compartment:
    a. Remove hydraulic reservoir cover located in rear top center of compartment by removing four attachment screws.
    b. Remove left rear closeout panel by removing the 13 remaining attachment screws.
2. Disconnect cable from regulator-control mechanism on cylinder by removing cotter pin and washer.
3. Release cable from all clamps and cut the tie wrap securing cable to high pressure oxygen line. Note position of tie wraps for installation.
4. Remove retaining nut from rear of control knob.
5. 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.

4. Remove retaining nut from rear of control knob.
5. Cut loop off end of cable core. Pull cable from airplane through instrument panel. When cable has cleared grommet in right side of station 44.5 bulkhead, slide retainer nut off cable.

To install new control knob and cable:

1. Trim cable shield to 33.0 inches (83.82 cm) long. Trim core to allow sufficient material to make a two turn loop, two inches (5.08 cm) from the end of the shield.
2. Insert cable through instrument panel. Slide retainer nut onto cable and secure control knob to instrument panel.

REMOVAL AND INSTALLATION OF OXYGEN ON/OFF CONTROL (Seneca IV models, s/n's 3448038 and up) (continued)

3. Route cable through grommet in station 44.5 bulkhead and along high pressure line to cylinder.
4. 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.
5. Bend core wire end for 1 1/2 to 2 turns with 0.188 (0.478 cm) inside diameter.
6. Place loop over pin on regulator lever and secure with washer and cotter pin provided by Scott.
8. Check operation before installing closeout panel.
9. Install closeout panel and hydraulic reservoir cover.
10. Close and secure nose baggage compartment door.

REFILLING OXYGEN SYSTEM

— 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 3503. The following are parameters to be followed for filling.

1. Only aviators breathing oxygen (MIL-0-27210) and appropriate filling equipment should be used to fill the system.
2. 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.
3. 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.

4. Attach service cart hose to recharge port. Fill the system at a rate not exceeding 200 psig per minute proceeding as follows:
    a. 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 3503.

REFILLING OXYGEN SYSTEM (continued)

CHART 3503. 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.

b. When using a recharge unit consisting of one supply cylinder, slowly open the valve of the supply unit and allow the oxygen to transfer.

c. When using a recharge unit consisting of two or more supply cylinders (cascade storage system), it is recommended that the following procedure be used:

   (1) 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.

   (2) 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.

   (3) 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.

   (4) 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.

   (5) 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.

d. 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 3503 after the cylinder temperature stabilizes.

5. After detaching the service cart, cap hose and fittings to prevent contamination.
6. Perform a leak check of the high pressure lines and clean off solution afterwards. If solution is not properly cleaned off, corrosion may result.

PORTABLE—OXYGEN SYSTEM (Seneca III models only)

REMOVAL OF OXYGEN UNIT(S) (Refer to Figure 35-100.)

— WARNING —

DO NOT USE GREASE OR ANY GREASE TYPE FITTINGS ON ANY HARDWARE THAT CONNECTS TO THE OXYGEN BOTTLE OR SYSTEM HARDWARE. WHEN WORKING WITH THE OXYGEN SYSTEM MAKE SURE HANDS, CLOTHING AND TOOLS ARE FREE OF OIL, GREASE, AND DIRT.

An oxygen unit can be released from its cradle by pulling down on the ring under the cradle, sliding the unit forward, and lifting it out of the cradle.

INSPECTION AND OVERHAUL TIME

Due to the nature of the process used to test compressed gas tanks, it is recommended that overhaul, service or hydrostatic tests be conducted by an FAA or manufacturer (Scott Aviation) approved shop. The following checks and charts give recommended inspection and overhaul times for the various parts of the oxygen system.

1. Inspect outlets, and using directions described in the next paragraph, check leaks both in the non-use and use condition.
2. Check the pressure gauge for accuracy by removing the back section of the unit and connecting a gauge of known accuracy, to the fill port.
3. Inspect tank for dents, bulges, major strap chafing marks or corrosion. Should any of these conditions exist, the tank should be hydrostatically tested.

CHART 3504. PORTABLE OXYGEN SYSTEM COMPONENT LIMITS

Parts	Inspection	Overhaul
Regulator	300 Flight Hours	5 Years
Pressure Gauge	300 Flight Hours	5 Years
Outlets	300 Flight Hours	5 Years
Recharge Valve	Each Use	Replace every 5 years
Masks	Each Use	Replace as necessary

TESTING FOR LEAKS

Apply detector fluid type CD- 1 solution or its equivalent. The solution should be shaken to obtain suds or foam. The suds or foam should be applied sparingly to the joints of a closed system. Look for traces of bubbles. No visible leakage should be found. Repair or replace any defective parts and retest system.

With the system pressurized to service pressure, further tests can be made. The rate of any leak should not exceed one percent of the total supply per 24 hour period. All traces of the detector fluid should be wiped off at the conclusion of the examination.

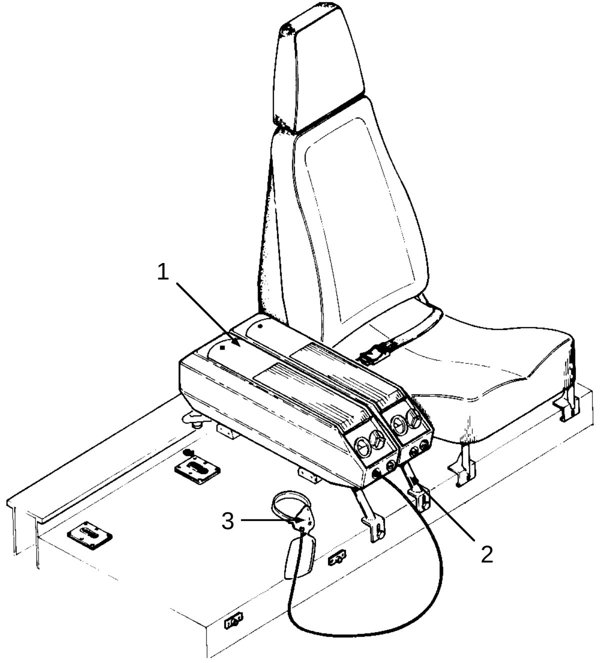


Figure 35-10. Oxygen Installation (Portable)

MAINTENANCE

1. Check the cylinder to be sure it is securely mounted.
2. Check the cylinder for the ICC identification number and for the date of the last FAA inspection and test.
3. If cylinder is completely empty it must be completely disassembled and inspected in an FAA or manufacturer approved facility before recharging.
4. Refer to FAA Manual AC 43.13-1A for more details.

REMOVAL OF OUTLETS

1. Make sure control valve is in full off position.
2. Connect a mask or connector to the valve to release any pressure.
3. Using a suitable spanner wrench, remove the outlet.
4. The outlet can now be removed from the low pressure line.

INSTALLATION OF OUTLETS

1. Apply sealant (Permacel 412) to the male end of the fitting.
2. Install the outlet to the regulator extension with a suitable spanner wrench.
3. Torque the fittings into the outlets approximately 30 inch-pounds. Do not over torque as this could damage the outlet.

PURGING OXYGEN SYSTEMS

The system should be purged whenever the cylinder pressure falls below 50 psi or if any lines are left open for any length of time. Also, if bottle is left at below 200 psi it may develop odors from bacterial growth. This will make it necessary to purge the system. Use the following procedures:

— CAUTION —

WHEN PURGING OXYGEN SYSTEMS ENSURE THE AREA IS A NO SMOKING AREA AND IS FREE OF OIL AND DIRT.

1. Keep all doors and windows open.
2. Connect the oxygen recharging unit to the filler valve.
3. Plug the oxygen masks into the outlet valves and turn on the system.
4. Set the recharging unit pressure regulator to deliver 50 psi and let the system purge for one hour. If any odor is still present repeat the procedure for one or more hours. If the odor persists after the second purging, send the unit to its manufacturer, or an approved shop.

CLEANING OF FACE MASKS

The disposable masks are designed for one-time use and require no maintenance. The pilot's and copilot's masks can be cleaned as follows:

1. Remove the microphone from the mask.
2. Remove the sponge rubber discs from the masks turrets. Do not use soap to clean sponge rubber discs, as this would deteriorate the rubber and give off unpleasant odors. Clean in clean water and squeeze dry.
3. Wash the rest of the mask with a very mild solution of soap and water.
4. Rinse the mask thoroughly to remove all traces of soap.
5. Make sure the sides of the breathing bag do not stick together while drying, as this may decrease the life of the rubber in the bag. The mask can be sterilized with a solution of 70 percent ethyl alcohol.

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CHAPTER

37

VACUUM

CHAPTER 37 - VACUUM

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

The material included in this chapter provides information on the location, removal, and maintenance of the vacuum system components. Maintenance, particularly that on instruments, not covered herein should be accomplished by qualified personnel, an authorized repair station, or the manufacturer.

DESCRIPTION AND OPERATION (Refer to Figures 37-1, 37-2, and 37-3)

Seneca III models utilize two vacuum system installations. Those airplanes having just gyro flight instruments installed are equipped with standard air pumps. Those airplanes that also have the pneumatic deice system installed utilize larger air pumps required for the operation of both gyro flight instruments and deice boots. Both systems use virtually the same installation.

The larger air pumps are standard on the Seneca IV.

Both Seneca III systems, and the Seneca IV, use two regulators, gyro inlet filter(s) 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 filter(s) 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.

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 gyro filter(s), mounted to the 49.50 bulkhead, must be replaced regularly. The filter(s) clean inlet air to the gyros.

Seneca III airplanes with a pneumatic deice installation will also include a vacuum line to the deice control valve. Pneumatic deice installation is standard on the Seneca IV. Refer to Chapter 30 for more information.

Both the Seneca III and IV have vacuum gauges installed in the instrument panel that read the amount of negative pressure being provided to the gyroscopic flight instruments in inches of mercury.

The Seneca III and IV are provided with lights on the annunciator panel to show if either pump fails.

TROUBLESHOOTING

CHART 3701. TROUBLESHOOTING VACUUM SYSTEM

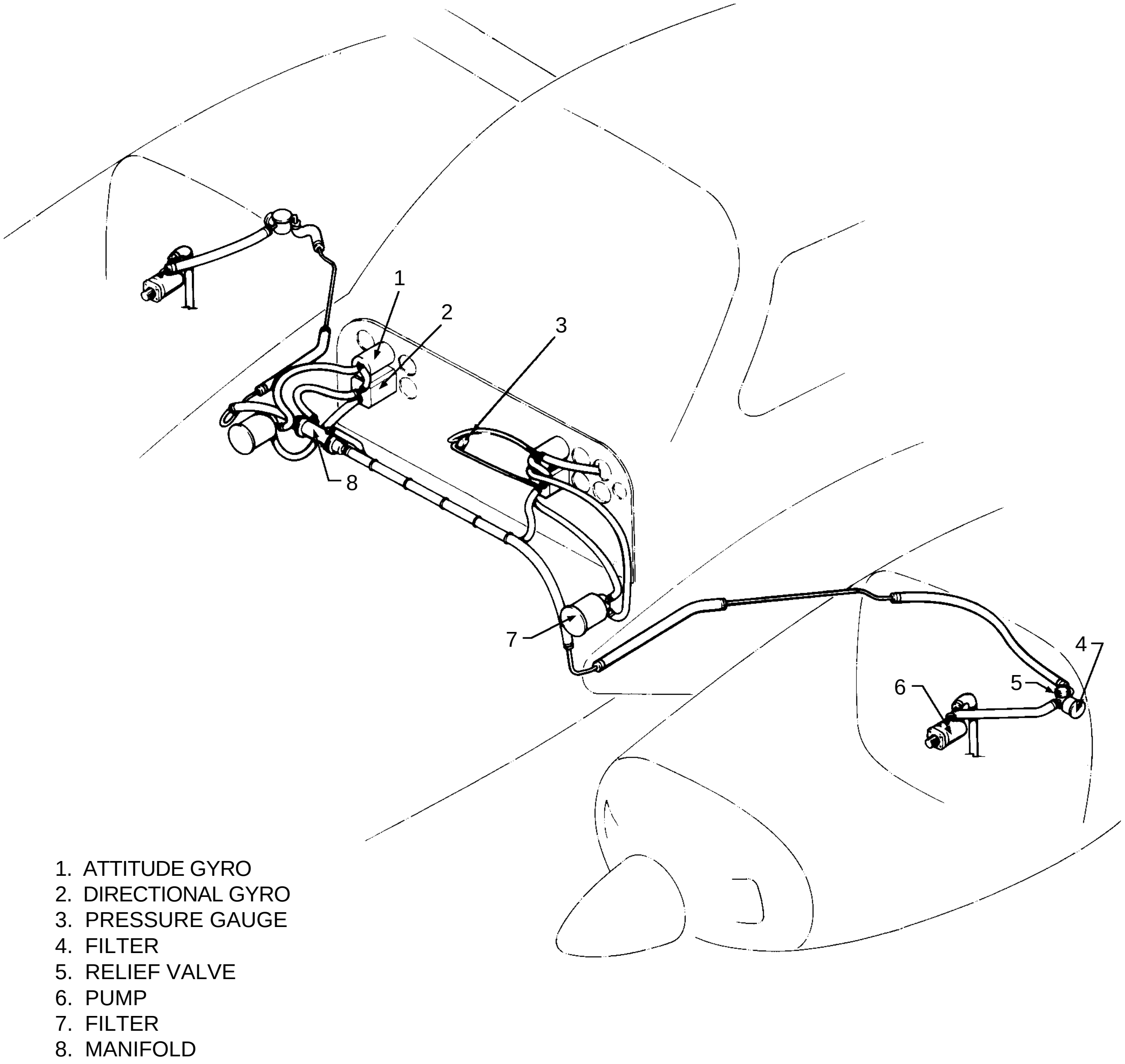
Trouble	Cause	Remedy
No vacuum gauge indication at instrument.	Gyro filter(s) clogged or dirty.	Clean or replace filter(s).
	Line(s) from gyro to gyro filter(s) restricted.	Check lines.
	Faulty gauge.	Replace gauge.
No vacuum gauge indication at instrument and/or source.	Malfunctioning pump(s).	Replace pump(s).

CHART 3701. TROUBLESHOOTING VACUUM SYSTEM (continued)

Trouble	**Cause**	**Remedy**
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.
Normal vacuum indication but sluggish operation. of instrument.	Faulty instrument.	Replace instrument.
	Faulty gauge.	Replace gauge.
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).
Vacuum correct on ground but will not maintain pressure at altitude	Air pump malfunctioning.	Replace pump.

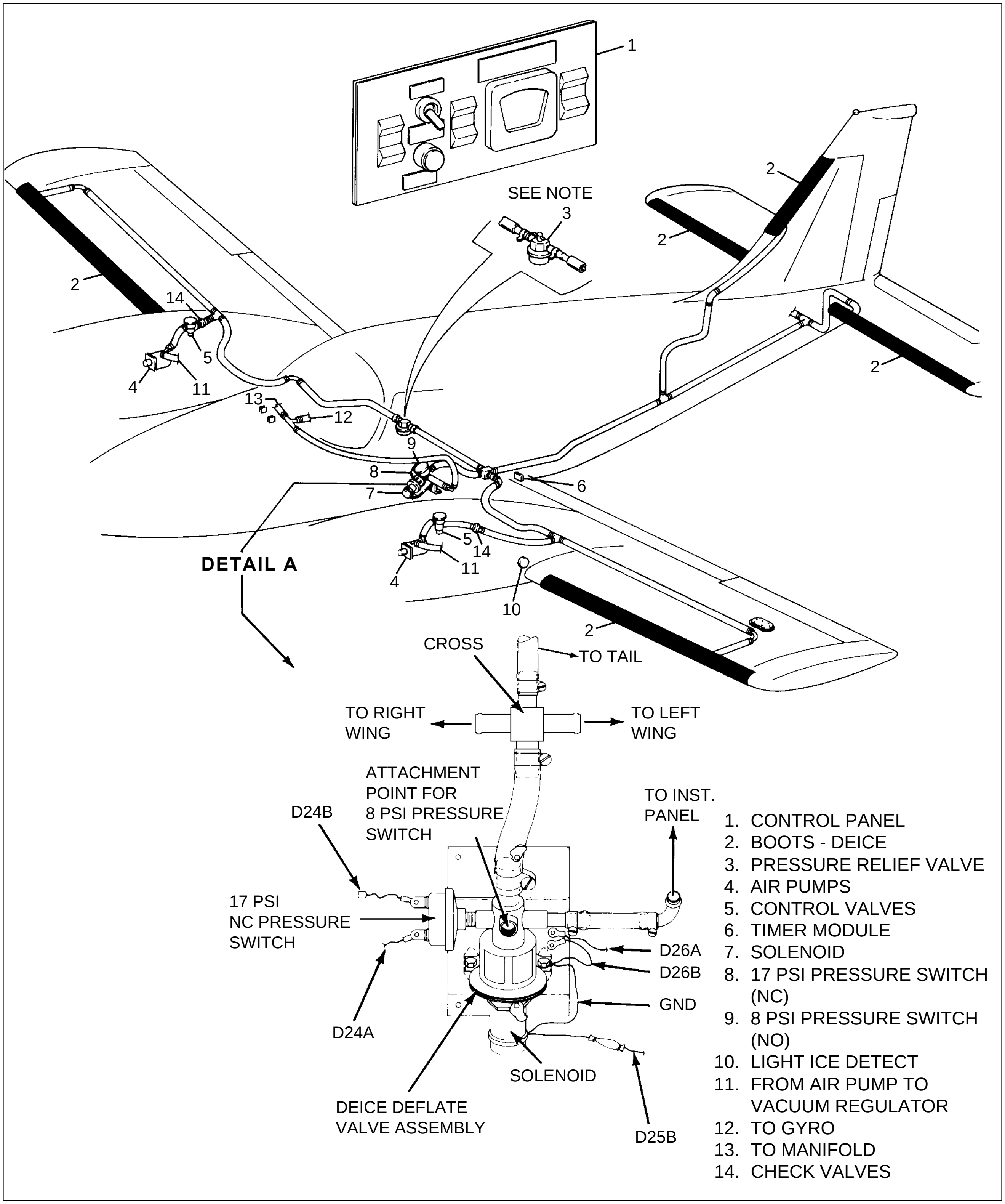
CHART 3701. TROUBLESHOOTING VACUUM SYSTEM (continued)

Trouble	Cause	Remedy
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.
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.



1. ATTITUDE GYRO
2. DIRECTIONAL GYRO
3. PRESSURE GAUGE
4. FILTER
5. RELIEF VALVE
6. PUMP
7. FILTER
8. MANIFOLD

Figure 37-1. Standard Gyro Vacuum System



1. CONTROL PANEL
2. BOOTS - DEICE
3. PRESSURE RELIEF VALVE
4. AIR PUMPS
5. CONTROL VALVES
6. TIMER MODULE
7. SOLENOID
8. 17 PSI PRESSURE SWITCH (NC)
9. 8 PSI PRESSURE SWITCH (NO)
10. LIGHT ICE DETECT
11. FROM AIR PUMP TO VACUUM REGULATOR
12. TO GYRO
13. TO MANIFOLD
14. CHECK VALVES

Figure 37-2. Seneca III Gyro and Pneumatic System (Optional)

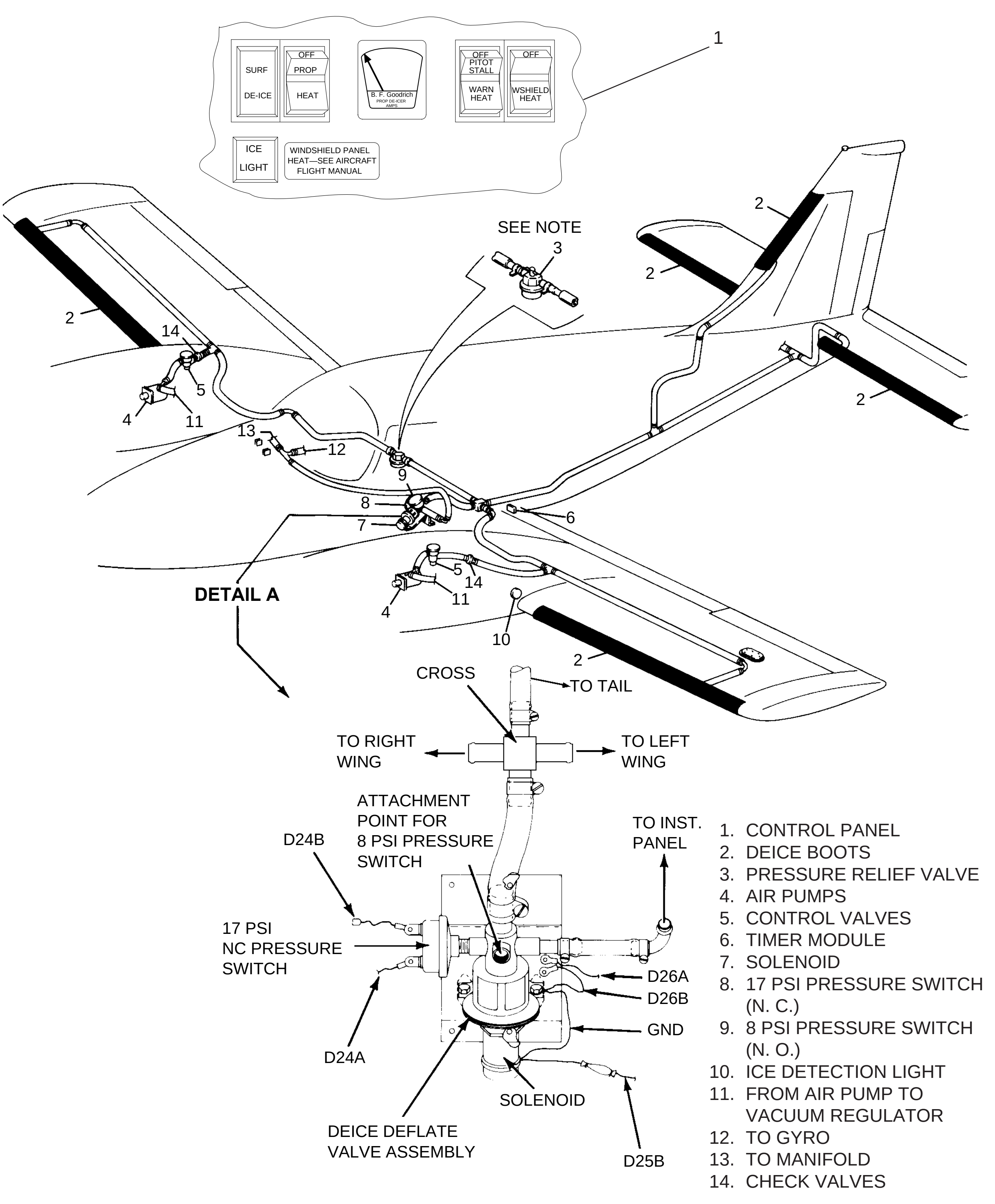


Figure 37-3. Seneca IV Gyro and Pneumatic System

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DISTRIBUTION

VACUUM SYSTEM AND GYRO PRESSURE SERVICE TIPS

The following information is intended to acquaint field service personnel with a means to diagnose vacuum system service symptoms on those components which are serviced by removal and replacement, along with recommended service practices. These items include hoses, clamps, gyro filters, vacuum regulating valves, vacuum gauges and air pumps.

1. Hoses and Clamps.
    a. These items should be examined periodically and inspected carefully whenever engine maintenance activities cause hose disconnections to be made at the pump, regulating valve, gyros and/or vacuum gauge.
    b. The ends of hoses should be examined for rubber separation and slivers of rubber on the inside diameter of the hoses. If these slivers become detached, the air pump will suck them into the system and eventually ingests them. This causes premature pump wear or failure.
    c. Hose, clamps and fittings should be replaced when broken, damaged or corroded.

— CAUTION —

DO NOT USE PIPE DOPE OR ANY OTHER ANTI-SEIZE TAPE OR COMPOUND WHEN REPLACING ANY THREADED FITTINGS. ALL AIRBORNE FITTINGS ARE CADMIUM PLATED TO AVOID THE NEED FOR ANY OTHER ANTI-SEIZE MATERIAL. THIS ACTION IS REQUIRED TO PROTECT THE PUMP FROM INGESTING FOREIGN MATERIALS THAT COULD CAUSE PREMATURE WEAR OR FAILURE. IF A THREAD LUBRICANT IS REQUIRED, USE (1) A POWDERED MOLYSULFIDE; (2) GRAPHITE IN DRY FORM OR IN AN EVAPORATING VEHICLE, OR; (3) A SILICONE SPRAY. APPLY SPARINGLY TO EXTERNAL THREADS OF FITTINGS ONLY.

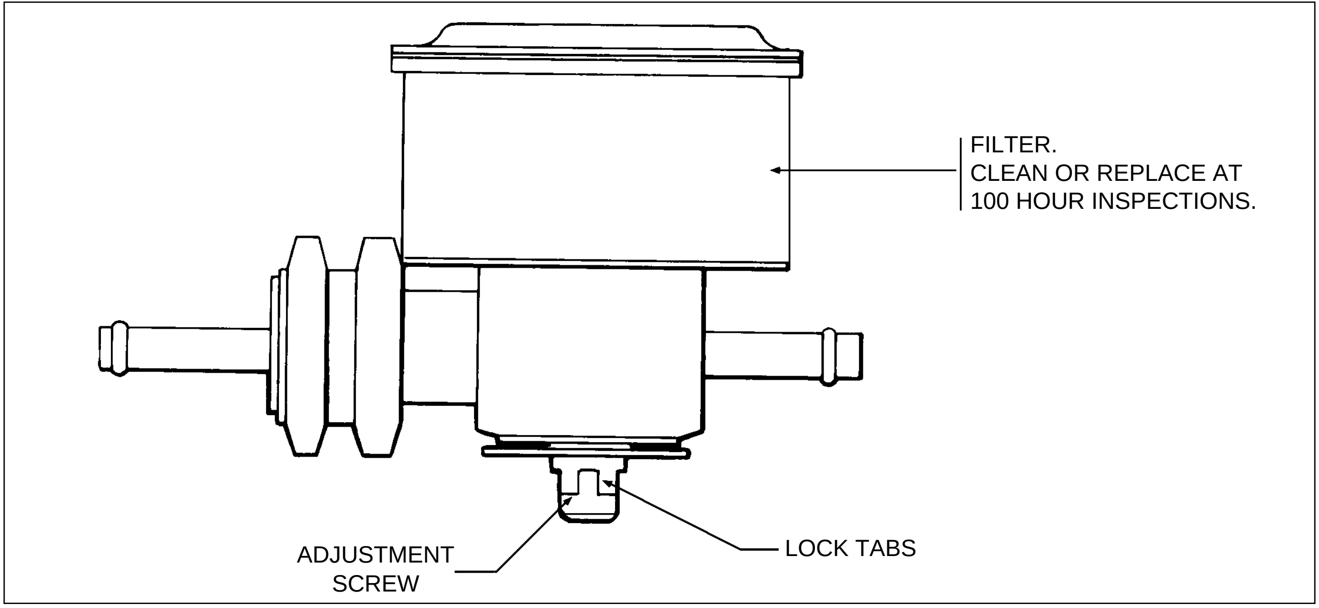

Figure 37-4. Vacuum Regulator

2. Vacuum Gauges:
   a. 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.

   b. If the vacuum gauge malfunctions in a manner to cause an incorrect reading in normal cruise conditions, the gauge must be checked by comparing the reading with a gauge of known accuracy. Reset the regulator only if the gauge is indicating correct values, but the system vacuum level is not in accordance with the specified vacuum.
   c. Visual examination of gauge performance should cover the following steps:
      (1) With engine stopped and no vacuum applied to the gauge, its pointer should rest against the internal stop in the 6 o'clock position. Any other displacement from this position suggests need for replacement.
      (2) A small overshoot during engine start-up, not to exceed one half an inch of mercury, is normal and is not cause to replace gauge.
      (3) With engine operating at normal cruise rpm, the gauge should read from 4.8 inches to 5.2 inches of mercury (vacuum).
      (4) At 1200 rpm, the vacuum gauge reading should be more than four inches of mercury.
3. Gyro Filters:
   a. Gyro filter(s) must be serviced each 100 hours time-in-service, or sooner, if conditions indicate.

— NOTE —

> This instrument panel differential vacuum gauge will show a decrease in gauge reading, should the gyro filter(s) become clogged, resulting in vacuum decreasing below recommended minimum value. Replace gyro filter(s) whenever the gauge or regulator is replaced. Two gyro filters are used when the optional copilot's gyro instruments are installed, .

4. Vacuum Regulator:
   a. The vacuum regulating valve seldom needs replacement. Symptoms that suggest replacement is required are:
      (1) Rapid fluctuation of the vacuum gauge needle.
      (2) Unable to obtain repeatable or consistent vacuum gauge reading at cruise rpm, from flight to flight, or after making repeated regulator adjustments, when the vacuum gauge is not suspect, or has been checked against a known test gauge. (Gently tap gauges used on Seneca III models before reading).
      b. All modes of regulator malfunction tend to increase the vacuum power applied to the gyros. Thus, the annunciator lights, which are activated by a loss of vacuum, will not illuminate. Regulator filters should be cleaned or replaced at least each 100 hours time-in-service.
      c. Although a faulty regulator may permit vacuum in excess of maximum desirable limits (5.2" Hg.) to be applied to the system, 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 range of 4.8 to 5.2 inches of mercury, then the regulating valve should be changed. Observe the usual precautions for maintaining system cleanliness to avoid premature pump failure (or wear).

5. Air Pump:
   a. Before installation of fittings on pump, check for external damage. A pump that has been damaged or dropped should not be installed.
   b. When a vise is used to secure the pump while installing fittings, caution must be exercised to avoid pump damage. The square mounting flange must be held between soft wood blocks and only at right angles to the vise jaws. Use only enough vise pressure to hold the pump firmly. Do not apply vise pressure to the outside diameter or overall length of the pump.

— NOTE —

Refer to **CAUTION** under Step 1.

   c. With the pump properly secured in the vise, insert fittings into the ports and hand tighten firmly; then using a wrench, tighten each fitting from one-half to two additional turns.

VACUUM GAUGE

The vacuum gauge on Seneca III models is mounted in the instrument panel above the throttle quadrant. On Seneca IV models it is mounted in the upper left section of the pilot’s instrument panel above the ELT switch. The gauge in both the Seneca III and IV 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. For troubleshooting of this instrument, refer to Chart 3701 of this section.

REMOVAL AND INSTALLATION OF FACE MOUNTED INSTRUMENTS

Since all instruments are mounted in a similar manner, a description of a typical removal and installation is provided as a guide. Special care should be taken when any operation pertaining to the instruments is performed.

1. Remove face panel (Seneca III, 14 Vdc models only).

— NOTE —

Tag instrument connections for ease of installation.

2. Remove electrical or mechanical connections from the instrument.
3. Remove the mounting screws of the instrument to be removed.
4. Install the instruments in the reverse order of removal. After installation is completed (before replacing the instrument face panel on Seneca III, 14 Vdc models only), check all components for security and clearance of the control column.

VACUUM REGULATOR VALVE

A vacuum regulator valve that contains a filter is incorporated in the system to control vacuum pressure to the gyro instruments.

ADJUSTMENTS OF VACUUM REGULATOR VALVE

1. Bend locking tabs up to rotate adjustment screw.

— NOTE —

Operation of engine at medium rpm is considered to be at magneto check rpm.

Do not attempt adjustment of this valve with the engine in operation.

2. Start the respective engine, after allowing time for warm-up, run the engine at medium rpm.
3. With appropriate engine running at medium rpm, the suction gauge should indicate 5.0 inches of mercury ±0.2 inches of mercury. 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 (5.0” Hg. ± 0.2” Hg.) is obtained. (It may be necessary to gently tap gauges installed in Seneca III models to obtain an accurate reading).
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.

AIR PUMP

The air pump is a rotary vane, positive displacement type. This unit consists of an aluminum housing containing a tempered sleeve in which an offset rotor, with moving blades incorporated. This assembly is driven by means of a coupling mated to the engine driven gear assembly. The pump is mounted on the accessory section of the engine. For troubleshooting of the pumps, refer to Chart 3701 of this section.

REMOVAL AND REPLACEMENT

To remove air pump:

1. Remove top portion of the engine cowling.
2. Loosen hose clamp and remove hose from air pump fitting.
3. Remove air pump by removing the four retaining nuts, lock washer and plain washers.

Install pump in reverse order of removal, noting alignment of spline on the pump drive with the spline on the engine drive assembly.

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CHAPTER

39

ELECTRICAL/ELECTRONIC PANELS & MULTIPURPOSE PARTS

CHAPTER 39 - ELECTRICAL/ELECTRONIC PANELS & MULTIPURPOSE PARTS

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

The purpose of this chapter is to supply information on the general or typical locations of items that are most widely used with the electrical instrumentation and control of the aircraft. For further repair to electrical instruments or controls not covered in this chapter refer to the chapter for the appropriate system. Those electrical instruments not covered in this manual must be repaired by an authorized repair station, manufacturer, or qualified personnel.

— NOTE —

Refer to Chapter 91, Electrical Schematics for additional information.

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INSTRUMENT AND CONTROL PANELS

REMOVAL OF FACE MOUNTED INSTRUMENTS

With all face mounted instruments mounted similarly, a description of typical removal instructions is provided as a simple guide for removing and installing affected instruments. Special care should be taken whenever maintenance is done on or around instruments.

1. Disconnect and label any lines connected to the instrument.
2. The instruments are fastened to the panel through the use of screws and Tinnerman nuts. It is recommended that when removing the screws, care be taken to prevent the nuts from loosening and falling out of the instrument bezel. If a nut does fall free, locate and remove it. Making sure it has not fallen into any controls.
3. Install the instruments in reverse order ensuring any lines are attached properly.

REMOVAL AND REPLACEMENT OF CLUSTER MOUNTED INSTRUMENTS (Seneca III Models)

A cluster, located on the instrument panel, contains individual instruments. Removal of these instruments can be accomplished by the following procedure:

1. Working behind the instrument panel, identify electrical wires as required and disconnect from instruments.
2. Disconnect oil pressure lines, and the electrical wire to the four cluster lights at the connector.
3. From the face of the panel, remove the two flush screws which hold the cluster lens, mask and housing in place. Remove the cluster assembly from behind the panel.
4. Remove and replace the individual instrument from the housing as required. Check all mountings for security.
5. Reverse the above procedures to reinstall the cluster. Masking tape may be used to hold the lens, mask and housing in register to aid in reinstallation of the assembly in the panel.

— NOTE —

When any connections in the static system are opened for checking, the system must be rechecked per FAR 23.1325.

CLOCK

The standard Seneca III equipment clock is an eight day time piece with a winding stem located in the lower left hand side of the dial. The standard equipment clock insatlled in the Seneca IV is electric. The clock in both models is located on the left side of the instrument panel.

An optional control wheel clock is available. When the control wheel clock is installed, the instrument clock is removed.

CONTROL WHEEL MOUNTED CLOCK (OPTIONAL)

REMOVAL AND INSTALLATION OF CONTROL WHEEL MOUNTED CLOCK

1. Remove the four screws which secure the clock in the control wheel assembly.
2. Disconnect the wires at lower end of control wheel assembly and remove the clock.
3. Remove light assembly from the back of the clock by pulling carefully until the light socket disengages from the clock.
4. Installation is reverse of removal.

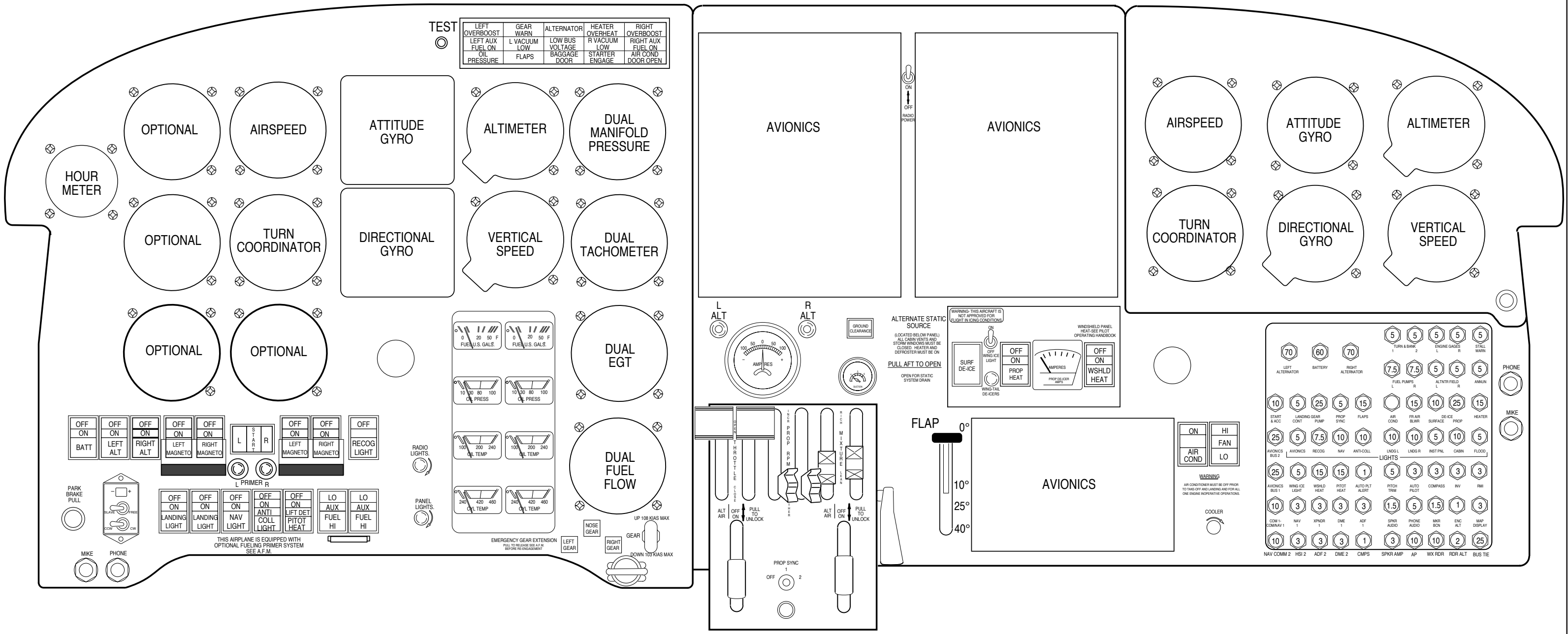

Figure 39-1. Typical Instrument Panel — Seneca III (Sheet 1 of 2)

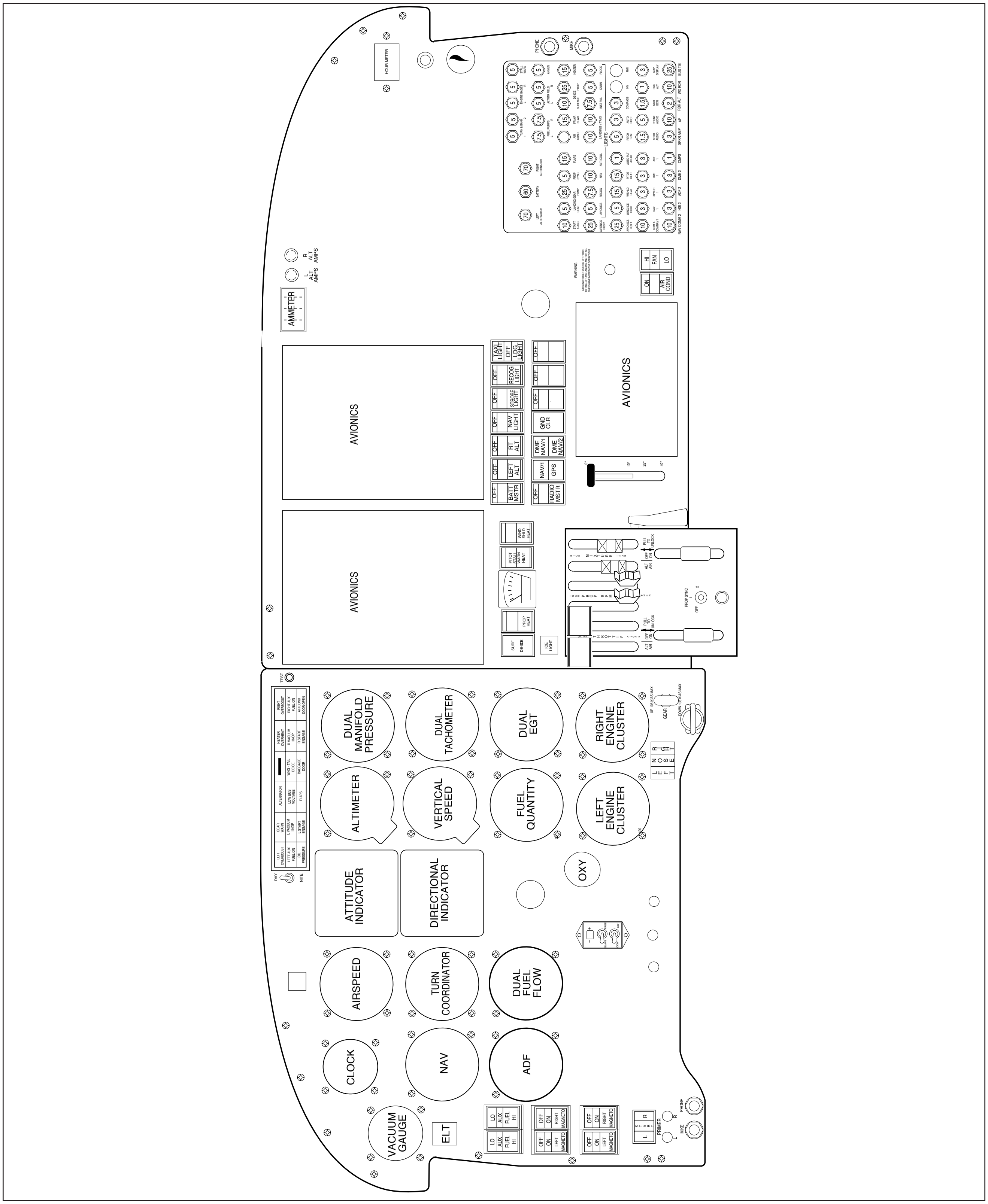

Figure 39-1. Typical Instrument Panel — Seneca IV (Sheet 2 of 2)

MULTIPURPOSE ELECTRICAL PARTS

ELECTRICAL SWITCHES

Seneca III airplane systems switches are located on the lower left of the instrument panel below the pilot's control column. (Refer to Figure 39-1, Sheet 1 of 2.)

Most systems switches on Seneca IV models are located on the center right instrument panel below the number two avionics panel. The magneto and auxiliary fuel pump switches are situated in a vertical row on the extreme lower left side of the instrument panel. All Seneca IV systems switches are internally lit. Refer to Chapter 33 for instructions on switch bulb replacement. (Refer to Figure 39-1, Sheet 2 of 2)

All of these switches in both the Seneca III and IV are of the snap-in type. The switches can be removed by reaching behind the panel and, while squeezing on the upper and lower clips, pushing the switch out through the front of the panel. Make sure to note and/or mark the particular wire locations on the switch terminals before disconnecting them.

Installation of the switches may be accomplished by reversing the removal procedures.

CIRCUIT BREAKERS

— WARNING —

ENSURE THAT THE BATTERY MASTER SWITCH IS IN THE OFF POSITION WHEN WORKING ON CIRCUIT BREAKER PANEL.

The circuit breakers are located on the lower right of the instrument panel. Each breaker is front and back mounted. To remove a particular breaker, disconnect it from the bus behind the panel, as well as removing the knurl nut from the panel side. Make sure to take note and/or mark the wire that was connected to the breaker.

Install breakers in the reverse manner.

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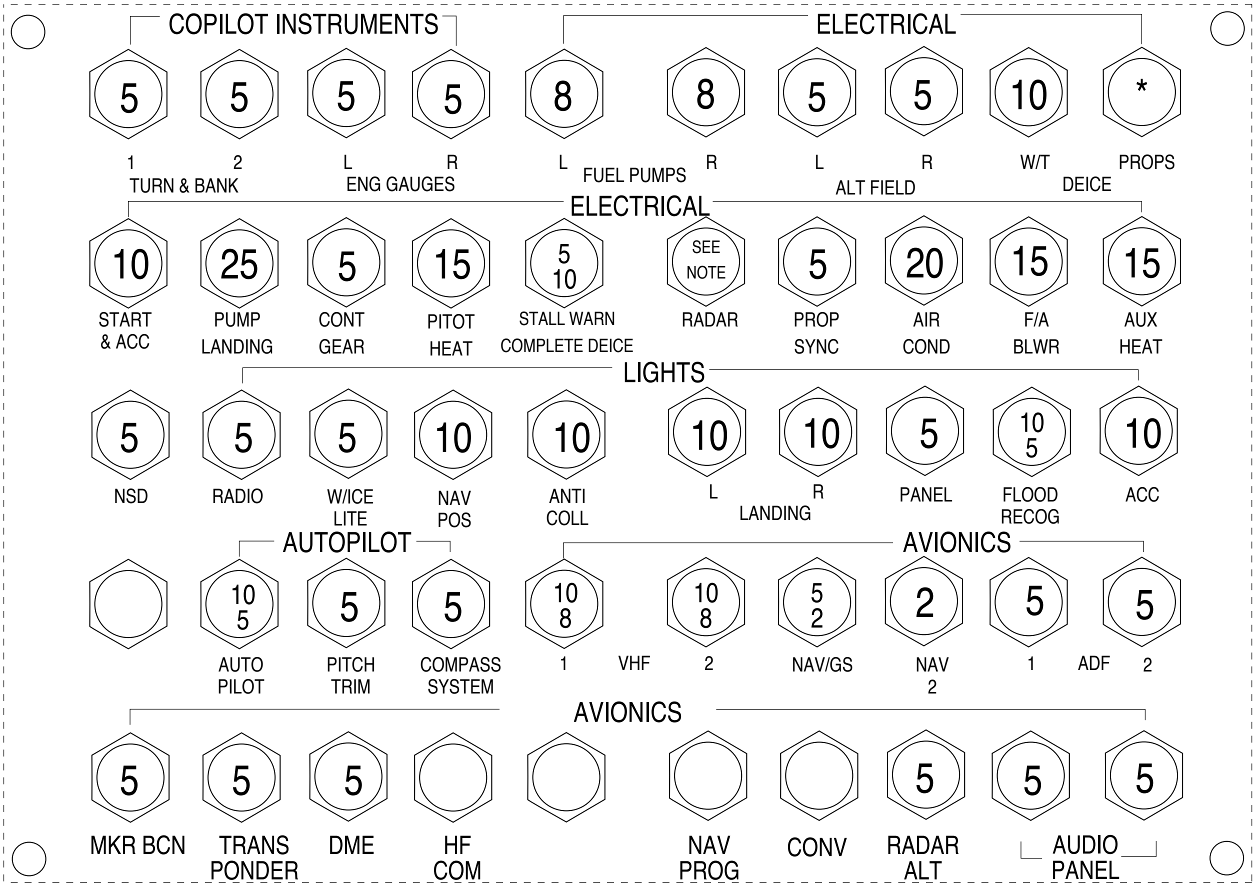


* 35 Amp for 3 Blade Prop/ 25 Amp for 2 Blade Prop

NOTE: 5 Amp RCA WEATHER SCOUT II
10 Amp RCA OR SPERRY COLOR RADAR
10 Amp BENDIX B&W OR COLOR RDR 160

Figure 39-2. Seneca III, 14 Volt System Circuit Breaker Panel

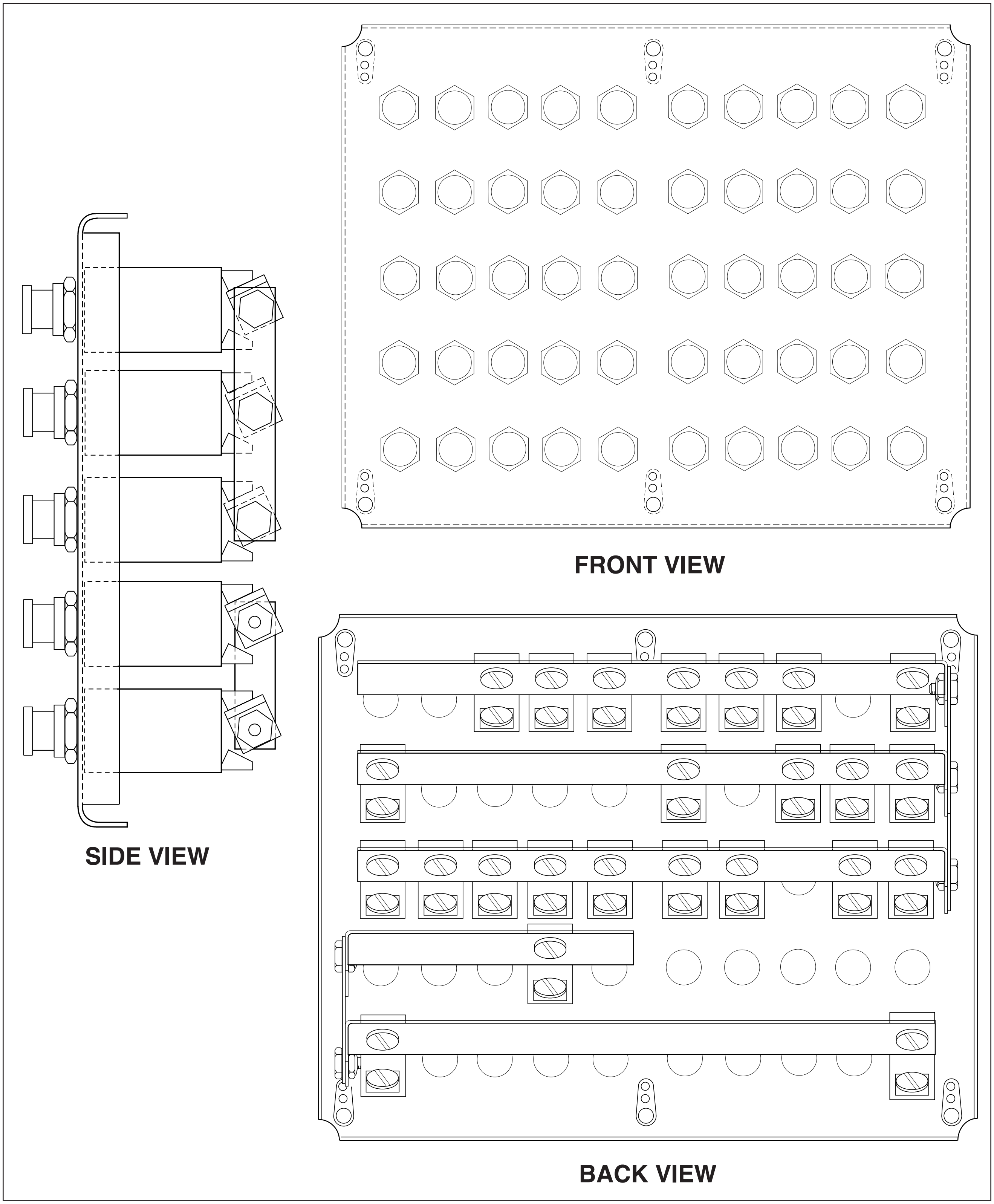
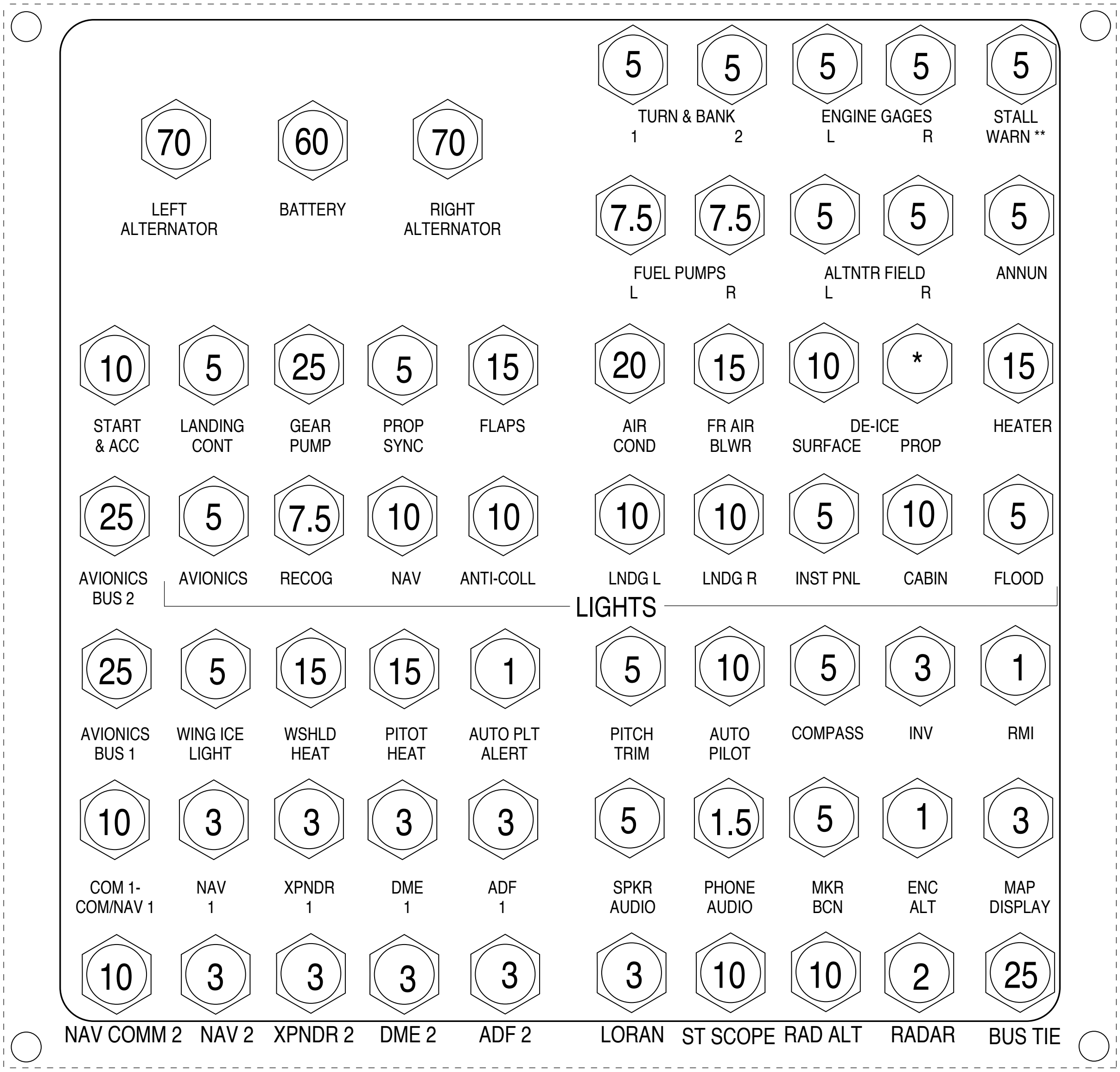


Figure 39-3. Seneca III, 14 Volt System Circuit Breaker installation



* 20 Amp for 3 Blade Prop/ 15 Amp for 2 Blade Prop

** 15 Amp complete Deice System

Figure 39-4. Seneca III, 28 Volt System Circuit Breaker Panel

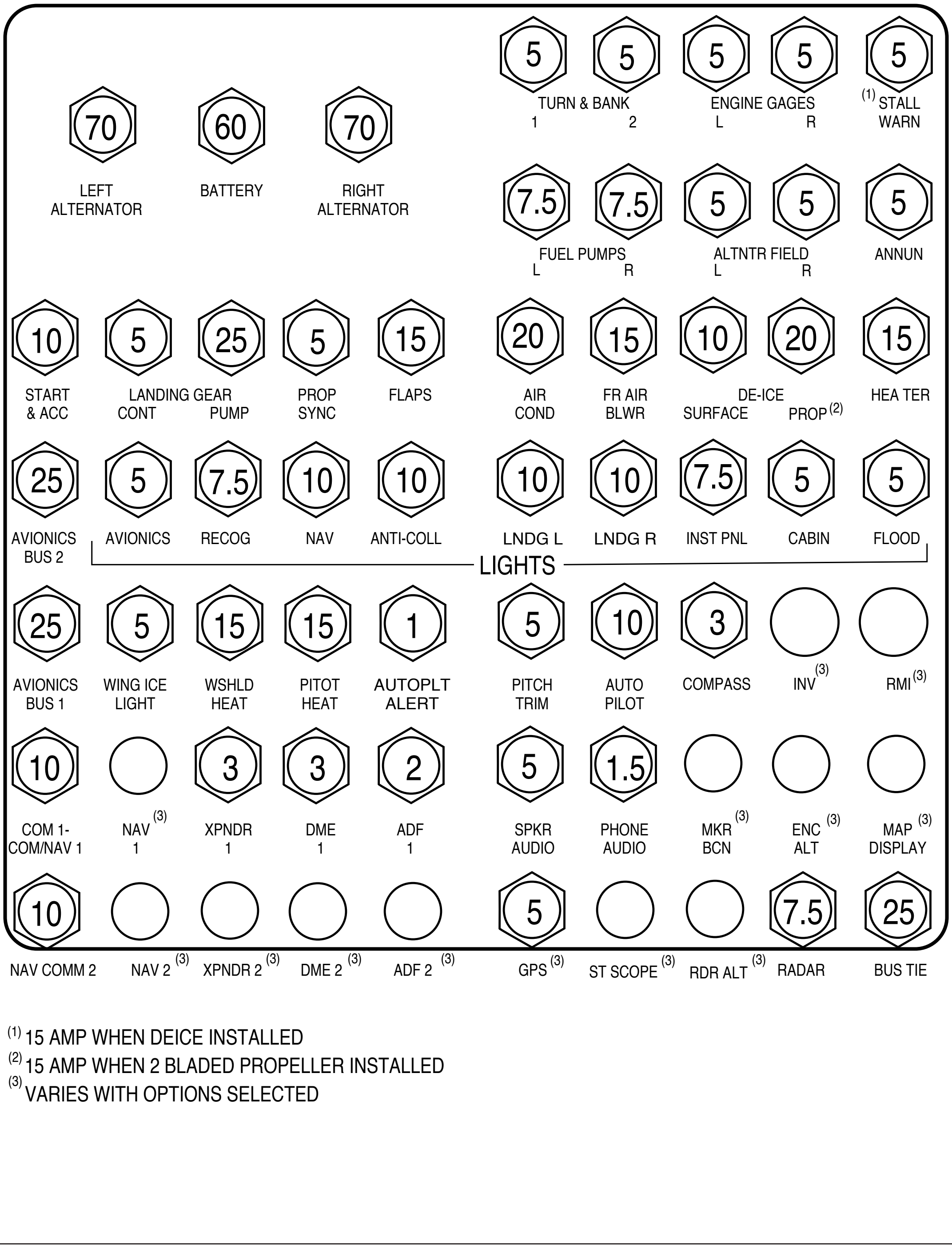


Figure 39-5. Seneca IV Circuit Breaker Panel

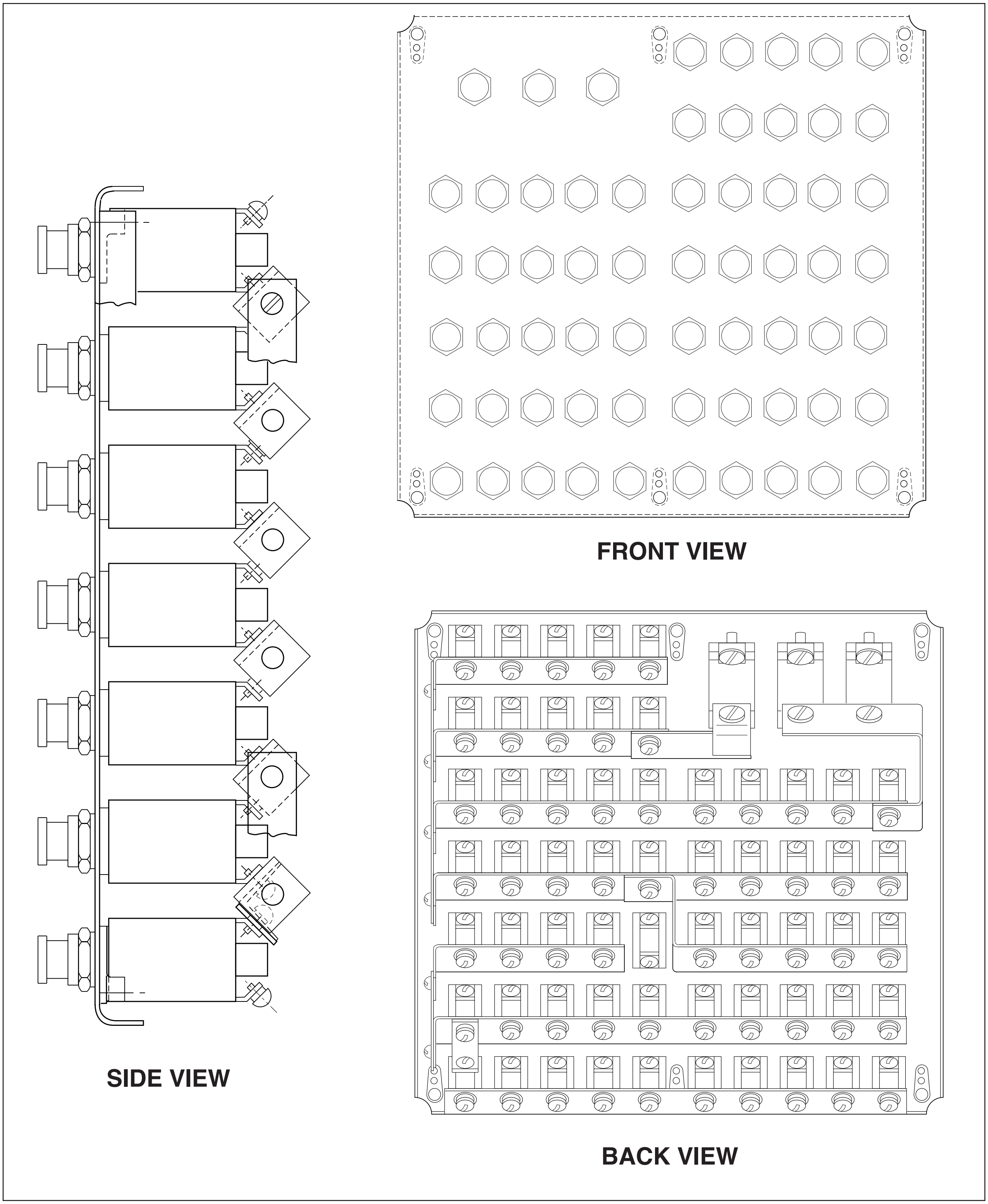


Figure 39-6. Seneca III, 28 Vdc models and Seneca IV Circuit Breaker Panel Installation

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CHAPTER

51

STRUCTURES

CHAPTER 51 - STRUCTURE

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

DESCRIPTION

The PA-34-220T (Seneca III and Seneca IV) 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. The cabin entrance door, located on the right side of the fuselage above the wing, is equipped with a safety latch in the top of the door that can be operated from the inside or outside. 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.

Each wing is an all metal, full cantilever, semi-monocoque type construction, with a removable fiberglass or thermoplastic tip. Installed in each wing ahead of the main spar of the Seneca III are two metal fuel tanks with a capacity of 24.5 U.S. gallons each or 49 U. S. gallons total per wing. Optional two U. S. 15 gallons fuel cells may be installed in each wing between the inboard and outboard metal fuel tanks of the Seneca III, increasing total fuel capacity to 128 U. S. gallons. Refer to Section 2 of the Pilot’s Operating Handbook, Report: VB-1150 or VB-1257, for information on unusable fuel.

The standard fuel system on the Seneca IV consists of two 24.5 U. S. gallons metal fuel tanks installed in each wing ahead of the main spar, plus two 15 U. S. gallons fuel cells installed between the inboard and outboard metal fuel tanks, providing a total fuel capacity of 128 U. S. gallons. Refer to Section 2 of the Pilot’s Operating Handbook, Report VB-1556, for information on unusable fuel.

Attached to each wing of the Seneca III or Seneca IV 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 enamel or acrylic lacquer. As an option, the airplane may be completely primed with zinc chromate.

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STRUCTURAL REPAIRS

Structural repair methods used must be made in accordance with the regulations set forth in FAA Advisory Circular 43-13-1A. To assist in making repairs and/or replacements, Figure 51-1 identifies the type and thickness of various skin material used.

— WARNING —

NO ACCESS HOLES ARE PERMITTED IN ANY CONTROL SURFACES. THE USE OF PATCH PLATES FOR REPAIRS OF ALL MOVABLE TAIL SURFACES IS PROHIBITED. THE USE OF ANY FILLER MATERIAL NORMALLY USED FOR REPAIR OF MINOR DENTS AND/OR MATERIALS USED FOR FILLING THE INSIDE OF SURFACES IS ALSO PROHIBITED ON ALL MOVABLE TAIL SURFACES.

Never make a skin replacement or patch plate from material other than the type of the original skin, or of a different thickness than the original skin. The repair must be as strong as the original skin. However, flexibility must be retained so the surrounding areas will not receive extra stress.

FIBERGLASS REPAIRS

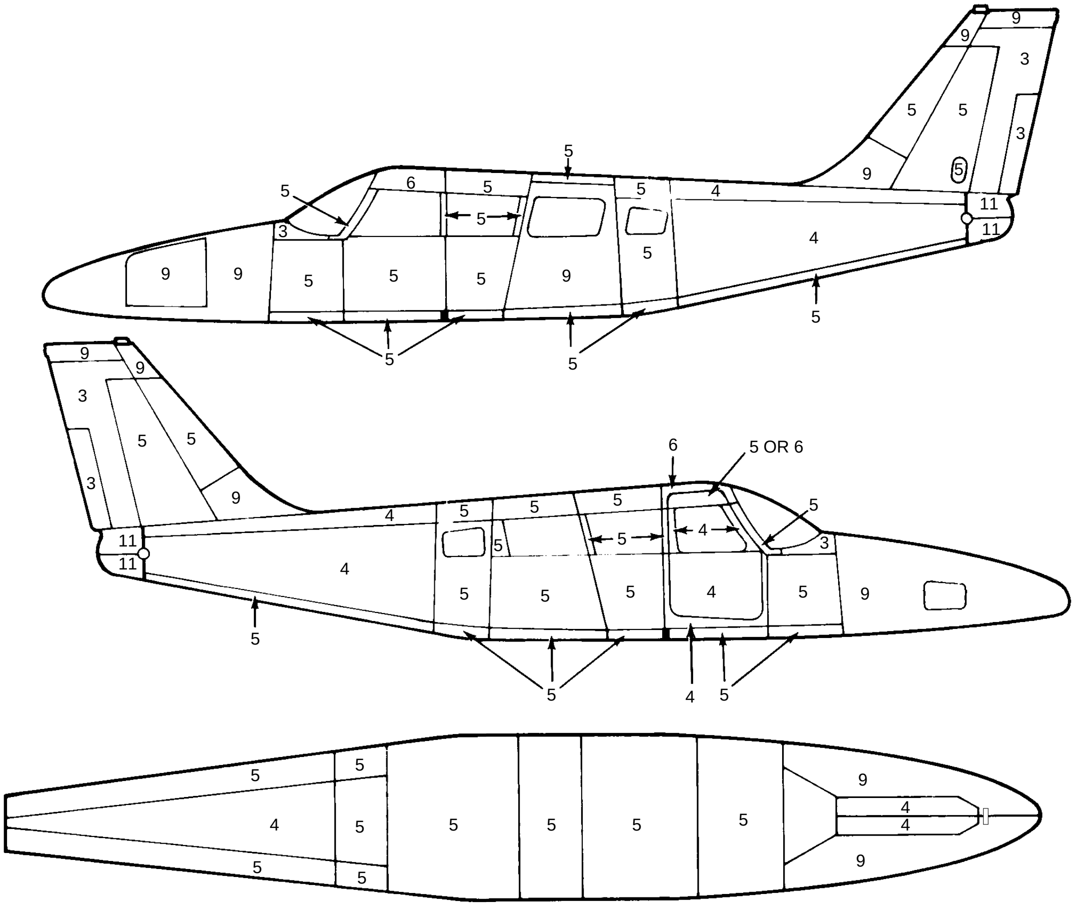
The repair procedure in this manual will describe the methods for repair of Fiberglass Reinforced Structures. Fiberglass Touch-Up and Surface Repairs such as blisters, open seams, delamination, cavities, small holes and minor damages that have not harmed the fiberglass cloth material, Fiberglass Fracture and Patch Repairs such as punctures, breaks and holes that have penetrated through the structure and damaged the fiberglass cloth. A repair kit, part number 756 729 will furnish necessary material for such repairs, and is available through Piper Aircraft Dealers.

— NOTE —

Very carefully follow resin and catalyst mixing instructions furnished with repair kit.

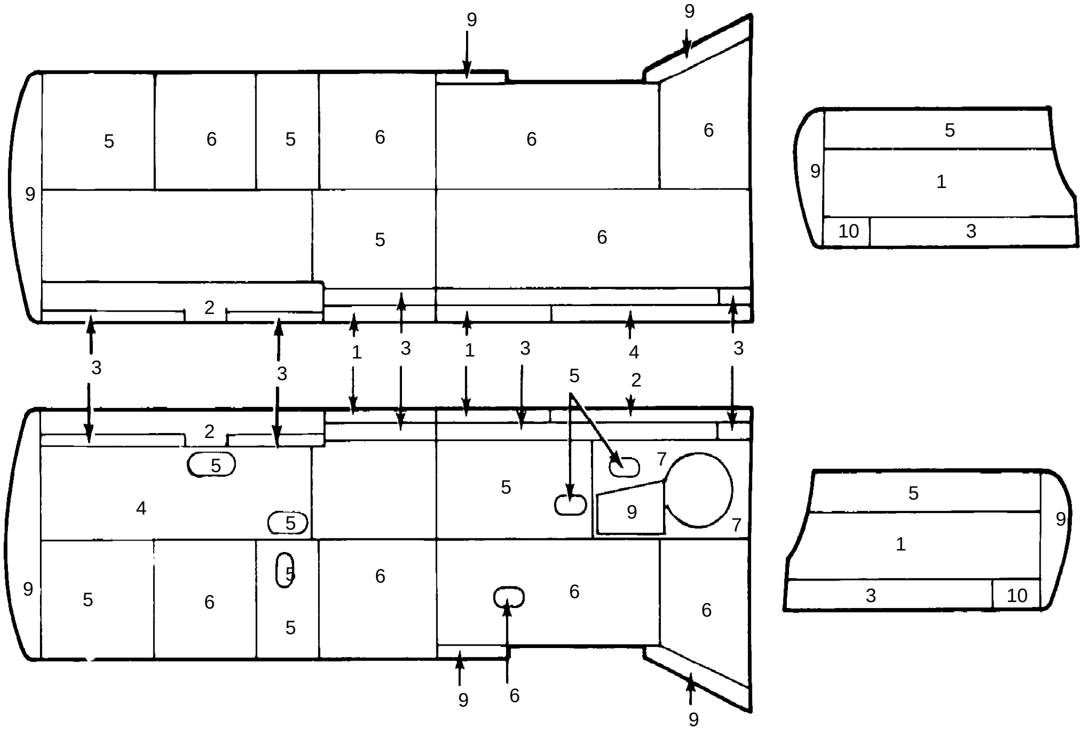
FIBERGLASS TOUCH-UP AND SURFACE REPAIRS

1. Remove wax, oil and dirt from around the damaged area with acetone, methylethylketone or equivalent and remove paint to gel coat.
2. The damaged area may be scraped with a fine blade knife or a power drill with a burr attachment to roughen the bottom and sides of the damaged area. Feather the edge surrounding the scratch or cavity. Do not undercut the edge. (If the scratch or cavity is shallow and penetrates only the surface coat, continue to Step 8.)
3. Pour a small amount of resin into a jar lid or on a piece of cardboard, just enough to fill the area being worked on. Mix an equal amount of milled fiberglass with the resin, using a putty knife or stick. Add catalyst, according to kit instruction, to the resin and mix thoroughly. A hypodermic needle may be used to inject gel into small cavities not requiring fiberglass millings mixed with the gel.
4. Work the mixture of resin, fibers and catalyst into the damaged area, using the sharp point of a putty knife or stick to press it into the bottom of the hole and to puncture any air bubbles which may be present. Fill the scratch or hole above the surrounding undamaged area about 1/16 inch.

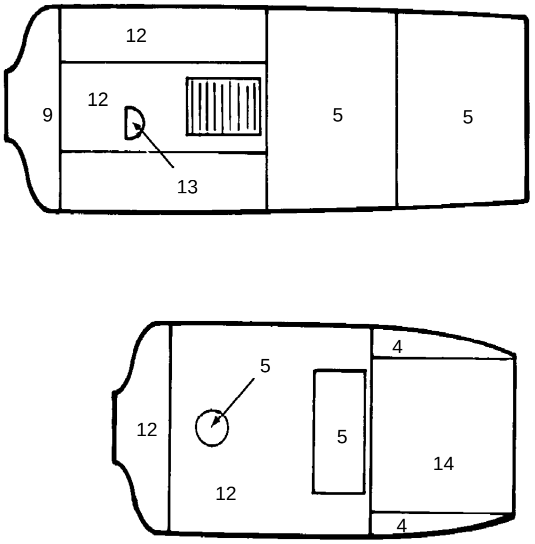


NUMBER	MATERIAL	THICKNESS
1	2024-T3	.018
2	2024-0*	.020
3	2024-T3	.020
4	2024-T3	.025
5	2024-T3	.032
6	2024-T3	.040
7	2024-T3	.051
8	2024-T3	.025
9	FIBERGLASS	
10	2024-T3	.020
11	THERMOPLASTIC OR FIBERGLASS	
12	2024-0*	.025
13	5052-H34	.040
14	321A ST. STL.	.016

Figure 51-1. Skin Material and Thickness (Sheet 1 of 2)



NUMBER	MATERIAL	THICKNESS
1	2024-T3	.018
2	2024-0*	.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	2024-0*	.025
13	5052-H34	.040
14	321A ST. STL.	.016



— NOTE —

Left wing shown, right wing opposite. Left nacelle shown, right nacelle opposite. * Heat treat to 2024 - T42 after forming.

Figure 51-1. Skin Material and Thickness (Sheet 2 of 2)

FIBERGLASS TOUCH-UP AND SURFACE REPAIRS (continued)

5. Lay a piece of cellophane or waxed paper over the repair to cut off air and start the cure of gel mixture.
6. Allow the gel to cure 10 to 15 minutes until it feels rubbery to the touch. Remove the cellophane and trim flush with the surface, using a sharp razor blade or knife. Replace the cellophane and allow to cure completely for 30 minutes to an hour. The patch will shrink slightly below the structure surface as it cures. (If wax paper is used, ascertain wax is removed from surface.)
7. Rough up the bottom and edges of the hole with an 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.
9. Using the tip of a putty knife or fingertips, fill the hole to about 1/16 inch above the surrounding surface with the gel coat mixture.
10. Lay a piece of cellophane over the patch to start the curing process. Repeat Step 6, trimming patch when partially cured.
11. After trimming the patch, immediately place another small amount of gel coat on cut edge of the patch and cover with cellophane. Then, using a squeegee or the back of a razor blade, squeegee level with area surrounding the patch, leave the cellophane on patch for one or two hours or overnight, for complete cure.
12. After repair has cured for 24 hours, sand the patched area using a sanding block with fine wet sandpaper. Finish by priming, again sanding and applying color coat.

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 the structure, bevel the edges to approximately a 30 degree angle and rough-sand the hole and the area around it, using 80-grit dry paper. Feather back for about two inches all around the hole. This roughens the surface for strong bond with patch.
5. Cover a piece of cardboard or metal with cellophane. Tape it to the outside of the structure covering the hole completely. The cellophane should face toward the inside of the structure. If the repair is on a sharp contour or shaped area, a sheet of aluminum formed to a similar contour may be placed over the area. The aluminum should also be covered with cellophane.
6. Prepare a patch of fiberglass mat and cloth to cover an area two inches larger than the hole.
7. Mix a 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 structures 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 the amount of reinforcements removed in order to maintain the original strength. If damage occurred as a stress crack, an extra layer or two of cloth may be used to strengthen area.

FIBERGLASS FRACTURE AND PATCH REPAIRS (continued)

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 the patch and they should all be worked out to the edge. Remove excess resin before it gels on the part. Allow patch to cure completely.
10. Remove cardboard or aluminum sheet from outside of hole and rough-sand the patch and edge of hole. Feather edge 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 the hole and one or more pieces of fiberglass cloth two inches larger than the hole. Brush catalyzed 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 the surface of structure. Wet out each layer thoroughly with resin.
12. With a squeegee or broad knife, work out all air bubbles in the patch. Work from center to edge, pressing patch firmly against the structure. Allow patch to cure for 15 to 20 minutes.
13. As soon as the 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 as acetone or methylethylketone. If solvents are not available, a strong solution of detergent and water may be used.

THERMOPLASTIC REPAIRS

The following procedure 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 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.

1. Surface Preparation:
   a. Surface dirt and paint, if applied, must be removed from the item being repaired. Household cleaners have proven most effective in removing surface dirt.
   b. Preliminary cleaning of the damaged area with perchlorethylene or VM & P Naptha will generally ensure

THERMOPLASTIC REPAIRS (continued)

CHART 5101. LIST OF MATERIALS (THERMOPLASTIC REPAIR)

ITEMS	DESCRIPTIONS	SUPPLIERS
Buffing and Rubbing Compounds	Automotive Type - DuPont #7	DuPont Company Wilmington, DE 19898
	Ram Chemical #69 x 1	Ram Chemicals Gardena, CA 90248
	Mirror Glaze #1	Mirror Bright Polish Co., Inc. Irvin, CA 92713
Cleaners	Fantastic Spray Perchlorethylene VM & P Naptha (Lighter Fluid)	Obtain From Local Suppliers
ABS-Solvent Cements	Solarite #11 Series	Solar Compounds Corp. Linden, NJ 07036
Solvents	Methylethyl Ketone Methylene Chloride Acetone	Obtain From Local Suppliers
Epoxy Patching Compound	Solarite #400	Solar Compounds Corp. Linden, NJ 07036
Hot Melt Adhesives Polyamids and Hot Melt Gun	Stick Form 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

2. Surface Scratches, Abrasion or Ground-in-Dirt: (Refer to Figure 51-2.)
   a. Shallow scratches and abraded surfaces are usually repaired by following directions on containers of conventional automotive buffing and rubbing compounds.
   b. If large dirt particles are embedded in thermoplastic parts, they can be removed with a hot air gun capable of supplying heat in the temperature range of 300° to 400°F. Use care not to overheat the material. Hold the nozzle of the gun about 1/4 of an inch away from the surface and apply heat with a circular motion until the area is sufficiently soft to remove the dirt particles.
   c. The thermoplastic will return to its original shape upon cooling.

THERMOPLASTIC REPAIRS (continued)

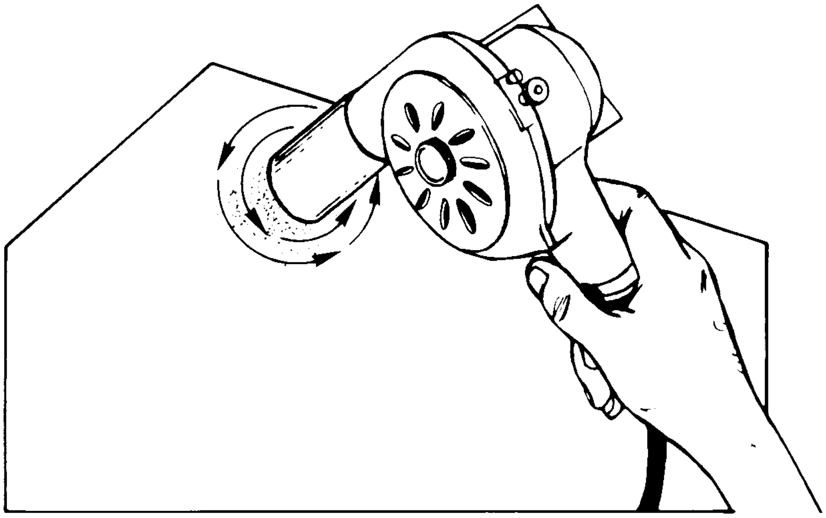


Figure 51-2. Surface Scratches, Abrasions or Ground-in-Dirt

3. Deep Scratches, Shallow Nicks and Small Holes: (Less than 1 inch in diameter.) (Refer to Figure 51-3).
    a. Solvent cements will fit virtually any of these applications. If the 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 the desired paste-like consistency is achieved.
    b. This mixture is then applied to the damaged area. Upon solvent evaporation, the hard durable solids remaining can easily be shaped to the desired contour by filing or sanding.
    c. Solvent adhesives are not recommended for highly stressed areas, on thin walled parts or for patching holes greater than 1/4 inch in diameter.
    d. For larger damages an epoxy patching compound is recommended. This type material is a two part, fast curing, easy sanding commercially available compound.
    e. Adhesion can be increased by roughing the bonding surface with sandpaper and by utilizing as much surface area for the bond as possible.
    f. The patching compound is mixed in equal portions on a hard flat surface using a figure eight motion. The damaged area is cleaned with perchlorethylene or VM & P Naptha prior to applying the compound. (Refer to Figure 51-4.)
    g. A mechanical sander can be used after the compound is cured, providing the sander is kept in constant motion to prevent heat buildup.
    h. For repairs in areas involving little or no shear stress the hot melt adhesives, polyamids which are supplied in stick form may be used. This type of repair has a low cohesive strength factor.
    i. For repairs in areas involving small holes, indentions or cracks in the material where high stress is apparent or thin walled sections are used, the welding method is suggested.
    j. This welding method requires a hot air gun and ABS rods. To weld, the gun should be held to direct the flow of hot air into the fusion (repair) zone, heating the damaged area and rod simultaneously. The gun should be moved continuously in a fanning motion to prevent discoloration of the material. Pressure must be maintained on the rod to ensure good adhesion. (Refer to Figure 51-5.)
    k. After the repair is completed, sanding is allowed to obtain a surface finish of acceptable appearance.

THERMOPLASTIC REPAIRS (continued)

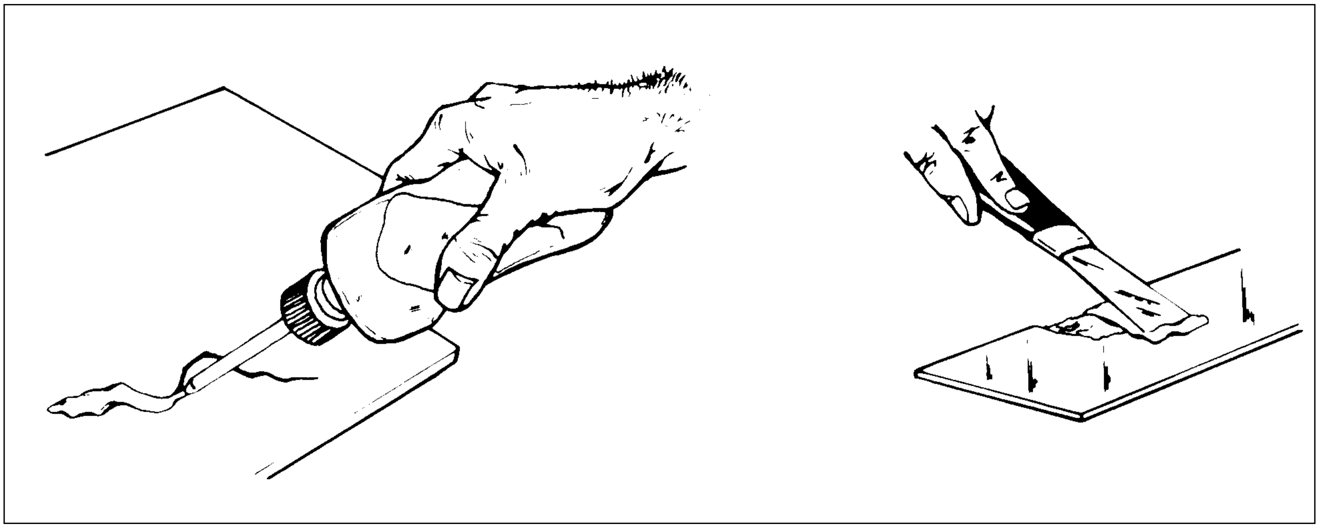


Figure 51-3. Deep Scratches, Shallow Nicks and Small Holes

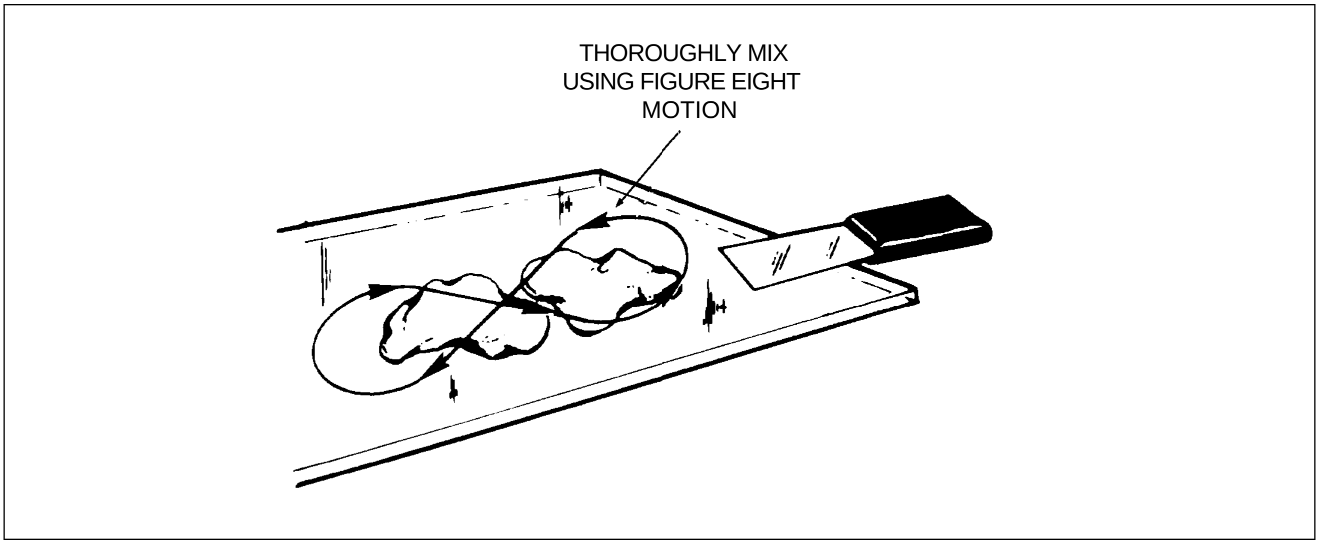


Figure 51-4. Mixing of Epoxy Patching Compound

4. Cracks: (Refer to Figure 51-6.)
   a. Before repairing a crack in the thermoplastic part, first determine what caused the crack and alleviate that condition to prevent it recurring after the repair is made.
   b. Drill small stop holes at each end of the crack.
   c. If possible, a double plate should be bonded to the reverse side of the crack to provide extra strength to the part.
   d. The 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.
   e. After the repair has cured, it may be sanded to match the surrounding finish.

THERMOPLASTIC REPAIRS (continued)

5. Repairing Major Damage: (Larger than 1 inch in diameter.) (Refer to Figure 51-7.)
    a. If possible a patch should be made of the same material and cut slightly larger than the section being repaired.
    b. When appearances are important, large holes, tears, etc, should be repaired by cutting out the damaged area and replacing it with a piece of similar material.
    c. When cutting away the damaged area, under cut the perimeter and maintain a smooth edge. The patch and/or plug should also have a smooth edge to insure a good fit.
    d. Coat the patch with solvent adhesive and firmly attach it over the damaged area.
    e. Let the patch dry for approximately one hour before any addition work is performed.
    f. The hole, etc, is then filled with the repair material. A slight overfilling of the repair material is suggested to allow for sanding and finishing after the repair has cured. If patching compound is used, the repair should be made in layers, not exceeding 1/2 inch in thickness at a time, thus allowing the compound to cure and ensuring a good solid buildup of successive layers as required.

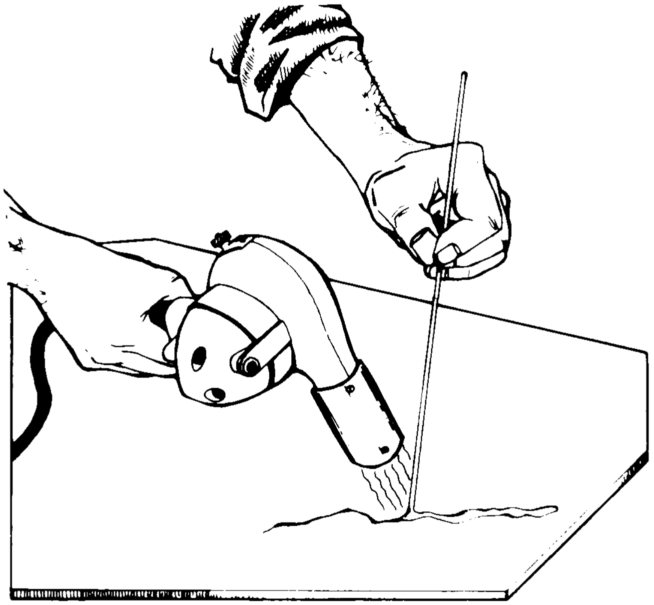


Figure 51-5. Welding Repair Method

6. Stress Lines: (Refer to Figure 51-8.)
    a. Stress lines produce a whitened appearance in a localized area and generally emanate from the severe bending or impacting of the material. (Refer to Figure 51-9.)
    b. To restore the material to its original condition and color, use a hot gun or similar heating device and carefully apply heat to the affected area. Do not overheat the material.

THERMOPLASTIC REPAIRS (continued)

7. Painting the Repair:
   a. An important factor in obtaining a quality paint finish is the proper preparation of the repair and surrounding area before applying any paint.
   b. 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.
   c. The paint used for coating thermoplastic can be either lacquers or enamels depending on which is preferred by the repair facility or customer. (See NOTE.)

— 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 the paints can significantly affect and degrade the plastic properties.

   d. 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 coatings may crack, thus creating a weak area.

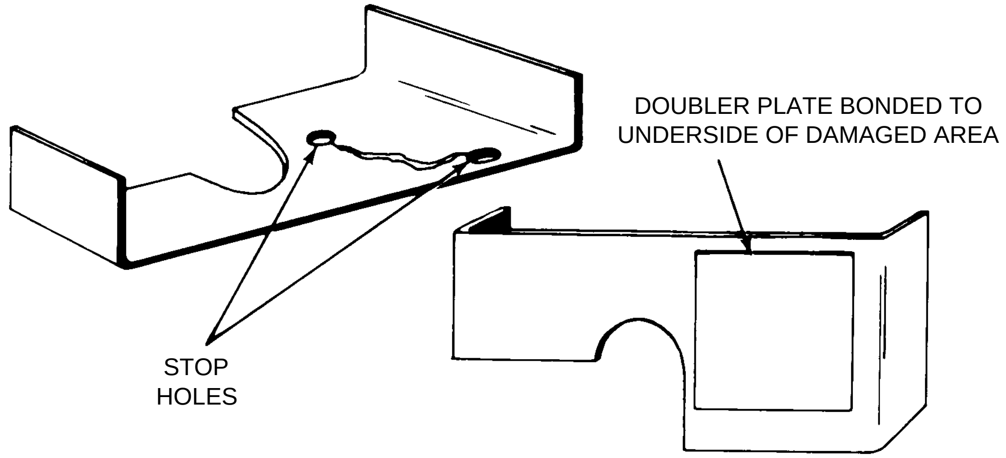


Figure 51-6. Repairing of Cracks

THERMOPLASTIC REPAIRS (continued)

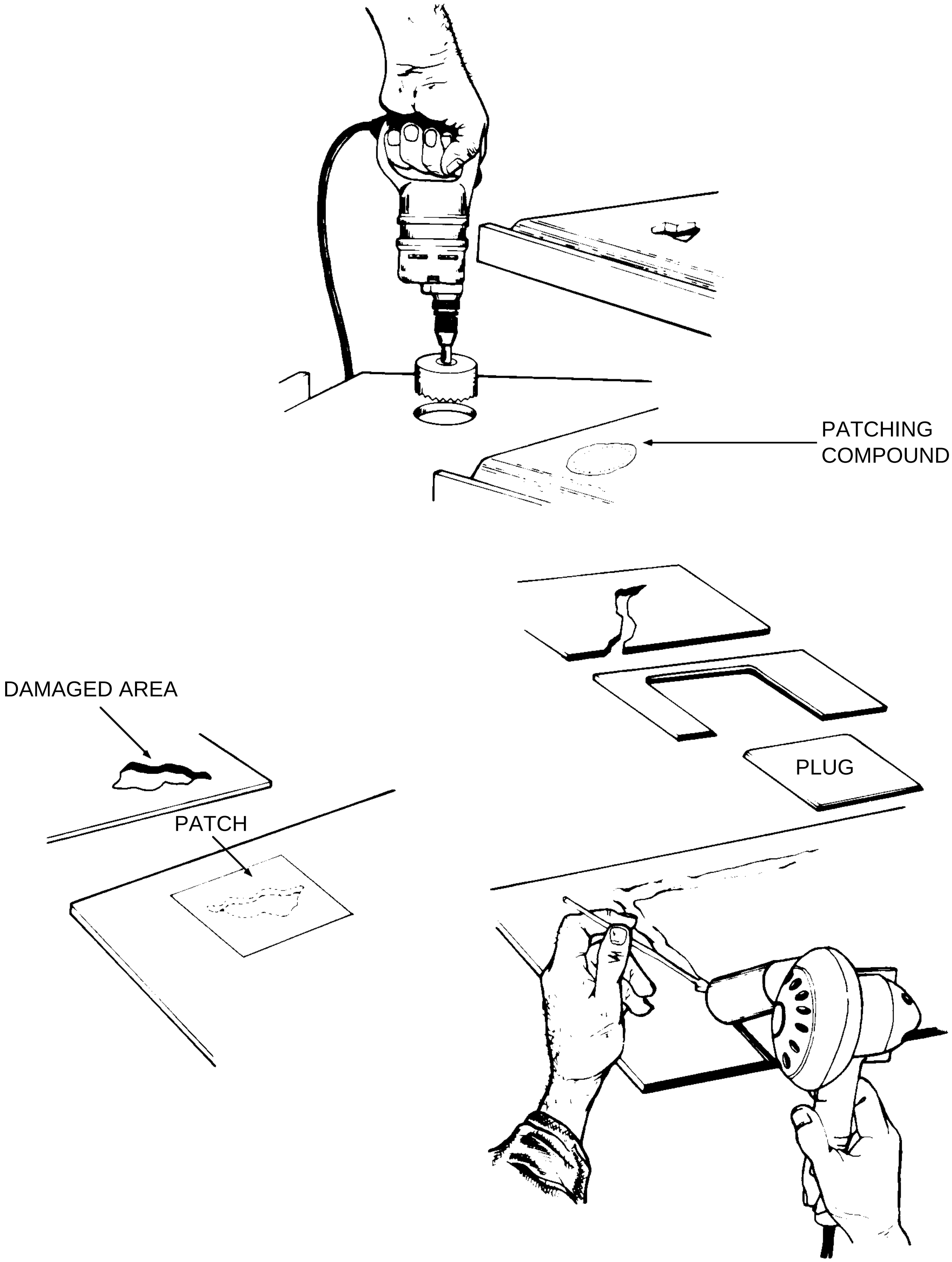
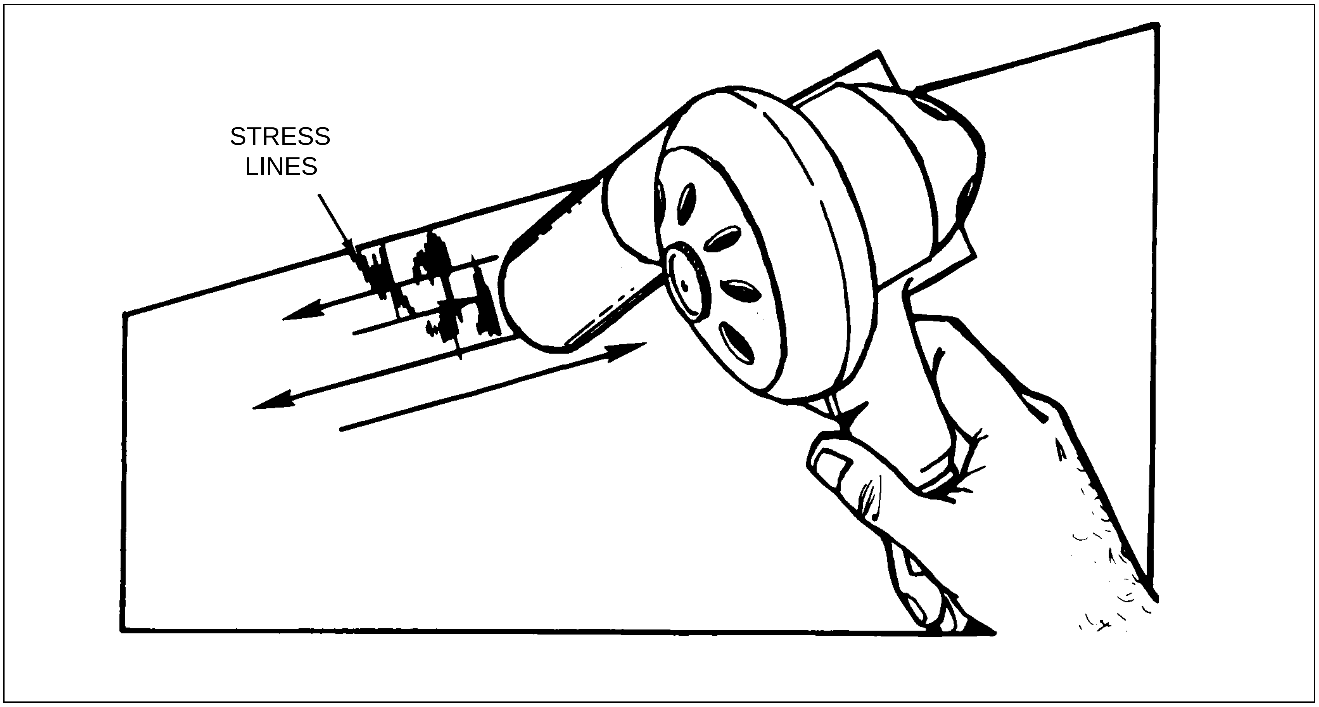
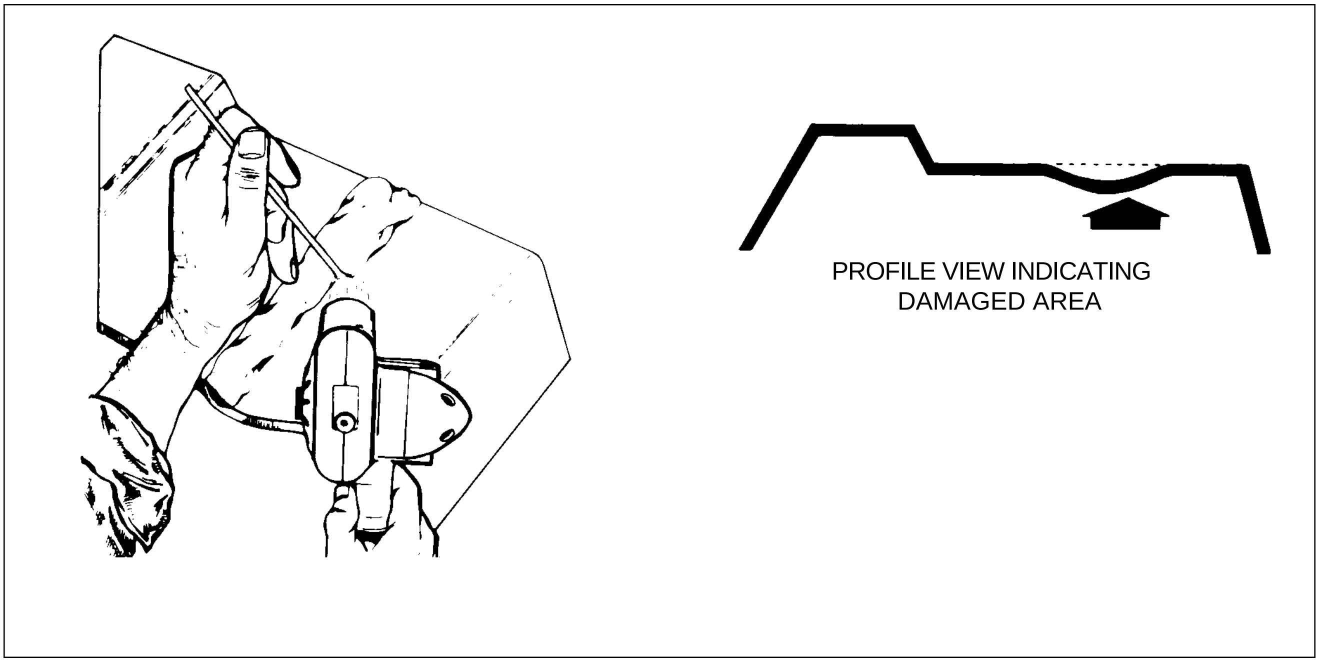


Figure 51-7. Various Repairs

THERMOPLASTIC REPAIRS (continued)



51-8. Stress Lines



51-9. Repair of Impact Damage

SAFETY WALK REPAIR

SURFACE PREPARATION

1. Clean all surfaces with a suitable cleaning solvent to remove dirt, grease and oils. Solvents may be applied by dipping, spraying or mopping.
2. Ensure that no moisture remains on the surface by wiping with a clean dry cloth.
3. Outline the area to which the liquid safety walk compound is to be applied and mask adjacent surfaces.

— NOTE —

Newly painted surfaces shall be allowed to dry for 2.5 hours minimum prior to the application of the safety walk.

PRODUCT LISTING FOR LIQUID SAFETY COMPOUND

1. Suggested Solvents:
   Safety Solvent per MIL-S-18718
   Sherwin Williams Lacquer Thinner R7KC120
   Glidden Thinner No. 207
2. Safety Walk Material:
   Walkway Compound and Matting Nonslip (included in Piper Part No. 179872)

APPLICATION OF LIQUID SAFETY WALK COMPOUND

Liquid safety walk compound shall be applied in an area, freee 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:

1. Mix and thin the liquid safety walk compound in accordance with the manufacturer's instructions on the container.
2. Coat the specified surfaces with a smooth, unbroken film of the liquid safety walk compound. A nap type roller or a stiff bristle brush is recommended, using fore and aft strokes.
3. Allow the coating to dry for 15 minutes to one hour before recoating or touch-up; if required after application of the initial coating.
4. After recoating or touch-up, if done, allow the coating to dry for 15 minutes to one hour before removing masking.

— NOTE —

The coated surface shall not be walked on for six hours minimum after application of final coating.

PRESSURE SENSITIVE SAFETY WALK.

SURFACE PREPARATION FOR PRESSURE SENSITIVE SAFETY WALK.

The areas to which the pressure sensitive safety walk is to be installed must be free from all contaminates and no moisture present. If liquid safety walk is currently installed the area must be prepared as follows:

1. Area must be masked off to protect painted surfaces.
2. Apply suitable stripper MEK Federal Spec. TT-M-261, U.S. Rubber No. 3339 to wingwalk compound. As compound softens remove by using putty knife or other suitable tool.

SURFACE PREPARATION FOR PRESSURE SENSITIVE SAFETY WALK. (continued)

3. Area must be clean and dry prior to painting.
4. Prime and paint area.

— NOTE —

Newly painted surfaces shall be allowed to dry for 2.5 hours minimum prior to the application of the safety walk.

APPLICATION OF PRESSURE SENSITIVE SAFETY WALK.

Wipe area with a clean dry cloth to ensure that no moisture remains on surface. Do not apply when surface temperature is below 50°F. Apply pressure sensitive safety walk as follows:

1. Peel back the full width of the protective liner approximately 2 inches from the leading edge of the safety walk.
2. Apply the safety walk to the wing area, begin at the leading edge, ensure proper alignment and position from wing lap.
3. Remove the remaining protective liner as the safety walk is being applied from front to back of wing area.
4. Roll firmly with a long handled cylindrical brush in both lengthwise directions. Make sure all edges adhere to the wing skin.
5. Install and rivet leading edge retainer.

— END —

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CHAPTER

52

DOORS

CHAPTER 52 - DOORS

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

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 right side of the fuselage at station 41.1.

REMOVAL AND INSTALLATION OF DOOR SNUBBERS

Door snubber seals have been incorporated in the three door jambs to improve on door sealing. For those aircraft equipped as such, the following procedure should be used. If snubbers are not installed, the Field Kit for Improved Sealing (Piper p/n 763-993V), should be consulted for installation if so desired.

— NOTE —

If the existing seal is torn or badly deteriorated, it should be replaced. If the seal is found to be loose, or the bond is marginal, it should be rebonded. The adhesives listed below are recommended for the following procedure:

1. Carboline Adhesive F-l,
2. Scotch Grip 2210,
3. Proco #6205-1.

Refer to the List of Consumable Materials for vendor information.

1. To remove the snubber proceed as follows:
   a. Back off the windlacing trim screws, tape the windlacing back out of the way. Remove all scuff plates and disconnect door holders.
   b. With mineral spirits, soak the edges of the snubber all around the door jamb.
   c. With a plastic scraper or other appropriate instrument, scrape off the snubber while applying mineral spirits as necessary to loosen the strip.
   d. With mineral spirits and a clean cloth clean off all excess adhesive.
2. Before proceeding with installation instructions make sure the windlacing is rolled back far enough to prevent adhesive from coming in contact with it.
3. If the door jamb is flaking or excessively scuffed proceed as follows:
   a. Rub down and feather the finish with wet or dry emery cloth. Make sure to go over the surface with fine (400 grit) paper.
   b. Go over the surface with Prep-Sol or other type of cleaner that will not leave an oily residue.
   c. Prime, sand (400 grit), and paint affected area. Wait for paint to dry before proceeding.
4. Go over the entire door jamb with Prep-Sol or other cleaner that will not leave an oily residue.

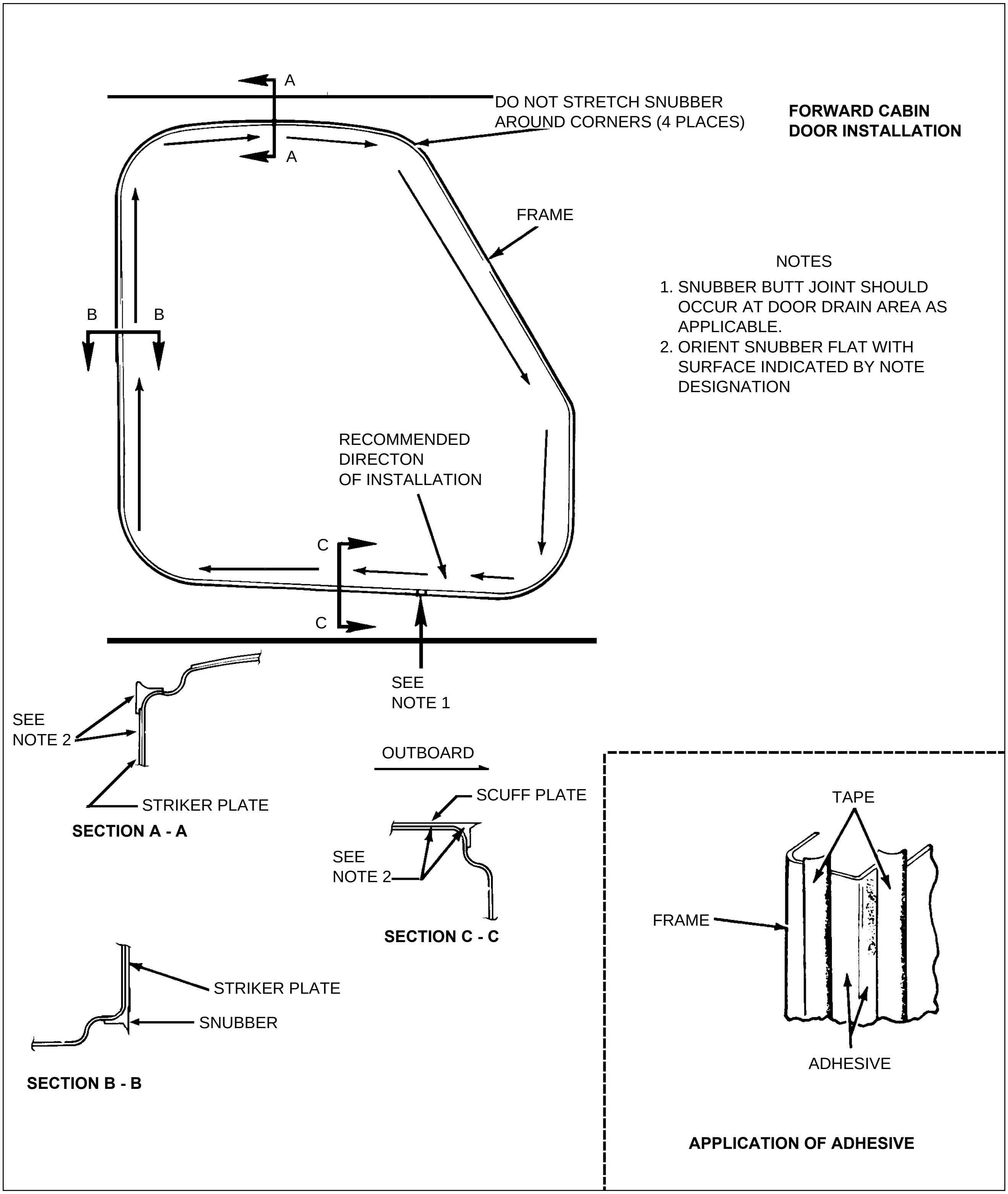
— NOTE —

Normal tack time for Carboline F-1 (which is used as a reference) is 30 to 45 minutes, less in a warm area.

— NOTE —

On forward cabin door make sure leg of snubber goes under striker plate on side latch and over the striker plate for the upper latch.

REMOVAL AND INSTALLATION OF DOOR SNUBBERS (continued)

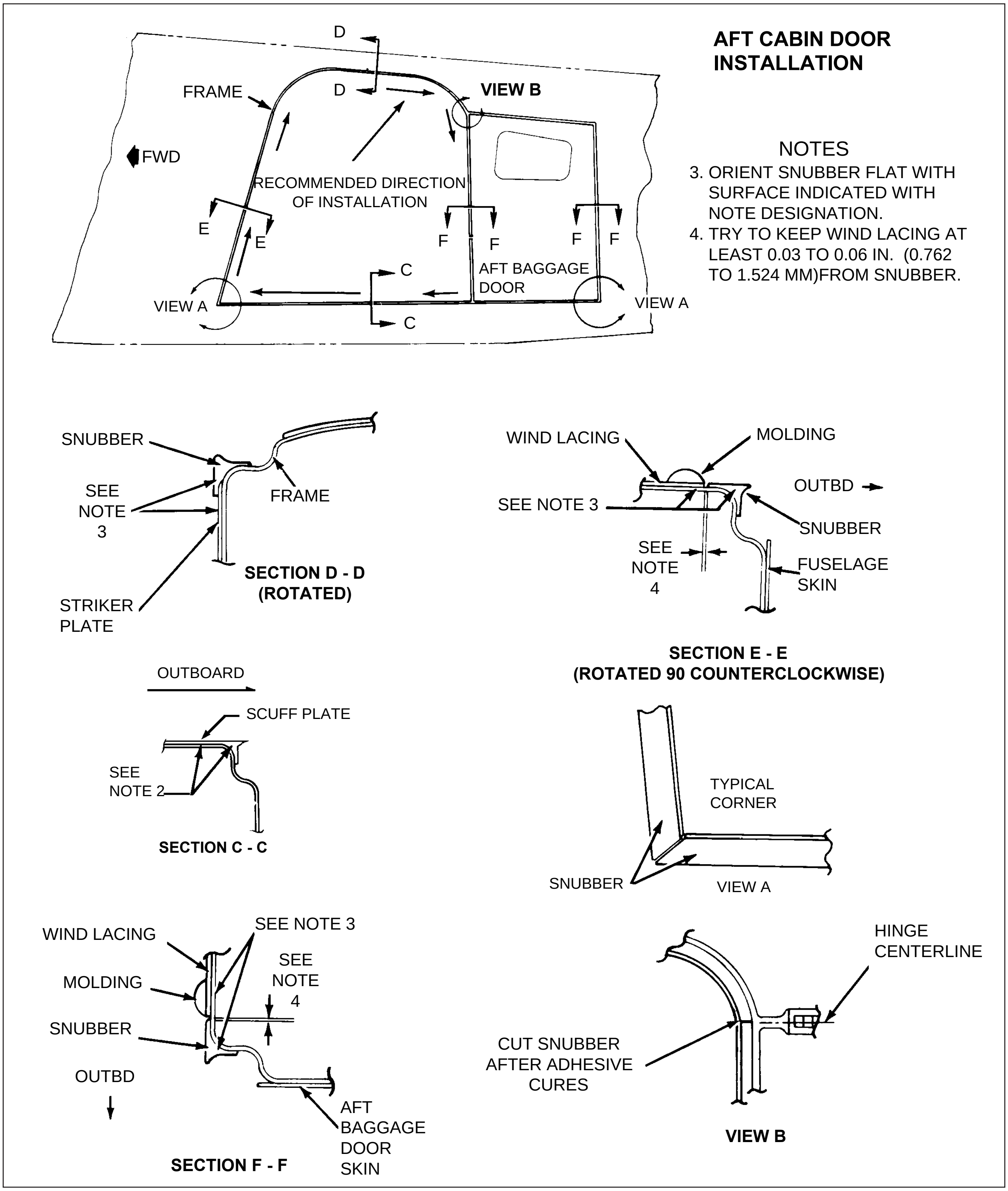


NOTES

1. SNUBBER BUTT JOINT SHOULD OCCUR AT DOOR DRAIN AREA AS APPLICABLE.
2. ORIENT SNUBBER FLAT WITH SURFACE INDICATED BY NOTE DESIGNATION

Figure 52-1. Snubber Installation - Forward Cabin Door (Sheet 1 of 3)

REMOVAL AND INSTALLATION OF DOOR SNUBBERS (continued)



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.

Figure 52-1. Snubber Installation - Aft Cabin Door (Sheet 2 of 3)

REMOVAL AND INSTALLATION OF DOOR SNUBBERS (continued)

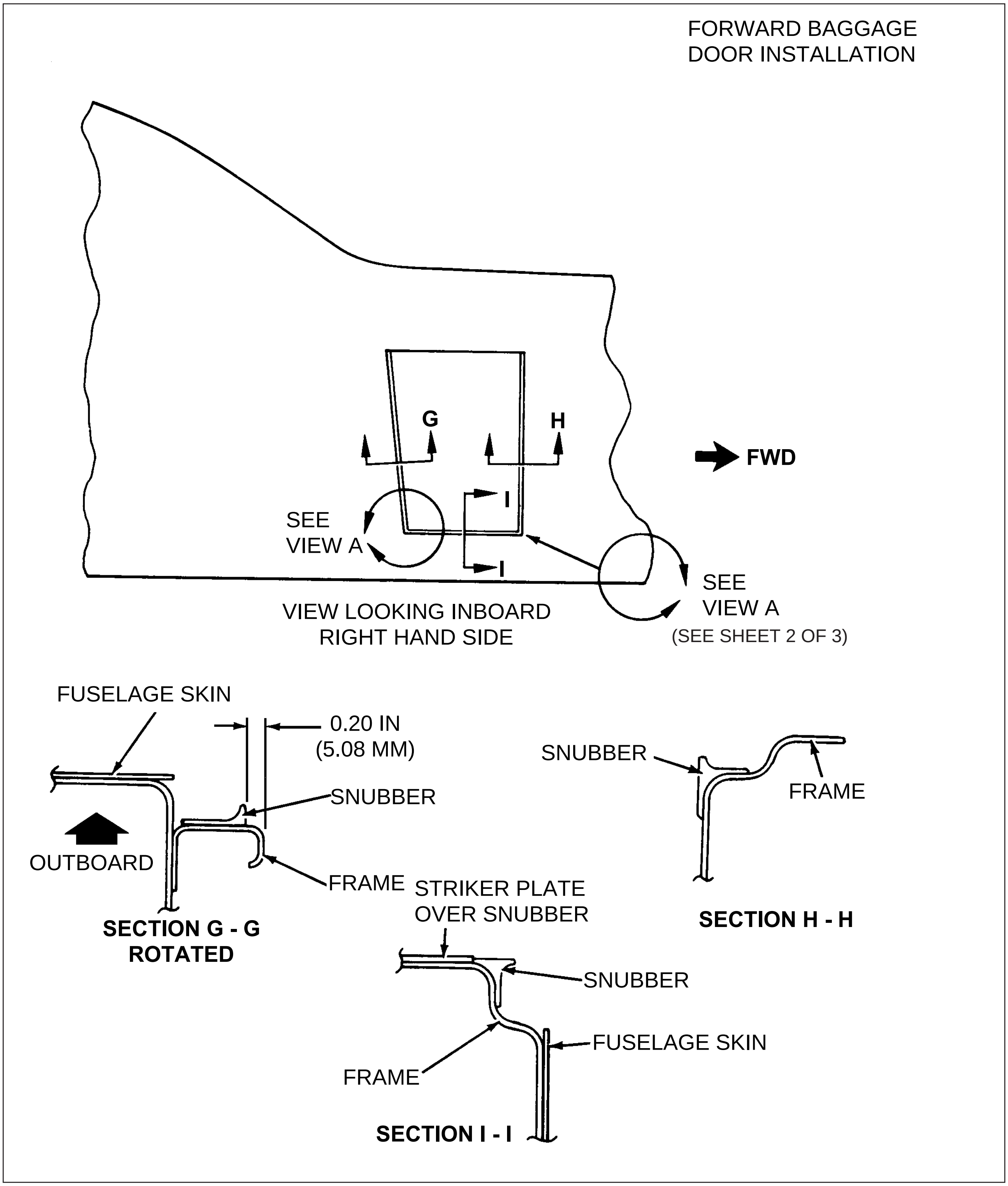


Figure 52-1. Snubber Installation - Forward Baggage Door (Sheet 3 of 3)

REMOVAL AND INSTALLATION OF DOOR SNUBBERS (CONTINUED)

On the aft cabin and cargo doors, make sure the baggage door is closed and start at the forward edge of the cabin door working upward. Make sure leg of snubber is under striker plate.

6. Although not critical, it is recommended that masking tape be applied to the door jamb at the borders of the area to be glued. (Refer to Figure 52-1 (Sheet 2 of 3).
7. Apply adhesive to the affected area on the door jamb and the inside surface of the snubber. It is recommended that the snubber be installed before the adhesive becomes tacky enabling manipulation of the snubber. Toluol can be used as a thinner to clean tools used during installation.
8. Position the snubber with the teat facing outboard, applying pressure to ensure a proper bond. DO NOT prestretch the snubber. Stretching the snubber will cause cracks.
9. Wait for at least two hours for the bond to cure. DO NOT allow door to close. The bond will cure more efficiently with the door left open and a maximum cure age will be effected.
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 52-1 (Sheet 2 of 3).
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

REMOVAL OF DOOR

1. Remove the clevis bolt, washer and bushing from the door holder assembly.
2. Remove cotter pins, clevis pins and washers from serrated door hinges.
3. Remove the door from the airplane.

INSTALLATION OF DOOR

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 of Door.
3. Hook up and install the clevis bolt, bushing and washer into the door holder assembly.

ADJUSTMENT OF DOOR

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, it is recommended they be lubricated with a dry lubricant in a spray can.

REMOVAL OF DOOR LATCH MECHANISM

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.

INSTALLATION OF DOOR LATCH MECHANISM

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.

ADJUSTMENT OF DOOR LATCH MECHANISM

To adjust the door latch, loosen the screws on the striker plate, make necessary adjustment, and retighten the screws.

REMOVAL OF DOOR LOCK ASSEMBLY

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.

INSTALLATION OF DOOR LOCK ASSEMBLY

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.

REMOVAL OF DOOR SAFETY LATCH

1. Remove the two handles and the five 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.

INSTALLATION OF DOOR SAFETY LATCH

1. Place the latch assembly into position for installation.
2. Replace the pan and install the five screws and handles.
3. Check the latch assembly for operation and be certain that it is free of rubbing on the trim panels.

ADJUSTMENT OF DOOR SAFETY LATCH

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.

— END —

CARGO

REMOVAL OF BAGGAGE DOOR

With the door open remove the hinge pin from the hinge and remove the door.

INSTALLATION OF BAGGAGE DOOR

Place the door in position so that the hinge halves are properly matched and install the hinge pin. It will not be necessary to replace the hinge pin with a new pin if it is free of bends and wear.

REMOVAL OF BAGGAGE DOOR LOCK ASSEMBLY

1. With the door open, remove the nut from the back of the lock assembly by use of a special made wrench. (This tool may be fabricated from the dimensions given in Chapter 91.)
2. Remove the lock assembly through the front of the door.

INSTALLATION OF BAGGAGE DOOR LOCK ASSEMBLY

1. Place the lock into position for installation.
2. Install the nut on the lock assembly and tighten with the use of a special wrench.

REMOVAL OF BAGGAGE DOOR HINGE

1. Remove the door from the airplane as described in Removal of Baggage Door.
2. Remove the hinge half from the airplane or door by drilling out the rivets and removing the hinge.

INSTALLATION OF BAGGAGE DOOR HINGE

1. Place the hinge halves together and install the hinge pin.
2. Install the door into the closed position and drill the two end rivet holes and install the rivets.
3. Operate the door and check for proper fit and installation. Drill the remaining holes and install the rivets.

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CHAPTER

55

STABILIZERS

CHAPTER 55 - STABILIZERS

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

Refer to Figure 1 for overview of empennage assemblies.

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 of a heavy pad to protect the bulkheads so as not to damage the fuselage skin or bulkhead.

CHECKING CONTROL SURFACES FREE PLAY

The following checks are recommended before balancing to determine the amount of free play in the stabilator trim tab and aileron:

1. Stabilator and Aileron: 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.
2. 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 Chapter 27 of this Service Manual 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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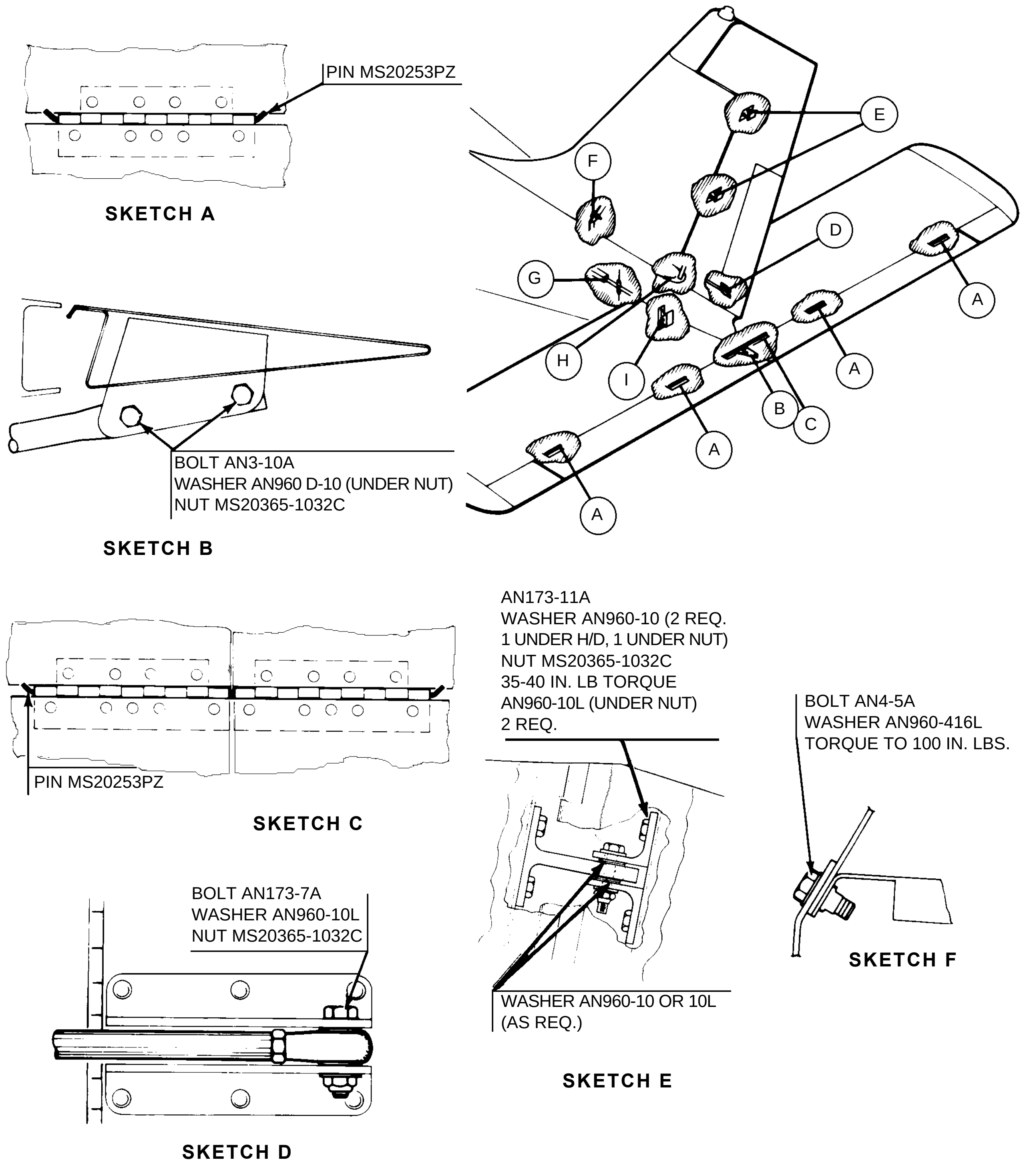

Figure 55-1. Empennage Assemblies (Sheet 1 of 2)

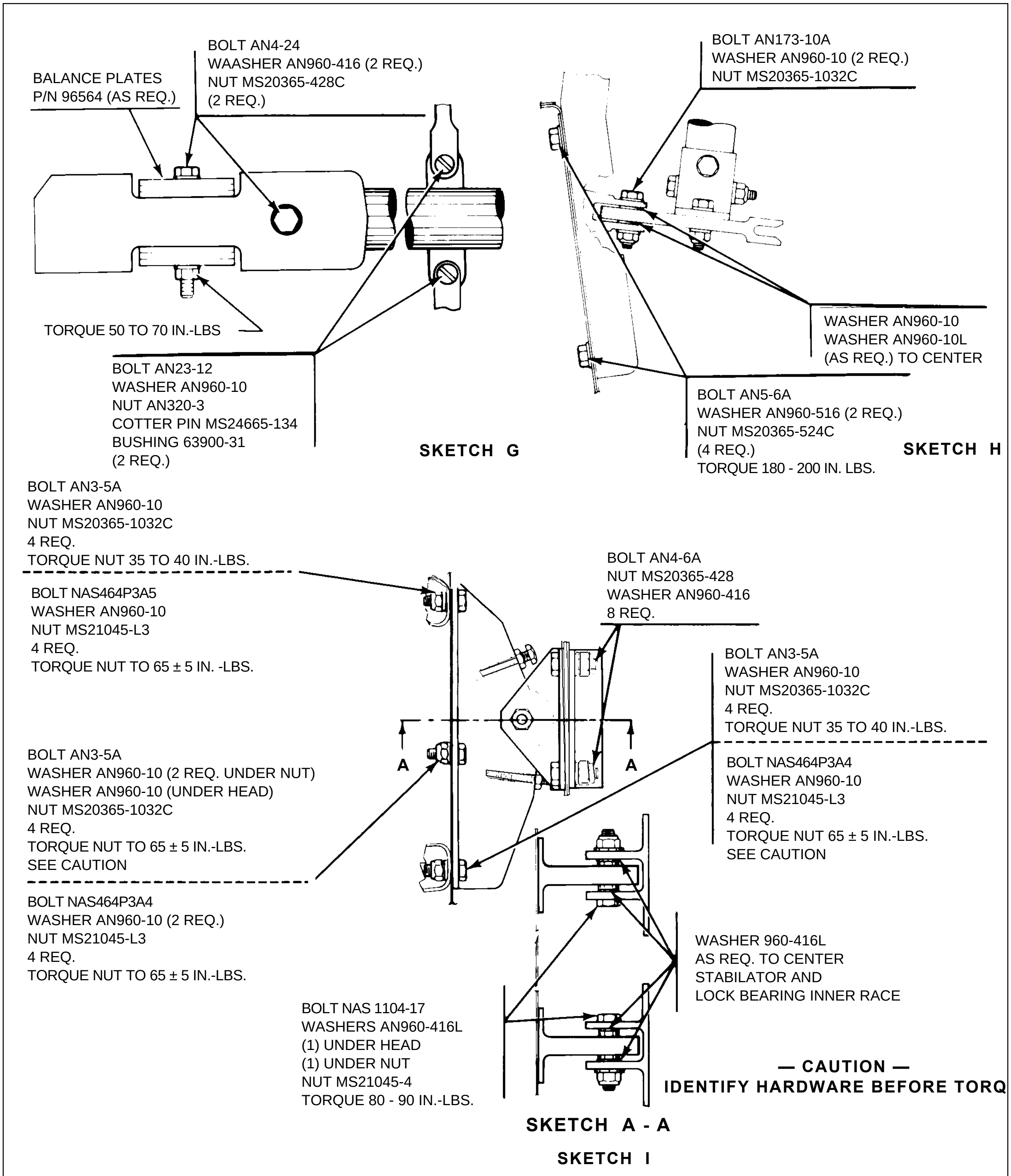

Figure 55-1. Empennage Assemblies (Sheet 2 of 2)

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STABILATOR

REMOVAL OF STABILATOR

— NOTE —

Should it be necessary to move the rudder to its extreme left or right or clearance, do so with the use of the rudder pedals or tow bar.

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, as illustrated in Figure 55-2, 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 stabilator by disconnecting the stabilator at its hinge points.

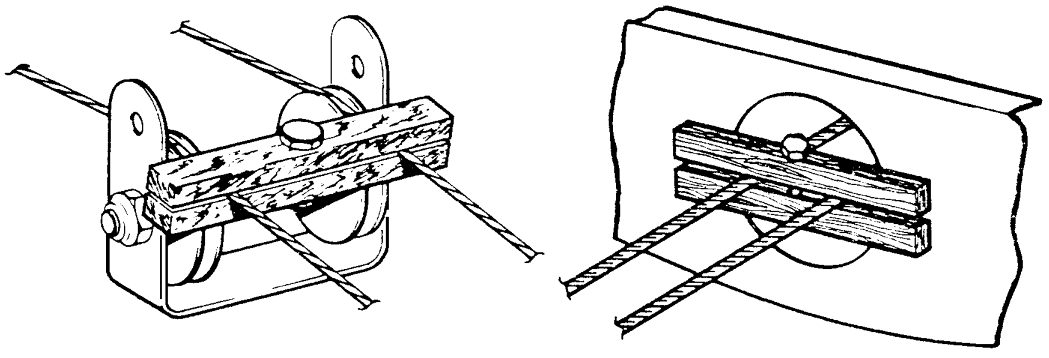


Figure 55-2. Blocking Control Cables

BALANCING EQUIPMENT (Refer to Chapter 95.)

The balancing must be done using a suitable tool capable of measuring unbalance in inch-pounds from the centerline of the control surface hinge pin. A suggested tool configuration is shown in Chapter 95. Other tool configurations may be used, provided accuracy is maintained and calibration capability is provided. The tool shown in Chapter 95 may be calibrated by placing it on the control surface to be balanced with the balance points over the control surface hinge centerline and the balance bar parallel to the chord line. Position the trailing edge support to align the tool with the control surface chord line and secure in this position. Remove the tool without disturbing the trailing edge support and balance the tool by adding weight to the light end as required. (The movable weight must be at the centerline.) Place the tool on the control surface perpendicular to the hinge centerline. Read the scale when the bubble level has been centered by adjustment of the movable weight.

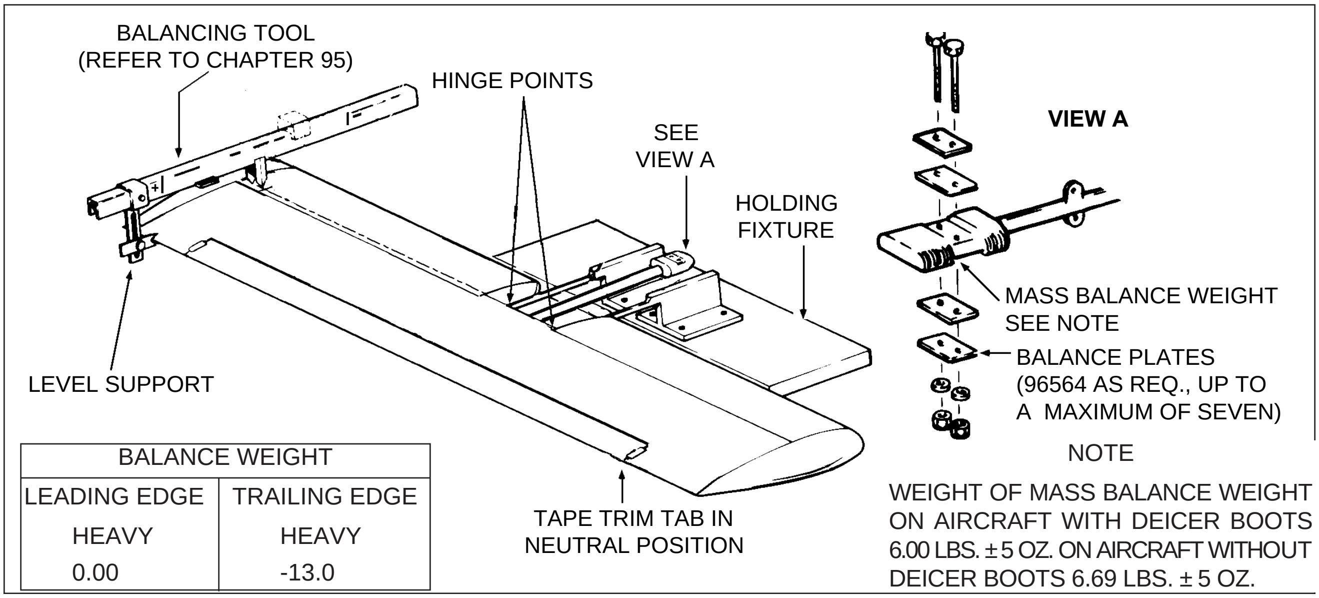
BALANCING STABILATOR (Refer to Figure 55-3.)

WARNING

Stabiltor must be rebalanced any time it is repainted, or deicer boots are added or removed.

To balance the stabilator, the assembly must be complete including the trim tab, the tab push rod and end bearing, stabilator tips and all attaching screws. Before balancing, tape the trim tab in neutral position with a small piece of tape. In a draft free area, set up the mechanism as shown in Figure 55-3 making sure there is unrestricted movement. Do not place the tool on the trim tab. Calibrate the tool as described in Balancing Equipment. Read the scale when the bubble level has been centered by adjustment of the movable weight and determine the static balance limit. If the static balance is not within the limits given, 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 the stabilator is out of limits on the trailing edge heavy side, add balance plates (up to seven maximum) to the mass balance weight until the static balance is within limits.



BALANCE WEIGHT	
LEADING EDGE HEAVY	TRAILING EDGE HEAVY
0.00	-13.0

NOTE

WEIGHT OF MASS BALANCE WEIGHT ON AIRCRAFT WITH DEICER BOOTS 6.00 LBS. ± 5 OZ. ON AIRCRAFT WITHOUT DEICER BOOTS 6.69 LBS. ± 5 OZ.

Figure 55-3. Stabilator Balancing

INSTALLATION OF STABILATOR (Refer to Figure 55-1.)

— NOTE —

A clearance of 0.25 ± .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.
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.
6. Set stabilator control cable tension and check rigging and adjustment according to Rigging and Adjustment of Stabilator Trim, Chapter 27.
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 of Stabilator Trim, Chapter 27.
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.

— NOTE —

When stabilator and/or stabilator trim tab is replaced, the balance may be disturbed. Rebalancing is required.

STABILATOR TRIM TAB

REMOVAL OF STABILATOR TRIM TAB (Refer to Figure 55-1.)

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.

INSTALLATION OF STABILATOR TRIM TAB (Refer to Figure 55-1.)

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.

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VERTICAL STABILIZER

REMOVAL OF VERTICAL FIN (Refer to Figure 55-1.)

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 instructions given previously.
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 Removal of Rudder Trim Assembly, Chapter 27.
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.

INSTALLATION OF VERTICAL FIN (Refer to Figure 55-1.)

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. Install the rudder trim assembly and trim cable per instructions given in Installation of Rudder Trim Assembly, Chapter 27.
4. Install the rudder per previous instructions.
5. Pull the electrical and antenna leads through the vertical fin with the line that was attached.
6. Connect the antenna leads to the proper terminals and secure with the washers and nuts.
7. Connect the electrical leads at the disconnects and insulate.
8. Rig and adjust the rudder and trim control cables as given in Chapter 27.
9. Check the operation of the radios and electrical lights.
10. Replace all fairings and access plates and secure with attaching screws.

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RUDDER

REMOVAL OF RUDDER (Refer to Figure 55-1.)

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.

INSTALLATION OF RUDDER (Refer to Figure 55-1.)

1. Place the rudder in position and install the hinge bolts, washers, nuts, and cotter pins.

— NOTE —

Use any washer combination of the hinge assembly to suit best, the 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 Rigging and Adjustment of Rudder, Section V.
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.

— NOTE —

When rudder and/or rudder trim tab is replaced, the balance may be disturbed. Rebalancing is required.

RUDDER TRIM TAB

REMOVAL OF RUDDER TRIM TAB (Refer to Figure 55-1.)

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.

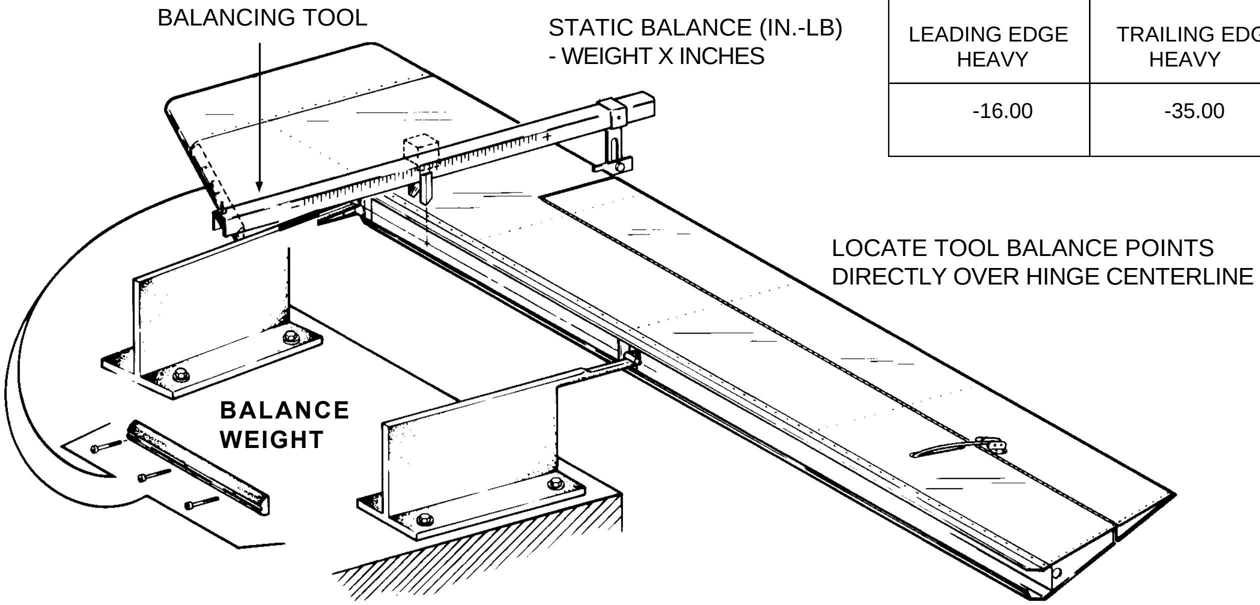
INSTALLATION OF RUDDER TRIM TAB (Refer to Figure 55-1.)

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.

BALANCING RUDDER (Refer to Figure 55-4.)

To balance the rudder, the assembly must be complete including sector assembly. Place the complete assembly horizontally on knife edge support in a draft-free area in a manner that allows unrestricted movement. Place the tool on the rudder with the beam perpendicular to the hinge centerline. Calibrate the tool as described in Balancing Equipment. Read the scale when the bubble level has been centered by adjustment of the movable weight and determine the static balance limit. If the static balance is not within the limits given, proceed as follows:

1. Nose Heavy: This condition is highly improbable; recheck calculations and measurements.
2. Nose Light: 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.



STATIC BALANCE (IN.-LB) - WEIGHT X INCHES

LEADING EDGE HEAVY	TRAILING EDGE HEAVY
-16.00	-35.00

Figure 55-4. Rudder Balancing

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CHAPTER

56

WINDOWS

CHAPTER 56 - WINDOWS

TABLE OF CONTENTS/EFFECTIVITY

FLIGHT COMPARTMENT

REMOVAL OF WINDSHIELD

The Seneca III and IV have a one-piece windshield. As shown in Figure 56-1, 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. To facilitate installation, the screws should be cross marked to the collars ensuring the proper screws are replaced in their appropriate positions.

1. Remove the screws around the forward part of the windshield.
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 —

> It is recommended that the old or damaged windshield be saved for use as a pattern for ensuring the proper outline of 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.

INSTALLATION OF WINDSHIELD (Refer to Figure 56-1.)

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.
2. Apply black vinyl tape to the inside collar surfaces that mate to the windshield and outside collars. Refer to Figure 56-1, 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 if aft into the fuselage channel.
5. Apply vinyl foam tape (see List of Consumable Materials, Chapter 91) to the inside of the outer collars and loosely connect them to the fuselage around the edge of the windshield.
6. Apply sealant ((PRC) PR 307, as specified in List of Consumable Materials) by forcing it under the flange edges specified in Figure 56-1. 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 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.

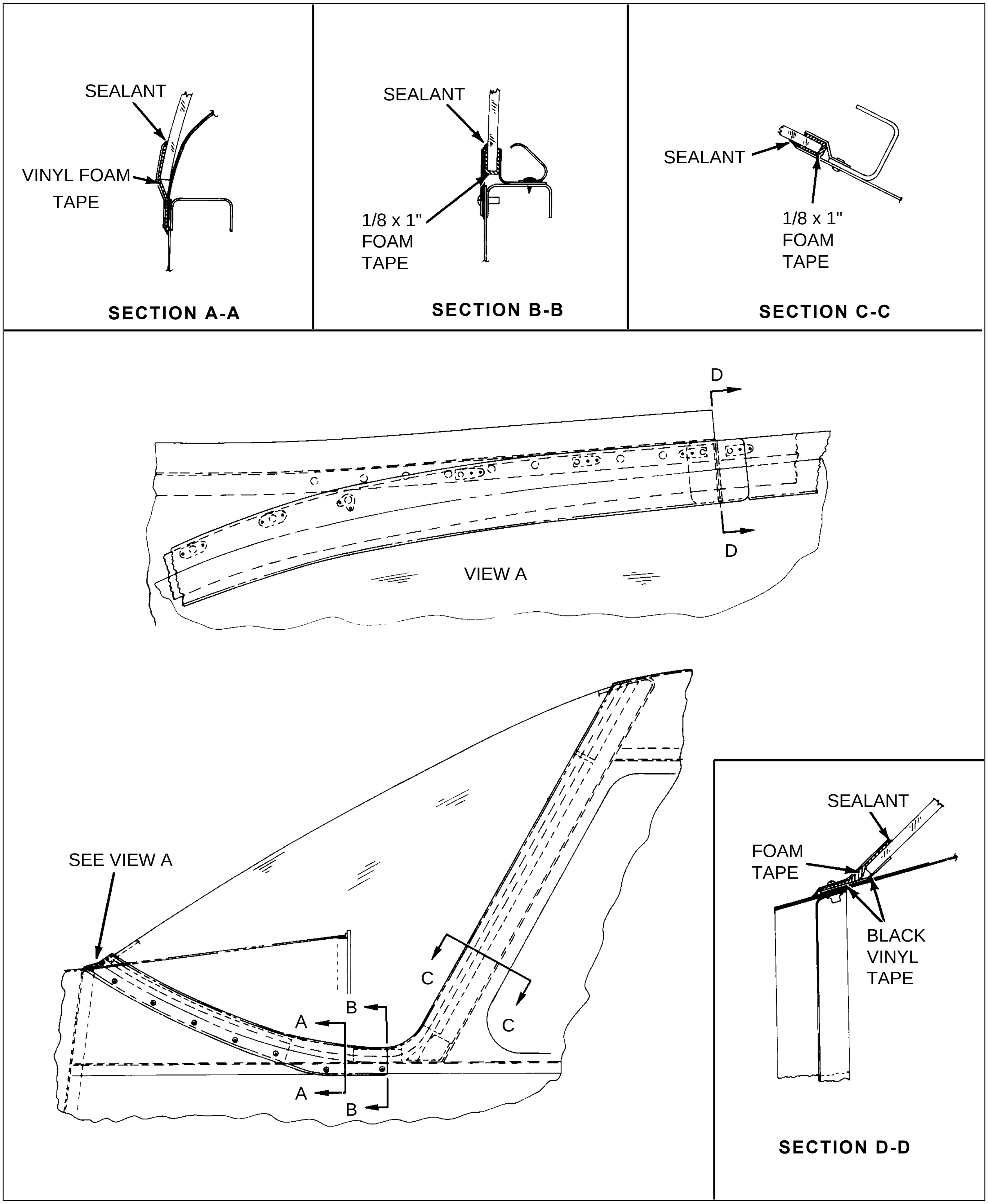

Figure 56-1. Windshield Installation (Typical)

CABIN

REMOVAL OF SIDE WINDOWS

The Seneca III is equipped with single pane side windows. For removal of the windows, the following instructions may be used:

1. Single Pane.
   a. Remove the retainer molding from around the window by removing the attachment screws or rivets.
   b. Carefully remove the window from the frame.

— NOTE —

A damaged window should be saved to provide a pattern for shaping the new window.

   c. Remove excess tape and sealer from the window frame and molding.

INSTALLATION OF SIDE WINDOWS (Refer to Figure 56-2.)

To install all side windows except cabin door windows.

1. Cut or grind the new window to the same dimension as the window removed.
2. Apply Norton vinyl foam tape number 510 or equivalent on both sides of the window around the outer edges.
3. Apply Behr-Manning Sealant number (PRC) PR 307 or equivalent completely around the outer surface of the windows.
4. Insert the window in the frame and install the retainer moldings.
5. Secure the molding with attachment screws or rivets and tighten until the vinyl foam tape is compressed by the retainers.
6. Remove the excess exposed sealer and tape.

INSTALLATION OF CABIN DOOR WINDOWS (Refer to Figure 56-3.)

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.

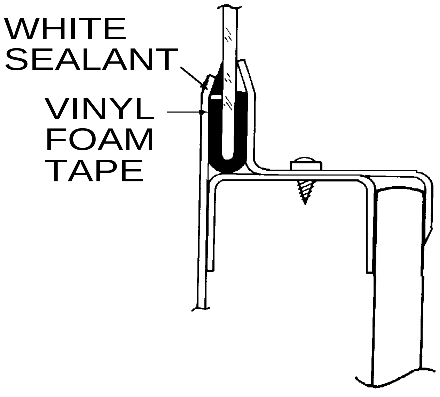

Figure 56-2. Side Window Installation, Single Pane (Typical)

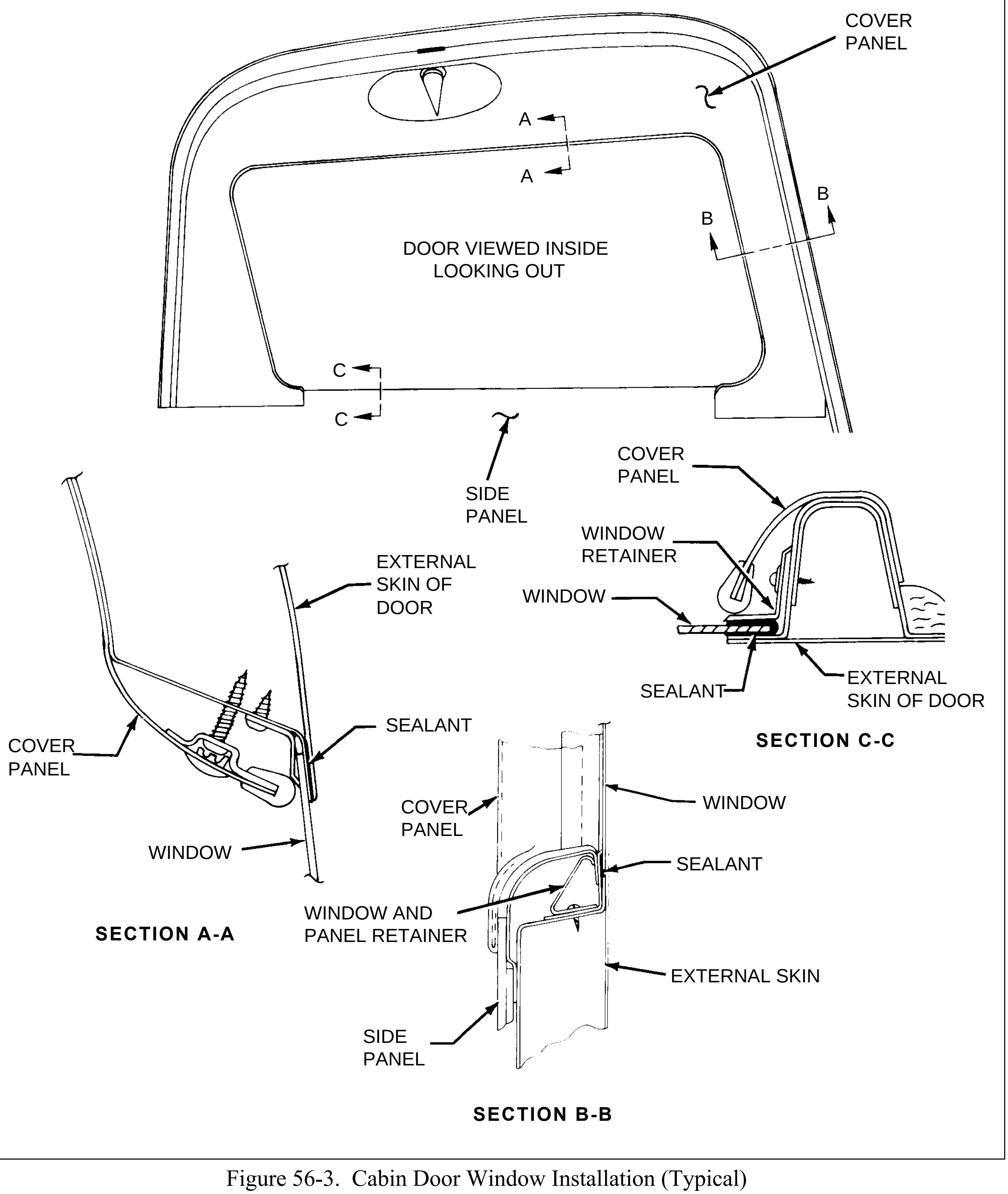

Figure 56-3. Cabin Door Window Installation (Typical)

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CHAPTER

57

WINGS

CHAPTER 57 - WINGS

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

This chapter explains the removal and installation procedures for the wings and related components installed on this aircraft.

DESCRIPTION

Each wing panel is an all metal, full cantilever semi-monocoque type construction with a removable fiberglass or thermoplastic tip. 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 total per wing. An optional system is available on Seneca III airplanes, consisting of a bladder cell 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 bladders are installed as standard equipment on Seneca IV models.

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.

— 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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AUXILIARY STRUCTURE

WING TIP

REMOVAL OF WING TIP

1. Remove the screws holding the wing tip, being careful not to damage the wing or wing tip.
2. Pull off the wing tip far enough to disconnect the position and strobe light wire assembly. The ground lead may be disconnected at the point of connection on the wing rib and the positive lead may be disconnected at the wire terminal or unscrewed from the light assembly.
3. Inspect the wing tip to ascertain that it is free of cracks, severe nicks, and minor damage. If repair is required, refer to Chapter 51.

INSTALLATION OF WING TIP

1. Place the wing tip in a position that the navigation and strobe light leads may be connected. Connect the ground lead to the wing rib by use of a screw and nut and the positive lead to the position light by connecting the wire terminals or screwing the connectors together. Insulate the wire terminals and be certain that the ground lead is free of dirt and film to ensure a good connection.
2. Insert the wing tip into position and install the screws around the tip. Use caution to refrain from damaging the wing tip or wing. Check operation of the lights.

REPAIR OF WING TIP

Badly damaged thermoplastic tips should be replaced. (Refer to Chapter 51.)

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ATTACH FITTING

WING TO FUSELAGE ATTACH FITTINGS

REMOVAL OF WING (Refer to Figure 57-1.)

1. Close the fuel valve and drain the fuel from the wing to be removed. (Refer to Draining Fuel System, Chapter 12.)
2. Drain the brake lines and reservoir. (Refer to Draining Brake System, Chapter 12.)
3. Remove the engine from the wing to be removed. (Refer to Removal of Engine, Chapter 71.)
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. (Refer to Access Plates and Panels, Chapter 6.)
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. (Refer to Jacking, Chapter7.)

— NOTE —

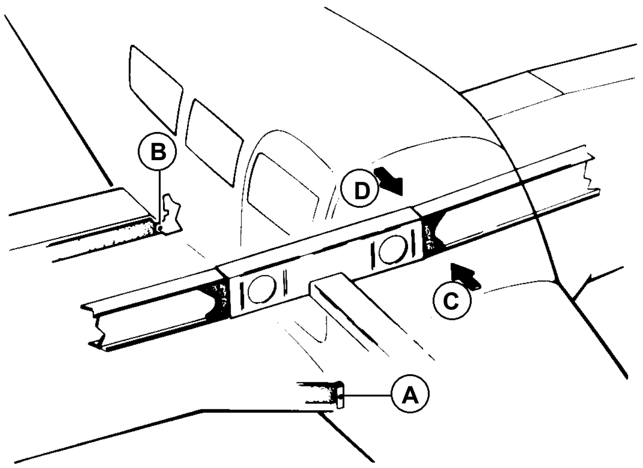
To help facilitate reinstallation of control cables, power plant controls, and fuel and hydraulic lines, mark cable and line ends in some identifying manner. Attach a line, where applicable, to cables before drawing them through the fuselage or wing.

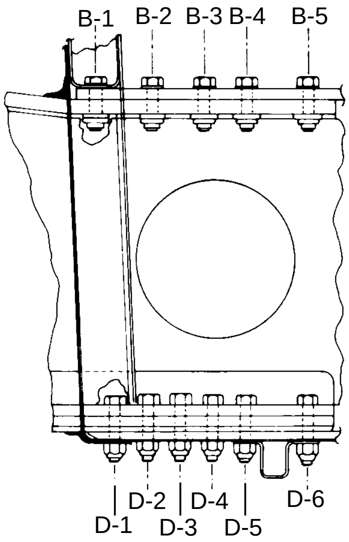
9. Disconnect the aileron balance and control cables at the turnbuckles that are located within the fuselage aft of the spar.
10. If the left wing is being removed, remove the cotter pin from the pulley bracket assembly to allow the left aileron balance cable end to pass between the pulley and bracket.
11. Disconnect the flap from the torque tube by extending the flap to its fullest degree and removing the bold and bushing from the bearing at the aft end of the control rod.
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.

— CAUTION —

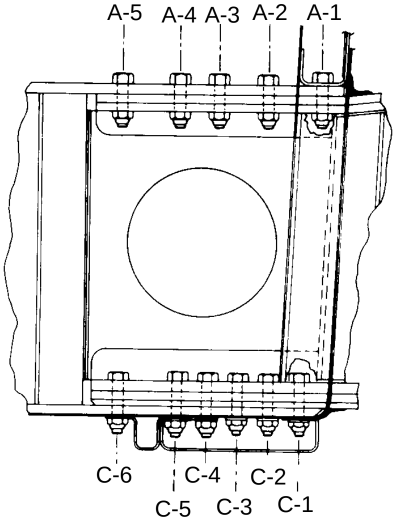
PLACE A PROTECTIVE COVER OVER FUEL, HYDRAULIC AND MISCELLANEOUS LINES ENDS TO PREVENT CONTAMINATION OR DAMAGE TO LINE FITTINGS AND ENDS .

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.





SKETCH C



SKETCH D

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 (2 MAX)
A3	NAS464P6LA16	MS21042-6	AN960-616	AN960-616 (2 MAX)
A4	NAS464P6LA16	MS21042-6	AN960-616	AN960-616 (2 MAX)
A5	NAS464P6LA16	MS21042-6	AN960-616	AN960-616 (2 MAX)
B1	NAS464P6LA15	MS21042-6	AN960-616L	96352-3
B2	NAS464P6LA14	MS21042-6	AN960-616	96352-3 SEE
B3	NAS464P6LA14	MS21042-6	AN960-616	96352-3 NOTE
B4	NAS464P6LA14	MS21042-6	AN960-616	96352-3 1
B5	NAS464P6LA14	MS21042-6	AN960-616	96352-3
C1	NAS464P5LA20	MS21042-5	AN960-516L	AN960-561 (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 SEE
C6	NAS464P6LA21	MS21042-5	AN960-616L	96352-3 NOTE 2
D1	NAS464P5LA20	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 SEE
D6	NAS464P5LA21	MS21042-5	AN960-616L	96352-3 NOTE 2

TORQUE BOLT HEADS ON UPPER SPAR CP & 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 TWO AN960-616 WASHERS OR ONE AN960-616 WASHER MAY ALSO BE USED UNDER THE SPECIAL WASHER.

Figure 57-1. Wing Installation (Sheet 1 of 2)

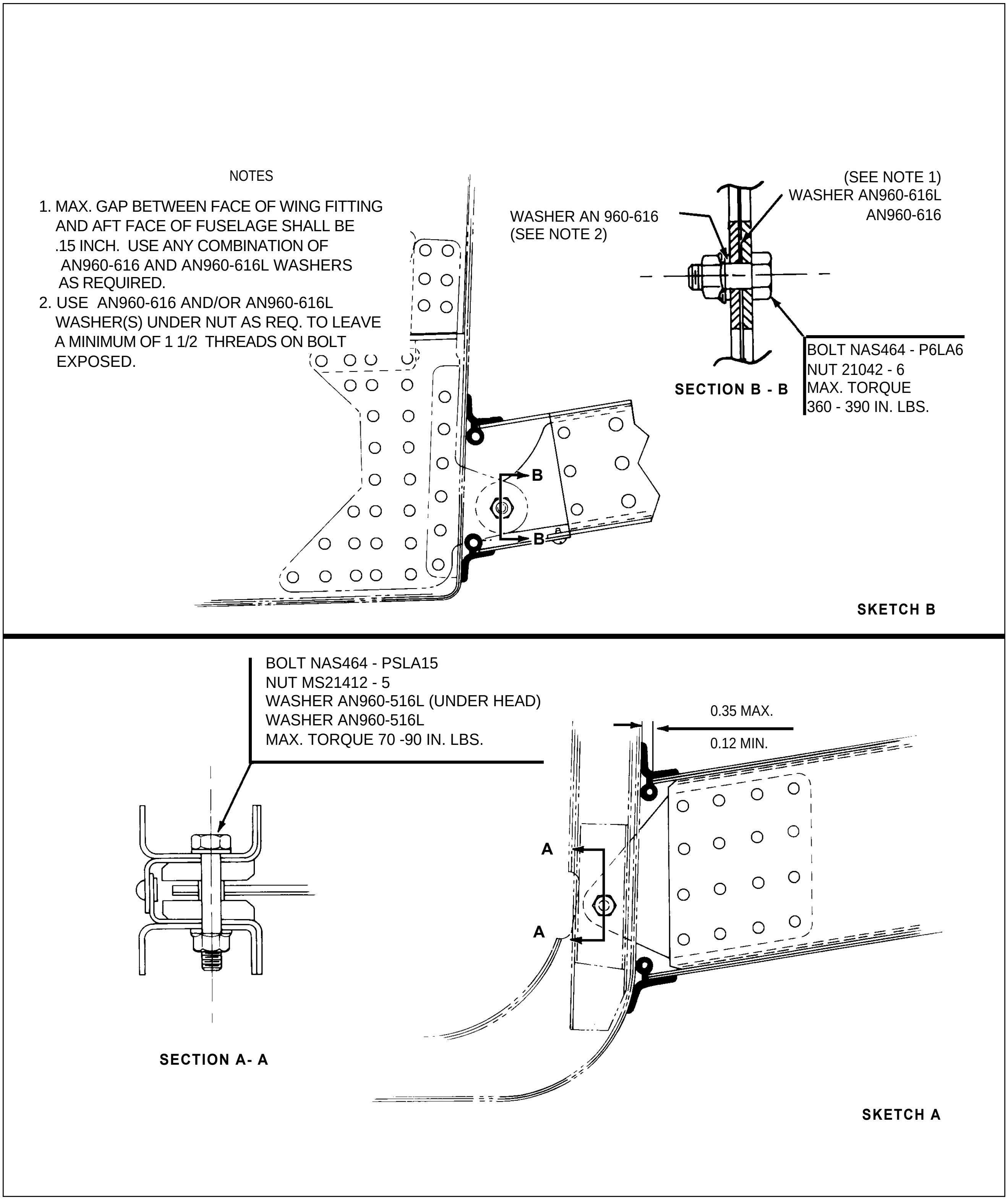


Figure 57-1. Wing Installation (Sheet 2 of 2)

REMOVAL OF WING (Refer to Figure 57-1.) (continued)

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.

INSTALLATION OF WING (Refer to Figure 57-1.)

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 57-1, 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. (Refer to Sketch A, Section A-A of Figure 57-1.)
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. (Refer to Sketch B, Section B-B of Figure 57-1.) 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 of Figure 57-1. The forward spar attachment bolt should be torqued to a maximum of 70 to 90 inch-pounds. The rear spar attachment bolt should be torqued to a maximum of 360 to 390 inch-pounds.
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, it is necessary that the pitot and static tubes be connected 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. (For assistance in connecting the electrical leads, 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. (Refer to Installation of Engine, Chapter 91.)

INSTALLATION OF WING (Refer to Figure 57-1.**)** (continued)

17. Check the rigging and control cable tension of the ailerons and flaps. (Refer to Rigging and Adjustment of Ailerons, and Rigging and Adjustment of Flaps, Chapter 27.)
18. Service and refill the brake system with hydraulic fluid in accordance with Servicing Brake System, Chapter 12. Bleed the system as outlined in Chapter 32 and check for fluid leaks.
19. Check the fluid level of the landing gear hydraulic system and fill in accordance with Servicing Hydraulic Pump/Reservoir, Chapter 12. With the airplane sitting on jacks, operate the gear through several retraction and extension cycles to be certain that there are no hydraulic leaks. Bleed the hydraulic system in accordance with Chapter 32. Ascertain that the landing gear is down and locked.
20. Service and fill the fuel system in accordance with Servicing Fuel System, Chapter 12. 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.

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FLIGHT SURFACES

AILERON

REMOVAL OF AILERON (Refer to Figure 57-2.)

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 hardware from the hinges at the leading edge of the aileron, to remove the aileron.

INSTALLATION OF AILERON. (Refer to Figure 57-2.)

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 ensure freedom of movement.

CHECKING AILERON FREE PLAY

The following checks are recommended before balancing to ascertain the amount of free play in the aileron:

Set the aileron in its neutral position and secure. 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. 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. Grasp the aileron and move it spanwise (inboard/outboard) to ensure maximum end play of 0.035 of an inch (0.889 mm) is not exceeded.

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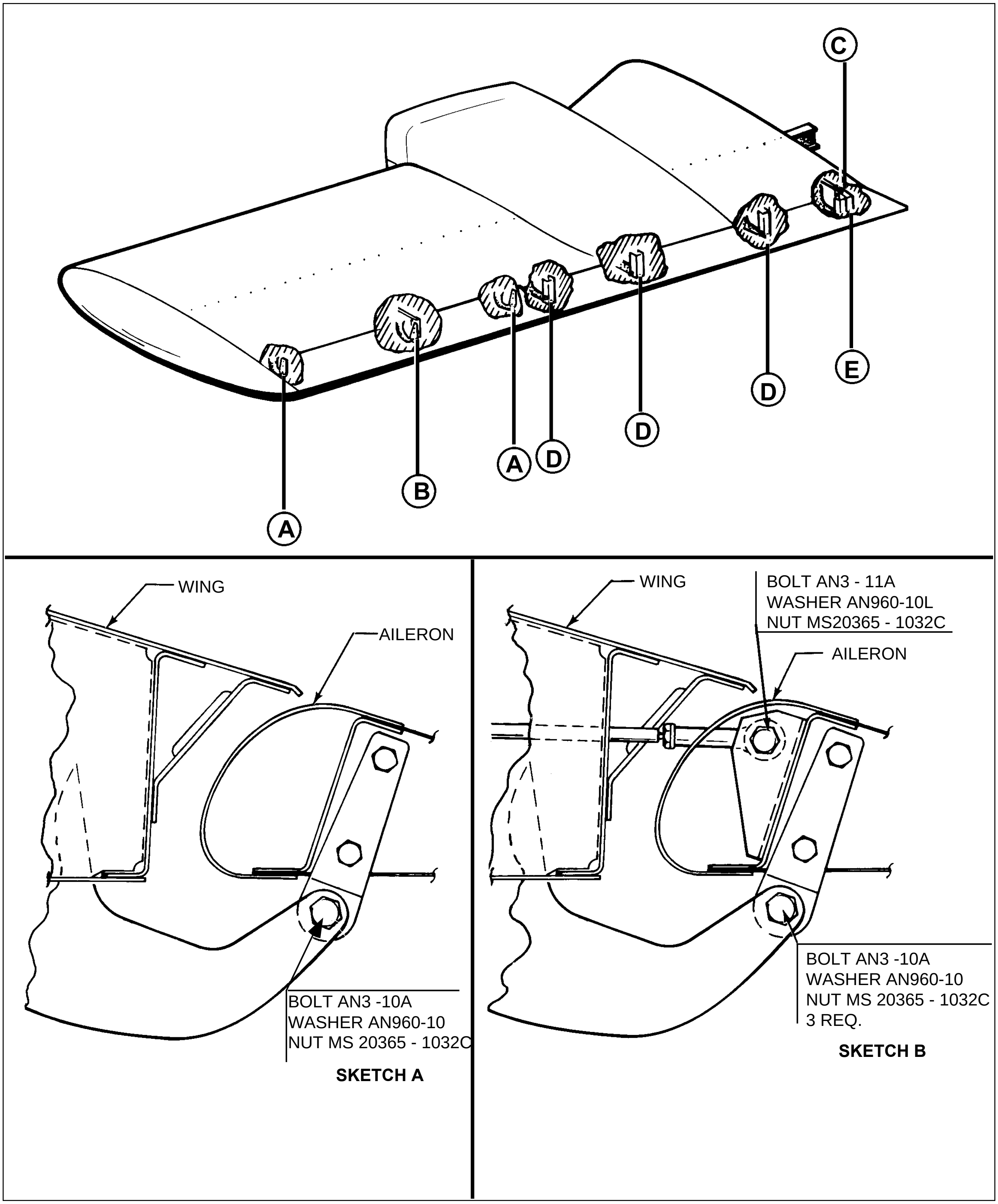


Figure 57-2. Aileron and Flap Installation (Sheet 1 of 2)

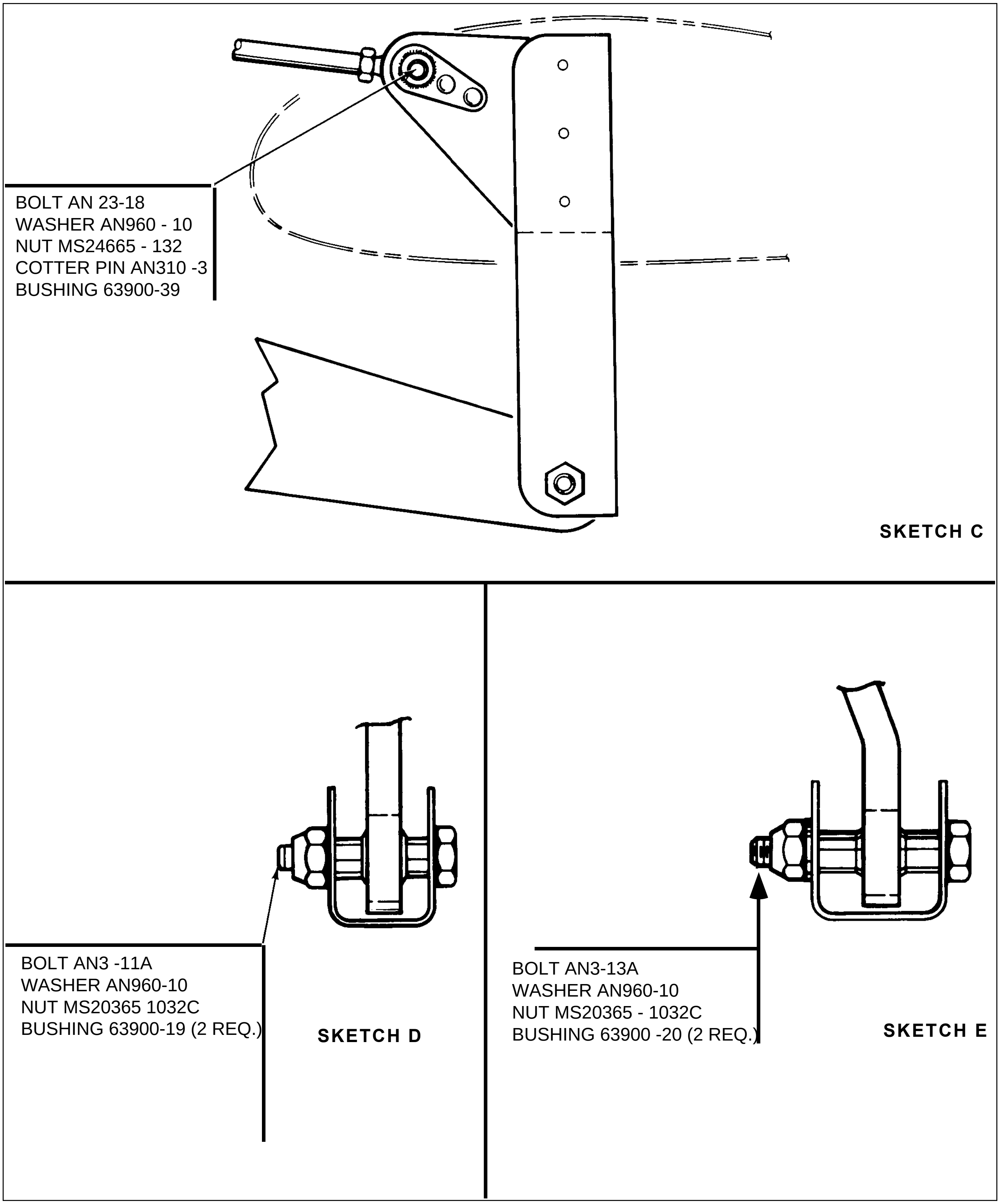
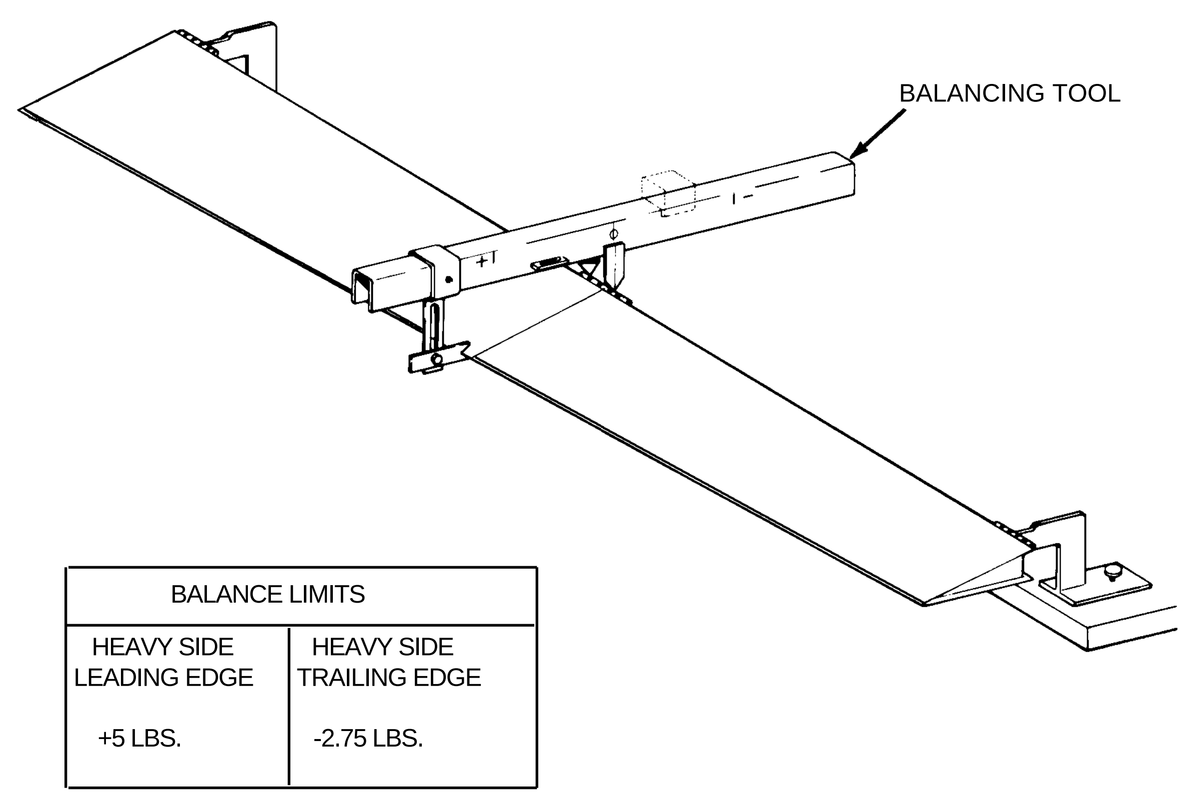


Figure 57-2. Aileron and Flap Installation (Sheet 2 of 2)

BALANCING AILERON (Refer to Figure 57-3.)

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 toll on the aileron, avoid 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 57-3, 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 ski or ribs, it will be necessary to replace all damaged parts and recheck the balance.



BALANCE LIMITS	
HEAVY SIDE LEADING EDGE	HEAVY SIDE TRAILING EDGE
+5 LBS.	-2.75 LBS.

Figure 57-3. Aileron Balance Configuration

WING FLAP

REMOVAL OF WING FLAP (REFER TO FIGURE 57-2.)

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.

INSTALLATION OF WING FLAP (REFER TO FIGURE 57-2.)

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.

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AIRPLANE

MAINTENANCE MANUAL

CARD 4 OF 5

PA-34-220T SENECA III
PA-34-220T SENECA IV

THIRD EDITION

PIPER AIRCRAFT CORPORATION

(PART NUMBER 761 751) November 29, 1993

Published by
Technical Publications

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2926 Piper Drive
Vero Beach, Florida 32960
U.S.A.

Member of GAMA
General Aviation
Manufacturers Association

GAMA

INTRODUCTION

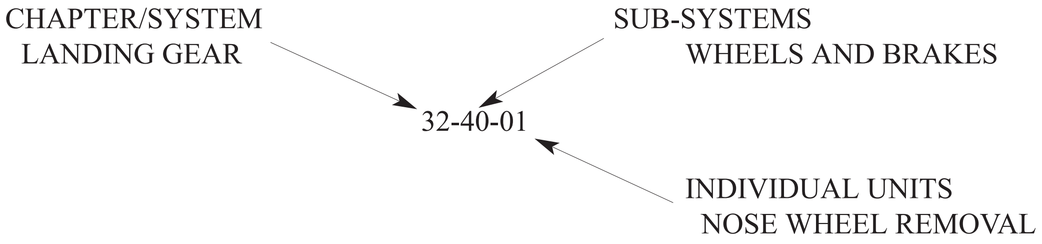
This PIPER AIRCRAFT Maintenance Manual is prepared in accordance with the GAMA (General Aviation Manufacturers Association) format. This maintenance manual is divided into various Groups which enable a broad separation of contents (Chapters) within each group.

The various Chapters are broken down into major systems such as Electrical Power, Flight Controls, Fuel, Landing Gear, etc. The System/Chapters are arranged more or less alphabetically rather than by precedence or importance. All System/Chapters are assigned a number, which becomes the first element of a standardized numbering system. Thus the element “32” of the number series 32-00-00 refers to the System/Chapter on “Landing Gear”. All information pertaining to the landing gear will be covered in this System/Chapter.

The major System/Chapters are then broken down into Sub-System/Sections. These sections are identified by the second element of the standardized numbering system. The number “40” of the basic number series 32-40-00 is for the “Wheels and Brakes” portion of the landing gear.

The individual units within a Sub-System/Section may be identified by a third element of the standardized numbering system, such as 32-40-01. This number could be assigned by the manufacturer to fit the coverage requirements of the publication.

Example:



This manual 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 761 750 and FAR 43 for proper utilization.

WARNINGS, CAUTIONS, and NOTES are used throughout this manual to emphasize important information.

— WARNING —

OPERATING PROCEDURES, PRACTICES, ETC., WHICH MAY RESULT IN PERSONAL INJURY OR LOSS OF LIFE IF NOT CAREFULLY FOLLOWED.

— CAUTION —

OPERATING PROCEDURES, PRACTICES, ETC., WHICH IF NOT STRICTLY OBSERVED MAY RESULT IN DAMAGE TO EQUIPMENT.

— NOTE —

An operating procedure, condition, etc., which is essential to emphasize.

AEROFICHE EXPLANATION AND REVISION STATUS

The Maintenance Manual information incorporated in this set of Aerofiche cards has been arranged in accordance with the general specifications of Aerofiche adopted by the General Aviation Manufacturer's Association, (GAMA). 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.

Conversion of Aerofiche alpha/numeric code numbers:
First number is the Aerofiche card number.
Letter is the horizontal line reference per card.
Second number is the vertical line reference per card.
Example: 2J16 = Aerofiche card number two of given set, Grid location J16.

To aid in locating the various chapters and related service information desired, the following is provided:

1. A complete manual System/Chapter Index Guide is given for all fiche in this set.
2. A complete list of Illustrations is for all fiche in this set following System/Chapter Index.
3. A complete list of Charts is for all fiche in this set following list of illustration.
4. A complete list of paragraph titles and appropriate Grid location numbers is given at the beginning of each Chapter relating to the information within that Chapter.
5. Identification of Revised Material:

   Revised text and illustrations are indicated by a black vertical line along the left-hand margin of the frame, opposite revised, added or deleted material. Revision lines indicate only current revisions with changes, additions to or deletions of existing text and illustrations. Changes in capitalization, spelling, punctuation, indexing, the physical location of the material or complete page additions are not identified by revision lines.

   A reference and record of the material revised is included in each chapter's Table of Contents/Effectivity.

   The codes used in the effectivity columns of each chapter are defined as follows:

TABLE OF CONTENTS/EFFECTIVITY CODES

Original Issue:	None
First Revision:	Revision Indication, (1R Month-Year)
Second Revision:	Revision Indication, (2R Month-Year)

All subsequent revisions will follow with consecutive revision numbers such as 3R, 4R, etc., along with the appropriate month-year

Added Subject:	Revision Identification, (A Month-Year)
Deleted Subject:	Revision Identification, (D Month-Year)

AEROFICHE EXPLANATION AND REVISION STATUS (CONTINUED)

6. Revisions to Maintenance Manual 761 751 issued December 19, 1980, are as follows:

Effectivity	Publication Date	Aerofiche Card Effectivity
ORG801219	December 19, 1980	1, 2 and 3
CR891220	December 20, 1989	1, 2, 3 and 4
CR931129	November 29, 1993	1, 2, 3, 4 and 5

The date on Aerofiche cards can not preceed the date noted for the respective card effectivity. Consult the latest Aerofiche card in the series for current Aerofiche card effectivity.

SERIAL NUMBER INFORMATION

The serial numbers of the PA-34-220T Seneca III airplanes covered by this Maintenance Manual are as follows:

34-8133001 through 34-8133277
34-8233001 through 34-8233205
34-8333001 through 34-8333129
34-8433001 through 34-8433088
34-8533001 through 34-8533069
34-8633001 through 34-8633031
3433001 and up
3448005 through 3448037

The serial numbers of the PA-34-220T Seneca IV airplanes covered by this Maintenance Manual are as follows:

3448038 and up

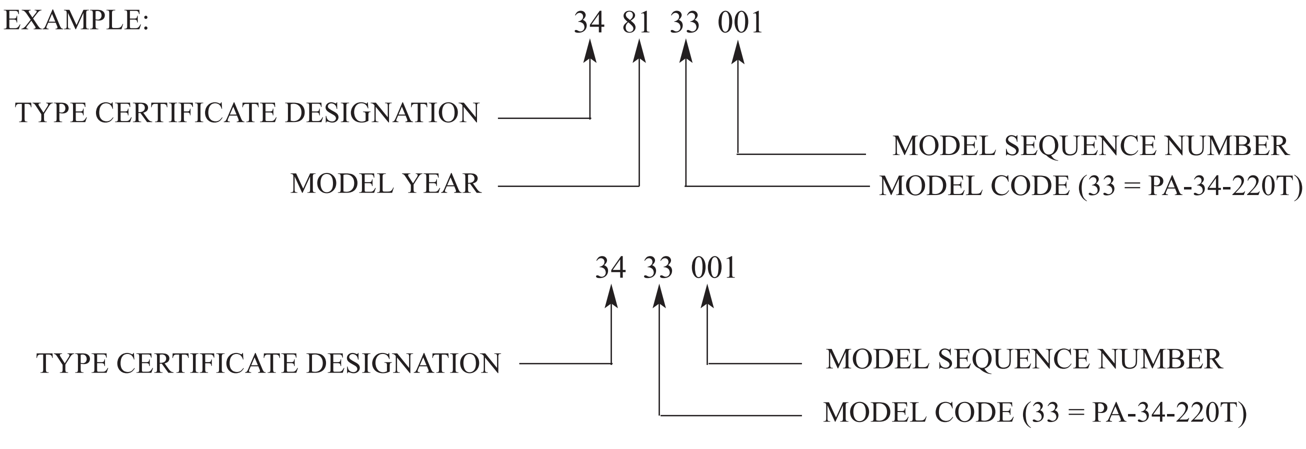
SERIAL NUMBER EXPLANATION

The serial number on the Manufacturer's Identification Plate is based on either a 3 or 4 set numbering system.

In the 4- set system, the first set defines the Type Certificate Designation, the second set is the Model Year, the third set is the Model Code, and the fourth set is the Model Sequence Number (within a model year).

The 3-set system omits the model year and begins a new sequence with 3433001. This new sequence continues without renumbering for a new year.

EXAMPLE:



VENDOR PUBLICATIONS

— WARNING —

WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, IT IS THE USER'S RESPONSIBILITY TO REFER TO THE APPLICABLE VENDOR PUBLICATION.

ENGINE:
Overhaul Manual = CONTINENTAL - OVERHAUL MANUAL
Form No. X-30030A
Teledyne Continental Motors - Aircraft Products Division
Mobile, Alabama 36601
Parts Catalog = CONTINENTAL- Form No. X-30034A
Teledyne Continental Motors - Aircraft Products Division
Mobile, Alabama 36601
Operators Handbook = CONTINENTAL - Form No. X-30553
Teledyne Continental Motors - Aircraft Products Division
Mobile, Alabama 36601

PROPELLER:
Overhaul Instructions = HARTZELL COMPACT CONSTANT SPEED and
FEATHERING PROPELLER- P/N 117 D - Hartzell Propeller Inc.
1 Propeller Place
Piqua, Ohio 45356
Service Manual = McCAULEY C500 SERVICES
FULL FEATHERING CONSTANT SPEED
PROPELLER- P/N 7512 01 - McCauley Accessory Division
335 McCauley Drive
P.O. Box 430
Vandalia, Ohio 45377

MAGNETOS:
Installation, Operation
and Maintenance
Instructions = S6LN-25P IGNITION SYSTEM- P/N L-928
Bendix Electrical Components Division
Sidney, New York 13838

VOLTAGE CONTROL:
Overhaul Manual
and Illustrated
Parts List: LAMAR INC.
POWER EQUIPMENT DIVISION
71 Inidel Aveneu
P. O. Box 251
Rancocas, New Jersey 08073

VENDOR PUBLICATIONS (CONTINUED)

AUTOFLIGHT (continued)

Flight Control: Bendix/King
System Flight Line KFC 150
Installation Manual P/N 006-0287-00
System Flight Line KFC 200
Maintenance Manual: P/N 006-5134-01
Vendor Address: Bendix/King Radio Corporation
400 N. Rogers Road
Olathe, Kansas 66062

WHEELS AND BRAKES:
Installation, Maintenance
and Overhaul Manual: Cleveland
Parker Hannifin Corporation
Aircraft Wheel and Brake Division
1160 Center Road
Avion, Ohio 44011

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

CORROSION INHIBITING COMPOUND:
DINOL International
25200 Malvina
Box 1065
Warren, Michigan 48090

OXYGEN SYSTEM
Components: Scott Aviation
225 Erie Street
Lancaster, New York 14086

FIRE EXTINGUISHER (PORTABLE)
Polk Fire Extinguisher Service, Inc.
P. O. Box 384
Lakeland, Florida 33802

PIPER PUBLICATIONS

AUTOFLITE:

AutoFlight II Service Manual =	Piper P/ N 761 481
Pitch Trim Service Manual =	Piper P/N 753 771
AutoControl IIIB and Altimatic IIIB Service Manual =	Piper P/N 753 502
Altimatic IIIC Service Manual =	Piper P/N 761 602
PARTS CATALOG:	761 750
PROGRESSIVE INSPECTION 50 HOUR EVENT:	761 837
PERIODIC REPORT	230 1061

SYSTEM/CHAPTER INDEX GUIDE

— NOTE —

The following chapters are not applicable to this Maintenance Manual: 31, 36, 38, 49, 53, 54, 60, 72, 78, and 83.

SYSTEM/CHAPTER INDEX GUIDE (CONTINUED)

SYSTEM/ CHAPTER	SUB-SYSTEM/ SECTION	TITLE	GRID NO.
12	SERVICING		1E3
	00	General	
	10	Replenishing	
	20	Scheduled Servicing	
20	STANDARD PRACTICES - AIRFRAME		1F6
	00	General	
	10	Standard Practices - Airframe	
21	ENVIRONMENTAL SYSTEMS		1F22
	00	General	
	20	Distribution	
	40	Heating	
	50	Cooling	
22	AUTO FLIGHT		1J6
	00	General	
	10	Autopilot	
23	COMMUNICATIONS		1J13
	00	General	
	10	Emergency Locator Transmitter	
24	ELECTRICAL POWER		1J23
	00	General	
	30	DC Generation	
	40	External Power	
	50	Electrical Load Distribution	
25	EQUIPMENT/FURNISHINGS		2B5
	10	Flight Compartment	
		Passenger Compartment	
26	FIRE PROTECTION		2B14
	00	General	
	20	Extinguishing	
27	FLIGHT CONTROLS		2B19
	00	General	
	10	Aileron and Tab	
	20	Rudder and Tab	
	30	Stabilator Controls	
	50	Flaps	

SYSTEM/CHAPTER INDEX GUIDE (CONTINUED)

SYSTEM/ CHAPTER	SUB-SYSTEM/ SECTION	TITLE	GRID NO.
28	FUEL		2E11
	00	General	
	10	Storage	
	20	Distribution	
	40	Indicating	
29	HYDRAULIC POWER		2F24
	00	General	
	10	Main	
30	ICE AND RAIN PROTECTION		2H12
	00	General	
	10	Airfoil	
	30	Pitot and Static	
	40	Windows, Windshields and Doors	
	60	Propellers/Rotors	
	80	Detection	
32	LANDING GEAR		3B5
	00	General	
	10	Main Gear and Doors	
	20	Nose Gear and Doors	
	40	Wheels and Brakes	
	60	Position and Warning	
33	LIGHTS		3D17
	00	General	
	10	Flight Compartment	
	20	Passenger Compartment	
	40	Exterior	
34	NAVIGATION AND PITOT /STATIC		3E24
	00	General	
	10	Flight Environment Data And Pitot/ Static	
	20	Attitude & Direction	
35	OXYGEN		3F21
	00	General	
	10	Crew/Passeng	
37	VACUUM		3H8
	00	General	
	10	Distribution	

SYSTEM/CHAPTER INDEX GUIDE (CONTINUED)

SYSTEM/ CHAPTER	SUB-SYSTEM/ SECTION	TITLE	GRID NO.
39	ELECTRICAL/ELECTRONIC PANELS & MULTIPURPOSE PARTS		3H24
	00	General	
	10	Instrument and Control Panels	
51	STRUCTURES		3I14
	00	General	
	10	Structural Repairs	
52	DOORS		3J11
	00	General	
	10	Passenger/Crew	
	30	Cargo	
55	STABILIZERS		3J24
	00	General	
	20	Stabilator	
	30	Vertical Stabilizer	
	40	Rudder	
56	WINDOWS		3K15
	10	Flight Compartment	
	20	Cabin	
57	WINGS		3K24
	00	General	
	20	Auxiliary Structure	
	40	Attach Fittings	
	50	Flight Surfaces	
61	PROPELLERS		4B5
	00	General	
	10	Propeller Assembly	
	20	Controlling	
70	STANDARD PRACTICES — ENGINES		4C9
	00	General	
71	POWER PLANT		4C13
	00	General	
	10	Cowling	
	20	Mounts	
	60	Air Intakes	
73	ENGINE FUEL AND CONTROL		4D11
	00	General	
	10	Distribution	
	30	Indicating	

SYSTEM/CHAPTER INDEX GUIDE (CONTINUED)

SYSTEM/ CHAPTER	SUB-SYSTEM/ SECTION	TITLE	GRID NO.
74	IGNITION		4D19
	00	General	
	10	Electrical Power Supply	
	20	Distribution	
76	ENGINE CONTROLS		4E15
	00	General	
	10	Power Control	
77	ENGINE INDICATING		4F6
	00	General	
	10	Power	
	20	Temperature	
79	OIL		4F18
	00	General	
	20	Distribution	
	30	Indicating	
80	STARTING		4G3
	00	General	
	10	Cranking	
81	TURBINES		4G13
	00	General	
	20	Turbocharger	
91	CHARTS AND WIRING DIAGRAMS		5B5
95	SPECIAL EQUIPMENT		5G9

LIST OF ILLUSTRATIONS

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— NOTE —

Refer to Chapter 91 For Electrical Schematic Index

LIST OF ILLUSTRATIONS

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LIST OF CHARTS

LIST OF CHARTS

GRIDS 4B1 THROUGH 4B4
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CHAPTER

61

PROPELLER

CHAPTER 61 - PROPELLERS

TABLE OF CONTENTS/EFFECTIVITY

CHAPTER 61 - PROPELLERS

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

DESCRIPTION

The Seneca III can be equipped with either a two or three bladed propeller. Hartzell assemblies are utilized for the two bladed installation, with McCauley assemblies utilized for the three bladed propeller installation. Refer to Figures 61-1 and 61-2, and Charts 6101 and 6102 for further information pertinent to installation, inspection, and maintenance.

The McCauley three bladed propeller is the standard installation on the Seneca IV. The Hartzell two bladed propeller is available as a 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.

Each engine is equipped with a governor that supplies engine oil at various 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 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.

Refer to section 61-30-00 for airplanes equipped with an unfeathering accumulators.

DO NOT unfeather a propeller if the engine was stopped due to mechanical failure.

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PROPELLER ASSEMBLY

MAINTENANCE OF PROPELLER

REMOVAL OF PROPELLER

— 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 (S/N 34-8133001, 34-8133173 through 34-8633031, 3433001 and up, and 3448001 and up), REMOVE PICKUP PRIOR TO REMOVING PROPELLER TO PREVENT DAMAGE TO THE PICKUP.

1. Remove the nose cowl. The top and side panels may be removed to ease propeller removal.
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. To remove the spinner from the Hartzell propeller, 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 loose the spacers, if any, between the valve boss locknut and front spinner bulkhead.
   b. The spinner on the McCauley 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 loose the spacers inside the support assembly.
6. Make sure to cover or plug the crankshaft port as well as the propeller hub port.

— NOTE —

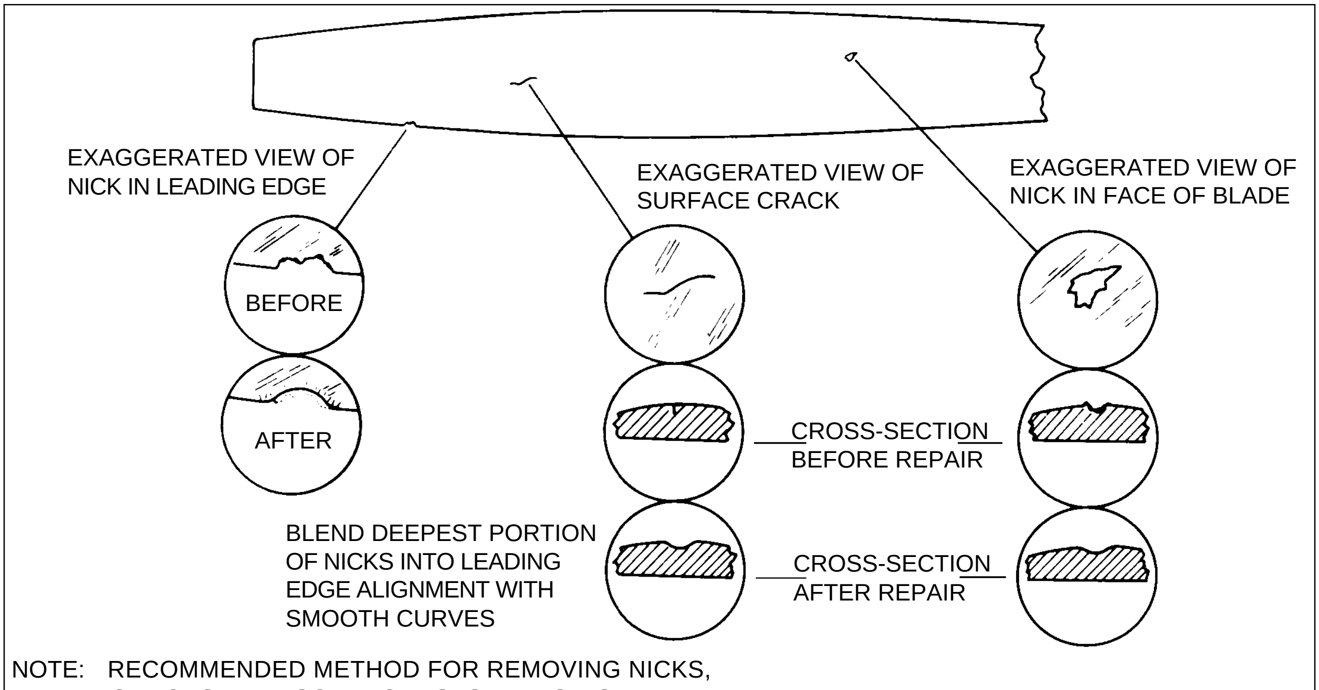
If the counterweight bolts on airplanes having S/N’s 34-8133001 through 34-8333106, equipped with McCauley Propellers Part No's. 3AF32C508 and C509, are not stamped with the letter M, or the counterweight does not have a white strip painted on it, the bolts must be replaced with new bolts with the letter M stamped on the head per McCauley Service Bulletin 147.

CLEANING, INSPECTION AND REPAIR OF PROPELLER

— NOTE —

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 replate 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.
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 61-1 for propeller blade care.)
8. Check the condition of the propeller mounting nuts and studs.



NOTE: RECOMMENDED METHOD FOR REMOVING NICKS, CRACKS, AND SCRATCHES IS BY USING RIFFLE FILE AND/OR CROCUS CLOTH.

Figure 61-1. Blade Inspection

CLEANING, INSPECTION AND REPAIR OF PROPELLER (continued)

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.

INSTALLATION OF PROPELLER

— WARNING —

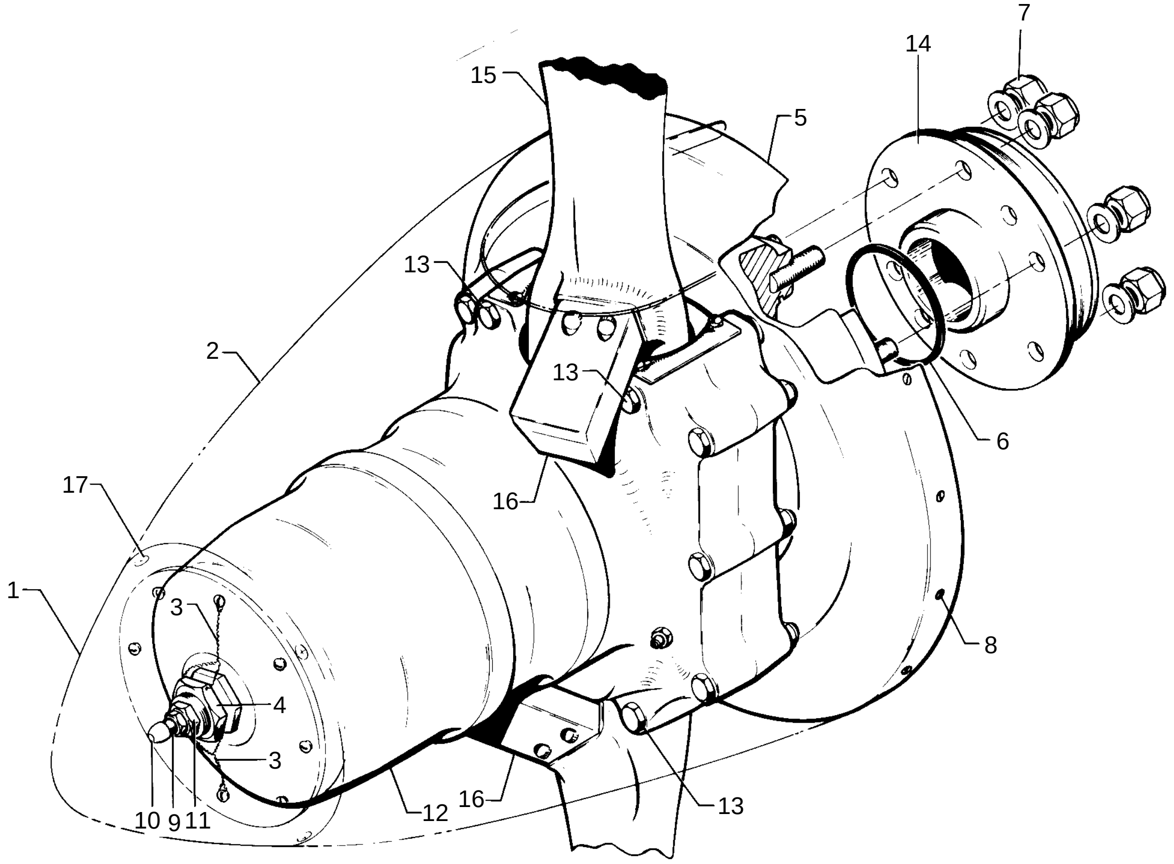
ENSURE MASTER AND MAGNETO SWITCHES ARE OFF AND MIXTURE CONTROL IS AT IDLE CUT-OFF.

To install Hartzell propellers: (Refer to Figure 61-2)

1. 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.
2. Remove the appropriate bolts and install the spinner back plate. Torque the nuts 20 to 22 foot-pounds.
3. Lubricate and install O-ring in the propeller hub.
4. Position the propeller on the shaft mounting flange.
5. Install the retaining nuts and torque them 60 to 70 foot-pounds.
6. Install the spacer(s) (A169-7) over the valve boss. The spacer(s) provide proper alignment of the spinner.
7. Slide the spinner onto the propeller. The holes in the spinner dome should be misaligned just forward of those in the bulkhead. Push slightly on the dome and install mounting screws.
8. Install check nut on the valve boss and torque 15 to 20 foot-pounds.
9. Safety wire the locknut and screws on the forward spinner bulkhead.
10. Install spinner nose cap.

To install McCauley propellers: (Refer to Figure 61-3)

1. 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.
2. Lubricate and install O-ring in the propeller hub.
3. Position the spinner back plate over the studs on the propeller hub
4. Rotate the engine until the number one cylinder is at its top dead center position.
5. 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.
6. Torque the mounting nuts 60 to 70 foot-pounds.
7. With the same amount of spacers in the spinner dome support as when removed, install the spinner support on the propeller hub dome.
8. 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.



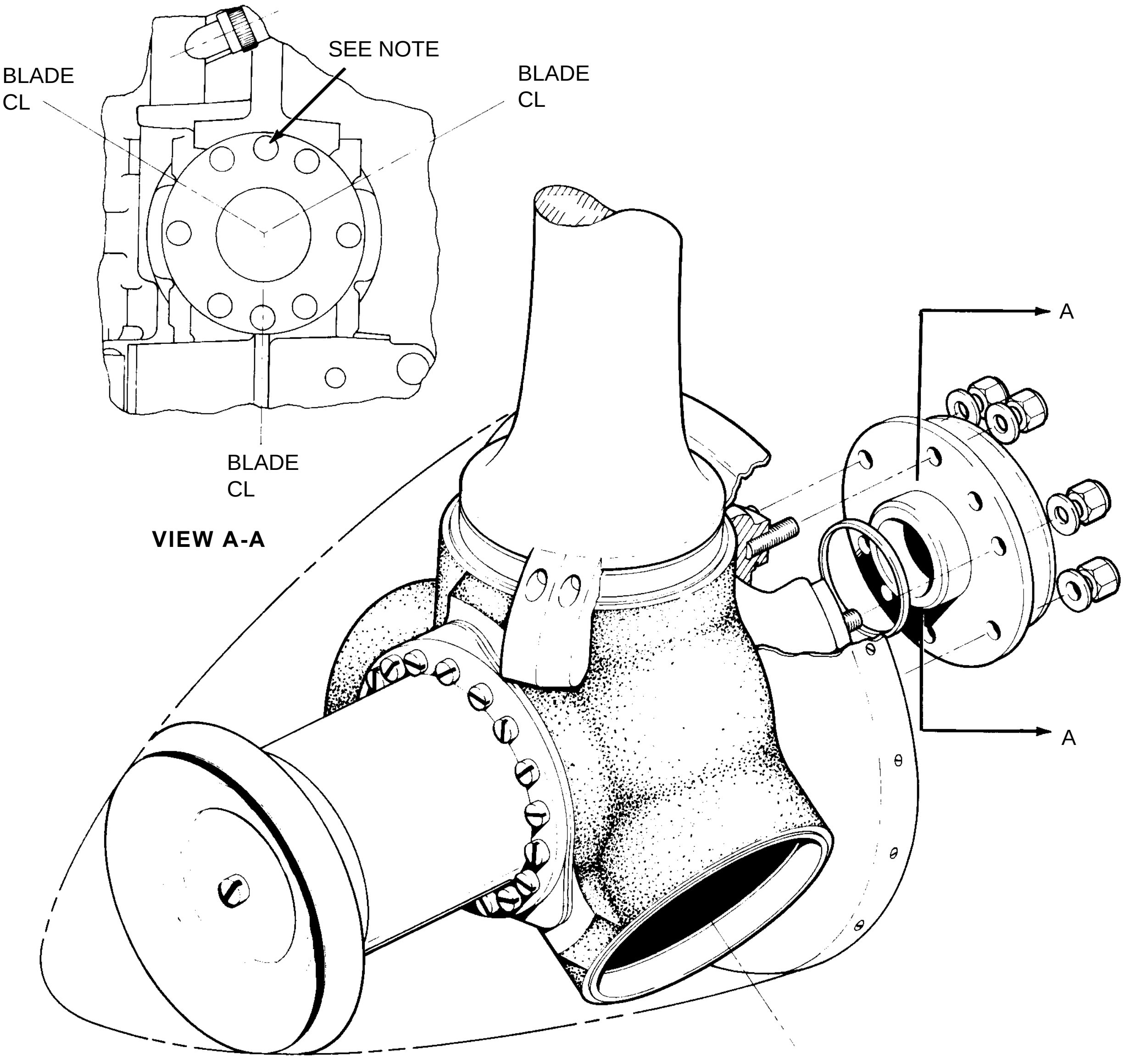
1. SPINNER CAP
2. SPINNER
3. SAFETY WIRE
4. SPINNER CHECK NUT
5. AFT BULKHEAD
6. O-RING
7. PROPELLER MOUNTING NUT
8. SPINNER ATTACHMENT SCREW
9. AIR VALVE
10. AIR VALVE CAP
11. LOW PITCH ADJUSTMENT
12. PROPELLER - R DOME
13. BULKHEAD BOLT
14. ENGINE FLANGE
15. PROPELLER BLADE
16. COUNTERWEIGHT
17. CAP ATTACHMENT SCREW

— NOTE —

The following propeller assemblies must be mounted in pairs and not mixed:

LEFT	RIGHT
BHC-C2YF-2CKF/FC8459-8R	BHC-C2YF-2CLKF/FJ8459-8R
BHC-C2YF-2CKUF/FC8459-8R	BHC-C2YF-2CLKUF/FJC8459-8R

Figure 61-2. Hartzell Two Bladed Propeller Installation



NOTE

PROPELLER MUST BE INSTALLED WITH NUMBER 1 CYLINDER AT TDC. DOWEL PIN MUST BE INSTALLED IN HOLE CLOSEST TO UPPER CRANK CASE SPLIT LINE AND BETWEEN BLADES.

ENSURE THAT A CORRECT NUMBER OF SPACER WASHERS ARE INSTALLED BETWEEN THE SPINNER DOMW SUPPORT AND THE PROPELLER HUB DOME.

Figure 61-3. McCauley Three Bladed Propeller Installation

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.

CHART 6101. PROPELLER SPECIFICATIONS

Blade Angle	Hartzell	McCauley
Low Pitch (High RPM)[1]	2.6° ± 0.2°	11.0° ± 0.2°
High Pitch (Low RPM)[1]	80° to 81.5°	81° to 83.5°
Propeller RPM Setting		
Engine Static High RPM	2800 RPM max.	2800 RPM max.
Propeller Torque Limits		
Description	Required Torque (Dry):	Required Torque (Dry):
Spinner Bulkhead (Aft)	20-22 foot-pounds	20-22 foot-pounds
Propeller Mounting	60-70 foot-pounds	60-70 foot-pounds
Locknut (Low Stop)	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

[1] Measured at 30 inch station.

CHART 6102. HARTZELL PROPELLER CHAMBER PRESSURE REQUIREMENTS WITH TEMPERATURE FOR COUNTERWEIGHT TYPE PROPELLERS

TEMP °F (C)	PRESSURE (psi)
	FOR 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

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

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GRID 4B17
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CONTROLLING

PROPELLER GOVERNOR

REMOVAL OF PROPELLER GOVERNOR

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.

INSTALLATION OF PROPELLER GOVERNOR

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 110 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.

RIGGING AND ADJUSTMENT OF PROPELLER GOVERNOR (Refer to Figure 61-4.)

1. Start engine; park 90° to wind direction and warm in normal manner.
2. 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 rpm should reach 2800 rpm and remain steady.
3. If the engine rpm does not read 2800 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. 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.

   — NOTE —

   One revolution of the fine adjustment screw will increase or decrease the engine speed approximately 20 rpm.

   c. Secure the cowl door(s) and repeat step 2 to ascertain proper rpm setting.
   d. 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.

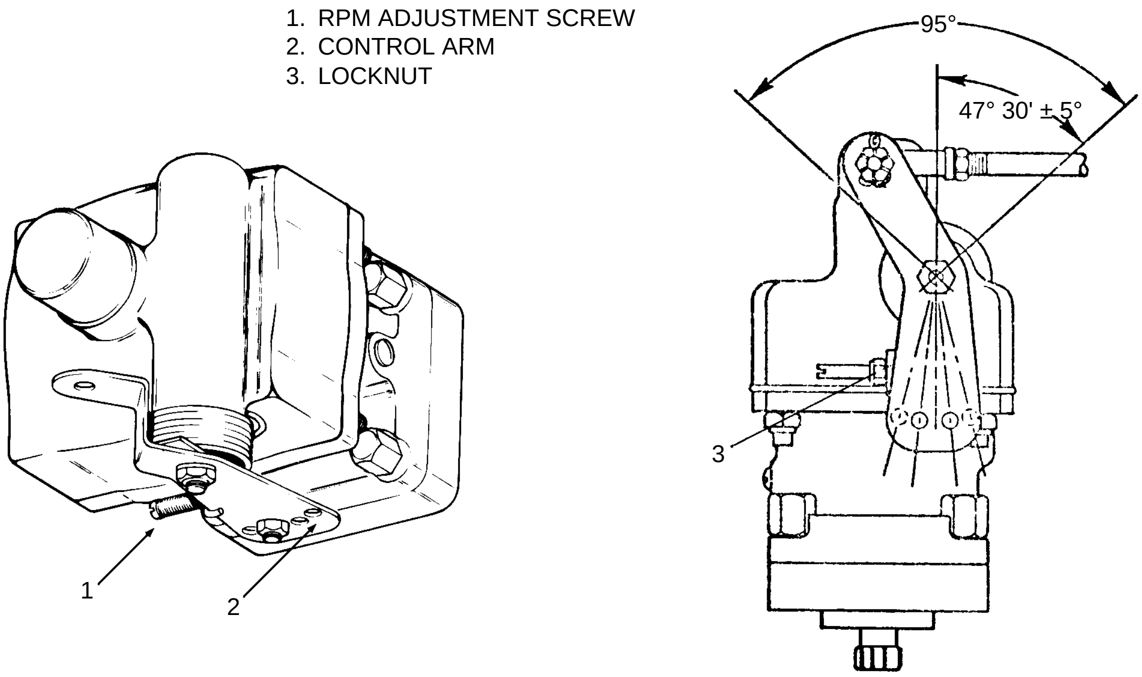


Figure 61-4. Rigging Propeller Governor

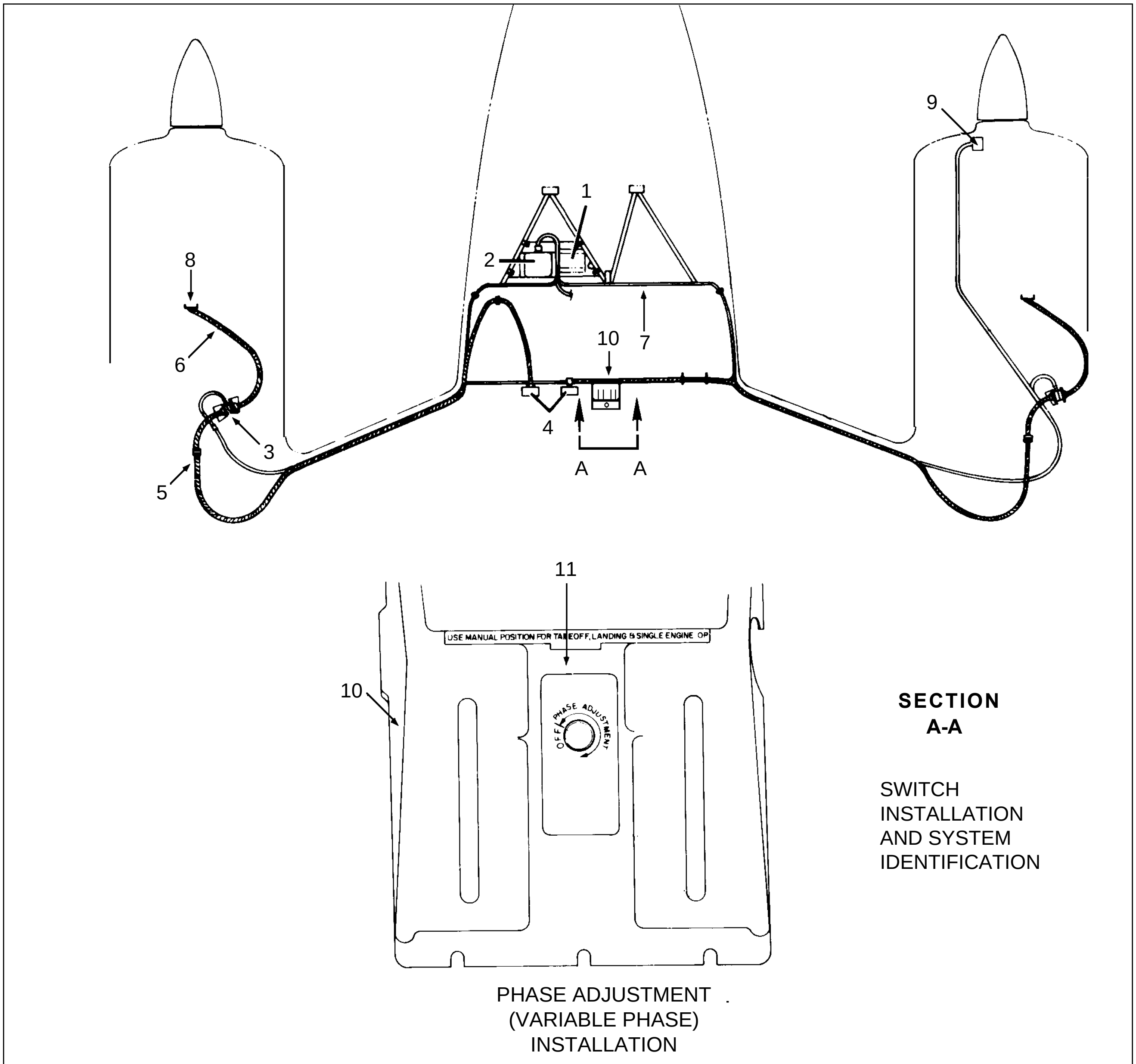
ENGINE SYNCHROPHASER WITH PULSE GENERATOR. (Seneca III, S/N 34-8133002 to 34-81331972 inclusive.)

The functional equipment for this system consists of right and left pulse generator, phasing computer and a 5 amp circuit breaker. Schematic description for the system can be found in Chapter 91.

The function of the synchrophaser is to maintain both propellers at the same rpm and at a selected phase angle. This eliminates the propeller “beat” effect and minimizes vibration. When the synchrophaser is installed, the left engine is established as the master engine and the right engine is equipped with a slave governor which automatically maintains its rpm with the left engine rpm. When the propeller synchrophaser is installed, a rotary switch is located on the throttle quadrant below the propeller controls. It is labeled OFF for manual control or standby and PHASE ADJUSTMENT for propeller synchronizing and phase angle adjustment.

SYSTEM OPERATING PROCEDURE

The rotary switch must be in the OFF position during taxi, takeoff, landing, and single engine operations. Before operating the synchrophaser system, ensure that the rotary switch is in the OFF position and manually synchronize the propellers to within 40 rpm. To operate, rotate the switch clockwise out of the OFF detent and slightly into the PHASE ADJUSTMENT range. It may require up to 30 seconds for the propellers to synchronize. The phase angle of propellers may then be adjusted by rotating the switch within the PHASE ADJUSTMENT range to obtain the smoothest operation. Remember to wait 30 seconds after any switch movement for the propellers to assume the new phase angle. Turn the synchrophaser switch to the OFF position for 30 seconds before changing power settings; reestablish synchrophaser operation following power changes using the above procedure. Pulling the circuit breakers completely deactivates the propeller synchrophaser system. If the master switch is turned OFF or if there is an electrical system failure, the slave engine will return to the control selected rpm plus approximately 25 rpm out of synchronization regardless of the position of the synchrophaser switch.



1. MOUNTING BRACKET
2. COMPUTER
3. PULSE GENERATOR
4. TACHOMETERS
5. TACH CABLE
6. TACH CABLE
7. WIRING HARNESS
8. TACH DRIVE
9. SLAVE GOVERNOR ASSEMBLY
10. CONTROL PEDESTAL
11. SYNCHROPHASER POTENTIOMETER CONTROL

Figure 61-5. Propeller Synchrophaser Installation With Pulse Generator
(Seneca III, S/N 34-8133002 to 34-8133172 inclusive)

SYSTEM CHECK AND ADJUSTMENT

The following wiring harness checks require the use of Hartzell Test Set B-4467-1.

1. Power light operating — indicates power supply to the system computer is of the proper polarity.
2. Right or left engine lights operating — indicates pulse generator for applicable engine is operating properly and correctly wired.
3. OFF/PHASE ADJUSTMENT operating — aircraft system OFF/PHASE ADJUSTMENT switch is wired correctly.
4. Coil light operating — governor solenoid coil is wired correctly.
5. Coil light not operating — open circuit, or wire on Pin Number 8 is grounded.
6. Coil short light operating — short circuit, in governor or solenoid coil or a short between coil leads.

GROUND CHECKS

1. Disconnect the synchrophaser computer from the wiring harness.
2. Connect Hartzell Test Set B-4467-1 to wiring harness at point where computer was disconnected.
3. Turn battery master switch ON and place synchrophaser mode in PHASE ADJUSTMENT position. Test set power light and coil should be lighted.

— NOTE —

Other lights on the test set may be lighted and should be ignored with this exception; if coil short light is lighted, place aircraft master switch in OFF position and replace governor solenoid coil.

4. If either the right or left engine lights are lighted, attempt to extinguish the light by rotating appropriate propeller in direction of normal rotation. If lights are not lighted, attempt to light by rotating propeller.
5. Place synchrophaser mode switch in the manual position. The test set manual light should light and the phase light should extinguish. Placing mode switch in PHASE ADJUSTMENT position should cause the reverse to occur.

— NOTE —

Failure of test lights to operate may indicate a defective wiring harness. Should the wiring harness prove to be good, but the engine lights or coil light fail to function properly, replace the applicable pulse generator or governor.

6. Disconnect the test set from the aircraft and reconnect the computer.

FLIGHT CHECK

1. At cruise altitude, set the engine controls at 75 percent power.
2. Beat synchronize the propellers.
3. With the propeller control, increase or decrease right engine speed approximately 50 revolutions per minute (rpm).

FLIGHT CHECK (continued)

4. Place the synchrophaser mode switch in the PHASE ADJUSTMENT position. The propellers will synchronize automatically if the system is operating properly. If synchronization is not attained, return mode switch to MANUAL for 30 to 45 seconds. Resynchronize the engines manually to within 25 to 30 rpm of each other. Return the mode switch to the PHASE ADJUSTMENT position. If synchronization is again not attained, repeat flight check.

— NOTE —

Place synchrophaser mode switch in manual position for all takeoff, landing and engine-out operations.

COMPUTER

REMOVAL OF COMPUTER ASSEMBLY

The computer assembly is located in the nose section of the aircraft, accessible thru the baggage compartment. It is mounted on the deice mounting bracket, on the left side of compartment.

1. Remove baggage compartment trim panels to gain access to the computer.
2. Disconnect the electrical plug from the computer assembly.
3. Remove the four (4) screws and washers securing the computer assembly to the mounting bracket.
4. Remove the computer assembly from the airplane.

INSTALLATION OF COMPUTER ASSEMBLY

1. Position the computer assembly on the mounting bracket and secure with screws and washers previously removed.
2. Reconnect electrical plug to computer assembly.
3. Install baggage compartment trim panels previously removed.

PULSE GENERATOR

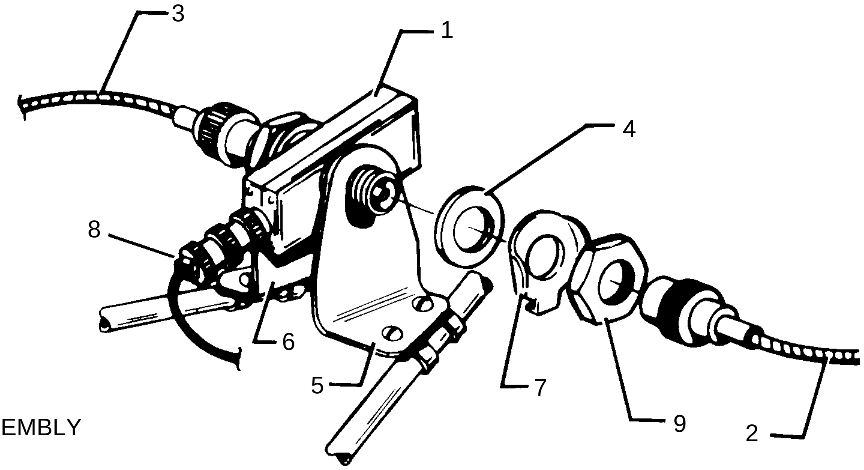
REMOVAL OF PULSE GENERATOR (Refer to Figure 61-6.)

There is a pulse generator on each engine. They are mounted on the engine mount tubes at the top of the engine. (Refer to Figure 61-5.)

1. Remove the engine cowling access panel.
2. Remove the electrical plug from the pulse generator.
3. Loosen the knurled nuts securing the tachometer shafts to the pulse generator and remove the shafts from the pulse generator assembly.
4. Remove the two hex nuts, tab washers and washers.
5. Loosen the screws and nuts securing the mounting brackets.
6. Spread the brackets sufficiently to allow the pulse generator to be removed.

INSTALLATION OF PULSE GENERATOR (Refer to Figure 61-6.)

1. Place the pulse generator in position between the mounting brackets.
2. Press brackets together and install washer, a new tab washer and the hex nut.
3. Tighten the nuts and screws securing the brackets to the engine mount tubes.
4. Attach tachometer shafts to pulse generator.
5. Attach the electrical plug to the pulse generator.



1. PULSE GENERATOR ASSEMBLY
2. TACHOMETER SHAFT
3. TACHOMETER SHAFT
4. WASHER
5. BRACKET
6. BRACKET
7. TAB WASHER
8. ELECTRICAL PLUG
9. HEX NUT

Figure 61-6. Pulse Generator Installation

TIMING OF PULSE GENERATOR (BOTH ENGINES)

— CAUTION —

BE CERTAIN MAGNETO SWITCHES ARE OFF.

— NOTE —

Refer to Chapter 91 for appropriate electrical schematic

1. Loosen the 1 inch hex nut securing the pulse generator to the dual drive unit.
2. Turn the engine in the direction of rotation to locate (No. 1 piston at top dead center) on the ignition stroke, (use the engine timing mark).

— NOTE —

If you miss this point, DO NOT TURN ENGINE BACKWARD,
START OVER.

3. Turn the pulse generator counterclockwise to align the timing mark with the center of the key-way.
4. Secure the 1 inch hex nut.
5. Pull the propeller through (in direction of rotation) two complete revolutions and stop at the phase position. Check timing mark alignment; reset if necessary.

ENGINE SYNCHROPHASER MAGNETIC PICKUP. (S/N 34-8133001, 34-8133173 through 34-8633031, 3433001 and up, and 3448001 and up)

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.

SYSTEM OPERATING PROCEDURE

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.

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.

TEST PROCEDURE (Continued)

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).
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.

PROP-SYNCH SWITCH

REMOVAL AND INSTALLATION OF PROP-SYNCH SWITCH

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.

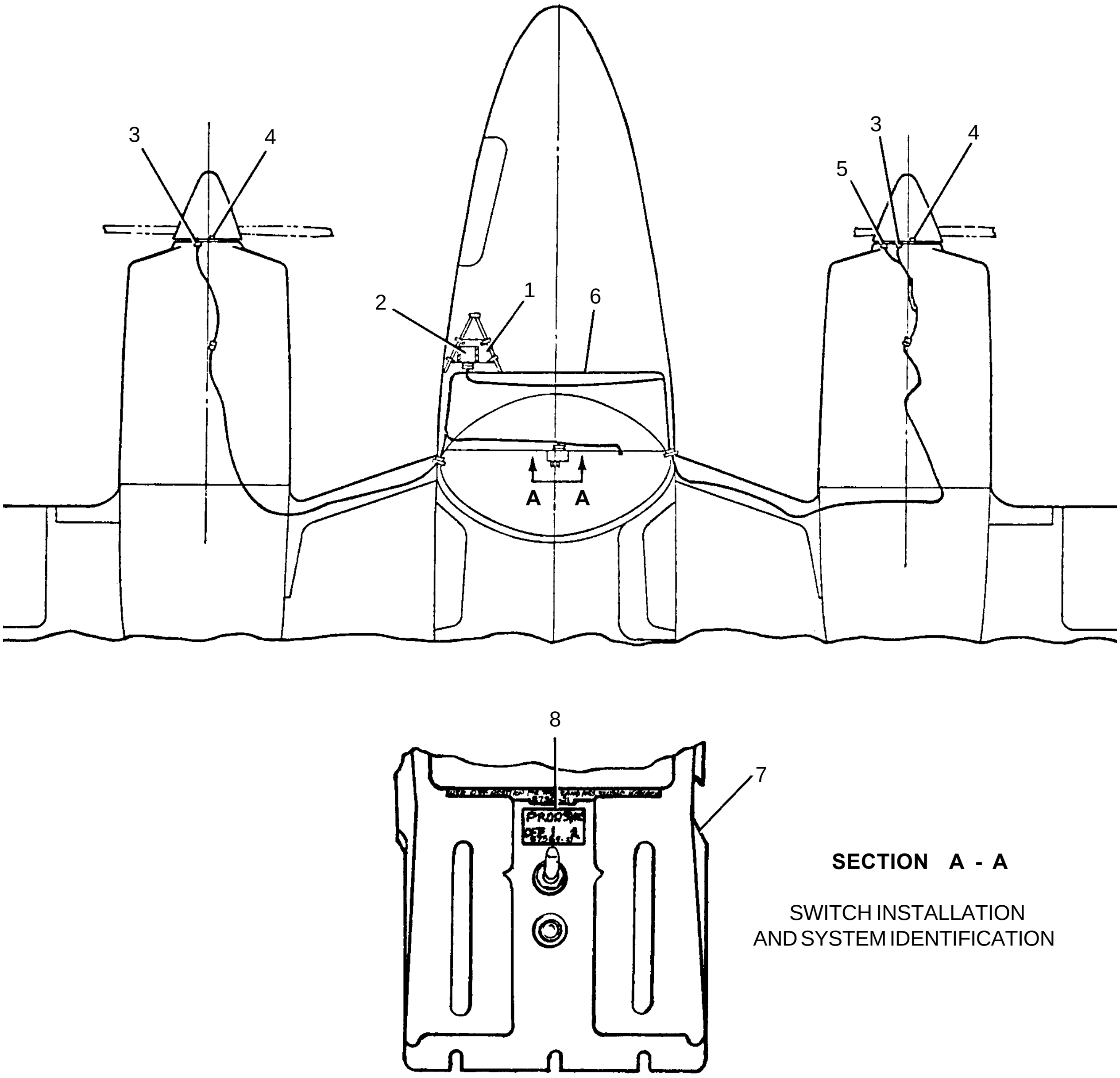
MAGNETIC PICKUP

REMOVAL AND INSTALLATION OF MAGNETIC PICKUP (Refer to Figures 61-8 and 61-9.)

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.



SECTION A - A

SWITCH INSTALLATION
AND SYSTEM IDENTIFICATION

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

"AUTO-SYNC"
(FIXED PHASE)
INSTALLATION

Figure 61-7. Propeller Synchrophaser Installation (Magnetic Pickup)
(S/N 34-8133001, 34-8133173 through 34-8633031, 3433001 and up, and 3448001 and up)

REMOVAL AND INSTALLATION OF MAGNETIC PICKUP (Refer to Figures 61-8 and 61-9.) (continued)

1. To remove magnetic pickup:
   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. To install magnetic pickup:
   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.

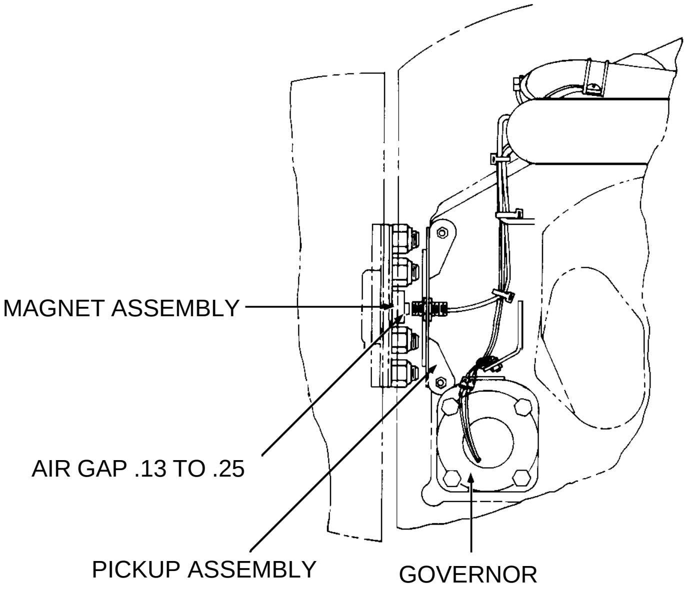
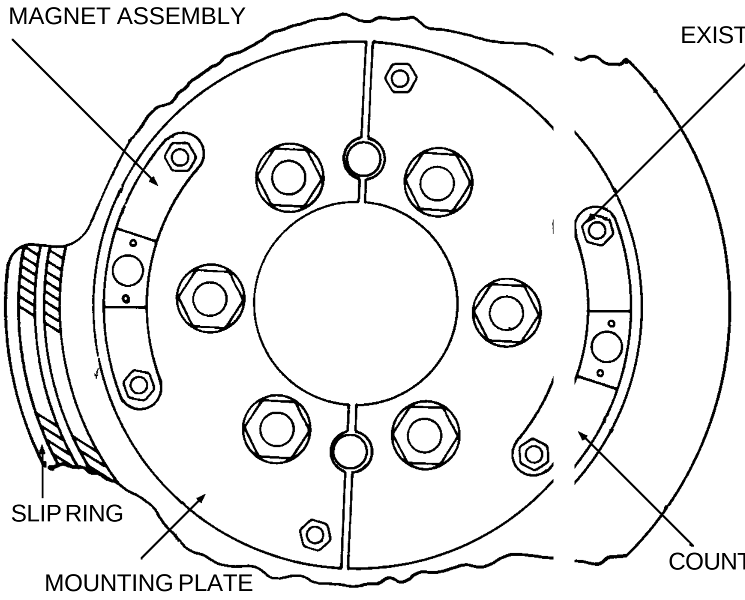


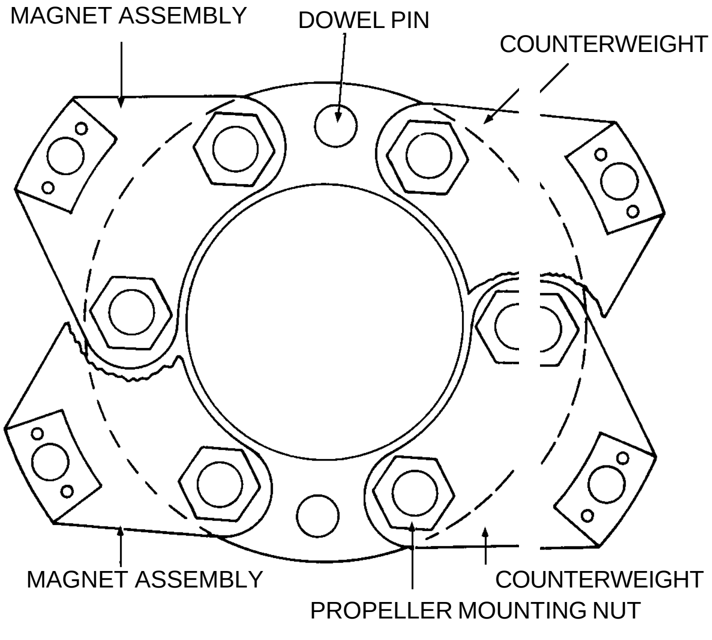
Figure 61-8. Magentic Pickup and Governor Installation



NOTE

ORIENT THE RIGHT ENGINE TO PLACE DOWL 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.

INSTALLATION WITH DEICE SYSTEM INSTALLED



NOTE

ORIENT THE RIGHT ENGINE TO PLACE DOWL 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.

INSTALLATION WITHOUT DEICE SYSTEM INSTALLED

Figure 61-9. Magnet Assemblies

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PROPELLER UNFEATHERING ACCUMULATOR SYSTEM

The optional 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 SERVICE

— 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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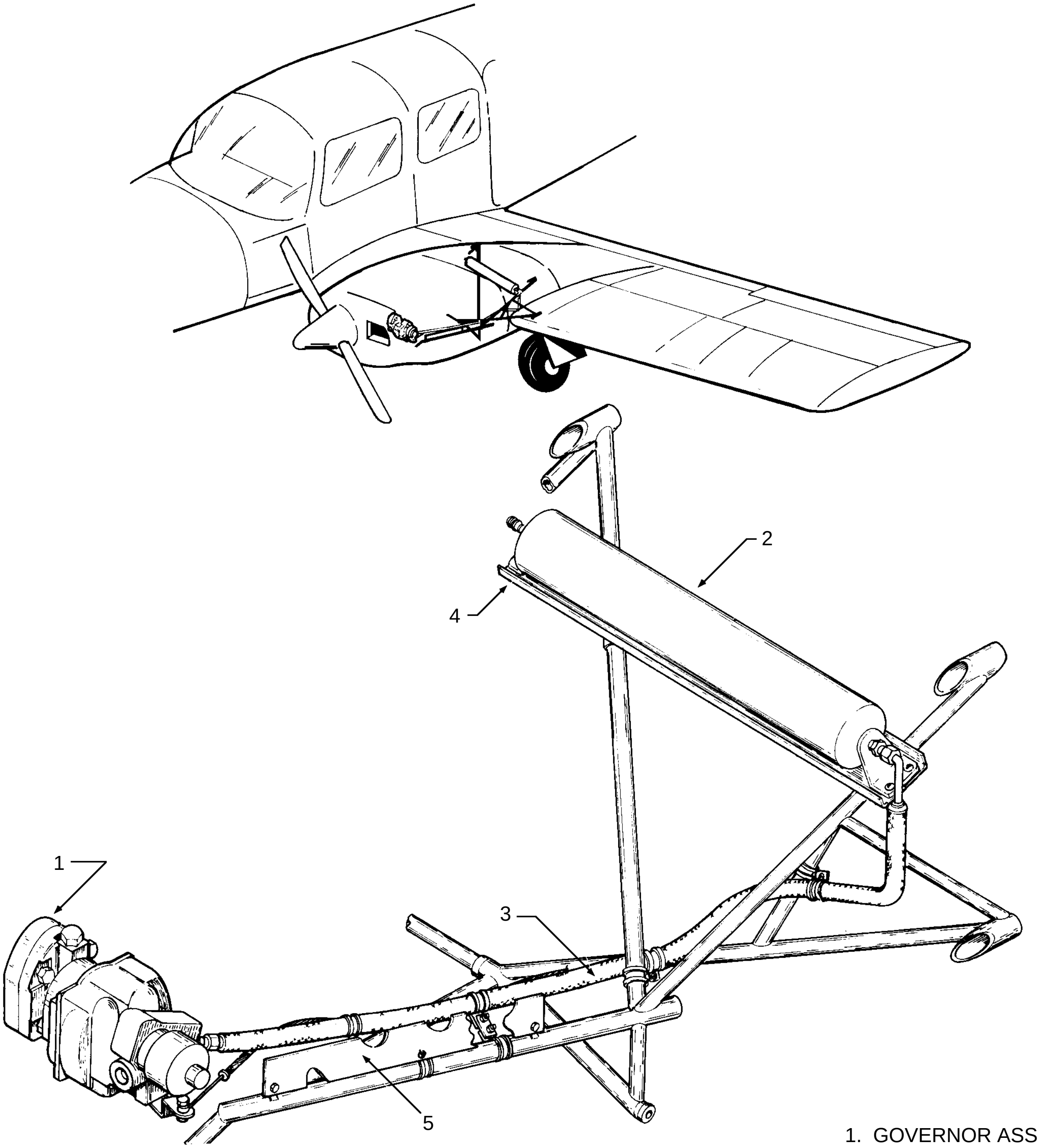

1. GOVERNOR ASSY.
2. ACCUMULATOR
3. HOSE ASSY.
4. BRACKET
5. HEAT SHIELD

Figure 61-10. Propeller Unfeathering Accumulator Installation

CHAPTER

70

STANDARD PRACTICES ENGINES

CHAPTER 70 - STANDARD PRACTICES ENGINE

TABLE OF CONTENTS/EFFECTIVITY

STANDARD PRACTICES - ENGINE

The following procedures should be used whenever applicable:

1. To facilitate and ensure proper reinstallation, tag and/or mark all parts and hardware as to their location before they are removed or disassembled.
2. When removing any tubes or engine parts, look for indications of scoring, burning or other undesirable conditions. Tag any unserviceable parts or units for investigation and possible repair.
3. Take extreme care to prevent foreign matter (lockwire, nuts, washers, dirt, etc) from entering the engine whether it is on or off the aircraft. Make use of protective caps, plugs, and covers to ensure openings are unexposed.

— CAUTION —

DUST CAPS USED TO PROTECT OPEN LINES SHOULD 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 THE DUST CAPS IN THE TUBE ENDS.

4. If anything is dropped into the engine, work should be stopped immediately and the item removed even if considerable time and labor is required.
5. Ensure all parts are thoroughly clean before assembling, especially during engine build up.
6. All lockwire and cotter pins must fit snugly in holes drilled in the specific hardware. On castellated nuts, the cotter pin head must fit into a recess of the nut with the other end bent such that one leg is back over the stud and the other is down flat against the nut. Use only corrosion resistant steel for cotter pins or lockwire.
7. When replacing gaskets, packings, or rubber parts, use the same type or composition as that removed.
8. Make sure replacement nonmetallic parts show no sign of storage deterioration.
9. Use only a mallet of plastic or rawhide when installation of a part requires such force.
10. Loose fitting spline drives external to the engine which have no means of lubrication should be lubricated with an anti-seize lubricant such as molybdenum disulfide.

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CHAPTER

71

POWER PLANT

CHAPTER 71 - POWER PLANT

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

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.

DESCRIPTION (REFER TO CHART 7101.)

Both the Seneca III and Seneca IV are powered by two continental engines; a TSIO 360-KB (left) and LTSIO 360-KB (right). EAch engine is turbocharged with a Rayjay turbo 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.

CHART 7101. ENGINE DATA

Model (Teledyne Continental)	TSIO & LTSIO-360-KB
Number of Cylinders	6 Horizontally Opposed
Bore (Inches)	4.44
Stroke (Inches)	3.88
Displacement (Cubic Inches)	360
Compression Ratio	7.5:1
Type of Propeller Drive, Flanged	Direct
Fuel, Minimum Octane	100 or 100 LL
Oil Sump Capacity	8 quarts
Oil Pressure (PSI):	
Minimum	10 (Idle)
Normal	30-80
Maximum	100 (Cold - Ground)
Oil Temperature (°F):	
Minimum	100
Normal	100-200
Maximum	240
Probe Location	Above Oil Cooler
Cylinder Head Temperature (°F)	
No. 2 cyl.:	
Minimum	240°F
Normal	240-420°F
Maximum	460°F

CHART 7101. ENGINE DATE (continued)

Magnetos	Bendix 25 Series
Left Bank	Fires 20° BTC Lower Right, Upper Left
Right Bank	Fires 20° BTC Lower Left, Upper Right
Firing Order:	
LTSIO-360-KB	1-4-5-2-3-6
TSIO-360-KB	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
Spark Plug Torque	360 to 420 inch-pounds
Alternator	12-volt, 60 ampere
Starter	12-volt, Prestolite
Engine Dry Weight With Accessories	392 pounds

TROUBLESHOOTING

Troubles peculiar to the power plane are listed in Chart 7102, 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.

CHART 7102. 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.

CHART 7102. TROUBLESHOOTING ENGINE (continued)

Trouble	Cause	Remedy
Engine will not start. (continued)	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.	Readjust idle setting. Turn adjustment screw clockwise to lean mixture and counterclockwise to richen mixture.
	Fouled spark plugs. idle. (continued)	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.
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.

CHART 7102. TROUBLESHOOTING ENGINE (continued)

Trouble	Cause	Remedy
Engine has poor acceleration. (continued)	Malfunctioning turbocharger.	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.	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.
t .	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.
	Improperly adjusted waste gate valve.	Check exhaust bypass screw adjustment.
	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).

CHART 7102. TROUBLESHOOTING ENGINE (continued)

Trouble	Cause	Remedy
Engine lacks power, reduction in maximum manifold pressure or critical altitude. (continued)	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 manifolding.	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.
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.

CHART 7102. TROUBLESHOOTING ENGINE (continued)

Trouble	Cause	Remedy
Low fuel flow. (continued)	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.
	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.
	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.
	Fuel gauge line leak or improperly purged lines.	Purge gauge line and tighten connections.

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.	Air 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.
While smoke exhaust.	Turbo choking oil forced through seal in turbine housing.	Clean or change turbocharger. Refer to Chapter 81.

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COWLING

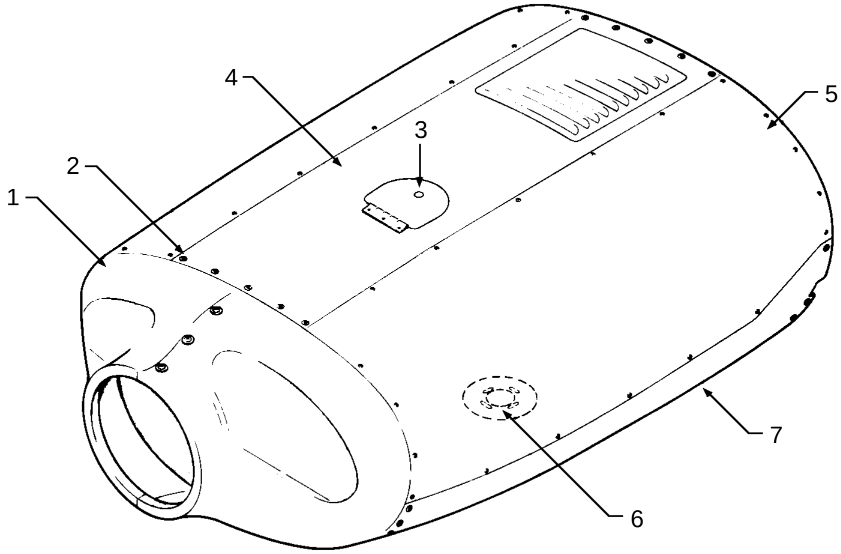
REMOVAL OF ENGINE COWLING (Refer to Figure 71-1.)

The procedure for removing the engine cowling is the same for both engines.

1. Release the fasteners securing the two side access panels.
2. Remove the fasteners securing the top cowl and then remove the top cowl.
3. Disconnect the cowl flap control.
4. Support the bottom cowl and remove the screws that attach the cowl to nose cowl, engine mount and nacelle.
5. The nose cowl may be removed by removing the attaching screws and separating the two cowl halves.

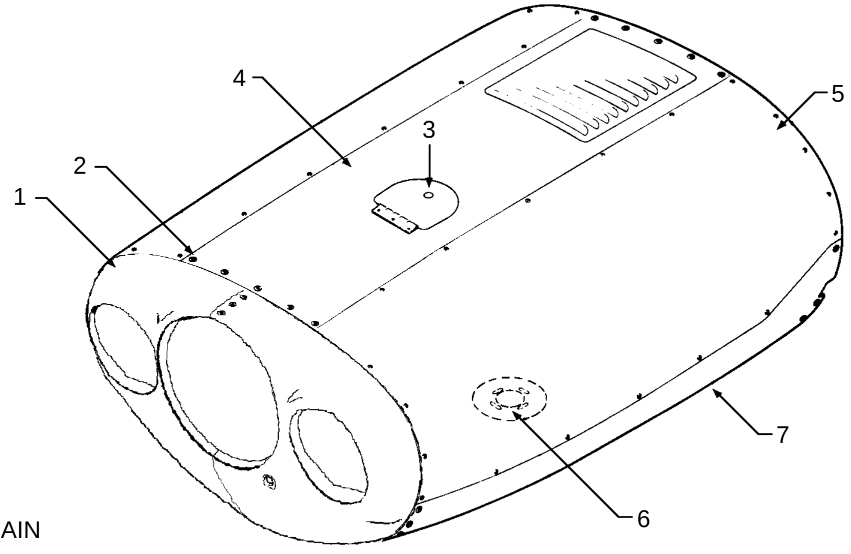
CLEANING, INSPECTION AND REPAIR OF ENGINE COWLING

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, Chapter 51.



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

Figure 71-1. Seneca III Engine Cowling Installation (Sheet 1 of 2)



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

Figure 71-1. Seneca IV Engine Cowling Installation (Sheet 2 of 2)

INSTALLATION OF ENGINE COWLING (Refer to Figure 71-1.)

1. Position the two nose cowl halves on the front of the engine and secure with screw fasteners.
2. Position the bottom cowl and secure with screw fasteners to the aft nacelle, engine mount and nacelle.
3. Connect the cowl flap control.
4. Position the top cowl and secure with attaching screw fasteners.
5. Secure the side cowls to the upper and lower cowling.

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MOUNTS

REPLACEMENT OF ENGINE SHOCK MOUNTS (Refer to Figure 71-2.)

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.

ENGINE

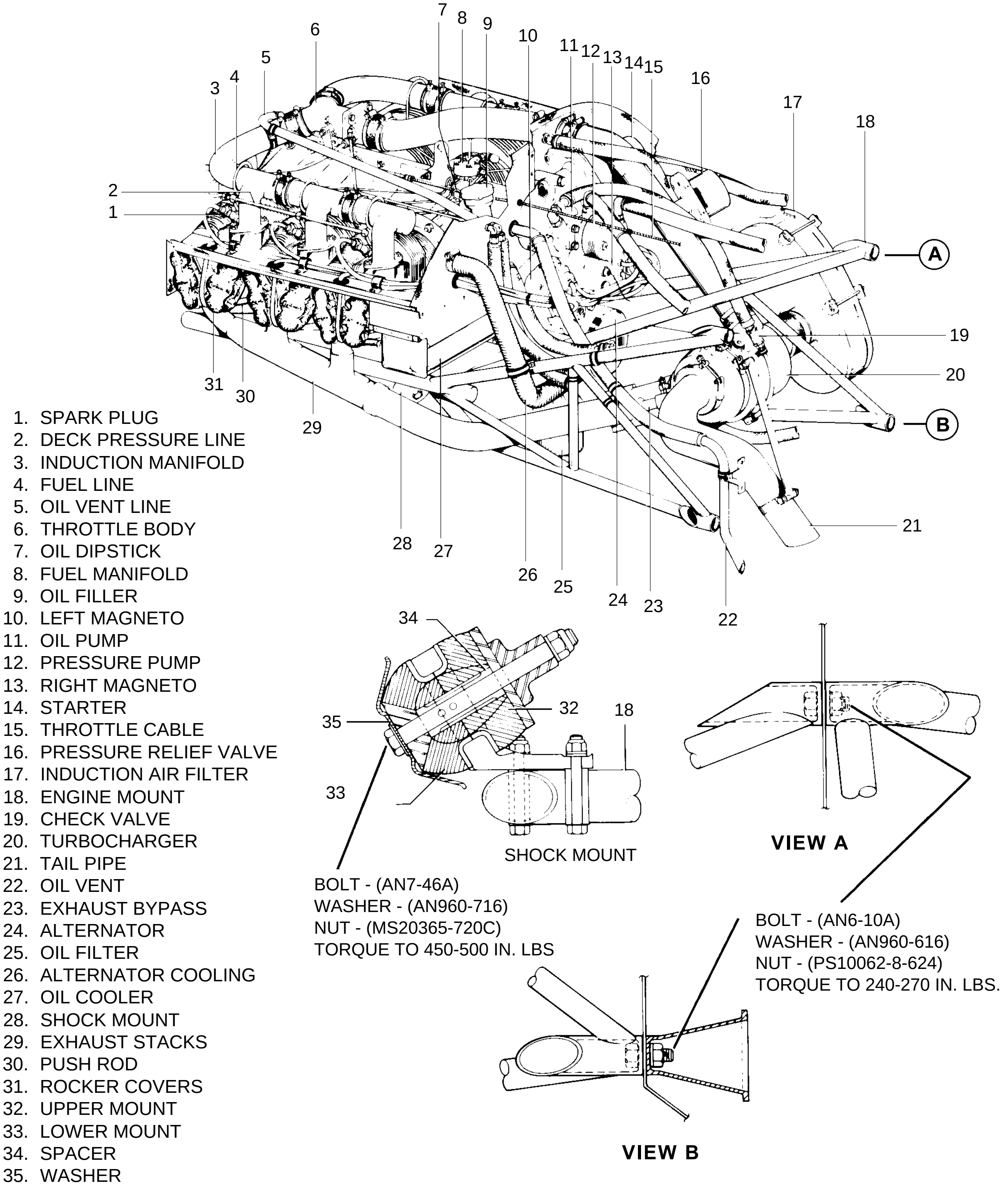
REMOVAL OF ENGINE (Refer to Figure 71-2.)

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 cowling.
4. Remove the propeller. (Refer to Chapter 61.)
5. Disconnect the starter positive lead and ground lead at the starter.
6. 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.
9. 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 vent line from the engine.
12. Disconnect the oil cooler lines.

— 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.

13. Disconnect the magneto “P” leads at the magnetos.
14. Disconnect the engine vent tube at the engine.
15. Disconnect the engine oil temperature lead at the aft end of the engine.
16. Untie the ignition harness, hoses and lines at the aft end of the engine.
17. Disconnect the pneumatic pump lines at pump and remove fittings from pump.
18. Disconnect the oil pressure line at the engine.
19. Disconnect the fuel flow line at the left rear engine baffle.
20. Disconnect the manifold pressure line at the left rear side of the engine.
21. Disconnect the alternator leads and the cable attachment clamps.



1. SPARK PLUG
2. DECK PRESSURE LINE
3. INDUCTION MANIFOLD
4. FUEL LINE
5. OIL VENT LINE
6. THROTTLE BODY
7. OIL DIPSTICK
8. FUEL MANIFOLD
9. OIL FILLER
10. LEFT MAGNETO
11. OIL PUMP
12. PRESSURE PUMP
13. RIGHT MAGNETO
14. STARTER
15. THROTTLE CABLE
16. PRESSURE RELIEF VALVE
17. INDUCTION AIR FILTER
18. ENGINE MOUNT
19. CHECK VALVE
20. TURBOCHARGER
21. TAIL PIPE
22. OIL VENT
23. EXHAUST BYPASS
24. ALTERNATOR
25. OIL FILTER
26. ALTERNATOR COOLING
27. OIL COOLER
28. SHOCK MOUNT
29. EXHAUST STACKS
30. PUSH ROD
31. ROCKER COVERS
32. UPPER MOUNT
33. LOWER MOUNT
34. SPACER
35. WASHER

BOLT - (AN7-46A)
WASHER - (AN960-716)
NUT - (MS20365-720C)
TORQUE TO 450-500 IN. LBS

BOLT - (AN6-10A)
WASHER - (AN960-616)
NUT - (PS10062-8-624)
TORQUE TO 240-270 IN. LBS.

Figure 71-2. Power Plant Installation

REMOVAL OF ENGINE (Refer to Figure 71-2.) (continued)

— CAUTION —

PLACE A TAIL STAND UNDER THE TAIL OF THE AIRPLANE BEFORE REMOVING AN ENGINE.

22. Attach a one-half ton (minimum) hoist to the hoisting straps and relieve the tension from the engine mounts.
23. Check the engine for any attachments remaining to obstruct its removal.

— NOTE —

Remove exhaust system components where they pass through engine mount.

24. Drain the engine oil.
25. Remove the engine mounting bolts and lower mount assembly.
26. 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.

INSTALLATION OF ENGINE (Refer to Figure 71-2.)

Prior to installing the engine, be sure to install all items that were removed after the engine was removed from the aircraft.

— NOTE —

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 450 to 400 inch-pounds.
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.
6. Reconnect all lines and hoses previously disconnected from the engine.

— NOTE —

Apply Lubon #404 to all male fuel system fittings. Do not allow to enter system.

7. Route and connect the electrical leads to the appropriate connections on the engine.
8. Connect the tachometer drive cable.

— NOTE —

Secure all cables, hoses and wires with clamps and Ty-strap in the same location as before removal.

9. Connect the air conditioning compressor lines, if compressor is installed.

INSTALLATION OF ENGINE (Refer to Figure 71-2.)

10. Install the propeller and spinner per Chapter 61.
11. Service the engine with the proper grade and quantity of oil; refer to Chapter 12.
12. Be certain all switches are in the OFF position and connect the battery cables.
13. Install the engine cowling.
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.

— NOTE —

Check exhaust pipe clearance. Minimum clearance to structure and cowl flap door opening should be 0.50 of an inch (12.7 mm).

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AIR INTAKES

INDUCTION SYSTEM AIR FILTER

REMOVAL OF AIR FILTER (Refer to Figure 71-3.)

1. Remove the side panel cowl on the right side of the engine.
2. Release the stud fasteners; remove the filter cover and withdraw the filter element.

CLEANING INDUCTION AIR FILTER

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.

— CAUTION —

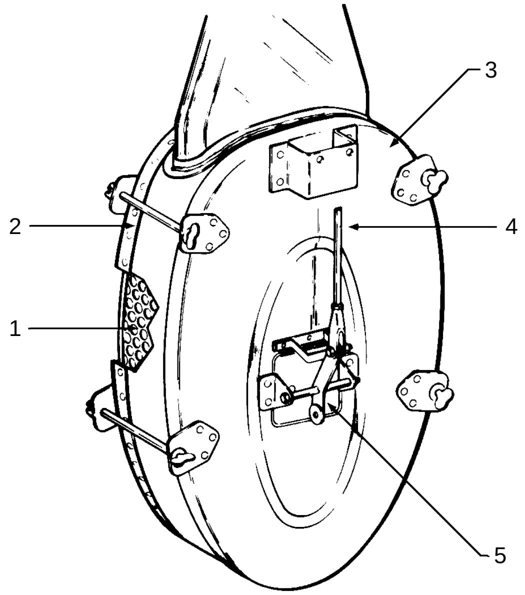
NEVER WASH THE FILTER ELEMENT IN ANY LIQUID OR SOAK IT IN OIL. NEVER ATTEMPT TO BLOW OFF DIRT WITH COMPRESSED AIR.

INSTALLATION OF AIR FILTER (Refer to Figure 71-3.)

1. Install the filter box assembly if removed.
2. Position the filter element in the box assembly and secure the cover assembly with the stud fasteners.

— NOTE —

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. FILTER ELEMENT CA-161-PL
2. BOX ASSEMBLY
3. COVER ASSEMBLY
4. ALTERNATE AIR CONTROL CABLE
5. ALTERNATE AIR DOOR

Figure 71-3. Induction System Installation

ALTERNATE AIR DOOR

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:

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.

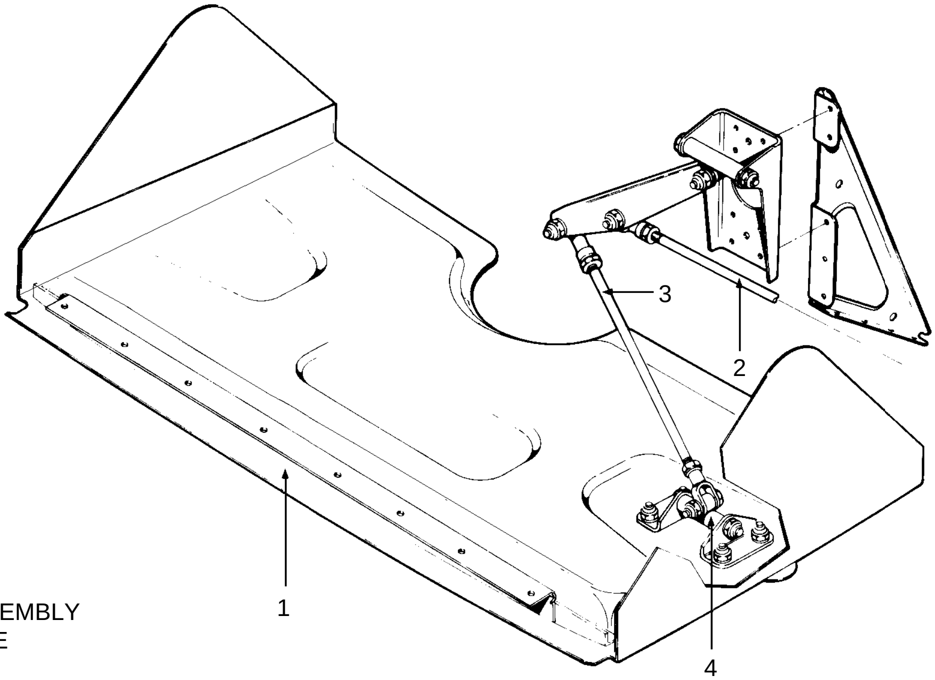
ENGINE COWL FLAPS

The cowl flaps are all metal flaps located on the rear of the bottom cowls. The flaps are manually operated through a push-pull control from the cockpit. The cowl flaps are connected to the engine cowls with full length piano type hinges.

OPERATION AND ADJUSTMENT OF COWL FLAPS

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:

1. Place the control in the up position.
2. Ascertain that the control lock is engaged.
3. Check the cowl flap to visually determine that the flap is flush with the bottom of the engine cowl.
4. If the flap is not flush, disconnect the push-pull control from the arm on the inboard side of the flap.
5. Loosen the jam nut on the clevis end and adjust the clevis to get a flush fit between the cowl flap and engine cowl.
6. 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.
7. If the cowl flap is not flush, repeat steps 4 through 6.
8. When the adjustment is completed, tighten the clevis jam nut and secure the push-pull control to the cowl flap.



1. COWL FLAP ASSEMBLY
2. CONTROL CABLE
3. ROD ASSEMBLY
4. TRUNNION ASSEMBLY

Figure 71-4. Cowl Flap Installation

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CHAPTER

73

ENGINE FUEL SYSTEM

CHAPTER 73 - ENGINE FUEL SYSTEMS

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

DESCRIPTION (Refer to Figure 73-1.)

The Continental injection system is used on each of the engines of both the Seneca III and 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.

TROUBLESHOOTING

Refer to Chart 7102, Chapter 71.

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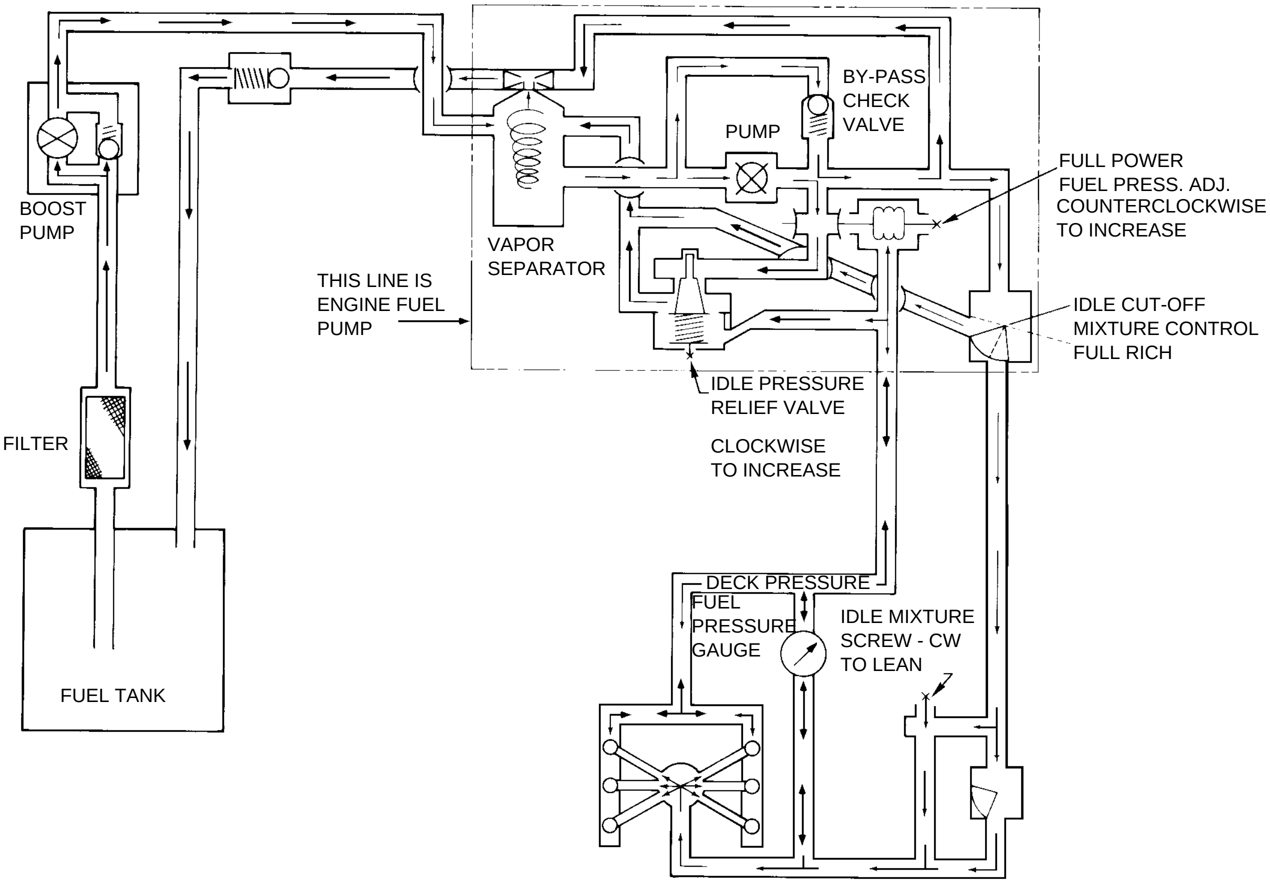


Figure 73-1. Schematic Diagram of Fuel Injection System

DISTRIBUTION

FUEL INJECTION SYSTEM MAINTENANCE

— CAUTION —

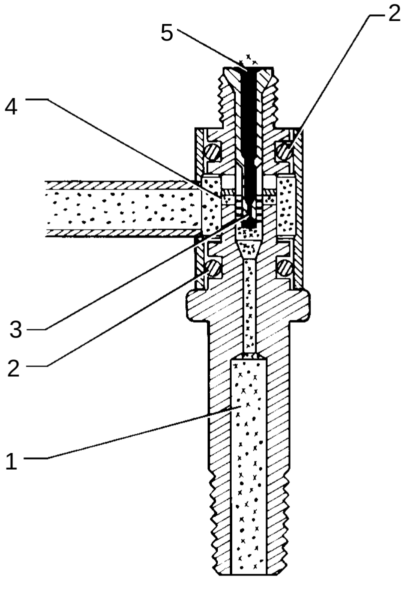
DO NOT USE ANY FORM OF THREAD COMPOUND ON FUEL LINE FITTINGS. USE ONLY A FUEL SOLUBLE LUBRICANT SUCH AS ENGINE OIL.

1. Check all attaching parts for tightness.
2. Check all fuel for leaks, evidence of damage, or chafing by metal to metal contact.
3. Check control connections, levers, and linkages for safety.
4. 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.

FUEL INJECTOR NOZZLE ASSEMBLY (Refer to Figure 73-2)

REMOVAL OF FUEL INJECTOR NOZZLES

1. Remove the cowling side access panels.
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.



1. INJECTION MIXTURE OUTLET
2. O-RING
3. CALIBRATED ORIFICE
4. RAM AIR INLET
5. FUEL INLET

Figure 73-2. Fuel Injector Nozzle Assembly

CLEANING AND INSPECTION OF FUEL INJECTOR NOZZLES.

— 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 fresh cleaning solvent. Use compressed air to dry.
2. Inspect the nozzles for cleanliness; pay particular attention to the orifices. Check the condition of the nozzle and cylinder threads.

INSTALLATION OF FUEL INJECTOR NOZZLES

1. Carefully start the nozzles by hand to prevent cross-threading. Torque nozzle to 60 inch-pounds.
2. Install reference air lines on nozzles.
3. Connect the fuel line to the nozzle.
4. Reinstall cowling side panels.

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INDICATING

DUAL FUEL FLOW GAUGE

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.

CHART 7301. 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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CHAPTER

74

IGNITION

CHAPTER 74 - IGNITION

TABLE OF CONTENTS/EFFECTIVITY

GENERAL (Refer to Figure 74-1)

— CAUTION —

ENSURE THAT THE PRIMARY CIRCUITS OF BOTH MAGNETOS ARE GROUNDED BEFORE WORKING ON THE ENGINE.

The service instructions contained in this chapter deal with general maintenance and timing of the magnetos to the engine. Refer to the magneto overhaul instructions manual L-205-10 for detailed maintenance. Also refer to the latest revision of Continental Service Bulletin No. M78-8 for additional information.

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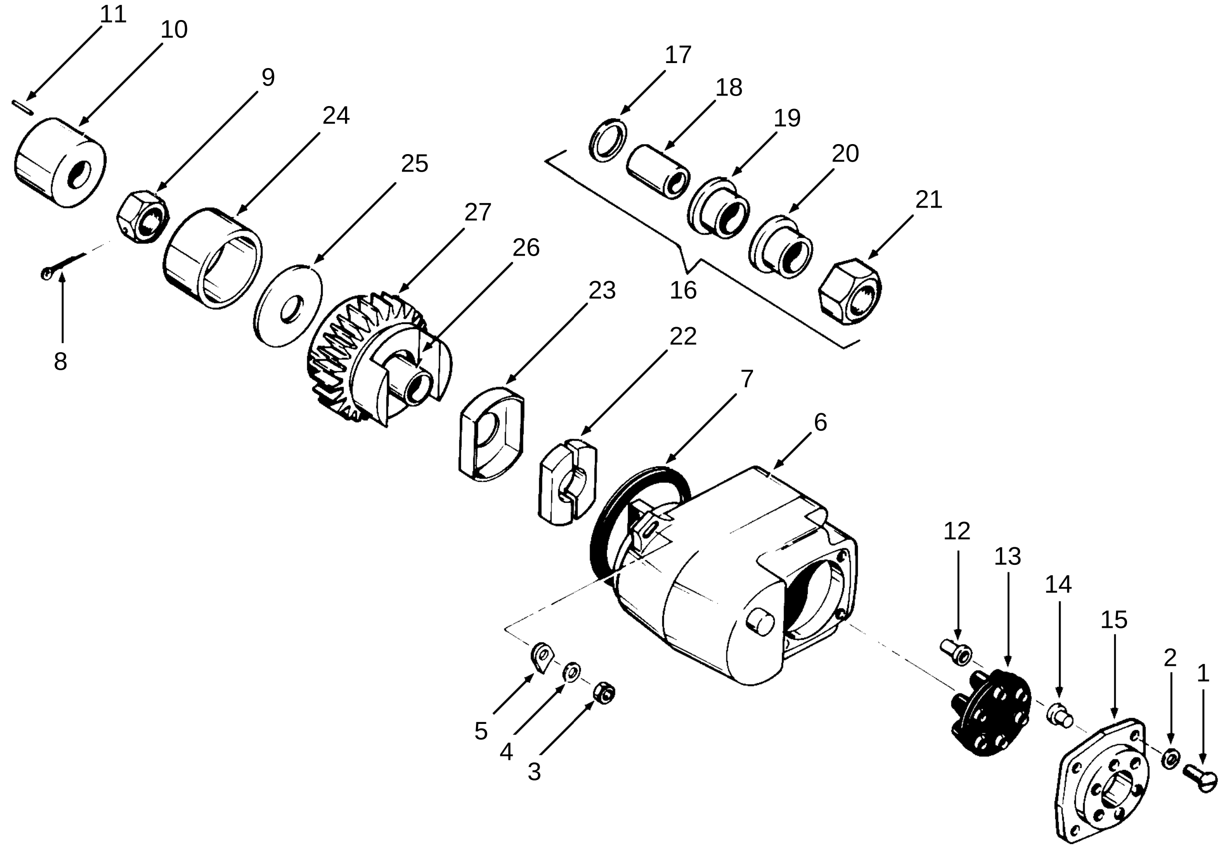

1. SCREW
2. LOCK WASHER
3. NUT
4. LOCK WASHER
5. HOLD DOWN WASHER
6. MAGNETO
7. GASKET
8. COTTER PIN
9. NUT
10. GEAR SUPPORT SHAFT
11. PIN
12. IGNITION CABLE EYELET
13. DISTRIBUTOR CABLE GROMMET
14. IGNITION CABLE FERRULE
15. DISTRIBUTOR CABLE PLATE
16. GROUND TERMINAL KIT
17. WASHER
18. INSULATING SLEEVE
19. INNER FERRULE
20. OUTER FERRULE
21. COUPLING NUT
22. COUPLING BUSHINGS
23. RETAINER
24. NEEDLE BEARING
25. WASHER
26. PILOT SLEEVE BUSHING
27. MAGNETO DRIVE GEAR

Figure 74-1. Magneto Assembly

ELECTRICAL POWER SUPPLY

INSPECTION OF MAGNETOS

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 74-2. 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 74-3 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.
8. Minor irregularities or roughness of point surfaces are not harmful (refer to Figure 74-3, 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 74-3, 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.

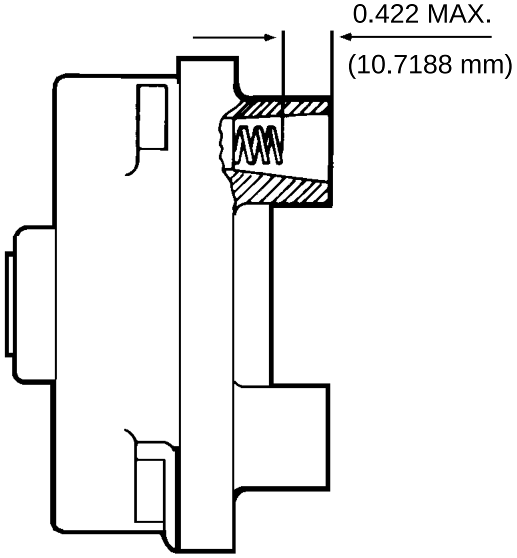

Figure 74-2. Contact Spring Inspection

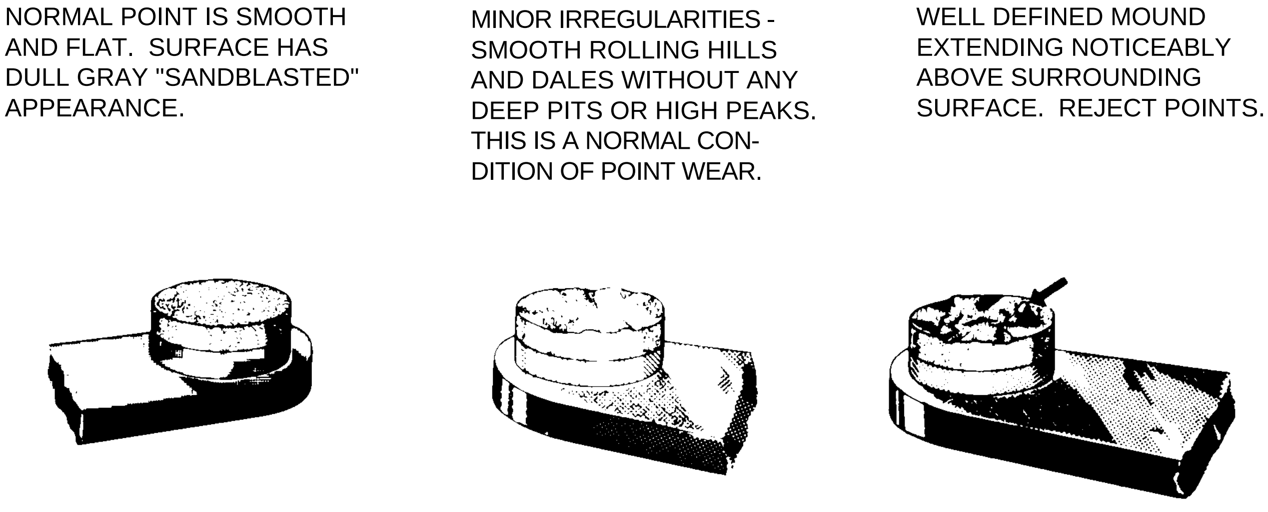

Figure 74-3. Contact Points

INSPECTION OF MAGNETOS (continued)

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 74-4, the cam assembly must be replaced. Check clearance between both flyweight and the cam of each cam assembly.
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 74-5. 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.

— NOTE —

Installation of pressurized magneto retrofit kit (Piper p/n 764 921) will provide pressurized air to the magneto, improving ignition system operation at higher altitudes, and reducing the frequency of ignition system maintenance. (Refer to Parts Catalog.)

REMOVAL OF MAGNETO

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.

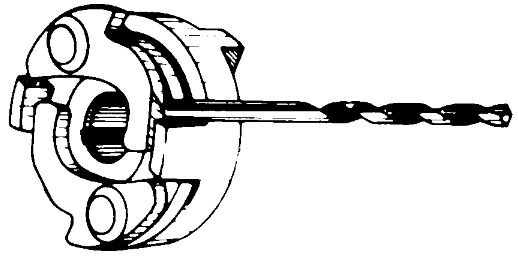

Figure 74-4. Impulse Coupling

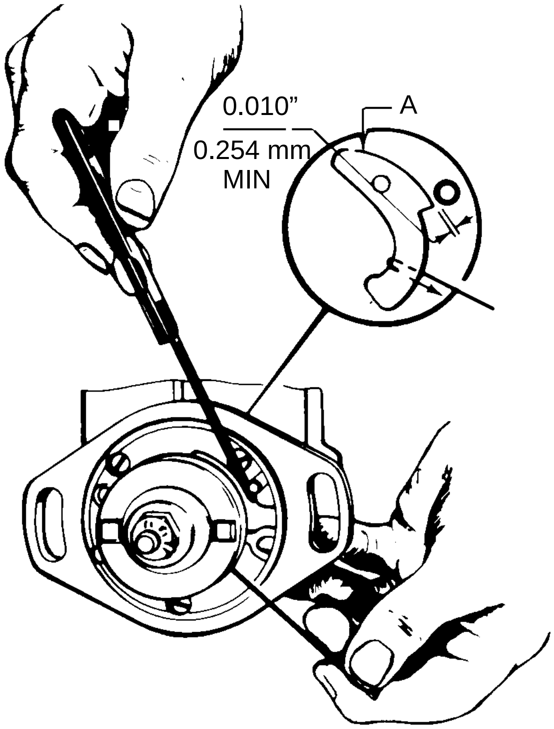

Figure 74-5. Flyweight Clearance of Impulse Coupling

MAGNETO INSTALLATION AND TIMING PROCEDURE (MAGNETO TO ENGINE) (LTSIO IS COUNTER-ROTATING) (Refer to Figure 74-6.)

— 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 74-6.)
   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 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.
   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 mark (midway between the 16 and 24 stamped on the crankshaft) will appear in the center of the inspection hole. The crankshaft has punch marks in 2 degree increments with 16 and 24 at each end. Tighten the magneto attachment nuts and replace the plug in the inspection hole on top of the engine.

MAGNETO INSTALLATION AND TIMING PROCEDURE (MAGNETO TO ENGINE) (LTSIO IS COUNTER-ROTATING) (Refer to Figure 74-6.) (continued)

2. LTS10 timing marks are on the outer edge of the crankshaft propeller flange. (Refer to Sketch B, Figure 74-6.)
   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 Before Top Center mark on the engine is now in the advanced ignition firing position.
   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.

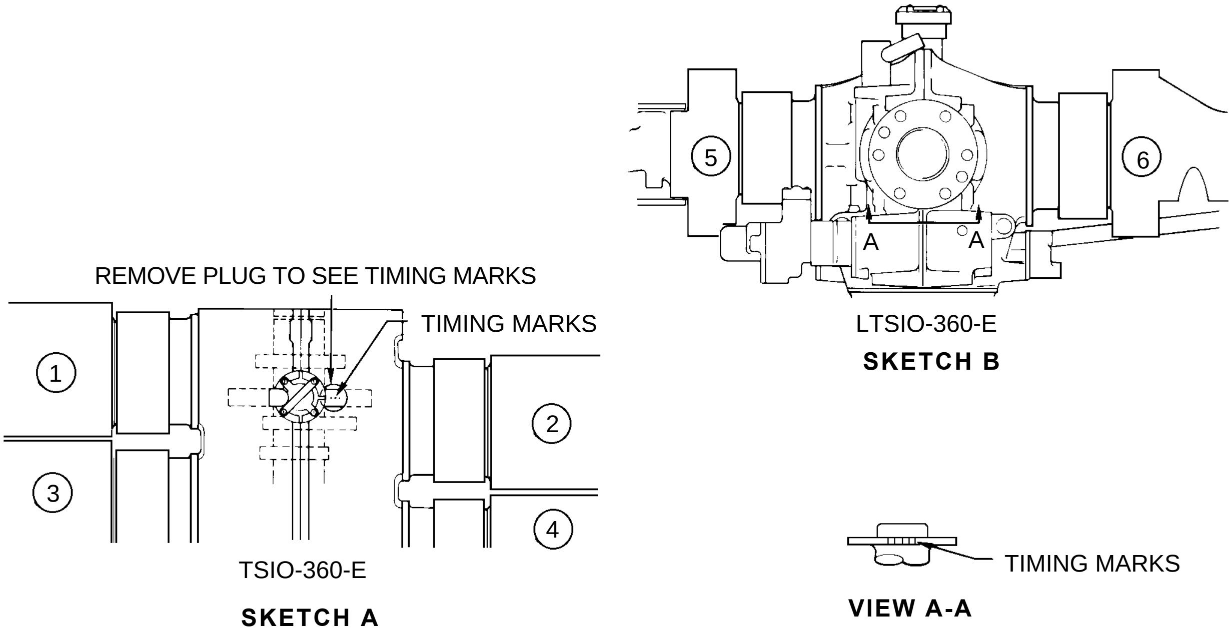

Figure 74-6. Engine Timing Marks

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GRID 4E6
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DISTRIBUTION

HARNESS ASSEMBLY

INSPECTION OF HARNESS

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.

REMOVAL OF HARNESS

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.

MAINTENANCE OF HARNESS

— NOTE —

Refer to the appropriate Bendix information manual for maintenance information pertaining to the specific harness used. See Vendor Information in front of manual for information on contacting Bendix .

INSTALLATION OF HARNESS

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, SM-O-O-TH 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 to22 inch-pounds.
2. Route the ignition wires to their respective cylinders as shown in Figure 74-7.
3. Clamp the harness assembly in position.
4. Connect the leads to the spark plugs.

SPARK PLUGS

REMOVAL OF SPARK PLUGS

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.

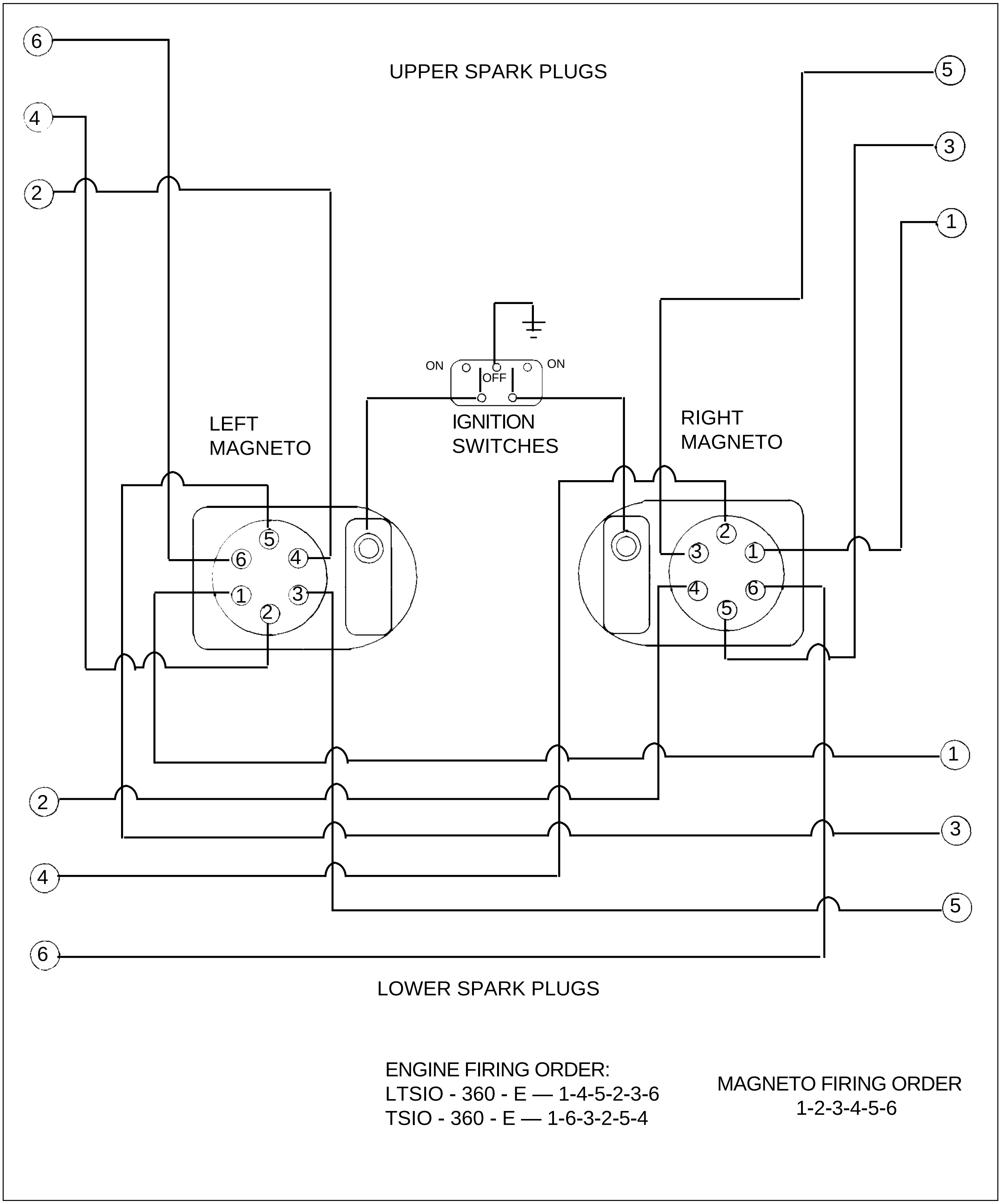

Figure 74-7. Ignition Schematic

REMOVAL OF SPARK PLUGS (continued)

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.
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 $C0_2$ bottle. (Refer to Figure 74-8.) 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 $C0_2$ 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.

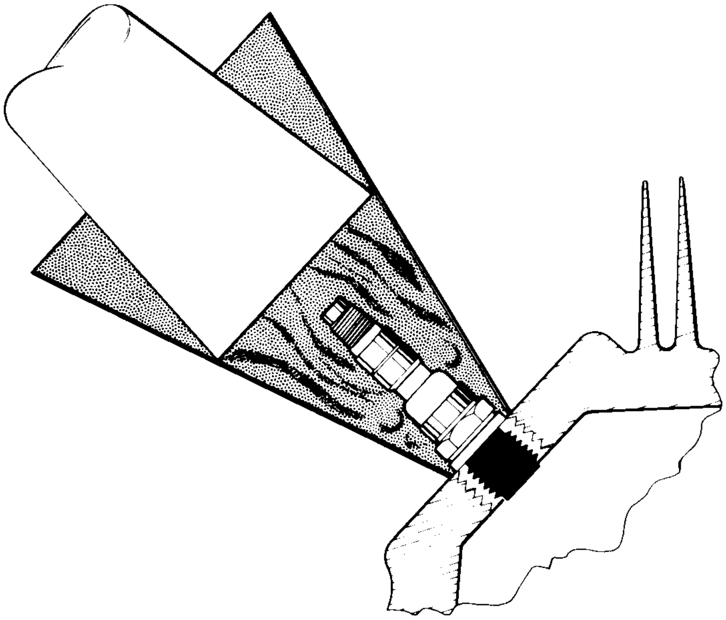

Figure 74-8. Removing Frozen Spark Plug

INSPECTION AND CLEANING OF SPARK PLUGS

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.

INSPECTION AND CLEANING OF SPARK PLUGS (continued)

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.

   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.

INSTALLATION OF SPARK PLUGS

— 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.

GRIDS 4E12 THROUGH 4E14
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CHAPTER

76

ENGINE CONTROLS

CHAPTER 76 - ENGINE CONTROLS

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

This chapter contains information on rigging the power plant controls; throttle, propeller, and mixture.

— NOTE —

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.

— NOTE —

Ensure all cotter pins and/or safety wire are replaced.

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POWER CONTROL

RIGGING OF THROTTLE CONTROLS (Refer to Figure 76-1)

1. Move the affected throttle lever to its full throttle position (full forward).
2. At the appropriate engine, remove the upper left cowl panel and disconnect the cable from the throttle valve arm.
3. 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.
4. Refer to Chapter 32 and check the rigging of the “Gear Warning Throttle Switch.”
5. Reinstall cowl panel.

RIGGING OF PROPELLER CONTROLS (Refer to Figure 76-1)

1. If not already done so, move the particular propeller control to full increase (full forward).
2. At the affected engine, remove the upper left cowl panel and disconnect the control cable from the governor control arm.
3. Refer to Figure 76-1 and check the travel of the control arm. The Hartzell governor must meet the 95° travel requirement.
4. 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.
5. Reinstall cowl panel and ensure alignment of the corresponding control for the other engine.

RIGGING OF MIXTURE CONTROLS (Refer to Figure 76-1)

1. Move the affected mixture control to its full rich (full forward) position.
2. Remove the upper right cowl panel on the appropriate engine and disconnect the control cable from the mixture control arm or the engine fuel pump.
3. Move or ensure the arm is to its full rich (full travel) position. Refer to Figure 76-1 for arm travel specifications.
4. 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.
5. Check the alignment of the corresponding mixture lever and install removed panels and cowl panel.

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. 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.
2. Ensure all lines are tight and that there are no indications of leaks. Fuel dye stains around a fuel fitting indicates a leak.
3. Ensure the overboost relief valve is seated.
4. Check exhaust and induction systems for tightness and no damage.
5. Ensure the intake inlets are clear and that the intake filter is clean.

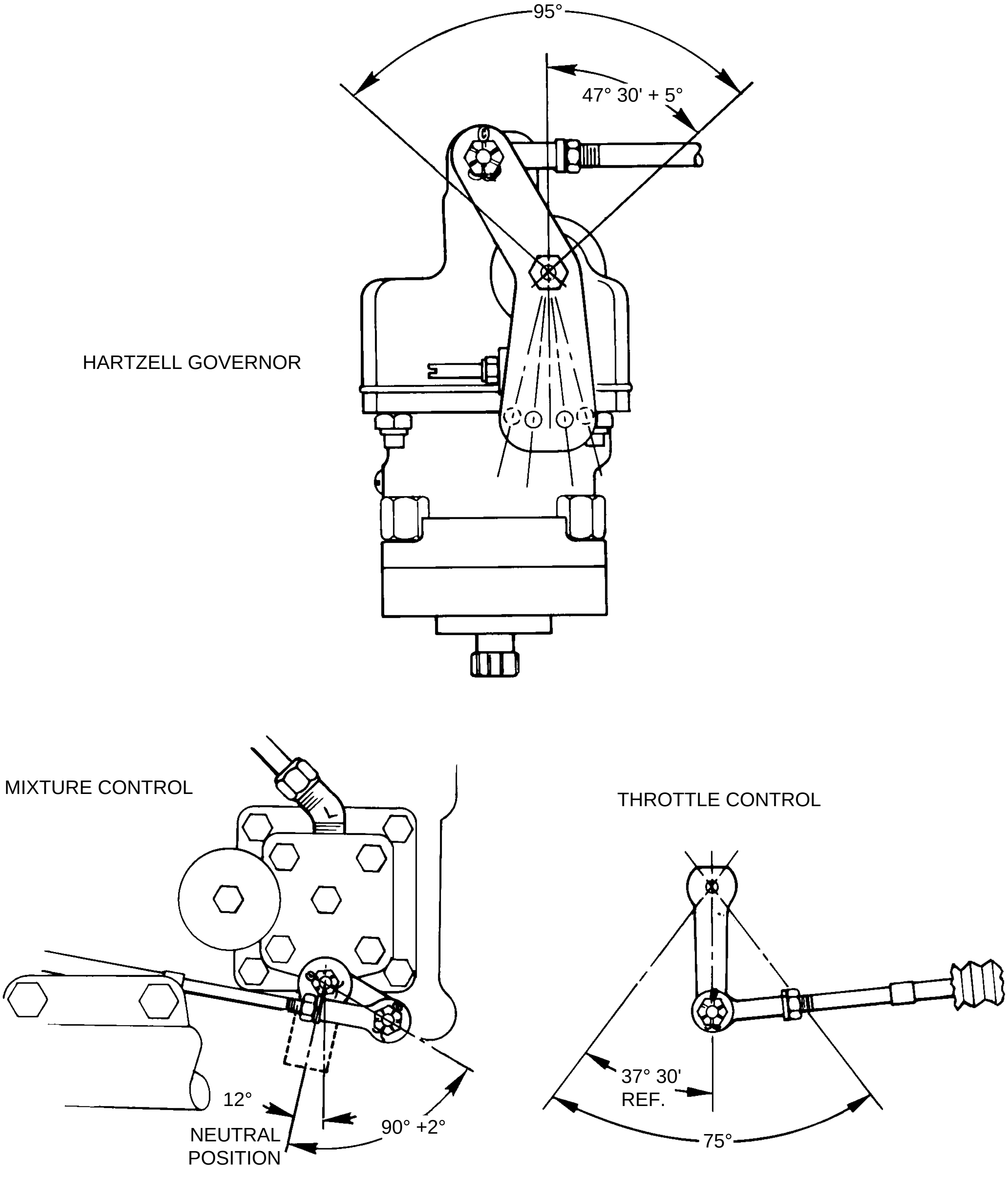


Figure 76-1. Engine Controls

ENGINE SETUP PROCEDURES (continued)

6. Check the turbocharger for evidence of damage or overheating. If overheat damage is suspect, check that the compressor/turbine are free to turn.
7. Inspect the ignition harness, cooling baffles, oil lines and fittings (for loss of oil), and other items that could affect engine performance.
8. Ensure the auxiliary fuel pump system operates properly, refer to Chapter 28.

LEAK CHECK - GAUGE LINES

1. 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.
2. 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.

3. 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.
4. Reconnect and tighten the manifold pressure, compressor discharge pressure and fuel pressure lines.
5. 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.

6. 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.

EXHAUST BYPASS CHECK

— 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.

EXHAUST BYPASS CHECK (continued)

The adjusting screw on turbochargers installed on early Seneca III models had fine threads. The adjusting screw on turbochargers installed on later model Seneca III's and Seneca IVs, as well as replacement turbochargers, have 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 adjustmentscrews having ***course*** threads should have three to four threads showning 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. (Refer to Figure 76-2.)

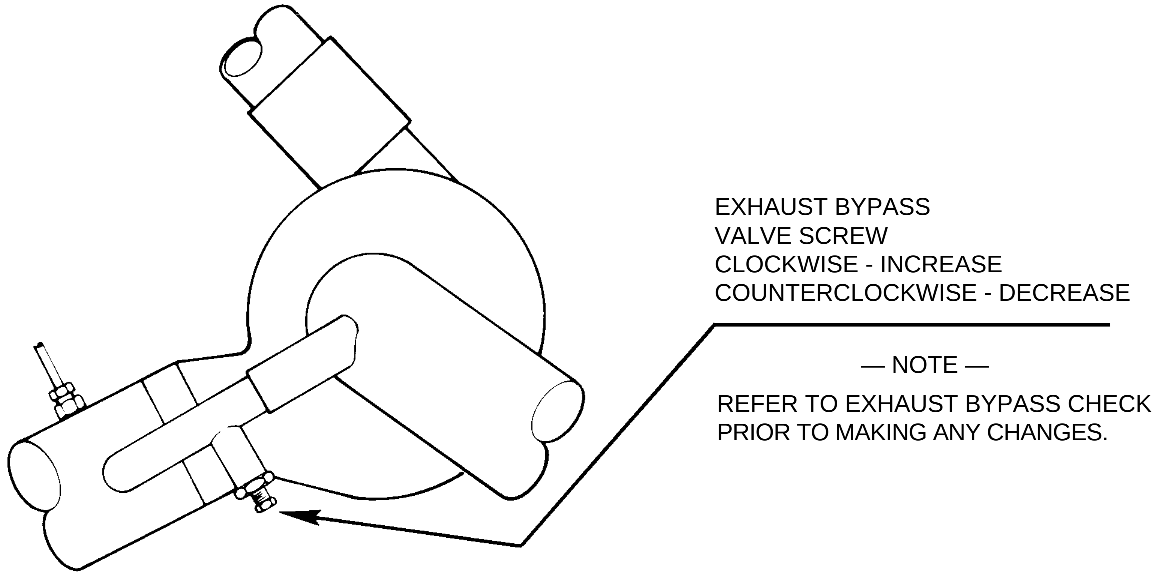


Figure 76-2. Exhaust Bypass Valve Screw

— 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.

IDLE PERFORMANCE CHECK

— NOTE —

Before performing any of these procedures, make sure the auxiliary fuel pump system is operating properly. Refer to Chapter 28.

1. Remove the cap from the tee fitting on the right side of the throttle body. (Refer to Figure 76-3.)
2. 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.
3. Purge the air from the tube.

CHECK AND ADJUSTMENT OF 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

1. Back off the idle speed adjusting screw two turns. (Refer to Figure 76-3.)
2. 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.
3. 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 76-4, item 6); clockwise adjustment increases pressure; counterclockwise adjustment decreases pressure.

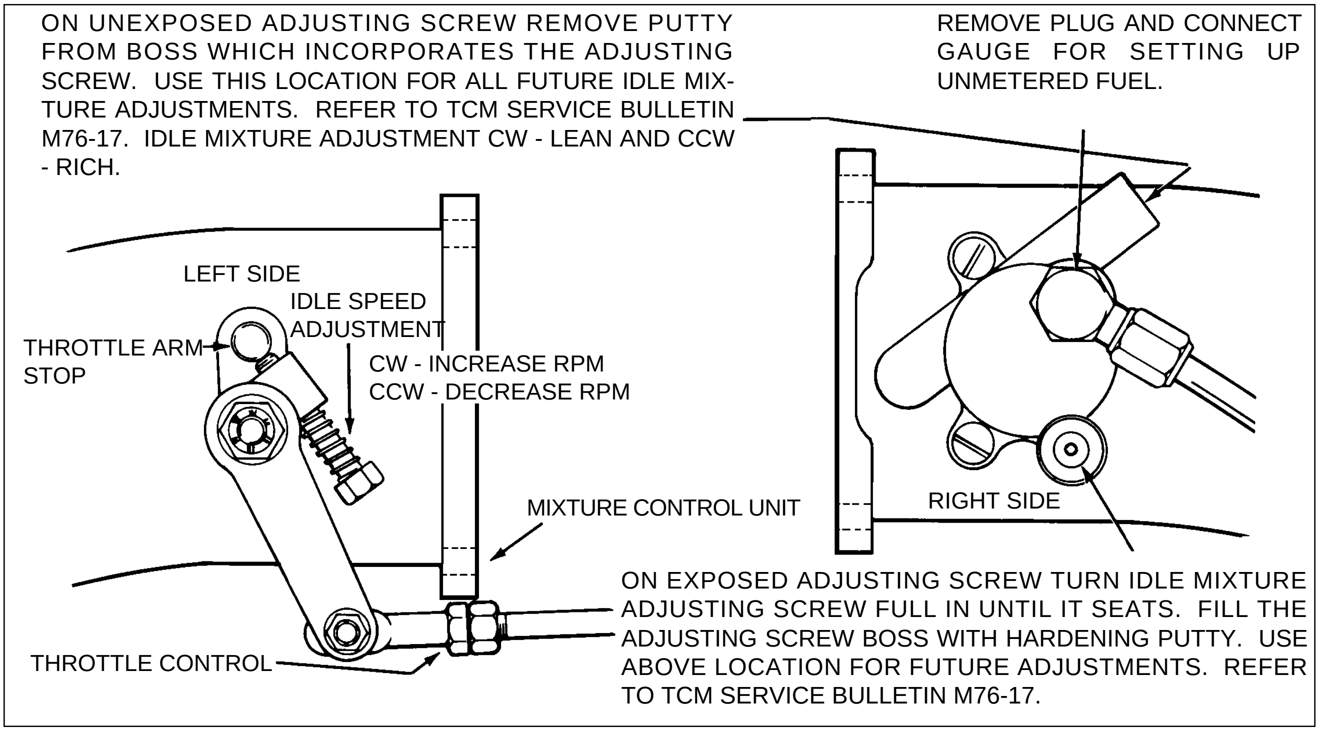


Figure 76-3. Idle Speed and Mixture Adjustment Points

CHECK AND ADJUSTMENT OF IDLE MIXTURE. (Refer to Figure 76-3.)

1. 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).
2. Reduce the engine speed and stabilize it at 700 ± 25 rpm.
3. 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.

CHECK AND ADJUSTMENT OF IDLE MIXTURE. (Refer to Figure 76-3.) (continued)

4. 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 lead the mixture (clockwise).
5. After each adjustment, increase rpm to 1500-1700 for 10 seconds to "clean out" the engine.
6. 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.

CHECK AND ADJUSTMENT OF IDLE SPEED (Refer to Figure 76-3.)

1. 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.
2. 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.

CHECK AND ADJUSTMENT FOR FULL POWER PERFORMANCE (Refer to Figure 76-4)

— 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 7601 to interpolate correct fuel flow for the actual engine rpm. Refer to engine operating manual for further information. Chartrs 7602 and 7603 are included for reference only.

1. 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.
2. 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.
3. Observe the 0-60 calibrated gauge to cross check performance. High unmetered pressure should be 36 to 40 psi.

CHECK AND ADJUSTMENT FOR FULL POWER PERFORMANCE (Refer to Figure 76-4) (continued)

4. 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 76-4, 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.

5. Restart the engines and recheck the high end fuel flow.
6. Recheck the idle settings as directed in the four previous subject paragraphs.
7. Recheck Full Power Fuel Flow settings.
8. 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.

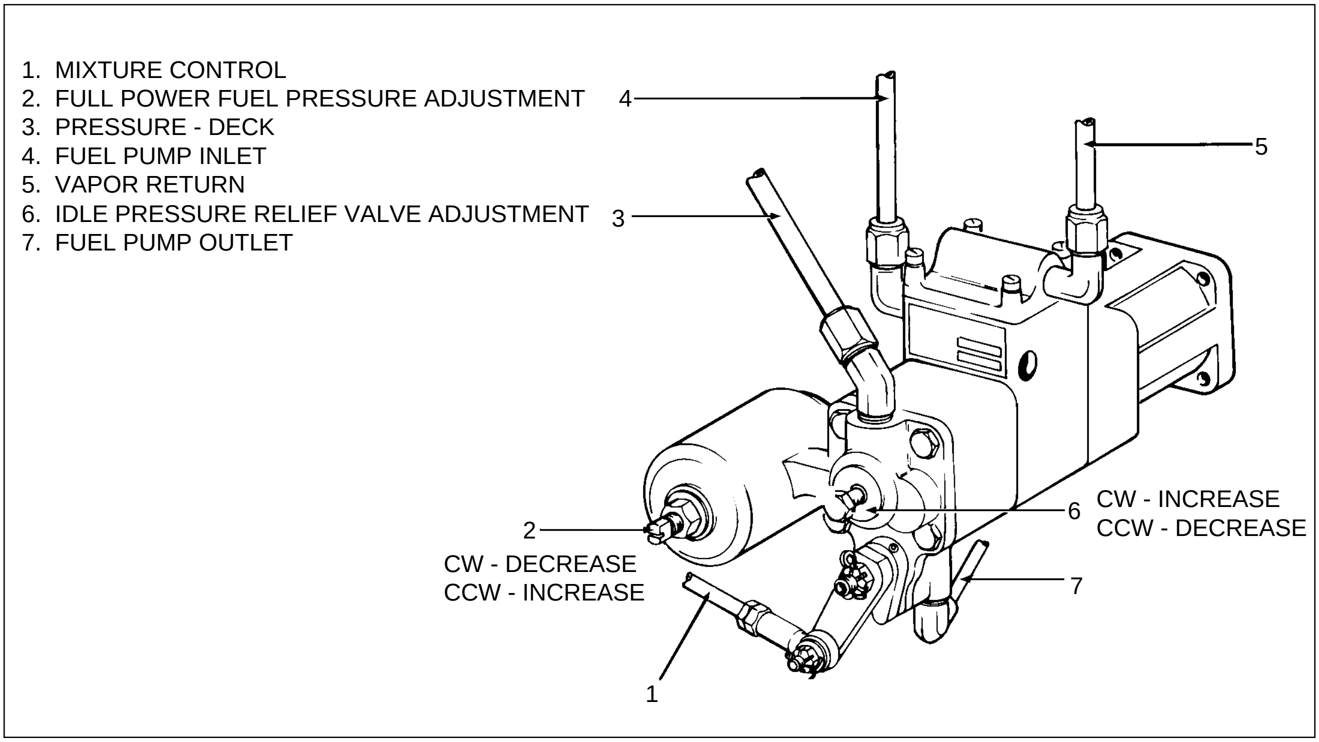
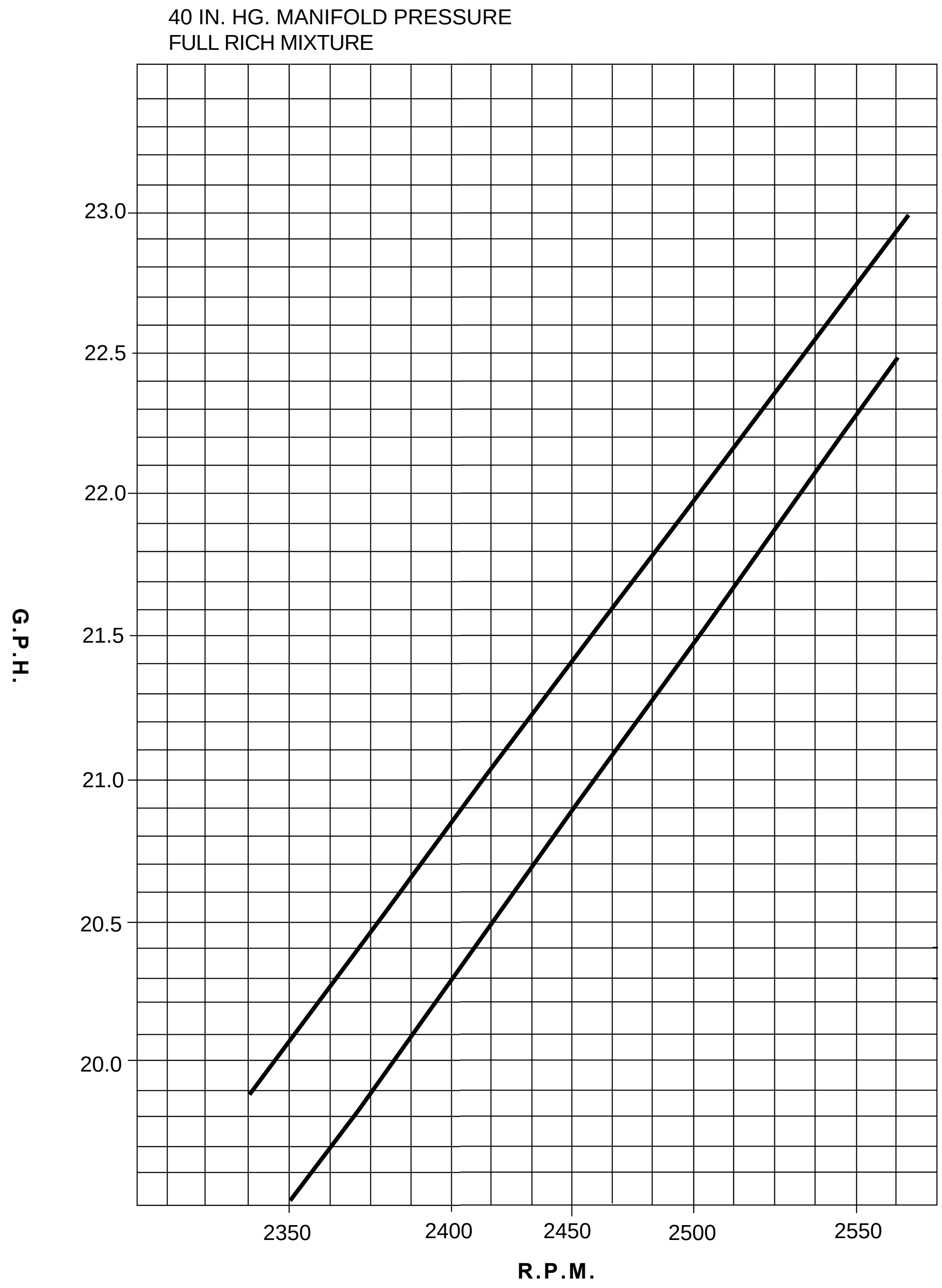


Figure 76-4. Sectional View of Altitude Compensating Fuel Pump Assembly

CHART 7601. FUEL FLOW VS. ENGINE SPEED



CHECKING FUEL SYSTEM MATCH

1. 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.
2. 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.

POST-SETUP PROCEDURES

1. 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.
2. 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 7601.

— NOTE —

The calibrated gauge fuel line must be purged of air and the reference side of the calibrated gauge vented to turbo discharge pressure.

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 adustment screws:
      (1) One flat turn ***in*** will ***increase*** critical altitude aproximately 200 feet.
      (2) One flat turn ***out*** will ***decrease*** critical altitude aproximately 200 feet.
   b. On turbochargers equipped with ***course*** thread adustment screws:
      (1) One flat turn ***in*** will ***increase*** critical altitude aproximately 300 feet.
      (2) One flat turn ***out*** will ***decrease*** critical altitude aproximately 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 win 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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CHART 7602. FUEL FLOW VS. FUEL PRESSURE

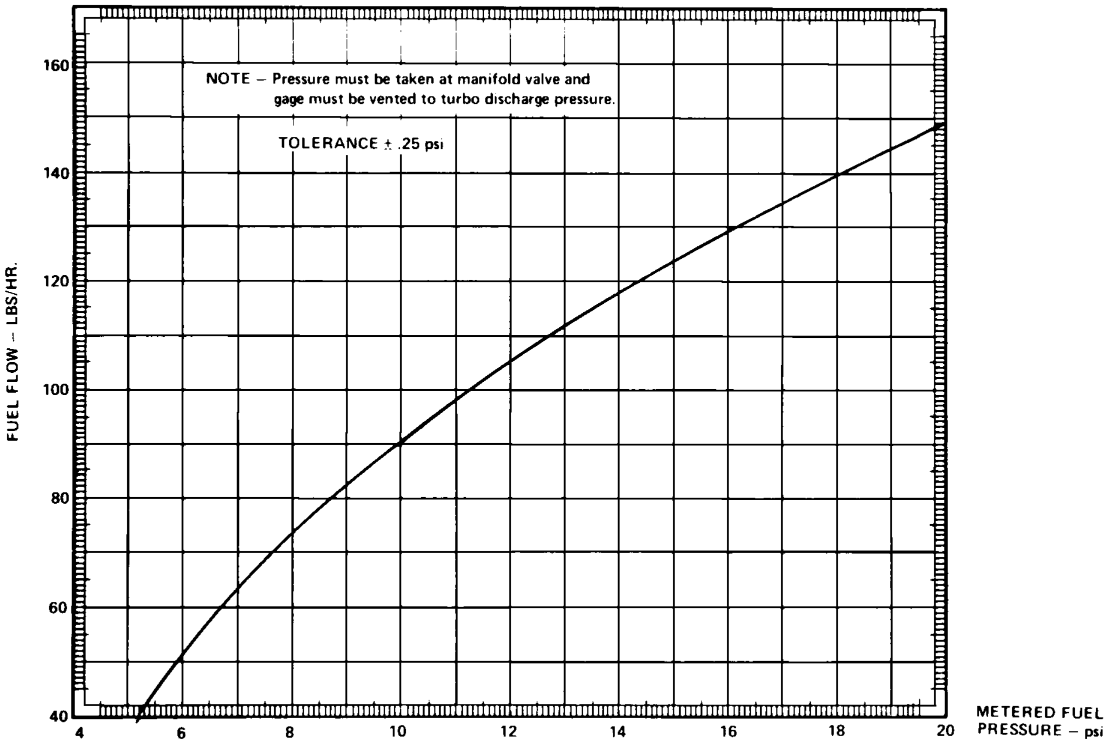
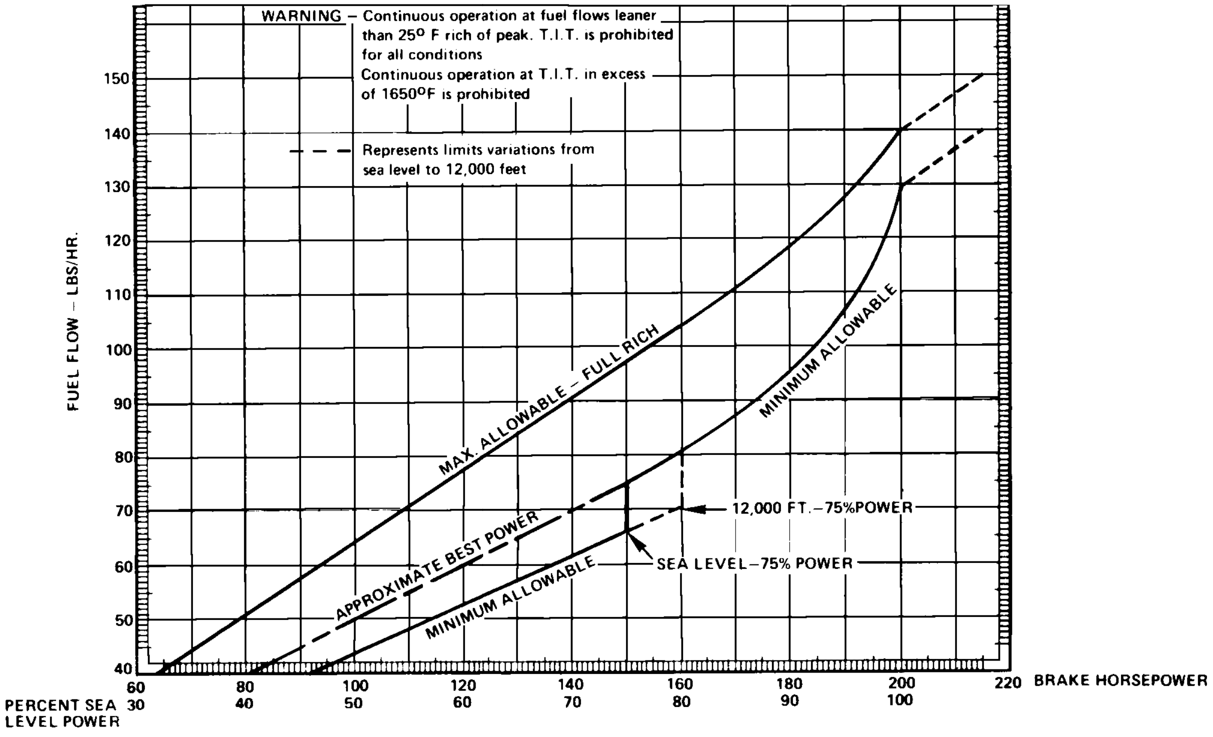


CHART 7603. LIMITS - FUEL FLOW VS. BRAKE HP



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CHAPTER

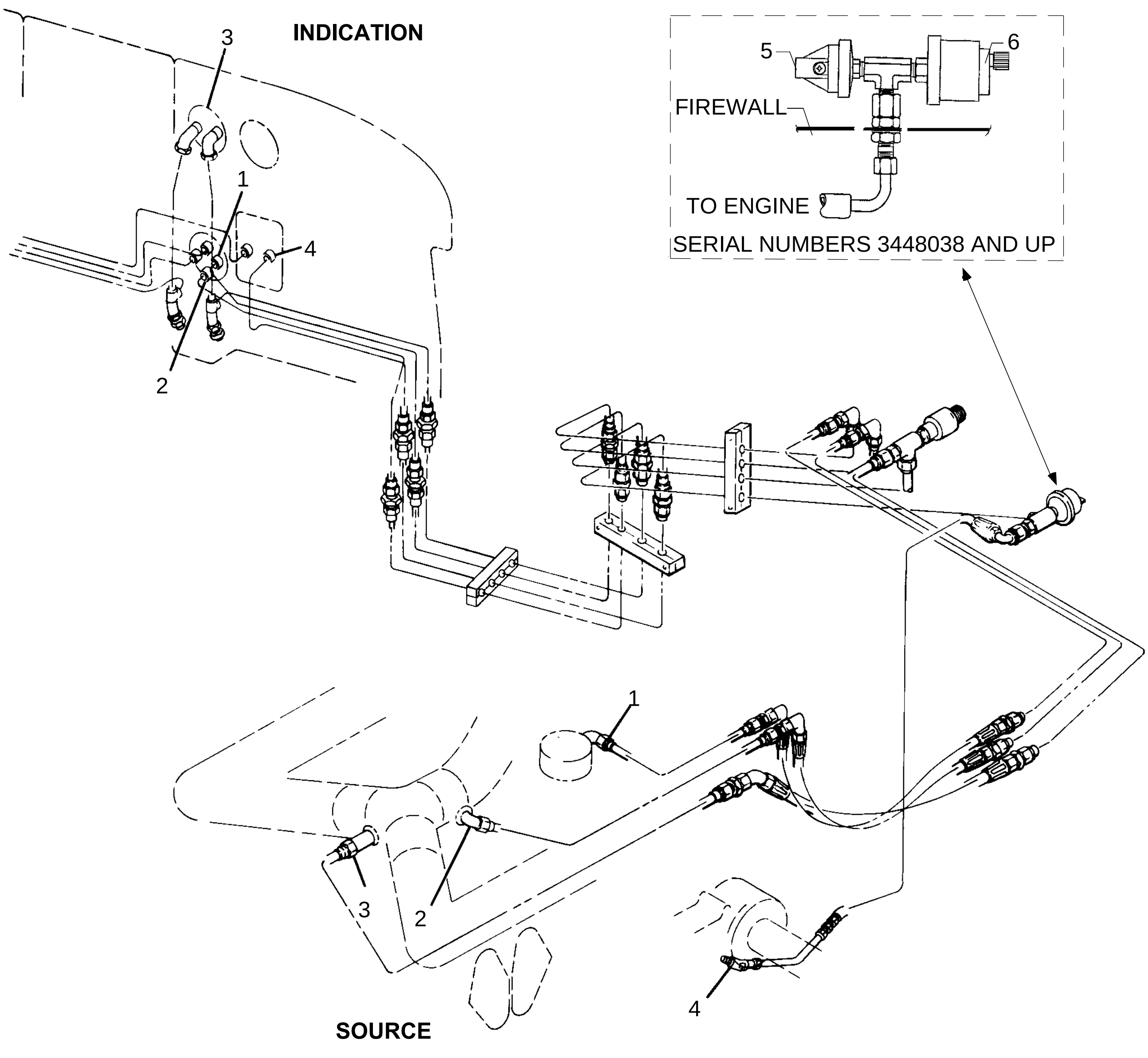
77

ENGINE INDICATING

CHAPTER 77 - ENGINE INDICATING

TABLE OF CONTENTS/EFFECTIVITY

GENERAL



1. FUEL FLOW PRESSURE
2. FUEL FLOW VENT
3. MANIFOLD PRESSURE
4. OIL PRESSURE
5. SWITCH, OIL PRESSURE
6. SENDER, OIL PRESSURE

Figure 77-1. Engine Instrument Lines Installation

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POWER

MANIFOLD PRESSURE GAUGE SYSTEM

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.

CHART 7701. TROUBLESHOOTING MANIFOLD PRESSURE INDICATOR

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.

ELECTRIC TACHOMETER INSTALLATION (Refer to Figure 77-2.)

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.

ELECTRIC TACHOMETER INSTALLATION (continued)

REMOVAL AND INSTALLATION OF TACHOMETER

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.

REMOVAL AND INSTALLATION OF TACHOMETER GENERATOR (Refer to Figure 77-2.)

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 7702. TROUBLESHOOTING ELECTRIC TACHOMETER

Trouble	Cause	Remedy
Both pointers inoperative.	Circuit breaker tripped.	Reset.
One pointer inoperative.	Defective generator.	Replace generator.
One pointer inaccurate.	Defective indicator.	Replace tachometer indicator.

— CAUTION —

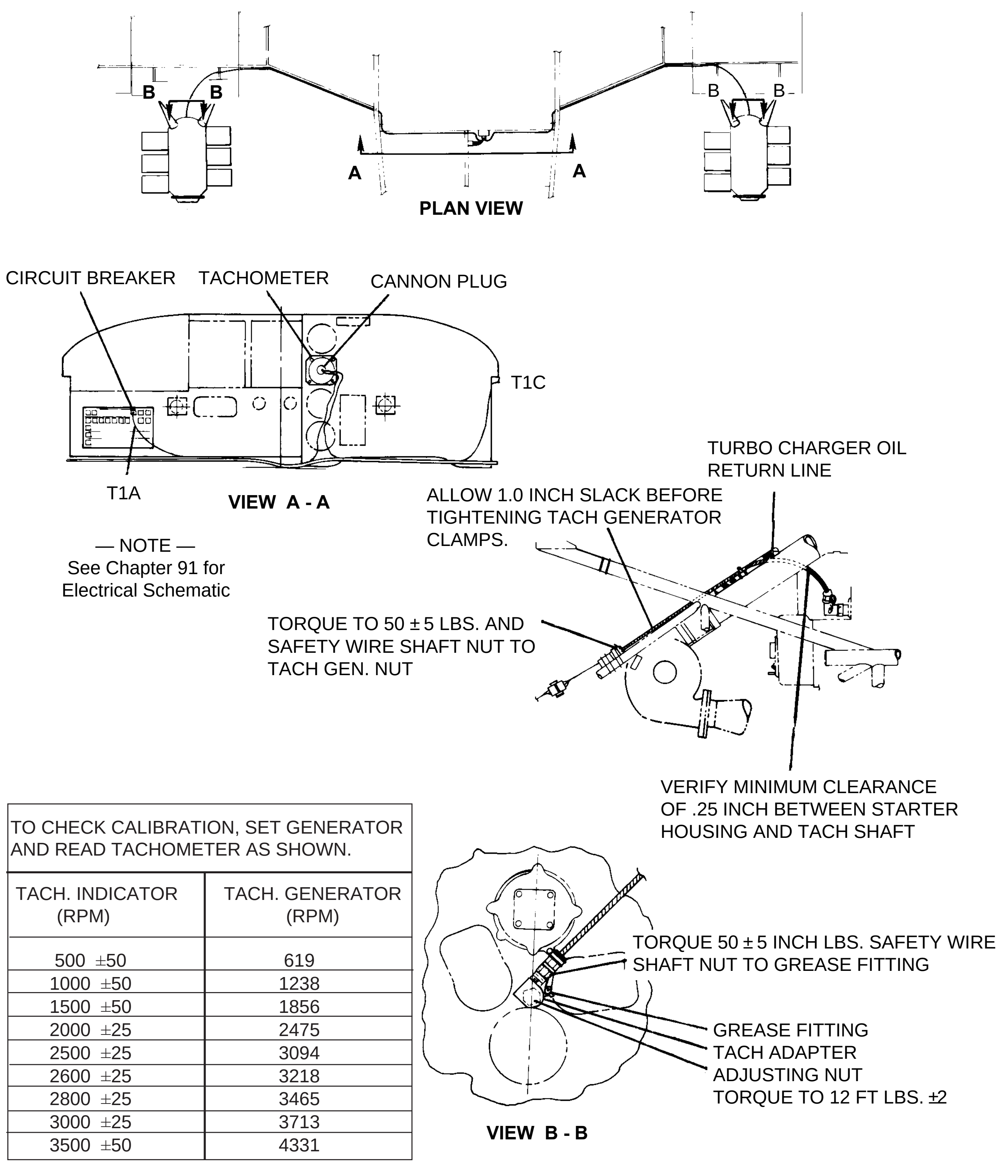
The adjustments within the tachometer indicator must be made only by a qualified instrument repair facility.

— 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.

The generators can be exchanged from one engine to the other for troubleshooting.

ELECTRIC TACHOMETER INSTALLATION (continued)



TO CHECK CALIBRATION, SET GENERATOR AND READ TACHOMETER AS SHOWN.

TACH. INDICATOR (RPM)	TACH. GENERATOR (RPM)
500 ±50	619
1000 ±50	1238
1500 ±50	1856
2000 ±25	2475
2500 ±25	3094
2600 ±25	3218
2800 ±25	3465
3000 ±25	3713
3500 ±50	4331

Figure 77-2. Electric Tachometer Installation

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TEMPERATURE

EXHAUST GAS TEMPERATURE GAUGE

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.

REMOVAL OF EGT PROBES AND GAUGE

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.

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.

INSTALLATION OF EGT PROBES AND GAUGE

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.

EXHAUST GAS TEMPERATURE GAUGE (continued)

CHART 7703. TROUBLESHOOTING EXHAUST GAS TEMPERATURE GAUGE

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.

CYLINDER HEAD TEMPERATURE GAUGE

On Seneca III models, the cylinder head temperature gauges are in the instrument cluster located on the instrument panel. On Seneca IV models, 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.

CHART 7704. TROUBLESHOOTING CYLINDER HEAD TEMPERATURE GAUGE

Trouble	Cause	Remedy
Instrument shows no indication.	Engine is cold.	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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CHAPTER

79

OIL

CHAPTER 79 - OIL

TABLE OF CONTENTS/EFFECTIVITY

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.

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 79-1.)

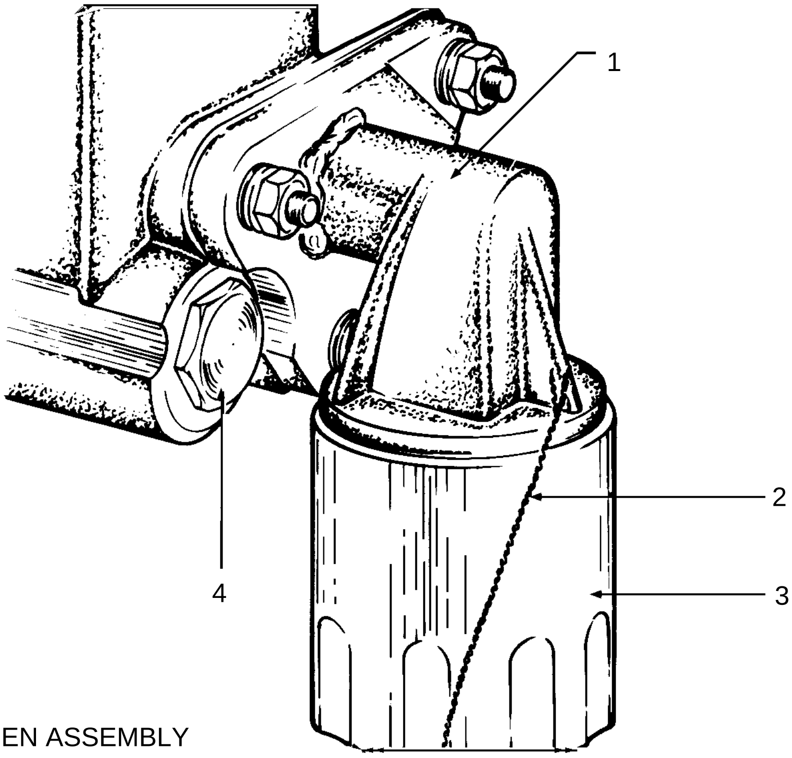
The oil filter element should be replaced after each 50 hours of engine operation. The filter element is mounted on the lower portion of the engine accessory case. Replace the filter element as follows:

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.



1. OIL FILTER ADAPTER
2. SAFETY WIRE
3. OIL FILTER ELEMENT
4. OIL SCAVENGE SCREEN ASSEMBLY

Figure 79-1. Oil Filter Installation

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INDICATING

ENGINE OIL PRESSURE

On Seneca III models, the oil pressure gauges are mounted in the cluster arrangement on the instrument panel. The oil pressure is transmitted to the gauge by means of an oil-filled line from the engine compartment to the gauge.

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. Removal of the instrument is explained in the General section of Chapter 77.

TROUBLESHOOTING OIL PRESSURE GAUGES (Refer to Chart 7901.)

ENGINE OIL TEMPERATURE

On Seneca III models, the oil temperature gauges are mounted in the cluster arrangement on the instrument panel. 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.

TROUBLESHOOTING OIL TEMPERATURE GAUGES (Refer to Chart 7902.)

CHART 7901. TROUBLESHOOTING ENGINE OIL PRESSURE GAUGES

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.

INDICATING (continued)

CHART 7901. TROUBLESHOOTING ENGINE OIL PRESSURE GAUGES (continued)

Trouble	Cause	Remedy
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) or gauge malfunction.	Replace transducer or gauge.
	Loss of oil in engine, or other engine failure.	Shut down engine. (Refer to Chapter 71, Chart 7102).

CHART 7902. TROUBLESHOOTING ENGINE OIL TEMPERATURE GAUGES

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

CHAPTER 80 - STARTING

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

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.

TROUBLESHOOTING

CHART 8001. 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.

CHART 8001. TROUBLESHOOTING STARTER (continued)

Trouble	Cause	Remedy
Starter fails to operate. (continued.)	Binding, worn, or improperly seated brush, or brushes with excessive side play.	***— 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 open armature.	Remove and replace with an armature known to be in good condition.
	Grounded or open field circuit.	Test, repair if possible or replace with a new part.
Low motor and cranking speed.	Worn, rough, or improperly lubricated motor or starter gearing.	Disassemble, clean, inspect, and relubricate, replacing ball bearings if worn.
	Same electrical causes as listed under "Motor Fails to Operate."	Same remedies listed for these troubles.

CHART 8001. TROUBLESHOOTING STARTER (continued)

Trouble	Cause	Remedy
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.

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CRANKING

MAINTENANCE OF SYSTEM

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. 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. 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.

3. 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. 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.

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

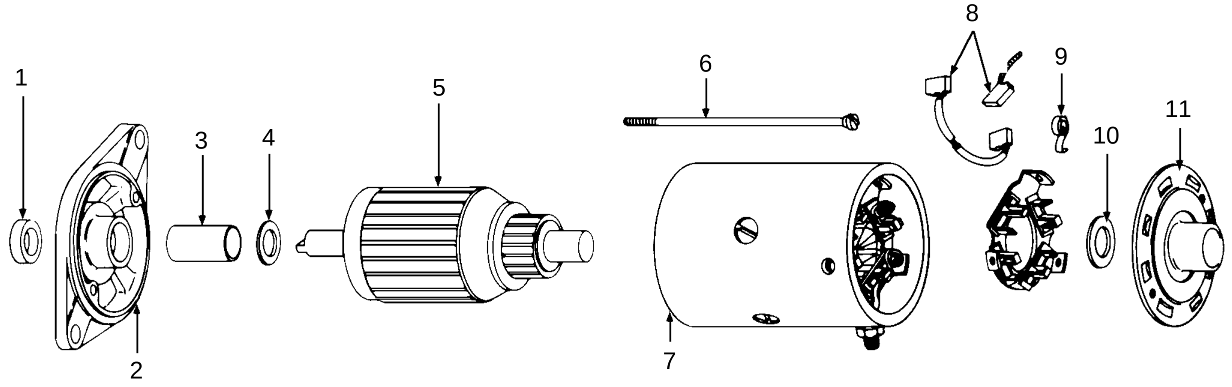

Figure 80-1. Exploded View of Starting Motor

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OVERHAUL OF STARTING MOTOR

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.

REMOVAL OF STARTING MOTOR

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.

STARTING MOTOR SERVICE TEST SPECIFICATIONS

CHART 8002. STARTING MOTOR SPECIFICATIONS (TCM 634592)

Min. Brush Tension	32 oz.
Max. Brush Tension	40 oz.
No-Load Test (75°F)	
Volt	6
Max. Amps	65
Min. RPM	4900
Stall Torque	
Amps	410
Min. Torque, ft. lbs.	8
Approx. Volts	2

CHART 8003. STARTING MOTOR SPECIFICATIONS (TCM 646275)

No-Load Test (75°F)	
Volt	20
Amps	30-50
RPM	4300

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CHAPTER

81

TURBINES

CHAPTER 81 - TURBINES

TABLE OF CONTENTS/EFFECTIVITY

GENERAL

DESCRIPTION AND OPERATION

The turbocharger system (Figure 81-5) consists of a turbine and compressor assembly, ground adjustable exhaust bypass screw, and the necessary hose 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, it is recommended that the items outlined in the Inspection Report be checked periodically.

TROUBLESHOOTING

CHART 8101. 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.

CHART 8101. TROUBLESHOOTING TURBOCHARGER (continued)

Trouble	Cause	Remedy
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.

TURBOCHARGER 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. The following is a list of commonly used terms and names as applied to turbocharging and a brief description.

TURBOCHARGER NOMENCLATURE

TERM	MEANING
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 indicated that the engine depends on a certain amount of turbo 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.

TURBOCHARGER NOMENCLATURE (continued)

TERM	MEANING
Manifold Pressure	The pressure measured downstream of the engine throttle valve and is almost directly proportioned 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.
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 mention 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.

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TURBOCHARGER

— WARNING —

WHEN SERVICING OR INSPECTING VENDOR EQUIPMENT INSTALLED IN PIPER AIRCRAFT, IT IS THE USER'S RESPONSIBILITY TO REFER TO THE APPLICABLE PUBLICATIONS.

REMOVAL OF 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.

1. Remove the upper cowling.
2. Remove the turbocharger compressor and turbine assembly as follows:
   a. Disconnect the oil supply and return lines from the center section of the turbo.
   b. Disconnect the air ducts from the compressor inlet and outlet and the exhaust system from the turbine inlet and outlet.
   c. Remove the bolts that attach the turbocharger to the mounting bracket and remove the turbocharger assembly.

ROUTINE TURBOCHARGER MAINTENANCE

PERIODIC INSPECTION

Whenever routine service of the engine is performed, inspect the turbocharger as follows:

1. 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.
2. Inspect for exhaust leakage from a cracked exhaust manifold, damaged gaskets, or loose turbocharger mounting.
3. Inspect the oil lines and fittings for kinks, damage, and leakage.
4. Note any unusual noises or vibration which would warrant further inspection of the turbocharger.
5. Observe engine exhaust. Excessive smoke may indicate a restricted air cleaner or intake piping, over fueling, or faulty turbocharger operation.

MAJOR INSPECTION AND CLEANING

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.

MAJOR INSPECTION AND CLEANING (continued)

Major inspection is as follows:

1. 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.
2. 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.
3. 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 accumulations 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.

4. 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. If there is no apparent damage, clean the unit and check for excessive end play as directed below.
5. Remove the six bolts that secure the compressor housing to the turbocharger bearing housing; remove the compressor housing and gasket. If necessary, tap the compressor housing with a plastic hammer while holding the bearing housing as shown in Figure 81-1.

— CAUTION —

Never use caustic solution or other cleaner that may attack metal.

— CAUTION —

Never use a wire brush that could score highly finished parts.

6. If the impeller requires cleaning, use a nylon-bristled brush and a solvent such as diesel fuel or kerosene to remove accumulated dirt. Thoroughly clean the impeller and the compressor housing. Failure to remove all dirt may result in a more severe disruption of balance than that which existed prior to cleaning.
7. Use two C-clamps as shown in Figure 81-2 to overcome the tension of the spring ring and hold the turbine shield away from the turbine wheel.
8. Attach a dial indicator to the bearing housing so that the indicator point is resting on the end of the shaft. Push up on the turbine wheel as shown in Figure 81-2 to measure shaft end play. The normal shaft end play is 0.005 to 0.009 inch. If shaft end play is excessive, rebuild the turbocharger.
9. Reposition the dial indicator so that the contact point is resting on the flat side surface of the impeller nut as shown in Figure 81-3 and adjust the indicator dial at zero. Push from side to side as shown in Figure 81-3 to determine the radial play of the shaft. Rotate the shaft slightly to get minimum readings on the nut flat. Maximum allowable radial play is 0.022 inch. If radial play is excessive, parts are worn and the turbocharger must be rebuilt.
10. If the unit is in satisfactory condition, position a new gasket on the compressor housing, making sure that the gasket surfaces are perfectly clean. Place the bearing housing in position; secure with six bolts. Tighten the bolts evenly and alternately to 80 to 100 inch-pounds.

MAJOR INSPECTION AND CLEANING (continued)

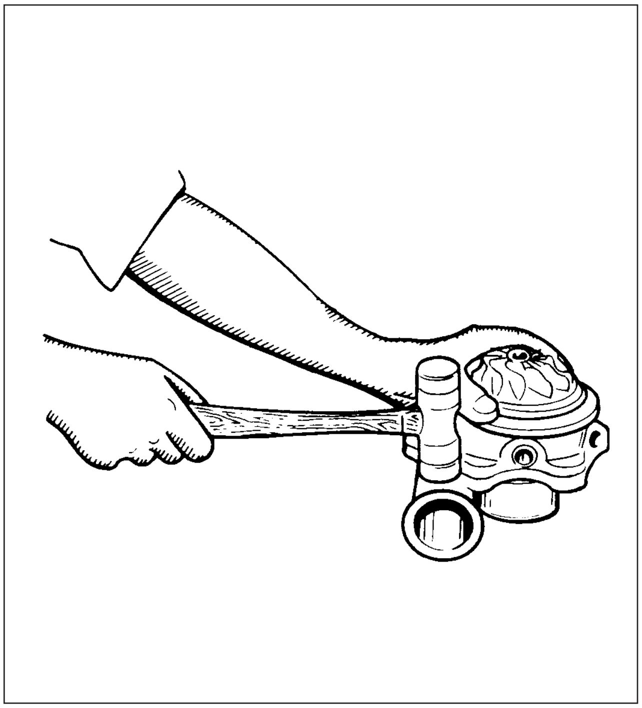

Figure 81-1. Removing Compressor Housing from Turbocharger

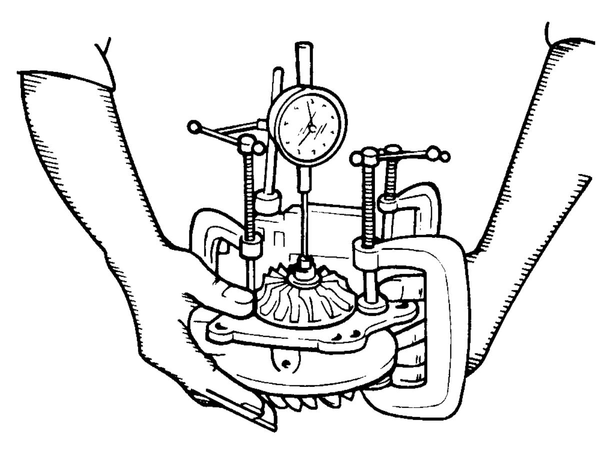

Figure 81-2. Measuring Turbine Shaft End Play

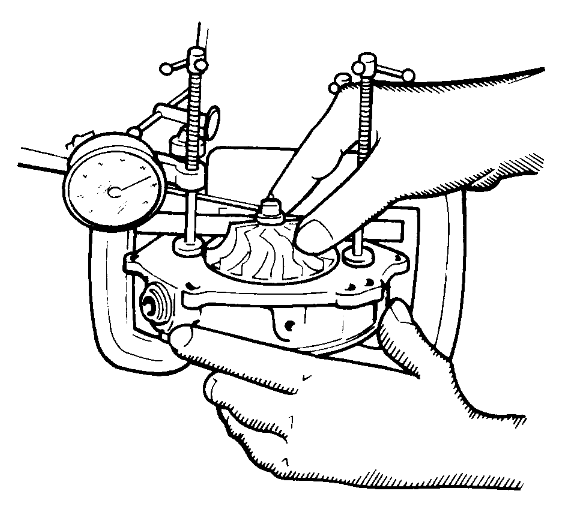

Figure 81-3. Measuring Turbine Shaft Radial Play

INSTALLATION OF TURBOCHARGER

— 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.

1. Position turbocharger assembly on the mounting bracket and secure with attaching hardware.
2. Align exhaust system manifold turbo inlet and the turbine inlet and secure with clamp temporarily.

— WARNING —

WHEN TIGHTENING ANY OF THE THREE V-BAND CLAMPS, IT IS NECESSARY TO TAP THE CLAMP ALL AROUND ITS CIRCUMFERENCE TO ENSURE PROPER SEATING. DO NOT RELY ON TIGHTENING ALONE FOR PROPER CLAMP SEATING.

3. Tighten the large diameter center clamp securing the turbine housing to the turbocharger.
4. Place turbine housing insulation blanket in proper position and safety blanket to turbocharger attaching hardware.
5. 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. If 8 minimum, 9 maximum threads are showing below jam nut, no adjustment is required. (See Figure 81-4.)

6. Tighten both turbine housing inlet clamps. (Refer to previous warning on tightening V-band clamps.)
7. 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.
8. If previously removed, install the overboost valve assembly as follows:
    a. Install a new O-ring on the overboost mounting flange of the induction tube.
    b. Position the overboost valve assembly on the mounting flange, with the holes in the valve aligning with the holes in the flange.
    c. Install the four bolts and secure with plain washers and self-locking nuts.
9. Connect the oil supply and return lines to the turbocharger center housing. Connect the oil pressure cockpit gauge line if it was previously disconnected.
10. Perform engine ground run-up and check for normal engine functioning, excessive exhaust manifold leakage and oil leaks. Repair as necessary.
11. Install the upper cowling.

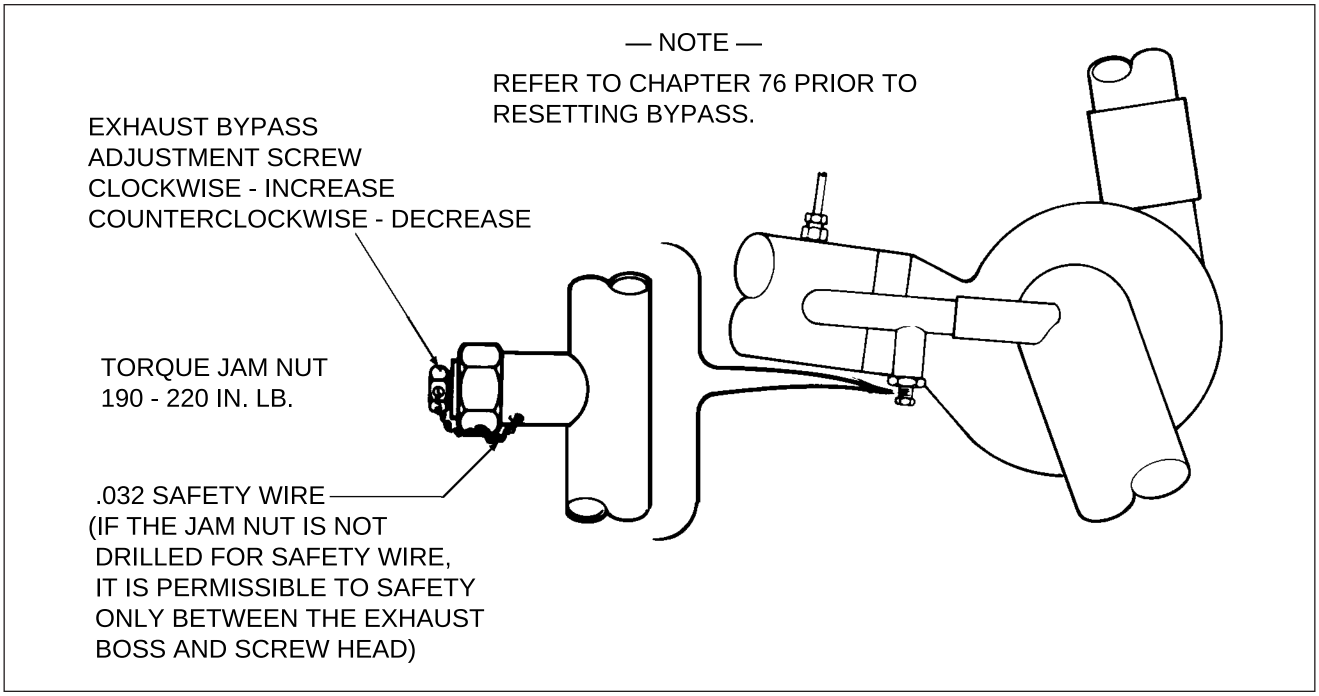

Figure 81-4. Exhaust Bypass Screw

ADJUSTMENT OF TURBOCHARGER (Refer to Chapter 76 under Engine Set Up Procedures.)

— NOTE —

A complete inspection of the power plant system should be performed before any turbo adjustments are made

OVERBOOST VALVE

REMOVAL OF OVERBOOST VALVE

1. Remove the four self-locking nuts, plain washers and bolts.
2. Lift the overboost valve assembly from the induction tube.
3. Remove the O-ring from the seating surface of the overboost mounting flange on the induction tube.

INSTALLATION OF OVERBOOST VALVE

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.

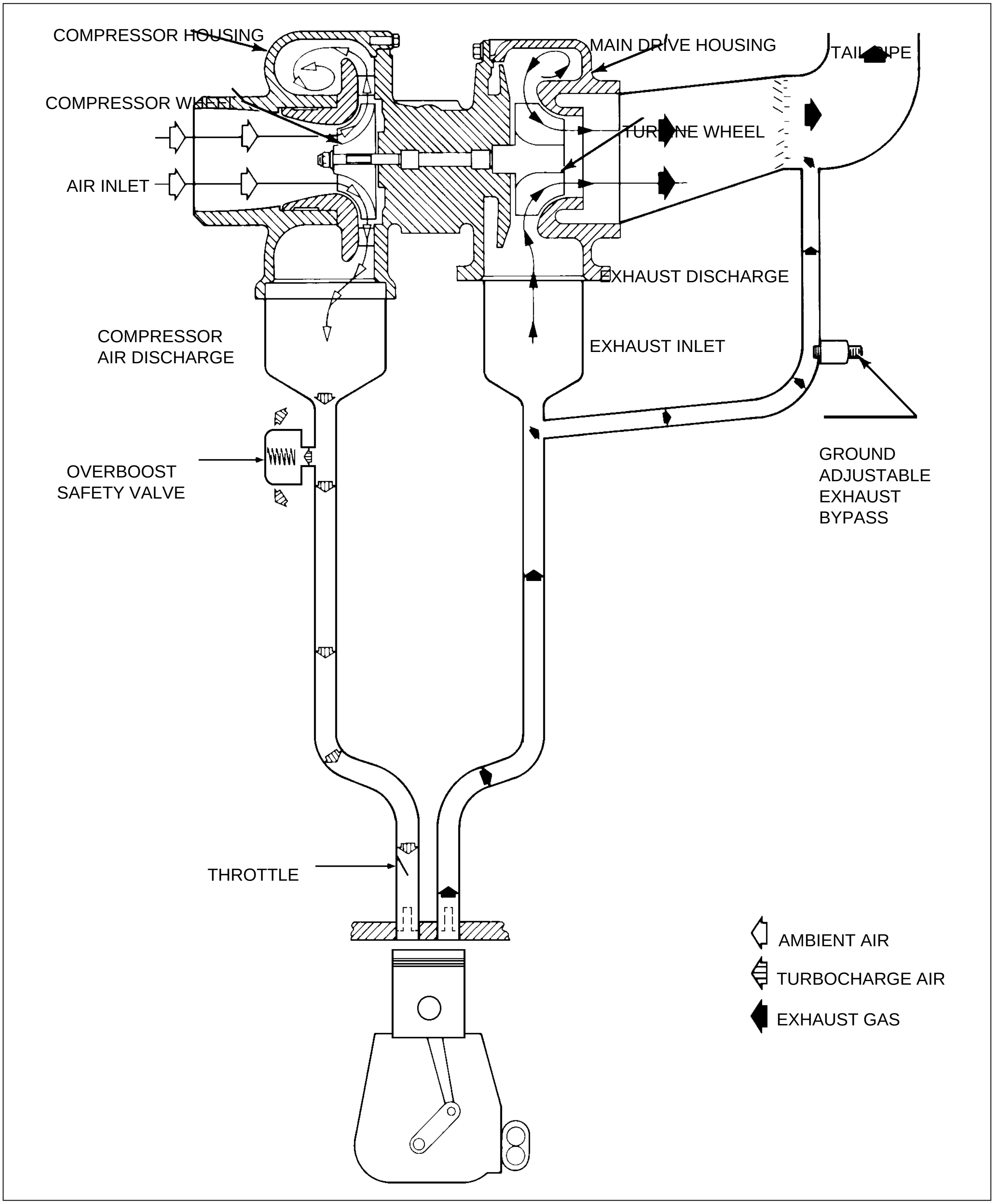

Figure 81-5. Schematic Diagram of Turbocharger System

GRIDS 4H1 THROUGH 4L24
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AIRPLANE MAINTENANCE MANUAL

CARD 5 OF 5

PA-34-220T

SENECA III

(ALL)

SENECA IV

(S/N's 3448038 THRU 3448079)

PIPER AIRCRAFT CORPORATION

PART NUMBER 761-751 APRIL 17, 2007

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AEROFICHE REVISION STATUS

Revisions to this Maintenance Manual (P/N 761-751) originally issued December 19, 1980, and completely reissued November 29, 1993, are as follows:

Revision	Publication Date	Aerofiche Card Effectivity
ORG801219	December 19, 1980	1, 2 and 3
CR891220	December 20, 1989	1, 2, 3 and 4
CR931129	November 29, 1993	1, 2, 3, 4 and 5
IR970205	February 5, 1997	1 and 3
PR070417 *	April 17, 2007	1, 3, and 5

* PARTIAL REVISION OF MAINTENANCE MANUAL 761-751

Revisions appear only in Aerofiche Cards 1, 3, and 5. Accordingly, discard your existing Aerofiche Cards 1, 3, and 5, and replace them with these dated April 17, 2007.

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

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GO TO GRID 1A5 FOR THE COMPLETE INTRODUCTION

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12. CHAPTER/SECTION INDEX GUIDE

NOTE: The following GAMA Specification No. 2 standard chapters are not included in this Maintenance Manual: 31, 36, 38, 49, 53, 54, 60, 72, 78, 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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LIST OF ILLUSTRATIONS

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LIST OF CHARTS

GRIDS 5A16 THRU 5B2
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CHAPTER

91

CHARTS AND WIRING DIAGRAMS

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CHAPTER 91 - CHARTS AND WIRING DIAGRAMS

TABLE OF CONTENTS

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CHARTS

1. TORQUE REQUIREMENTS

(PIR-PPS20015-1, Rev. S.)

CAUTION: DO NOT OVERTORQUE FITTINGS.

Chart 9101 lists the torque values for flared fittings of various sizes and material.

NOTE: When installing flared fittings, verify that male threads are properly lubricated.

The torque values given in Chart 9102 are derived from oil-free cadmium-plated threads and are recommended for all airframe installation procedures where torquing is required, unless other values are specified in subject chapter/section. Engine torque values are found in the latest revision of Teledyne Continental Motors SB96-7; and propeller torque values are found in 61-10-00.

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.

A. Calibrate the torque wrench periodically to assure accuracy, and recheck frequently.

B. If the fastener, screw, or nut is listed in Chart 9102, but the mating fastener is not listed, tighten only to the low end of the torque range specified for the listed fastener. In addition, the following limitations shall apply:

(1) Fastener and nut threads shall be clean and dry (free of lubricants). If the subject chapter/section requires the fastener and/or nut to be lubricated prior to tightening and does not specify a torque requirement, use the Chart 9102 torque range reduced 50 percent.

(2) Chart 9102, Sheet 1, shall be used for free running nuts, provided minimal friction drag is determined as specified below.

CHART 9101. FLARE FITTING TORQUE VALUES

	Torque — Inch-Pounds					
Tubing OD Inches	Aluminum - Alloy Tubing Flare - and 10061 or 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	—	—	—	—	—	—

CHART 9102. RECOMMENDED NUT TORQUES (Sheet 1 of 2)

	Bolts - Steel								Bolts - Aluminum			
	AN 3 thru AN 20 AN 42 thru AN 49 AN 525 MS 20033 thru MS 20046 MS 20073 MS 20074 MS 24694 MS 27039				MS 20004 NAS 333 thru NAS 340 NAS 464 NAS 624 thru NAS 644 NAS 1580 NAS 6203 thru NAS 6220 NAS 6603 thru NAS 6620 NAS 6703 thru NAS 6720				AN 3DD Series			
	Nuts - Steel								Nuts - Aluminum			
	Tension		Shear		Tension		Shear		Tension		Shear	
	AN 310 AN 315 MS 20365 MS 21042 MS 21044 MS 21045 NAS 679		AN 320 MS 20364 MS 21083 MS 21245		AN 310 AN 315 MS 20365 MS 21042 MS 21044 MS 21045 NAS 679		AN 320 MS 20364 MS 21083 MS 21245		AN 310D AN 315D		AN 320D	
	FINE THREAD SERIES - ADD FRICTION DRAG											
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

COARSE THREAD SERIES - ADD FRICTION DRAG

Nut-Bolt Size	Torque Limits In.-Lbs.		Torque Limits In.-Lbs.	
	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

NOTE: Unless otherwise specified, torque size No. 6 screws used with self-locking nutplates to no greater than 4 to 5 in.-lbs.

Use an appropriately calibrated driver.

CHART 9102. RECOMMENDED NUT TORQUES (Sheet 2 of 2)

Bolts - Steel		Bolts - Aluminum
AN 3 thru AN 20 AN 42 thru AN 49 AN 525 MS 20033 thru MS 20046 MS 20073 MS 20074 MS 24694 MS 27039	MS 20004 NAS 333 thru NAS 340 NAS 464 NAS 624 thru NAS 644 NAS 1580 NAS 6203 thru NAS 6220 NAS 6603 thru NAS 6620 NAS 6703 thru NAS 6720	AN 3DD Series

Nuts - Steel				Nuts - Aluminum	
Tension	Shear	Tension	Shear	Tension	Shear
AN 310 AN 315 MS 20365 MS 21042 MS 21044 MS 21045 NAS 679	AN 320 MS 20364 MS 21083 MS 21245	AN 310 AN 315 MS 20365 MS 21042 MS 21044 MS 21045 NAS 679	AN 320 MS 20364 MS 21083 MS 21245	AN 310D AN 315D	AN 320D

FINE THREAD SERIES - INCLUDES FRICTION DRAG

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.
10-32	38	43	30	33	43	48	33	38	28	33	23	28
1/4-28	65	100	60	70	110	130	80	90	60	75	45	60
5/16-24	160	200	120	145	180	205	130	150	100	125	85	100
3/8-24	240	270	175	190	280	330	200	230	155	190	125	150
7/16-20	550	600	370	400	620	730	400	500	280	380	210	270

COARSE THREAD SERIES - INCLUDES FRICTION DRAG

Nut-Bolt Size	Torque Limits In.-Lbs.		Torque Limits In.-Lbs.	
	Min.	Max.	Min.	Max.
8-32	27	30	22	24
10-24	38	43	30	33
1/4-20	70	80	55	60
5/16-18	140	150	108	115
3/8-16	240	265	175	190
7/16-14	335	355	240	255

NOTE: Unless otherwise specified, torque size No. 6 screws used with self-locking nutplates to no greater than 4 to 5 in.-lbs.

Use an appropriately calibrated driver.

(3) The friction drag torque can be determined as follows: Run the nut down to near contact (but not in contact) with the bearing surface and check the "friction drag torque" required to turn the nut.

NOTE: Check 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.)

(4) The friction drag torque (if any) shall be added to the desired torque specified in Chart 9102, Sheet 1. This final torque should register on the indicator or be the setting for a snap-over torque limiting device.

(5) Torque requirements do not apply to cross recessed or slotted screws or to fasteners installed into rivnuts, pressnuts or other nuts not designed to rotate for wrenching at the fastener unless otherwise specified in the subject chapter/section.

(6) Fasteners listed in Chart 9102 installed into nutplates, and which are accessible to be torqued at the fastener, must be tightened to the low end of the torque range specified in the appropriate “shear” column. Torque requirements do not apply if the fastener can not be torqued due to torque device accessability.

NOTE: When the fastener is stationary and the nut is torqued, use the lower side of the torque range.

When the nut is stationary and the fastener is torqued, use the higher side of the torque range. In this case, ensure one (1) washer is installed under the head as follows:

(a) If the subject chapter/section does not specify the use of a washer under the head, install one (1) NAS1149 .032 thick washer under the head. If additional washers are required under nut to adjust for grip length variation: reduce them .032 to allow for the additional .032 washer now installed under head. Check to ensure threads are not bearing loads, due to the added .032 washer thickness.

(b) All added washers are to be of the correct diameter, material and finish that matches the fastener being installed.

(7) Apply a smooth even pull when applying torque pressure. If chattering or a jerking motion occurs during final torque, back off and re-torque.

(8) When installing a castellated nut, start alignment with the cotter pin hole at minimum recommended torque, and do not exceed maximum recommended torque. If the hole in the fastener shank and the nut castellation do not align within this range, change washers and try again. Do not exceed the maximum recommended torque. If self-locking castellated nuts are used, include friction drag torque.

(9) Unless otherwise specified in the subject chapter/section, when castellated nuts are used with a cotter pin on moving joints, the nut shall not be torqued to Chart 9102 values. Nuts shall be tightened to remove looseness in the joint and then the cotter pin installed.

C. Gap Conditions Between Parts Attached with Threaded Fasteners

If a gap condition exists between mating parts where a threaded fastener is to be installed, install fasteners and associated hardware per subject chapter/section or to buildup noted during removal. Then, torque to a value 10% of the final torque required plus the friction drag torque.

For example, if Chart 9102, Sheet 2, torque is 190 in.-lbs. and the friction drag torque of the nut is 80 in.-lbs. (i.e. - Chart 9102, Sheet 2, torque minus Chart 9102, Sheet 1, torque), torque to a value of:

Maximum Permissible
Gap Closing Torque = (Chart 9102, Sheet 1, Torque x .10) + (Sheet 2 - Sheet 1) Torque

Example: 3/8-24 (190 x .10) + (270-190) = 19 + 80 = 99 in.-lbs.

Accomplish this for all fasteners common to the gapped interface. If no gap exists after accomplishing the above, finish torquing to final torque. If a gap remains consult your Piper Dealer’s Service Advisor (DSA) for further assistance.

D. After the final torque, apply a 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.

CHART 9103. CONVERSION TABLES

1. These charts contain the various conversion data that may be useful when figuring capacities, length, temperatures, and various weights and measures from the English system values to the metric system values or back again.
2. The English system is in use by England and the United States. All other countries use the metric system.

CHART 9103. CONVERSION TABLES (continued)

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	0.0965	0.0990
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	0.1447	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	0.016	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	5.558	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

CHART 9103. CONVERSION TABLES (continued)

CENTIGRADE — FAHRENHEIT CONVERSION TABLE

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
38.89	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
71.00	160	320.0	232.22	450	842.0
76.67	170	338.0	257.78	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

CHART 9103. CONVERSION TABLES (continued)

MULTIPLY	BY	TO OBTAIN
CENTIMETERS	0.3937 0.03281	IN. FT.
CU. CENTIMETERS	0.001 0.06102 0.0002642	LITERS CU. IN U.S. GAL.
CU. FT.	28.320 1.728 7.481 28.32	CU. CM CU. IN. U.S. GAL. LITERS
CU. IN.	16.39 0.01639 0.004329 0.01732	CU. CM LITERS U.S. GAL. QUARTS
CU. METERS	1000000 35.314 61.023 264.17 999.97	CU. CM CU. FT. CU. IN GAL. LITERS
FEET	0.3048 12.000 304.8 0.3333	METERS MILS MM. YARDS
FT.-LB.	0.1383 0.001285 0.000000376	M-KG BTU KW-HR
FLUID OZ.	8 29.6	DRAM CU. CM
GAL., IMPERIAL	277.4 1.201 4.546	CU. IN. U.S. GAL. LITERS
GAL., U.S. DRY	268.8 0.1556 1.164 4.405	CU. IN. CU. FT. U.S. GAL., LIQ. LITERS
GAL., U.S. LIQ.	231.0 0.1337 3.785 0.8327 128	CU. IN. CU. FT. LITERS IMPERIAL GAL. FLUID OZ.
IN.	2.540 .08333	CM. FT.
JOULES	0.000948 0.7376	FT. FT.-LB.

MULTIPLY	BY	TO OBTAIN
KILOGRAMS	2.205 35.27 1000	LB. OZ. GRAMS
LITERS	1000 61.03 0.03532 0.2642 0.22 1.057	CU. CM. CU. IN. CU. FT. U.S. GAL. IMPERIAL GAL. QUARTS
METERS	39.37 3.281 1000	IN. FT. MM.
METER-KILOGRAM	7.233 9.807	FT.-LB. JOULES
OUNCES, AVDP	0.0625 28.35 437.5	LB., AVDP GRAMS GRAINS
OUNCES, FLUID	29.57 1.805	CU. CM. CU. IN.
LB., AVDP	453.6 7000 16.0	GRAMS GRAINS OUNCES
SQUARE INCH	6.4516	SQ. CM.
POUND PER SQUARE INCH (PSI)	0.0703	KG.-CM SQUARED
STATUTE MILE	1.609 0.8684	KILOMETER NAUTICAL MILE
NAUTICAL MILE	1.151	STATUTE MILE
QUART	.9463	LITER
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

CHART 9104. DECIMAL CONVERSIONS

4ths	8ths	16ths	32nds	64ths	TO 3 PLACES	TO 2 PLACES	M.M. EQUIV
				1/64	.016	.02	.397
			1/32		.031	.03	.794
				3/64	.047	.05	1.191
		1/16			.062	.06	1.587
				5/64	.078	.08	1.984
			3/32		.094	.09	2.381
				7/64	.109	.11	2.778
	1/8				.125	.12	3.175
				9/64	.141	.14	3.572
			5/32		.156	.16	3.969
				11/64	.172	.17	4.366
		3/16			.188	.19	4.762
				13/64	.203	.20	5.159
			7/32		.219	.22	5.556
				15/64	.234	.23	5.593
1/4					.250	.25	6.350
				17/64	.266	.27	6.747
			9/32		.281	.28	7.144
				19/64	.297	.30	7.540
		5/16			.312	.31	7.937
				21/64	.328	.33	8.334
			11/32		.344	.34	8.731
				23/64	.359	.36	9.128
	3/8				.375	.38	9.525
				25/64	.391	.39	9.922
			13/32		.406	.41	10.319
				27/64	.422	.42	10.716
		7/16			.438	.44	11.112
				29/64	.453	.45	11.509
			15/32		.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**
				33/64	.516	.52	13.097
			17/32		.531	.53	13.494
				35/64	.547	.55	13.891
		9/16			.562	.56	14.288
				37/64	.578	.58	14.684
			19/32		.594	.59	15.081
				39/64	.609	.61	15.478
	5/8				.625	.62	15.875
				41/64	.641	.64	16.272
			21/32		.656	.66	16.669
				43/64	.672	.67	17.065
		11/16			.688	.69	17.462
				45/64	.703	.70	17.859
			23/32		.719	.72	18.256
				47/64	.734	.73	18.653
3/4					.750	.75	19.050
				49/64	.766	.77	19.447
			25/32		.781	.78	19.844
				51/64	.797	.80	20.241
		13/16			.812	.81	20.637
				53/64	.828	.83	21.034
			27/32		.844	.84	21.431
				55/64	.859	.86	21.828
	7/8				.875	.88	22.225
				57/64	.891	.89	22.622
			29/32		.906	.91	23.019
				59/64	.922	.92	23.416
		15/16			.938	.94	23.812
				61/64	.953	.95	24.209
			31/32		.969	.97	24.606
				63/64	.984	.98	25.003
					1.000	1.00	25.400

CHART 9105. DECIMAL / MILLIMETER EQUIVALENTS OF 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.

LIST OF CONSUMABLE MATERIALS.

A list of materials used in the maintenance and repair of the aircraft are included in the following Chart 9106. A list of the vendors and their addresses is included at the rear of the chart.

CHART 9106. LIST OF CONSUMABLE MATERIALS

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Fuel, Engine	(See Note l)	100 octane green / blue	
Oil, Engine	MIL-L-6082 or MIL-L-2285 1 (See Note 3)		
Corrosion Preventive Compound and Broken Oil	MIL-C-6529 Type II Per latest revision Lycoming Service Letter L121		
Lubricating Oil (General Purpose Low Temperature)	MIL-L-7870		
Oil Filter			
Air Filter			
Dry Lubricant	#MS-122 (Purch.)		
Lubricating Oil		Aero Lubriplate or Mag 1 (Purch.)	Fiske Bros. Refining Co. 129 Lockwood St. Newark, N.J. 07105 (201)-589-9150
Lubricating Grease (General Purpose superseded by MIL-G-81322)	MIL-L-7711	Regal AFB2	Texaco Inc. 2000 Westchester Ave. White Plains,N.Y. 10650 (914)-253-4000
		Aeroshell Grease No. 6	Shell Oil Co. One Shell Plaza Houston, TX 77002 (713)-220-6697
		2242 International	Lubricants Co. New Orleans, La.
Lubricating Grease (High Temperature)	MIL-G-81322 (See Note 2)	Mobilgrease 28	Mobil Oil Corp. 150 E. 42nd St. New York, NY 10017 (212) 883-4242

CHART 9106. LIST OF CONSUMABLE MATERIALS (continued)

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Lubricating Grease (High Temperature) cont)		Aeroshell No. 22	Shell Oil Co. One Shell Plaza Houston, Texas 77002 (713)-220-6697
Lubricating Grease Aircraft and Instrument. Low and High Temperature)	MIL-G-23827 (See Note 2)	Supermil Grease No. A72832	American Oil Co. 910 South Michigan Ave. Chicago, Ill. 60680
	Royco 27A	Royal Lubricants Co. River Road Hanover, N.J. 07936 (201)-887-3100	
	Shell 6249 Grease	Shell Oil Co. One Shell Plaza Houston, Texas 77002 (713)-220-6697	
Lubricating Grease (All Purpose)		Texaco Marfak All Purpose Grease or	
	Mobil Mobilgrease 77 or Mobilux EP2) Grease or Shell Alvania EP Grease 2		
Hydraulic Fluid	MIL-H-5606 Univis - 40	Brayco 756D	Bray Oil Co. 1925 Marianna Ave. Los Angeles, Cal. 98103 (213)-268-6171
		TL-5874	Texaco Inc. 2000 Westchester Ave. White Plains, N.Y. 10650 (914)-253-4000
		PED 3565	Standard Oil Co. of California, 225 Bush St. San Francisco, CA 94104 (415)-894-7700
Sealer		PR 1321 B1/2	Products Research Co. 2919 Empire Avenue Burbank, Cal. 91504 (213)-849-3992

CHART 9106. LIST OF CONSUMABLE MATERIALS (continued)

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Solvent	PD680		
Toluol	TT-T-548		
Buffing and Rubbing Compounds		Automotive Type DuPont #7	Dupont Company Finishes Division DuPont Bldg. Wilmington, Del. 19898 (302)-774-1000
		Ram Chemical #69 x 1	Ram Chemicals 210 E. Alondra Blvd. Gardena, CA 90248 (213)-321-0710
		Mirro Glaze #1	Mirro Bright Polish Co.,Inc. Irvine Industrial Complex P.O. Box 17177 Irvine, CA. 92173 (714)-557-9200
Cleaners		Fantastic Spray Perchlorethylene VM&P Naphtha	Local Suppliers (Lighter Fluid)
ABS-Solvent Cements		Methylethyl Ketone Methylene Chloride Acetone	Local Suppliers
Epoxy Patching Compound		Solarite #400	Solar Compounds Corp. 1201 W. Blanke St. P.O. Box 227 Linden, N.J. 07036 (201)-862-2813
Hot Melt Adhesives Polyamids and Hot Melt Gun	Stick Form 1/2 in. dia. 3 in. long		Sears Roebuck & Co. or Most Hardware Stores
Sealant		PR307	Piper Aircraft Corp.
Tapes, Vinyl Foam	1/8 in. x 1 in. 510 Series, Type II		Norton Tape Division Dept . 6610 Troy, NY 12181 (518)-273-0100

CHART 9106. LIST OF CONSUMABLE MATERIALS (continued)

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Black Vinyl Plastic	2 in. x 9 mil. and or 11/7 in. x 9 mil.		Norton Tape Division Dept. 6610 Troy, NY 12181 (518)-273-0100
Vinyl Foam	1 in. x l/8 in. 530 Series, Type I		Same as above.
Teflon Tape	.003" x .5" wide		Minnesota Mining and Mfg. 3M Center St. Paul, Minnesota 55144 (612)-733-1110
			Shamban W.S. and Co. 1857 Centinela Ave. Santa Monica, CA 90404 (213)-397-2195
	.003 x .25 wide		Johnson and Johnson Inc. Permacel Div. 501 George Street New Brunswick, N.J. 08903 (201)-524-0400
Leak Detector Solution For Oxygen	MIL-L-25567C	Alpha 73 Oxygen Leak Detector Type 1	U.S. Gulf Corp. P.O. Box 233 Stoneybrook, N.Y.11790 (212)-683-9221
		Leak Tec #16-OX	American Gas and Chemical Co. Ltd. 220 Pegasus Avenue Northvale, N.J. 07647 (201)-767-7300
Neoprene Rubber	PMS-C1002-S	Scotch Grip 2210	Minnesota Mining and Mfg.; 3M Center St. Paul, Minnesota 55144 (612)-733-1110
		Contact Adhesive B10161	Delta Laboratories, Inc. P.O. Box 1650 Ocala, FL 32670 (904)-629-8101

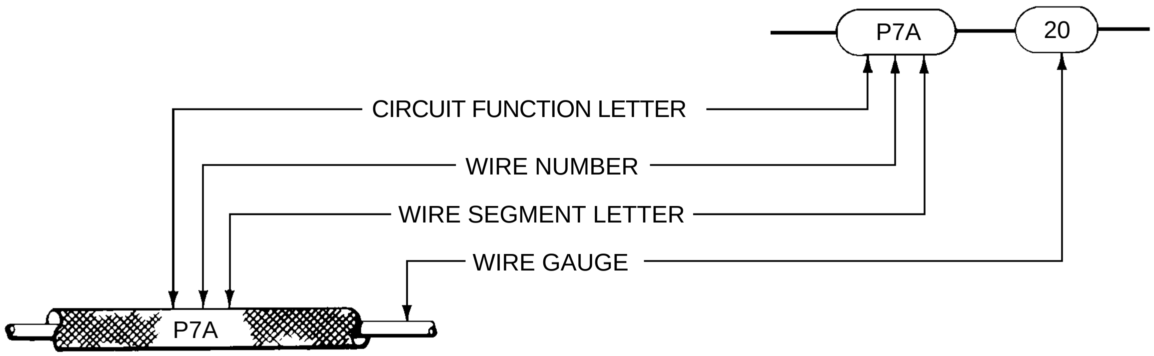
CHART 9106. LIST OF CONSUMABLE MATERIALS (continued)

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Rain Repellent	FSCM 50159	Repcon	Unelko Corporation 727 E. 110th Street Chicago, Illinois 60628
Tube Fitting		Swageloc Fitting	Crawford Fitting Co. 29500 Solon Road Solon, Ohio 44139 (216)-248-4600

— NOTE —

1. If 100 octane (green)fuel is not available, use 100 octane low lead (blue) fuel
2. Precautions should be taken when using MIL-G-23827 and MIL-G-81322, since these greases contain chemicals harmful to painted surfaces.
3. Refer to the latest revision of Lycoming Service Instruction No. 1014 for Lubricating Recommendations.

CHART 9107. ELECTRICAL WIRE CODING



CIRCUIT FUNCTION LETTER	CIRCUITS
A	AUTOPILOT
C	CONTROL SURFACE
F	FLIGHT INSTRUMENT
G	LANDING GEAR
H	HEATER - VENTILATING & DEICING
L	LIGHTING
P	POWER
Q	FUEL, OIL & ENGINE INSTRUMENT
RP	RADIO POWER
RZ	RADIO AUDIO
J	IGNITION
W	WARNING
K	STARTER

CHART 9108. ELECTRICAL SYMBOLS (Sheet 1 of 2)

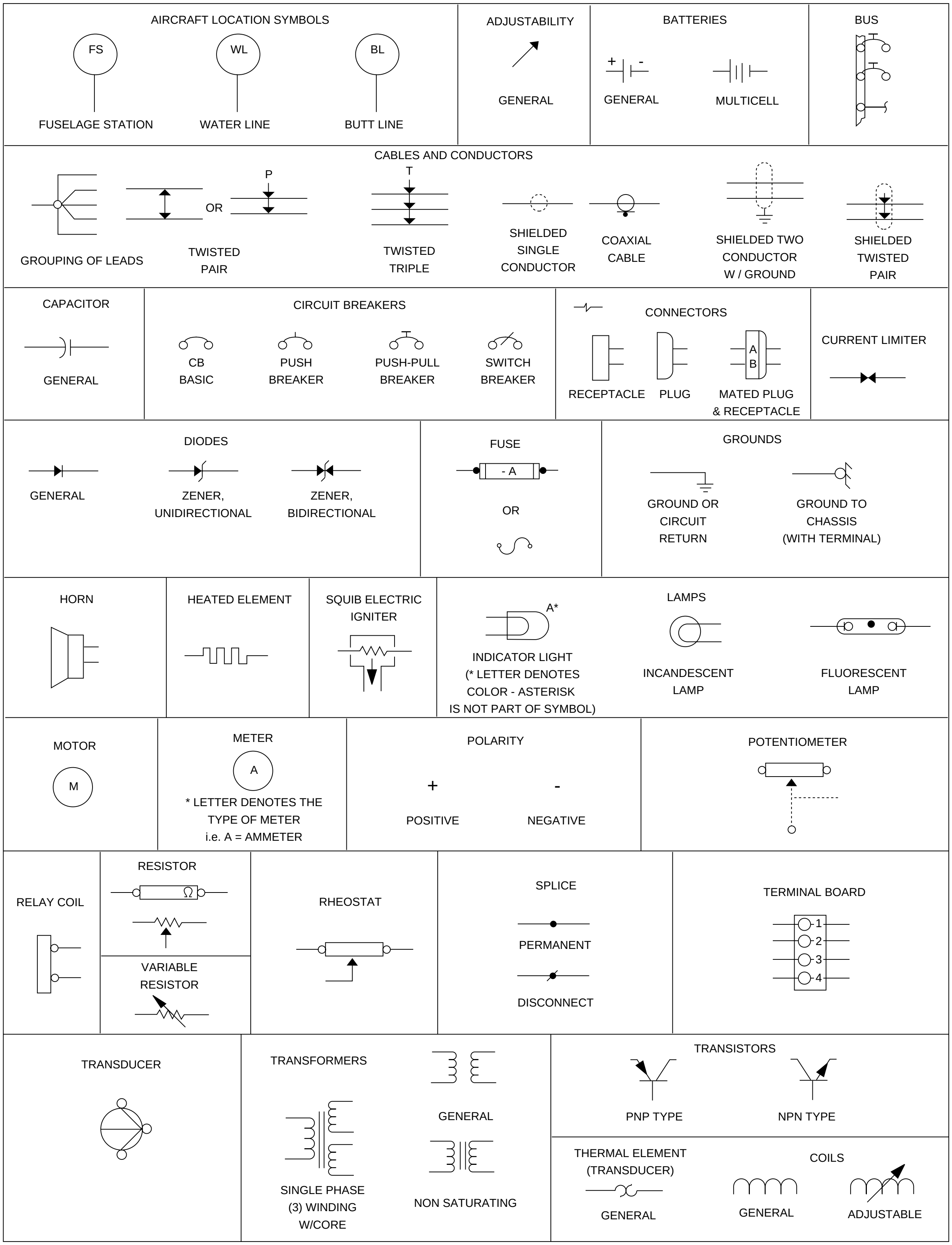
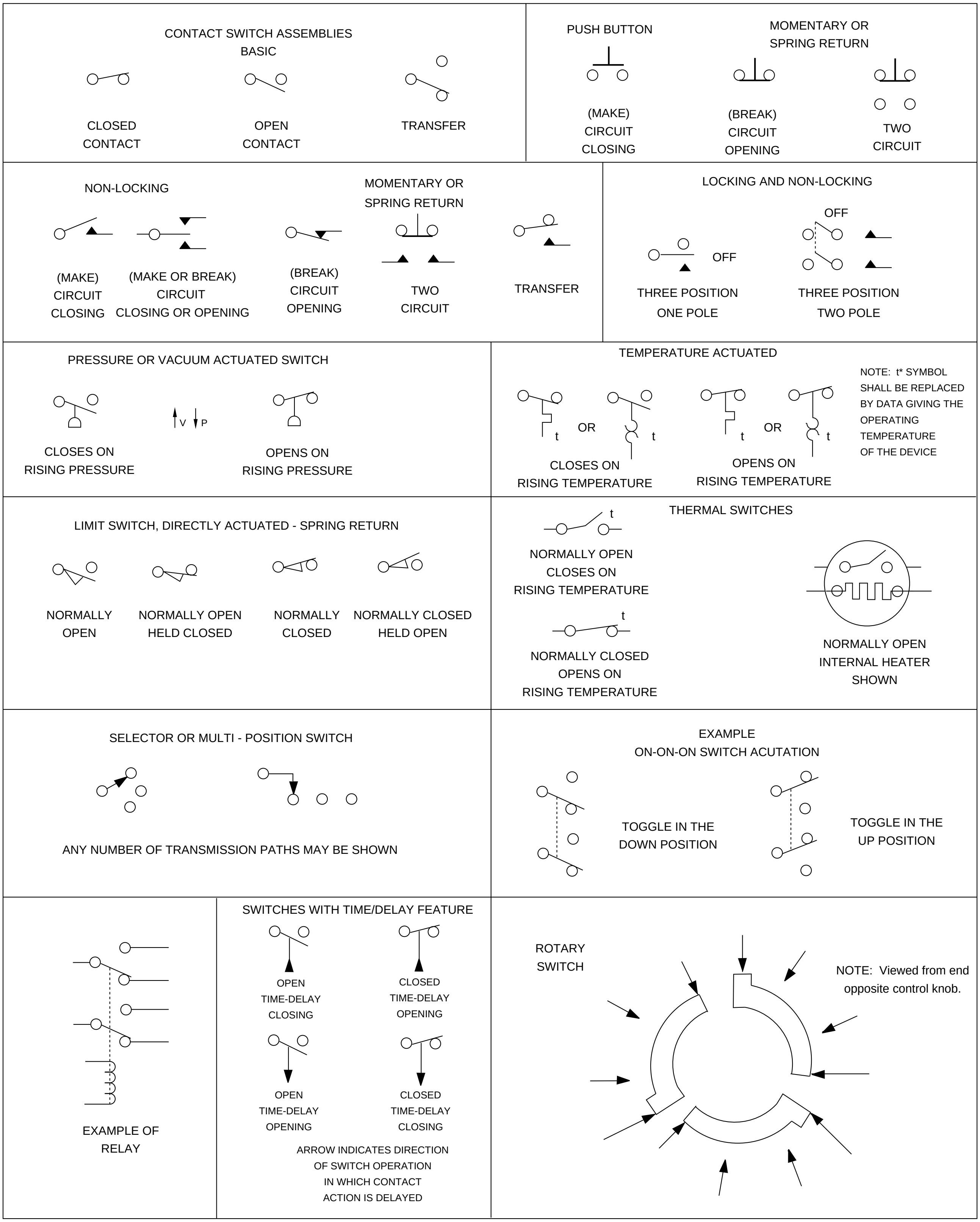


CHART 9108. ELECTRICAL SYMBOLS (Sheet 2 of 2)



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WIRING DIAGRAM INDEX GUIDE

FIGURE NO.	SCHEMATIC	GRID NO.
	ANNUNCIATOR SYSTEMS	
	Annunciator	
91-1	Seneca III (14 Volt System)	5C11
91-2	Seneca III (28 Volt System, includes s/n 3448001 thru 3448037)	5C12
91-3	Seneca IV	5C14
	Baggage Door Annunciation	
91-4	Seneca IV	5C17
	CONTROL SYSTEMS	
	Electric Flaps	
91-5	Seneca III (28 Volt System, includes s/n 3448001 thru 3448037)	5C18
91-6	Seneca IV	5C19
	DE-ICE SYSTEMS	
	Pitot Heat and Stall Warning	
91-7	Seneca III (14 Volt System)	5C20
91-8	Seneca III (28 Volt System, includes s/n 3448001 thru 3448037)	5C21
91-9	Seneca IV	5C22
	Propeller De-ice	
91-10	Two-blade	5C23
91-11	Three-blade	5C24
	Surface De-ice	
91-12	Seneca III (14 Volt System)	5D1
91-13	Seneca III (28 Volt System, includes s/n 3448001 thru 3448037)	5D2
91-14	Seneca IV	5D3
	Windshield Heat	
91-15	All models	5D4

WIRING DIAGRAM INDEX GUIDE (continued)

FIGURE NO.	SCHEMATIC	GRID NO.
	ELECTRICAL POWER SYSTEMS	
	Alternator Power (Seneca III see Power Distribution schematic)	
91-16	Seneca IV	5D5
	Avionics	
91-17	Seneca III (14 Volt System)	5D6
91-18	Seneca III (28 Volt System)	5D7
	Battery Master / External Power (Seneca III see Power Distribution schematic)	
91-19	Seneca IV	5D8
	Ground Clearance	
91-20	Seneca III (14 Volt System)	5D9
91-21	Seneca III (28 Volt System, includes s/n 3448001 thru 3448037)	5D10
91-22	Seneca IV	5D11
	Power Distribution (Seneca IV see Alternator Power schematic)	
91-23	Seneca III (14 Volt System)	5D12
91-24	Seneca III (28 Volt System)	5D14
	Radio Master (Seneca III see Power Distribution schematic)	
91-25	Seneca IV	5D16

WIRING DIAGRAM INDEX GUIDE (continued)

FIGURE NO.	SCHEMATIC	GRID NO.
	ENGINE SYSTEMS	
	Magnetos	
91-26	Seneca III	5D17
91-27	Seneca IV	5D18
	Starter and Accessories (Seneca III see Power Distribution schematic)	
91-28	Seneca IV	5D19
	ENVIRONMENTAL SYSTEMS	
	Air conditioning	
91-29	Seneca III (14 Volt System)	5D20
91-30	Seneca III (28 Volt System)	5D22
	Heating and Defrosting	
91-31	Seneca III (14 Volt System)	5D24
91-32	Seneca III (28 Volt System, includes s/n 3448001 thru 3448037)	5E1
91-33	Seneca IV	5E2
	Ventilation - Fresh Air	
91-34	Seneca III (14 Volt System)	5E3
91-35	Seneca III (28 Volt System, includes s/n 3448001 thru 3448037)	5E3
91-36	Seneca IV	5E4
	FUEL SYSTEMS	
	Fuel Pumps	
91-37	Seneca III (14 Volt System)	5E5
91-38	Seneca III (28 Volt System, includes s/n 3448001 thru 3448037)	5E6
91-39	Seneca IV (Left Pump)	5E7
91-40	Seneca IV (Right Pump)	5E8

WIRING DIAGRAM INDEX GUIDE (continued)

FIGURE NO.	SCHEMATIC	GRID NO.
	INDICATORS	
	Ammeter / Low Voltage Monitor	
91-41	Seneca IV	5E9
	Clock	
91-42	Seneca III (14 Volt System)	5E11
91-43	Seneca III (28 Volt System, includes s/n 3448001 thru 3448037)	5E12
91-44	Seneca IV	5E12
	Engine Gauges	
91-45	Seneca III (14 Volt System)	5E13
91-46	Seneca III (28 Volt System, includes s/n 3448001 thru 3448037)	5E14
91-47	Seneca IV	5E15
	Fuel Quantity (Seneca III see Engine Gauges schematic)	
91-48	Seneca IV	5E16
	Hour Meter	
91-49	Seneca III (14 Volt System)	5E17
91-50	Seneca III (28 Volt System, includes s/n 3448001 thru 3448037)	5E18
91-51	Seneca IV	5E18
	Tachometer (Seneca III see Engine Gauges schematic)	
91-52	Seneca IV	5E19
	Turn and Bank	
91-53	Seneca III (14 Volt System)	5E20
91-54	Seneca III (28 Volt System, includes s/n 3448001 thru 3448037)	5E20
91-55	Seneca IV	5E21

WIRING DIAGRAM INDEX GUIDE (continued)

FIGURE NO.	SCHEMATIC	GRID NO.
	LANDING GEAR SYSTEMS	
	Landing Gear Control and Warning	
91-56	Seneca III (14 Volt System)	5E22
91-57	Seneca III (28 Volt System, includes s/n 3448001 thru 3448037)	5E23
91-58	Seneca IV	5E24
	LIGHTING SYSTEMS - EXTERNAL	
	Anti-Collision Lights (Seneca IV see Navigation Lights schematic)	
91-59	Seneca III (14 Volt System)	5F1
91-60	Seneca III (28 Volt System, includes s/n 3448001 thru 3448037)	5F2
	Landing / Taxi Lights	
91-61	Seneca III (14 Volt System)	5F3
91-62	Seneca III (28 Volt System, includes s/n 3448001 thru 3448037)	5F3
91-63	Seneca IV	5F4
	Navigation Lights	
91-64	Seneca III (14 Volt System)	5F5
91-65	Seneca III (28 Volt System, includes s/n 3448001 thru 3448037)	5F6
91-66	Seneca IV	5F7
	Recognition Lights	
91-67	Seneca III (14 Volt System)	5F8
91-68	Seneca III (28 Volt System, includes s/n 3448001 thru 3448037)	5F8
91-69	Seneca IV	5F9
	Flood Lights - Tail	
91-70	All models	5F10
	Wing Ice Light	
91-71	All Models	5F10

WIRING DIAGRAM INDEX GUIDE (continued)

FIGURE NO.	SCHEMATIC	GRID NO.
	LIGHTING SYSTEMS - INTERNAL (See also Annunciator schematics)	
	Avionics Lights Dimming (Seneca III see Flight Instruments / Avionics Lights schematic)	
91-72	Seneca IV	5F11
	Baggage Compartment Light	
91-73	Seneca III (14 Volt System)	5F12
91-74	Seneca III (28 Volt System, includes s/n 3448001 thru 3448037)	5F12
91-75	Seneca IV	5F13
	Cabin Lights (Seneca IV see Courtesy Lights schematic)	
91-76	Seneca III (14 Volt System)	5F14
91-77	Seneca III (28 Volt System, includes s/n 3448001 thru 3448037)	5F14
	Courtesy Lights	
91-78	Seneca III (14 Volt System)	5F15
91-79	Seneca III (28 Volt System, includes s/n 3448001 thru 3448037)	5F15
91-80	Seneca IV	5F16
	Flight Instruments / Avionics Lights	
91-81	Seneca III (14 Volt System)	5F17
91-82	Seneca III (28 Volt System, includes s/n 3448001 thru 3448037)	5F18
	Instrument Panel Post Lights	
91-83	Seneca IV	5F19
	Overhead Flood Lights	
91-84	Seneca III (14 Volt System)	5F20
91-85	Seneca III (28 Volt System, includes s/n 3448001 thru 3448037)	5F20
91-86	Seneca IV	5F21

WIRING DIAGRAM INDEX GUIDE (continued)

FIGURE NO.	SCHEMATIC	GRID NO.
	LIGHTING SYSTEMS - INTERNAL (continued)	
	Switch Lights Dimming (Seneca III see Flight Instruments / Avionics Lights schematic)	
91-87	Seneca IV	5F22
	PROPELLERS	
	Propeller Synchrophaser	
91-88	Seneca III (14 Volt System, includes s/n 34-8133002 thru 34-8133172)	5F23
91-89	Seneca III (14 Volt System, includes s/n 34-8133001, 34-8133173 thru 34-8633031, 3433001 thru 3433208)	5F24
91-90	Seneca III (28 Volt System)	5G1
	WARNING SYSTEMS (See also Annunciator schematic)	
	Stall Warning (Seneca IV see Pitot and Stall Warning Schematic)	
91-91	Seneca III (14 Volt System)	5G2
91-92	Seneca III (28 Volt System, includes s/n 3448001 thru 3448037)	5G3
	Emergency Locator Transmitter (ELT)	
91-93	ELT-10	5G4
91-94	ELT-910 (14 Volt System)	5G5
91-95	ELT-910 (28 Volt System)	5G6

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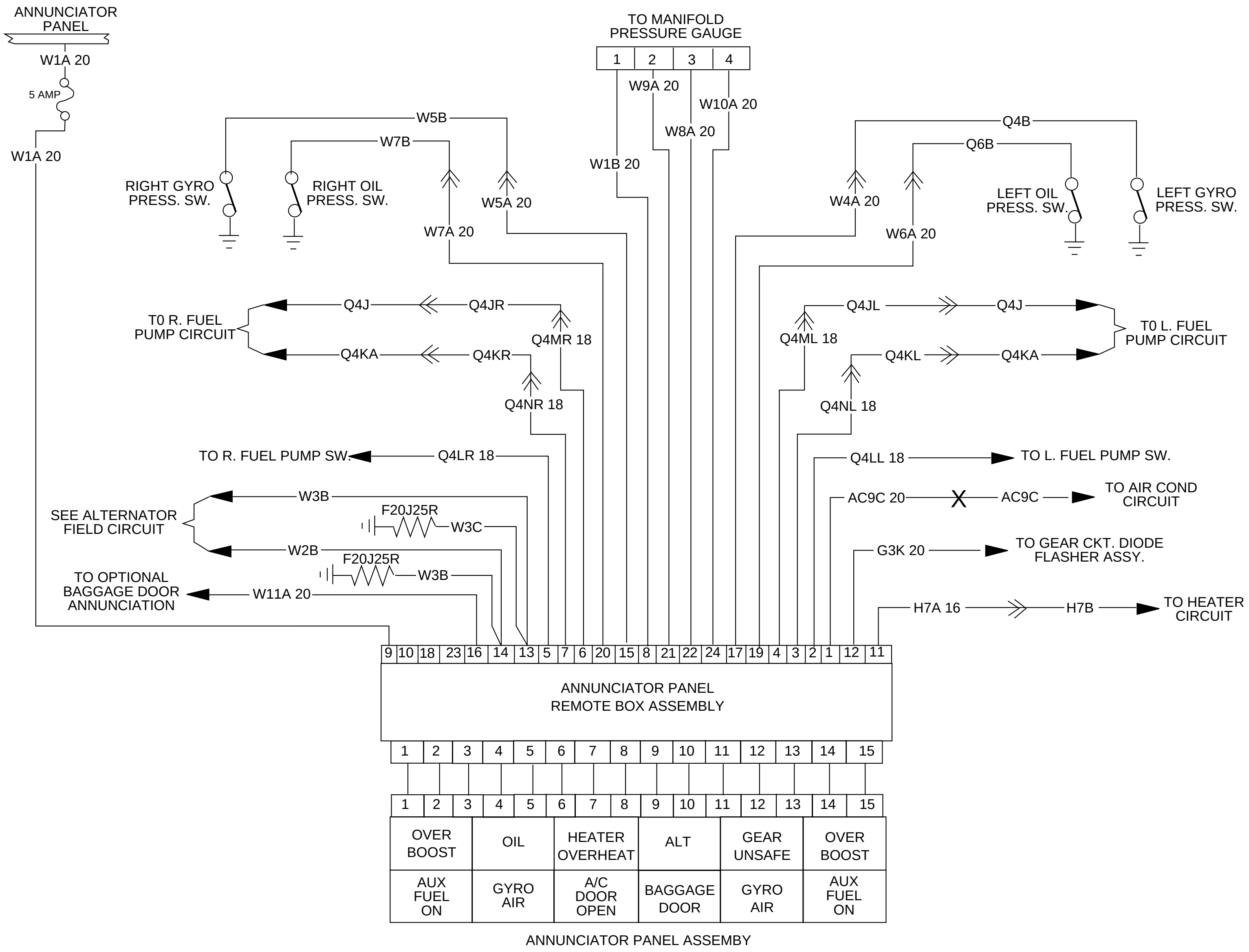

Figure 91-1. Annunciator - Seneca III (14 Volt System)

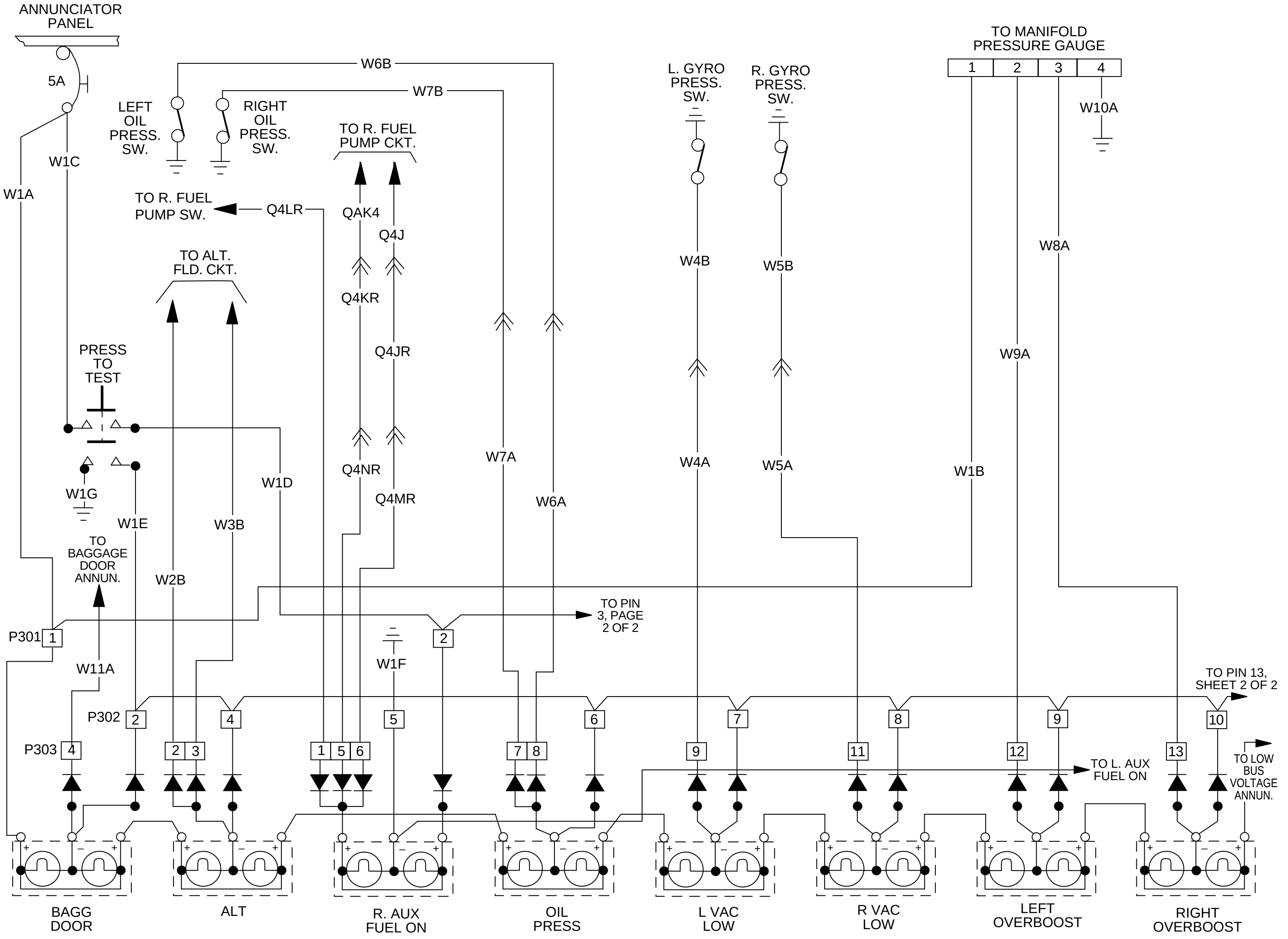

Figure 91-2. Annunciator - Seneca III (28 Volt System)
(Includes s/n 3448001 thru 3448037)
(Sheet 1 of 2)

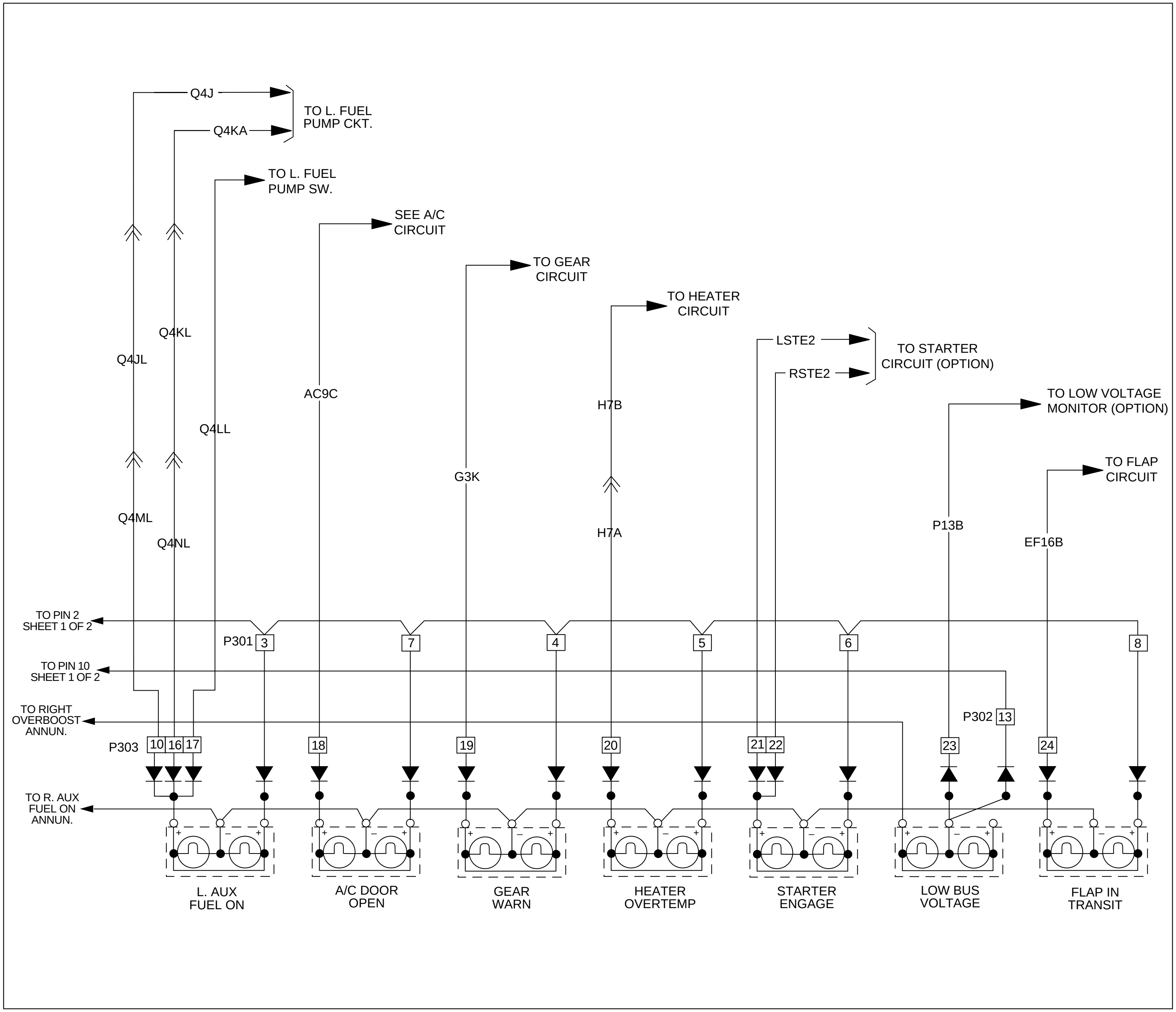

Figure 91-2. Annunciator - Seneca III (28 Volt System)
(Includes s/n 3448001 thru 3448037)
(Sheet 2 of 2)

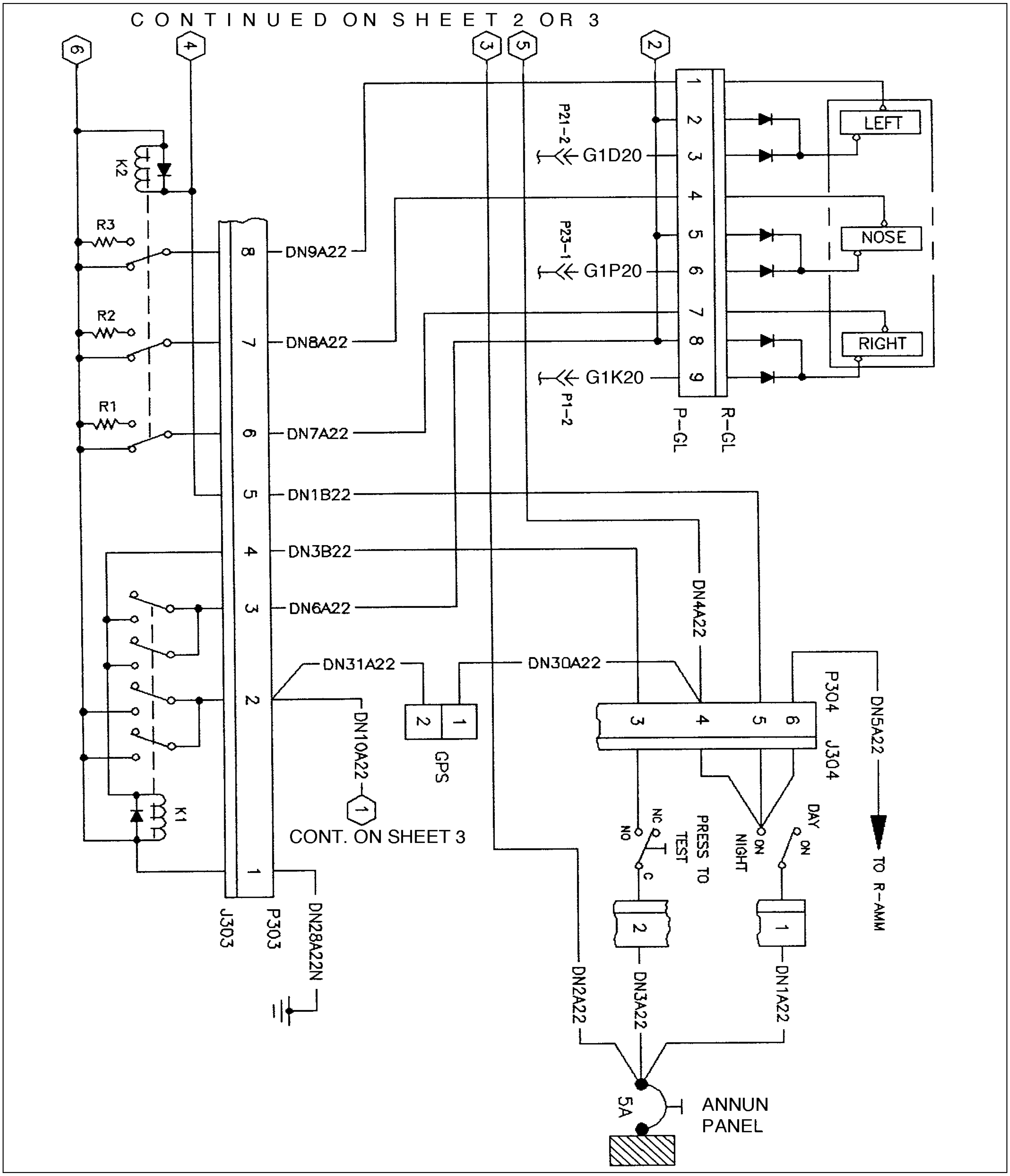

Figure 91-3. Annunciator - Seneca IV
(Sheet 1 of 3)

CONTINUED ON SHEET 3

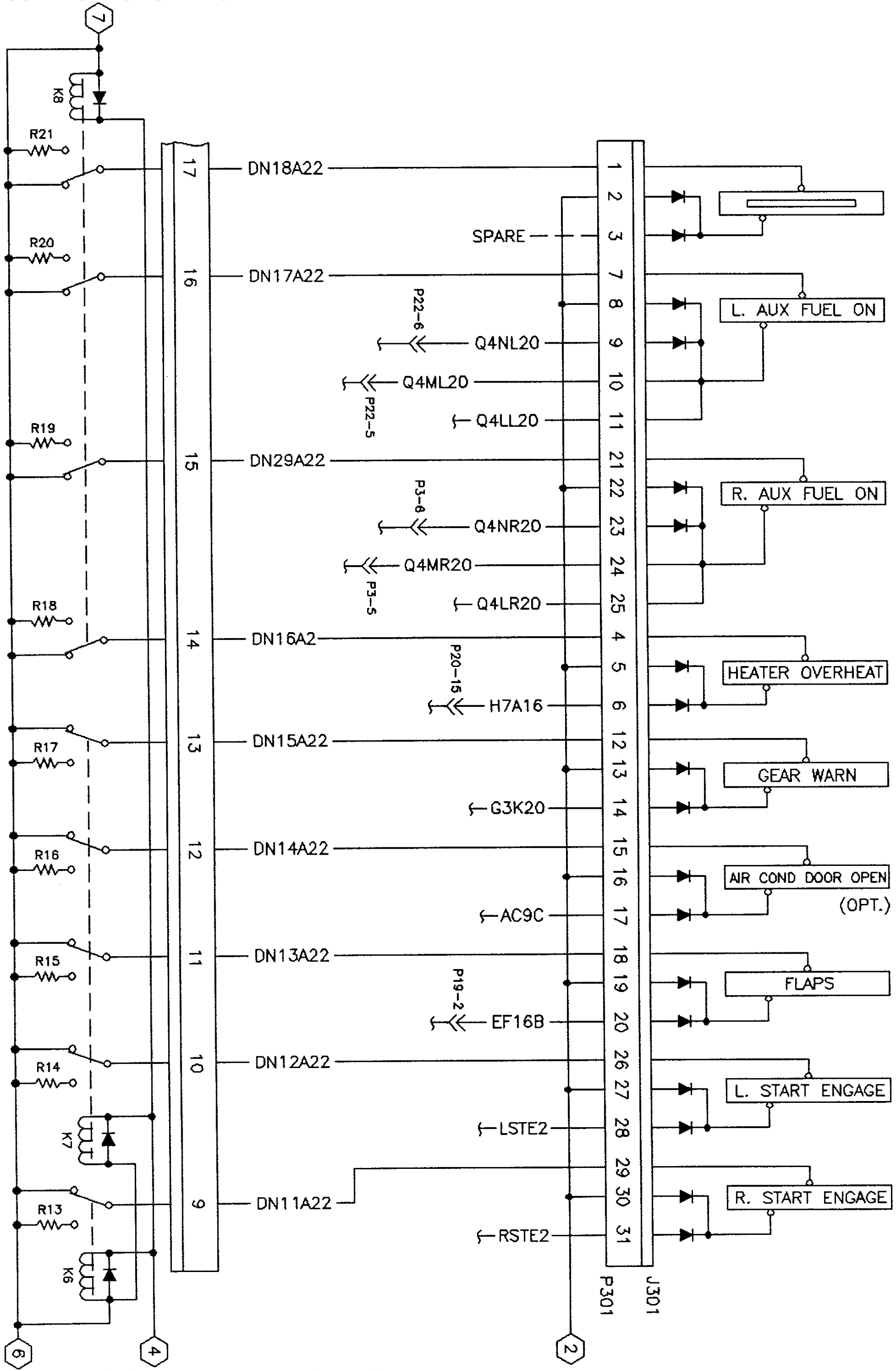

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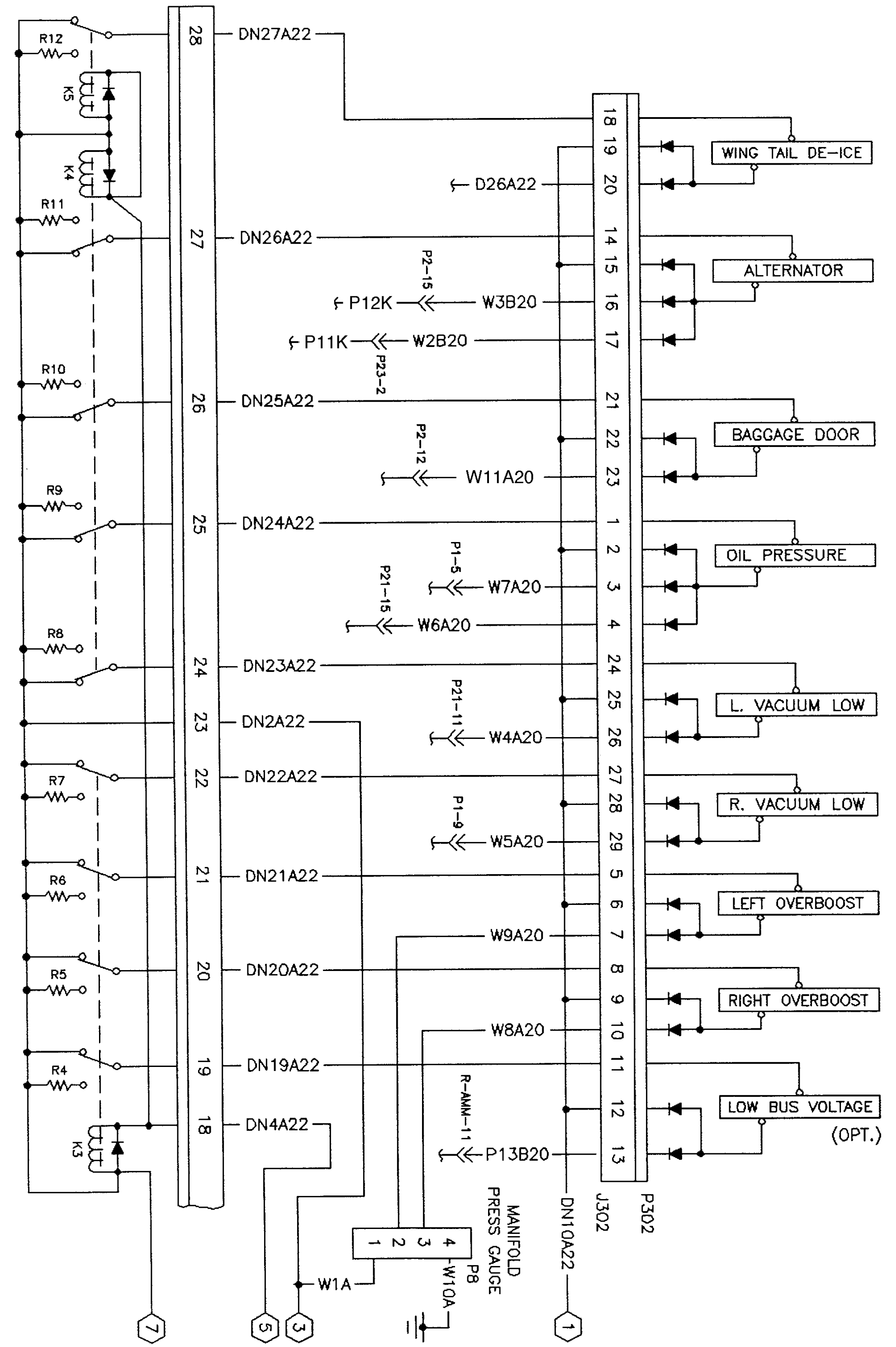
Figure 91-3. Annunciator - Seneca IV
(Sheet 2 of 3)



CONTINUED ON SHEET 1 OR 2

Figure 91-3. Annunciator - Seneca IV
(Sheet 3 of 3)

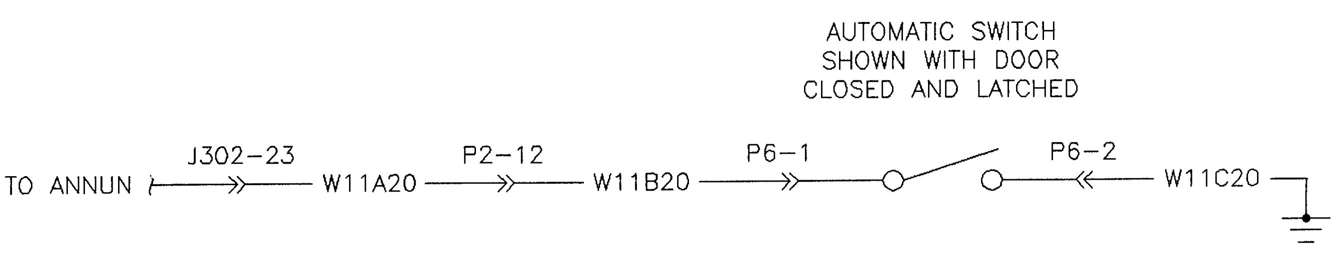


Figure 91-4. Baggage Door Annunciation - Seneca IV

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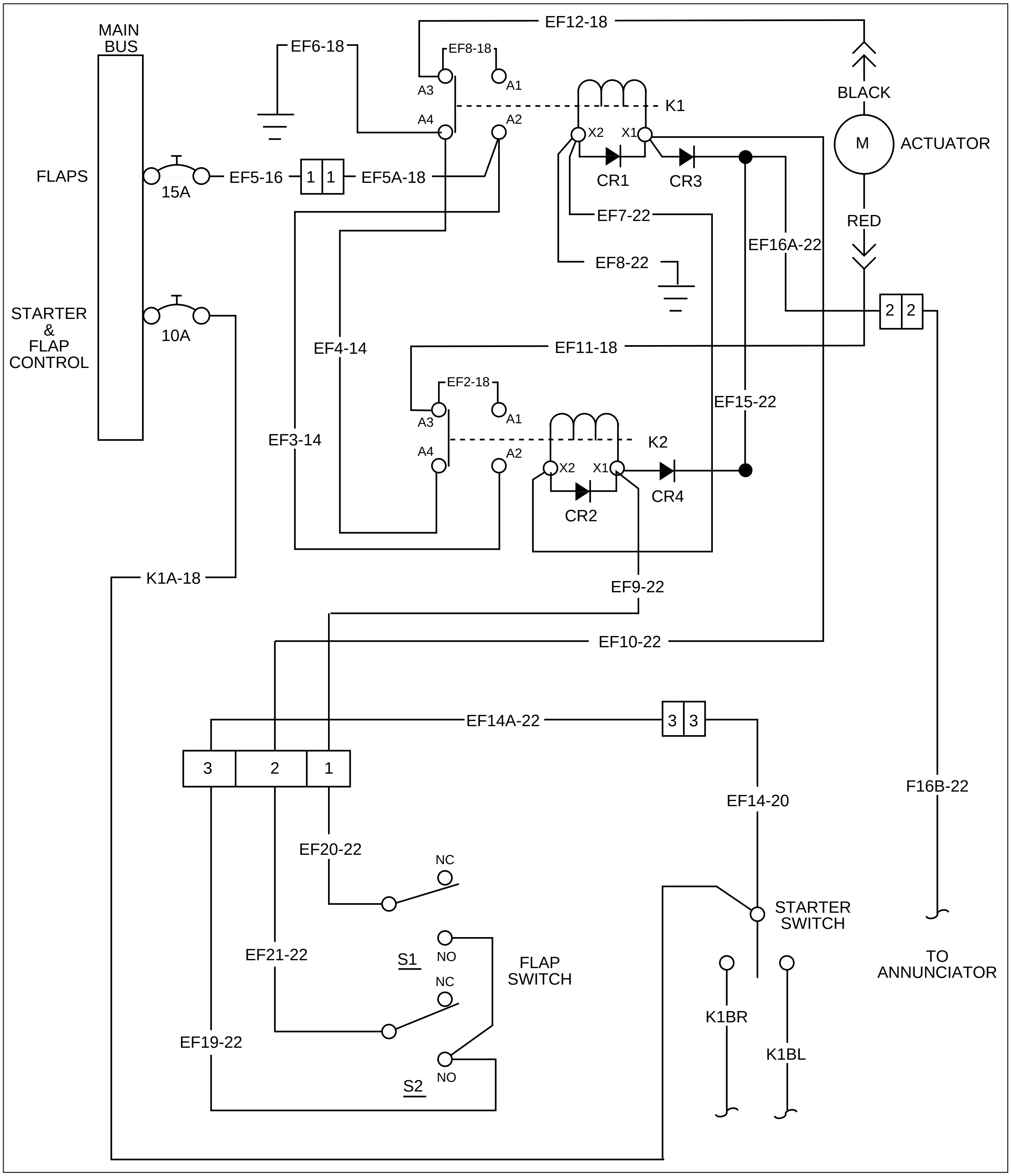


Figure 91-5. Electric Flaps - Seneca III (28 Volt System)
(Includes s/n 3448001 thru 3448037)

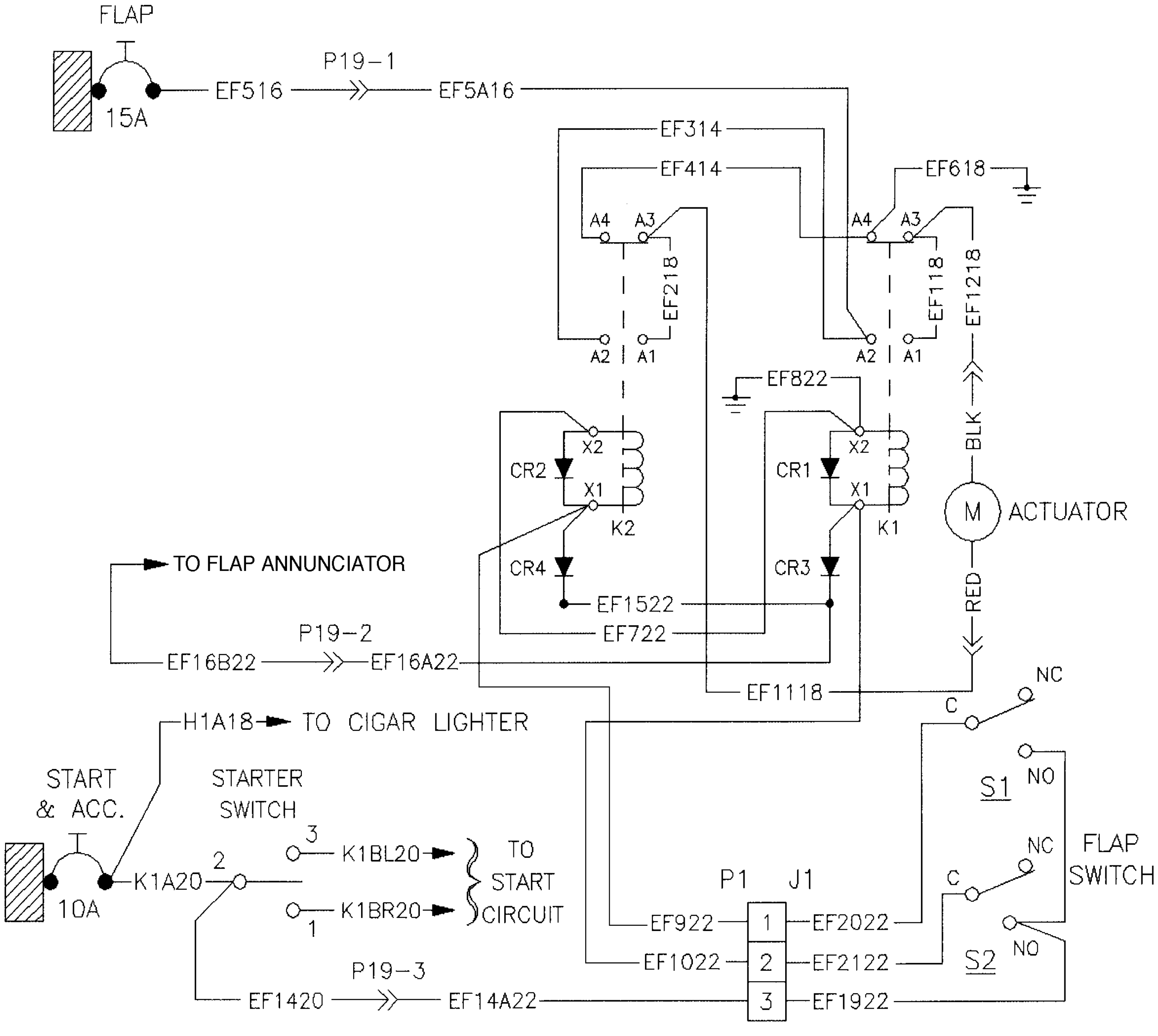


Figure 91-6. Electric Flaps - Seneca IV

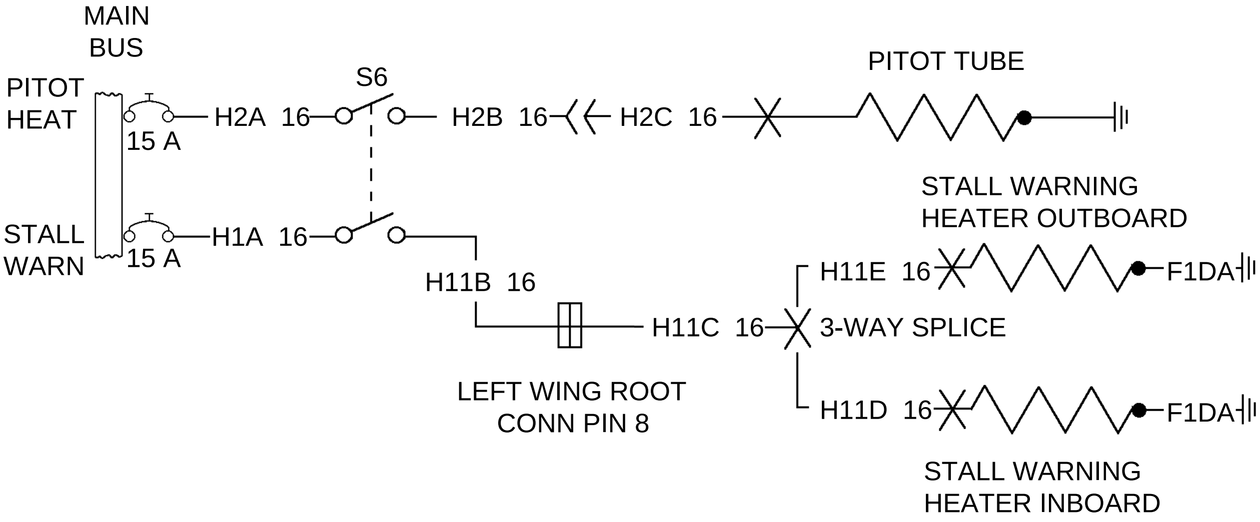
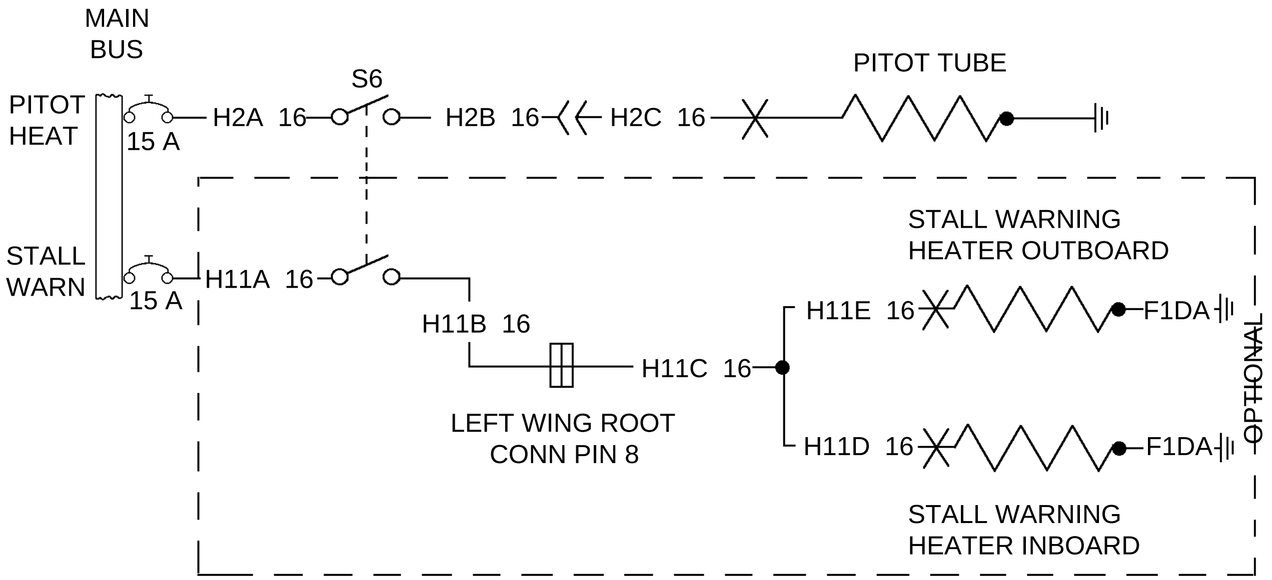


Figure 91-7. Pitot Heat and Stall Warning - Seneca III (14 Volt System)



NOTE: STALL WARN CB IS 15 AMP WITH COMPLETE DEICE SYSTEM, WITHOUT COMPLETE DEICE SYSTEM, SEE STALL WARNING SCHEMATIC.

Figure 91-8. Pitot Heat and Stall Warning - Seneca III (28 Volt System)
(Includes s/n 3448001 thru 3448037)

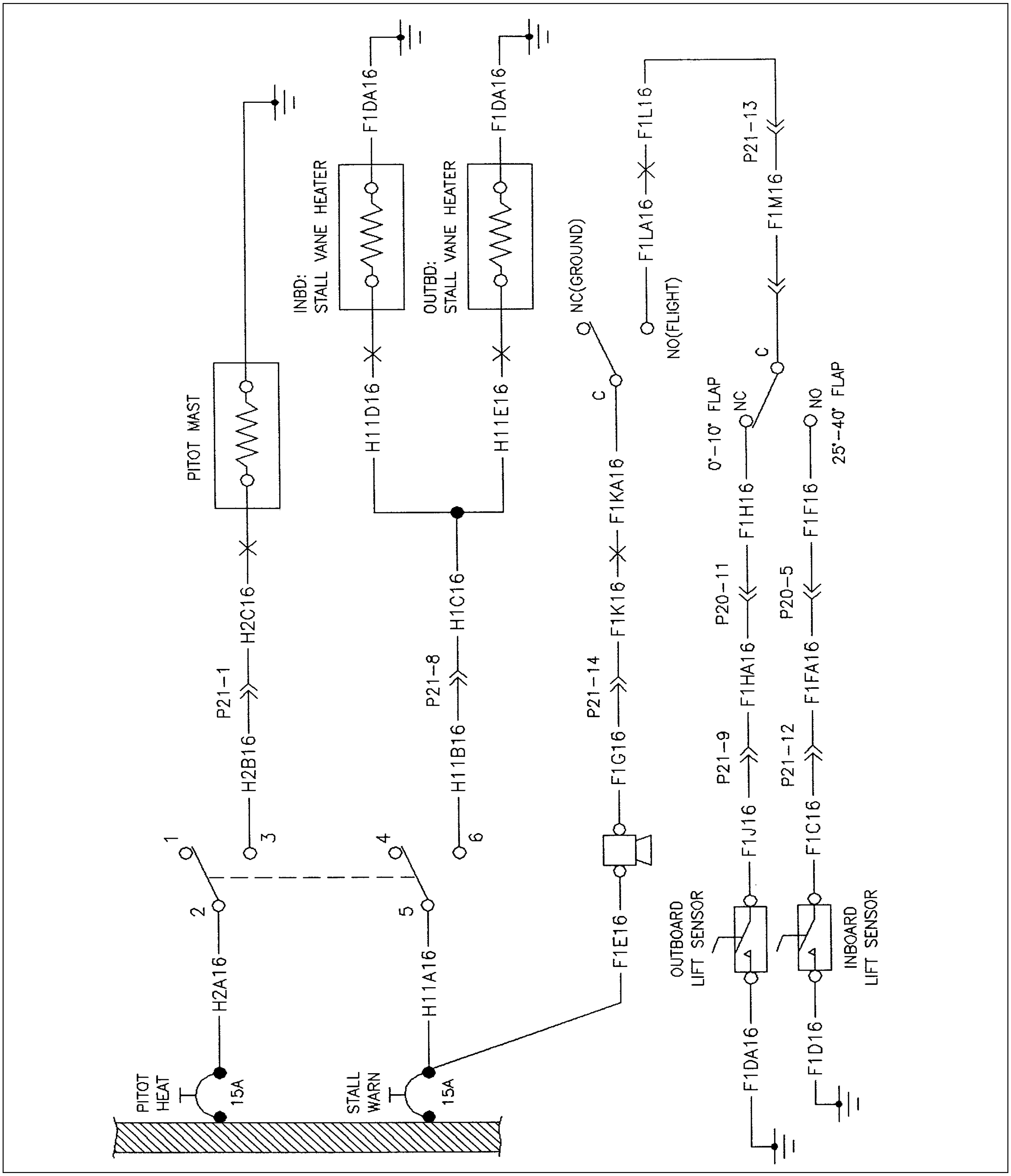


Figure 91-9. Pitot Heat and Stall Warning - Seneca IV

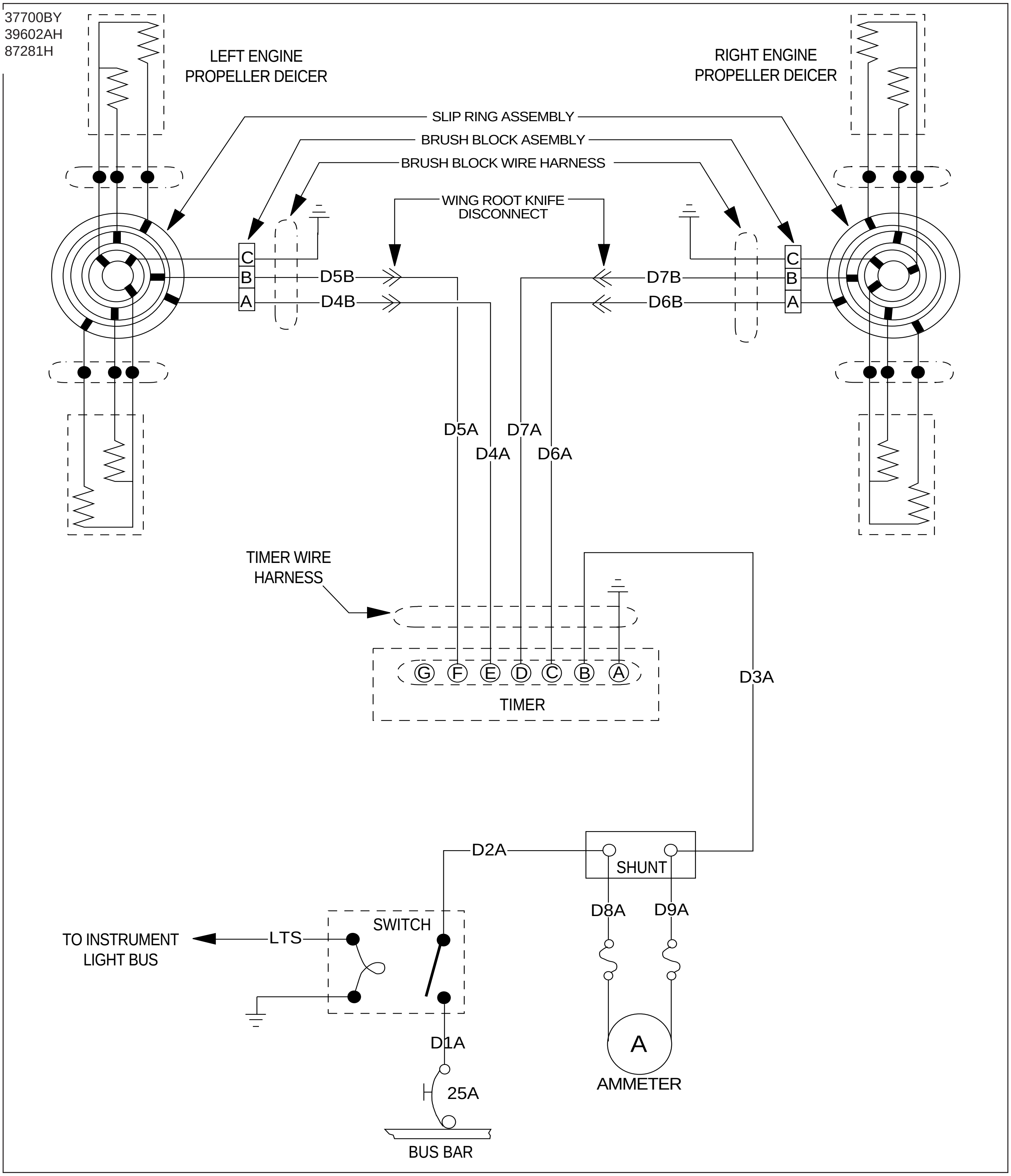


Figure 91-10. Propeller De-icer (Two-blade)

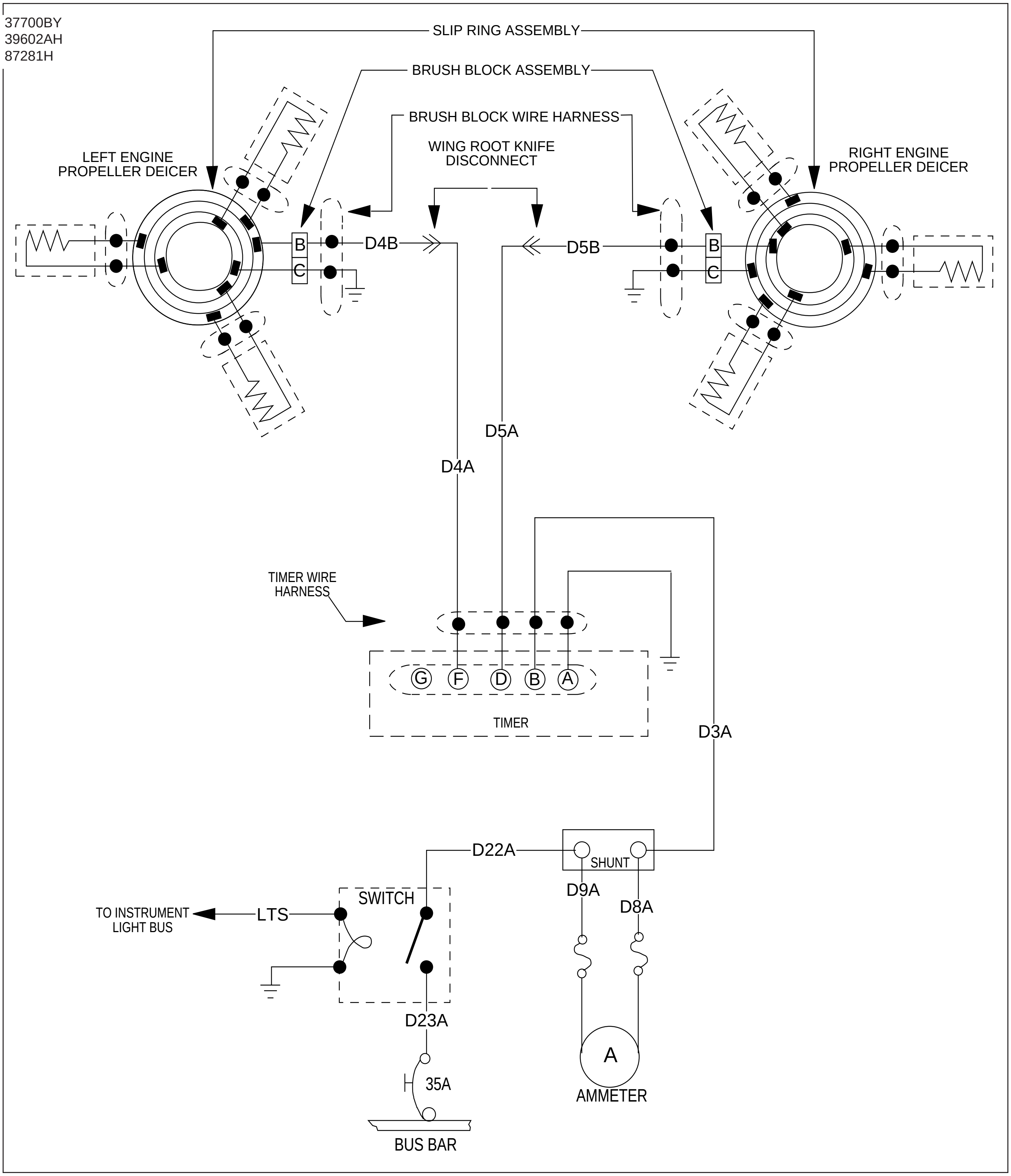


Figure 91-11. Propeller De-icer (Three-blade)

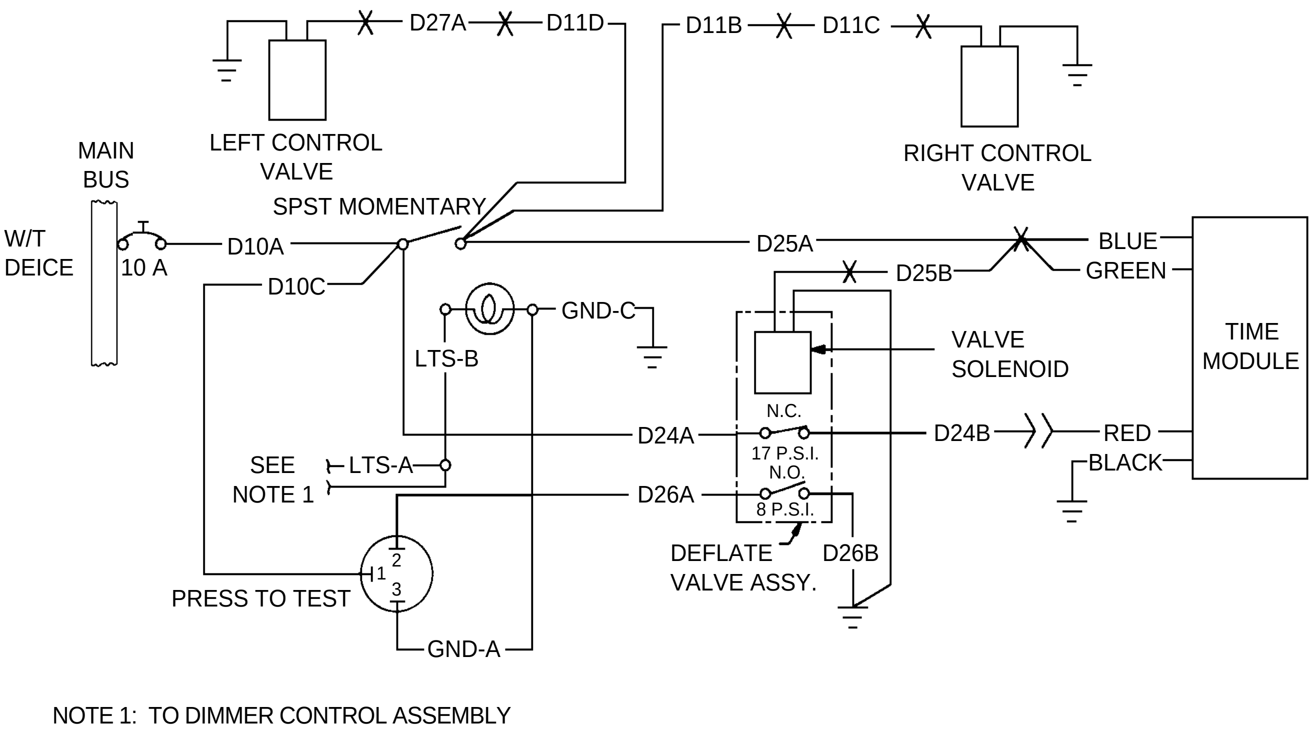


Figure 91-12. Surface De-ice - Seneca III (14 Volt System)

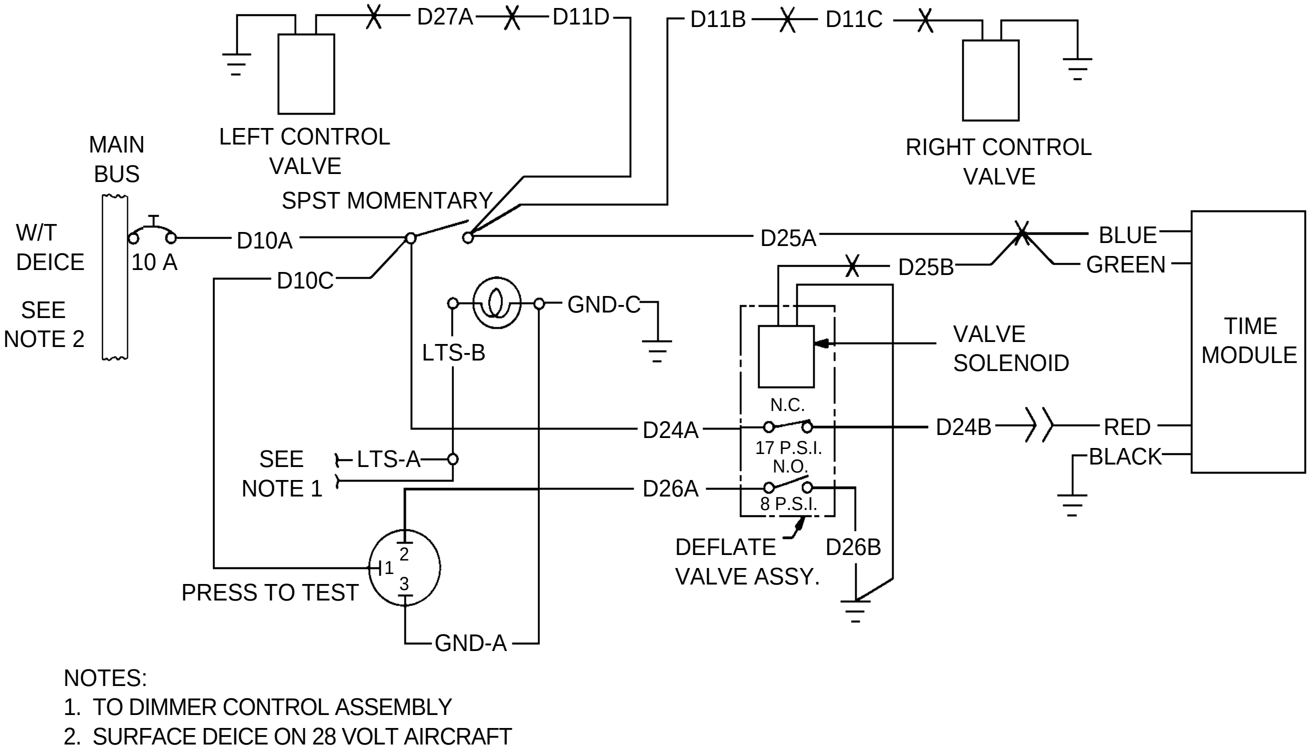


Figure 91-13. Surface De-ice - Seneca III (28 Volt System)
(Includes s/n 3448001 thru 3448037)

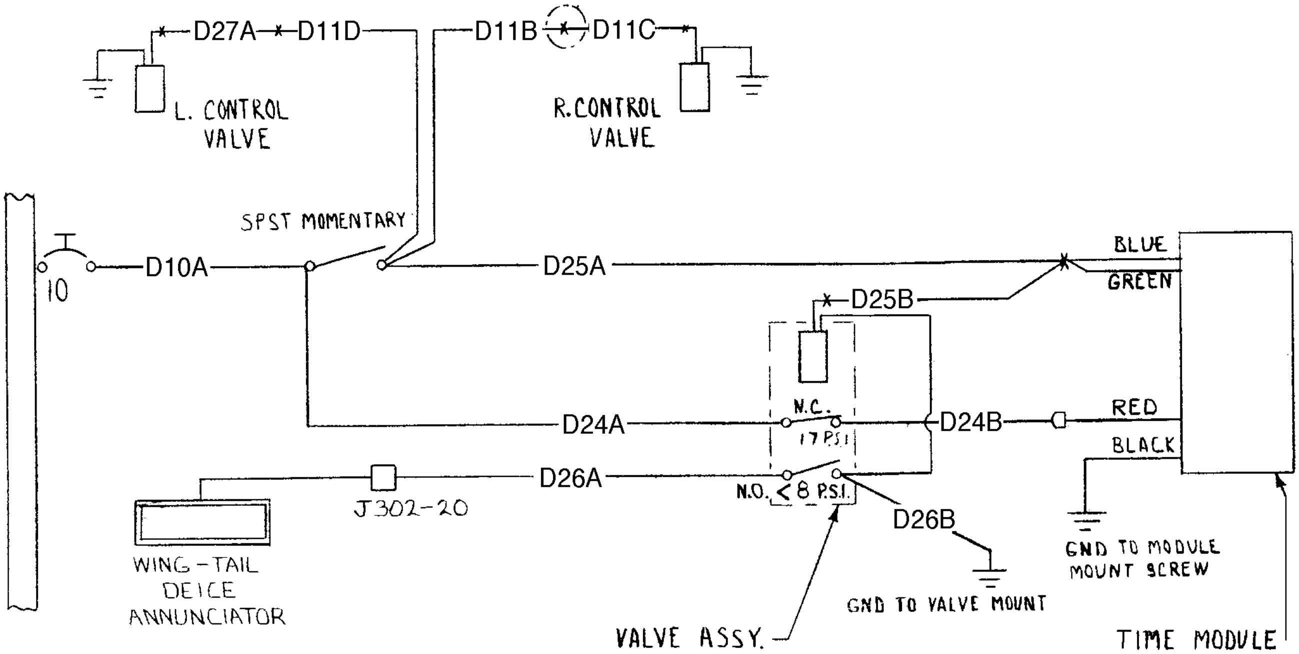


Figure 91-14. Surface De-ice - Seneca IV

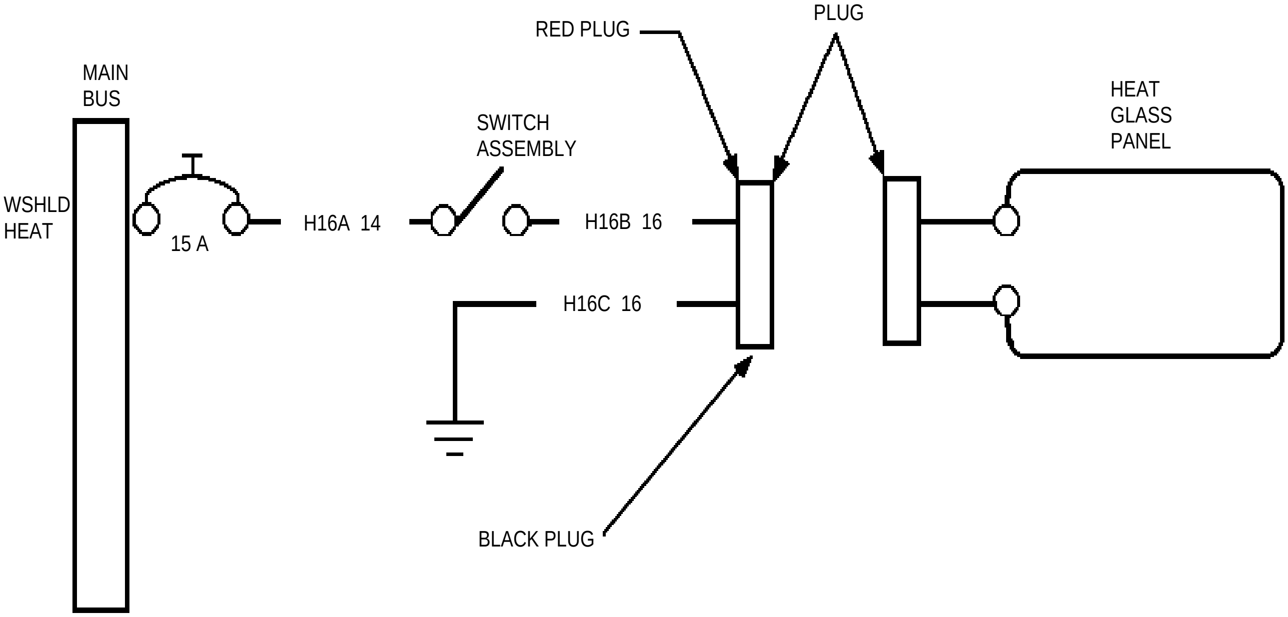


Figure 91-15. Windshield Heat

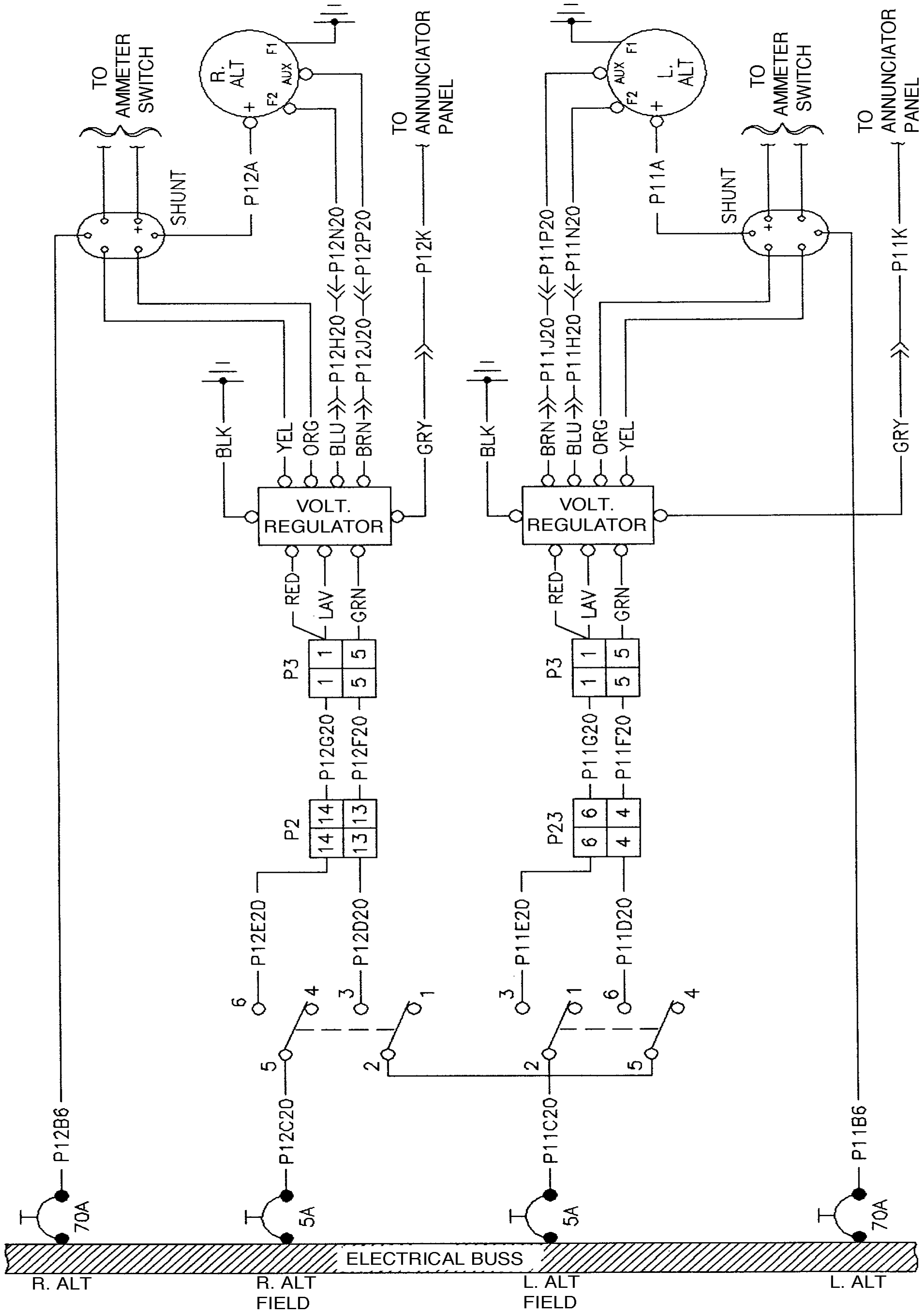


Figure 91-16. Alternator Power - Seneca IV

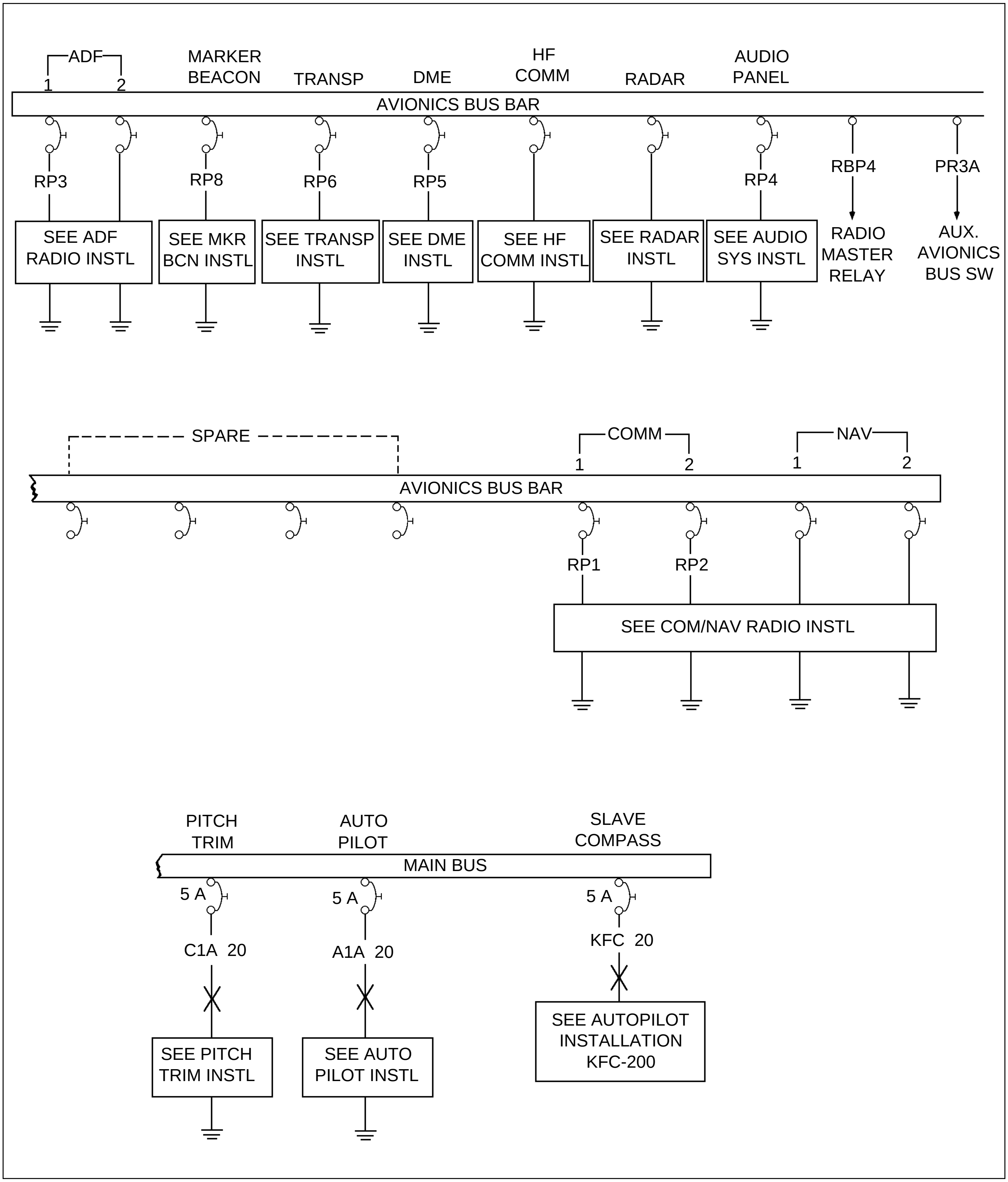


Figure 91-17. Avionics - Seneca III (14 Volt System)

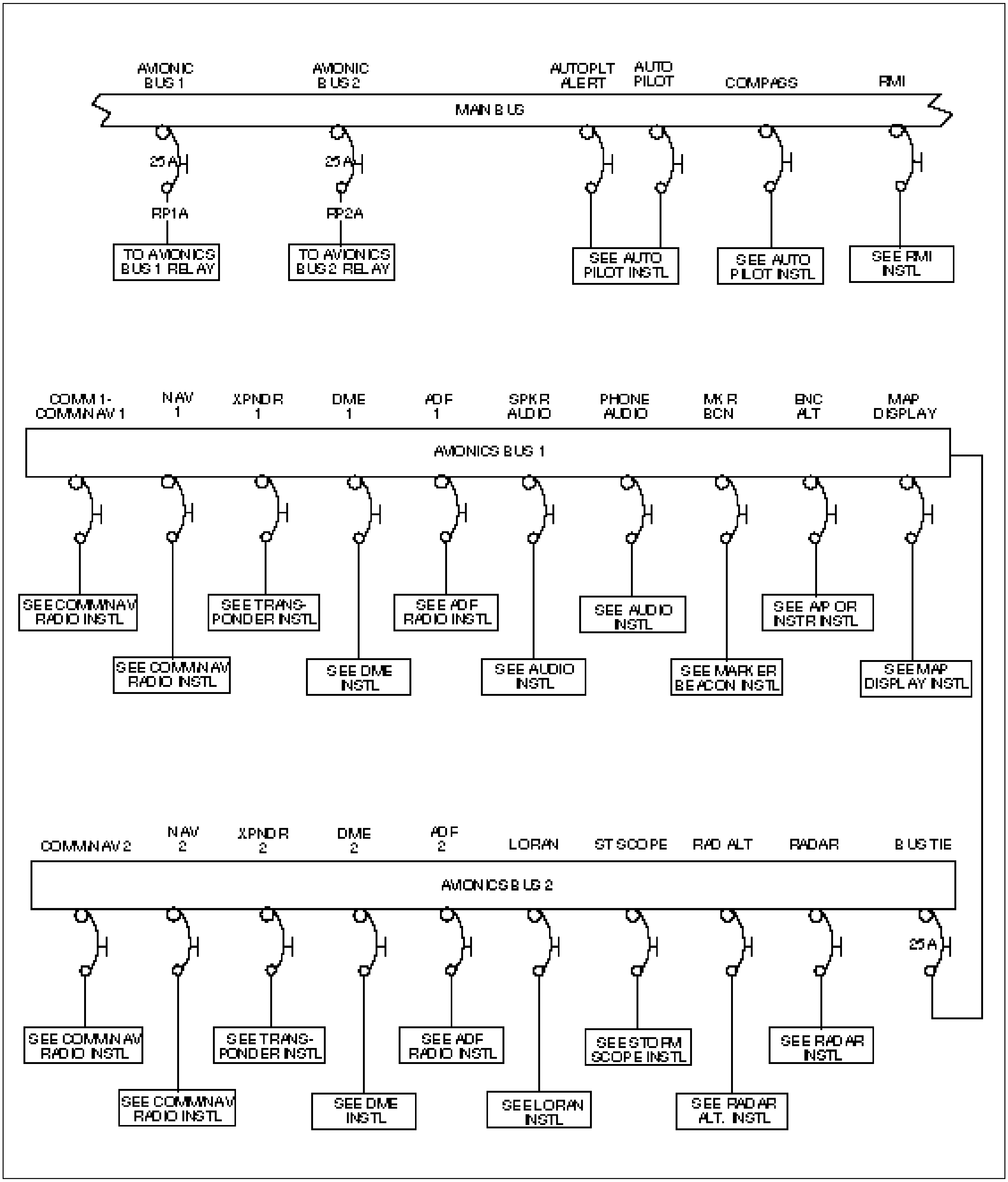


Figure 91-18. Avionics - Seneca III (28 Volt System)

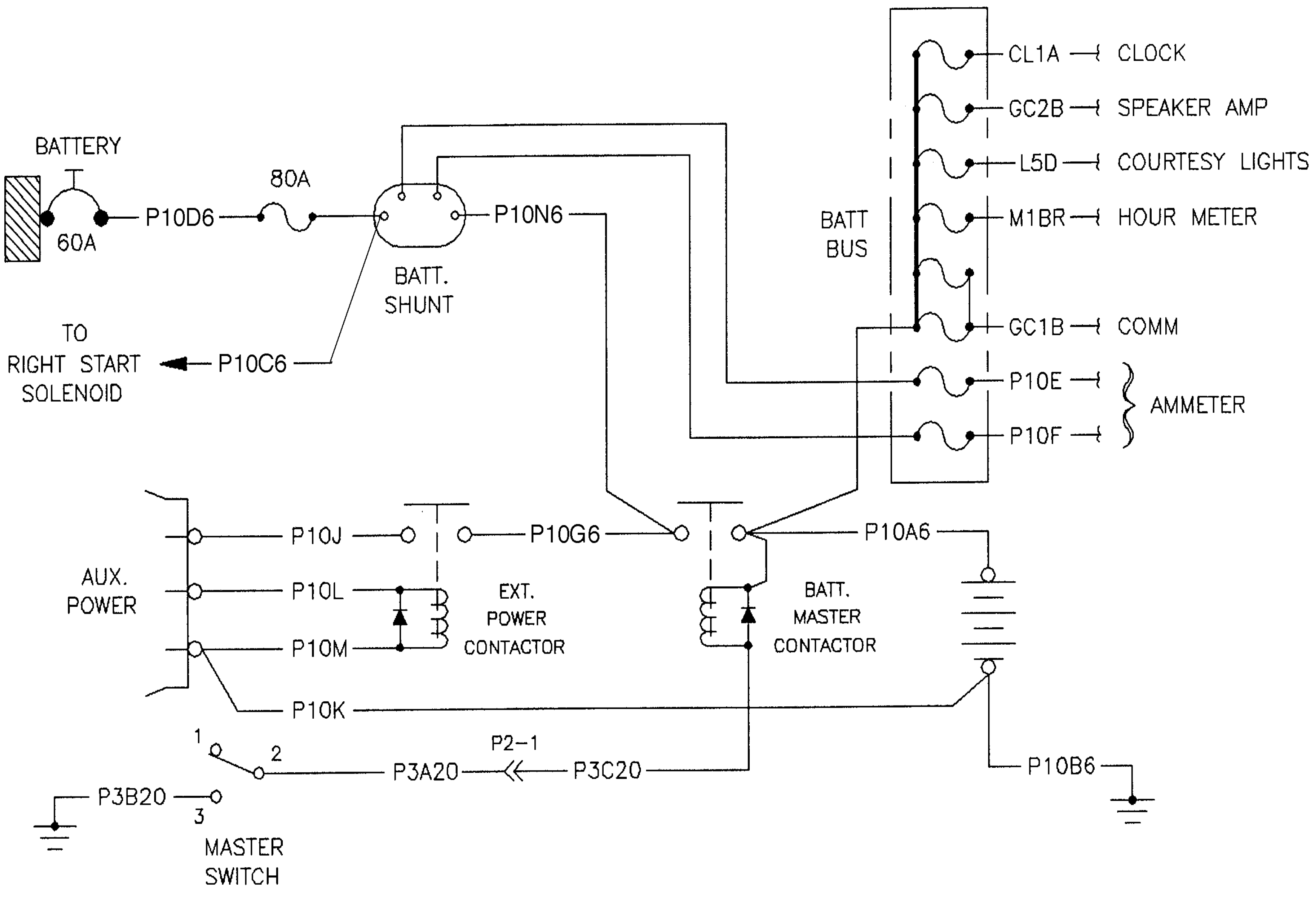


Figure 91-19. Battery Master / External Power - Seneca IV

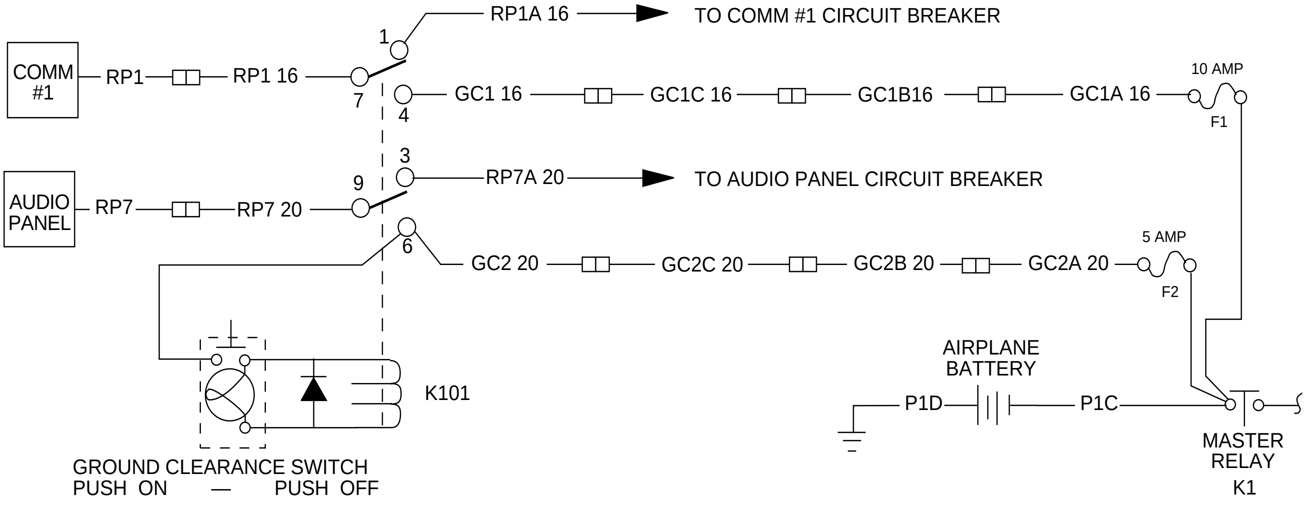


Figure 91-20. Ground Clearance Switch - Seneca III (14 Volt System)

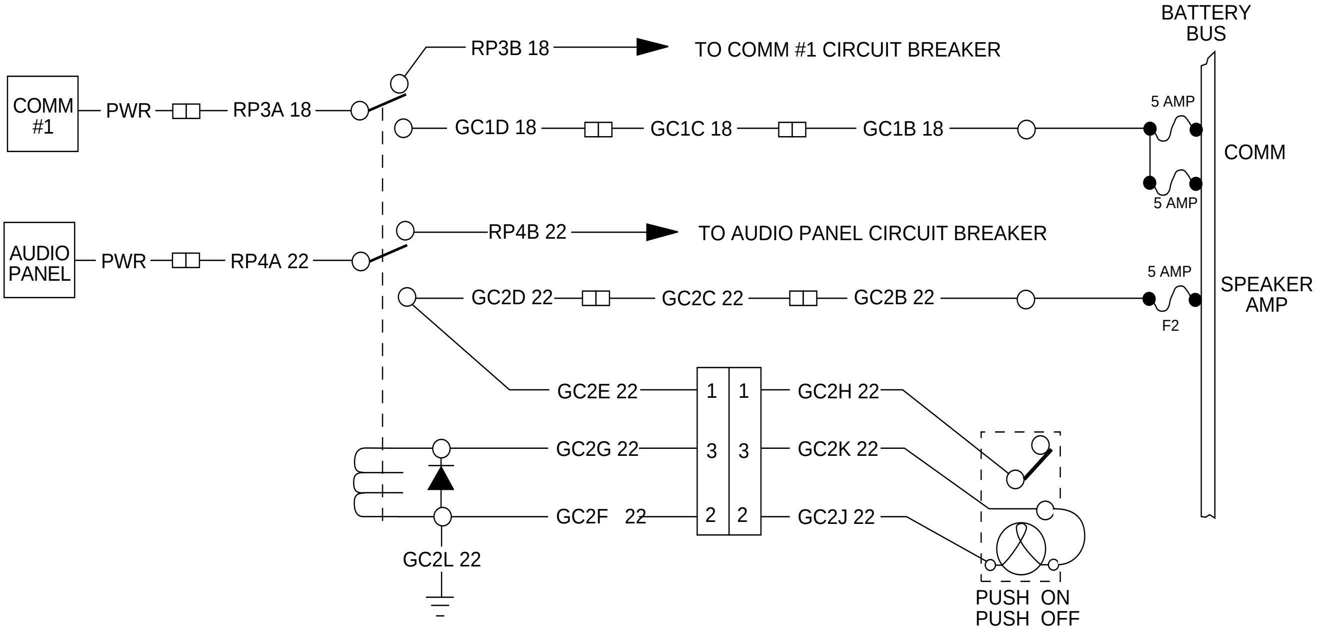


Figure 91-21. Ground Clearance Switch - Seneca III (28 Volt System)
(Includes s/n 3448001 thru 3448037)

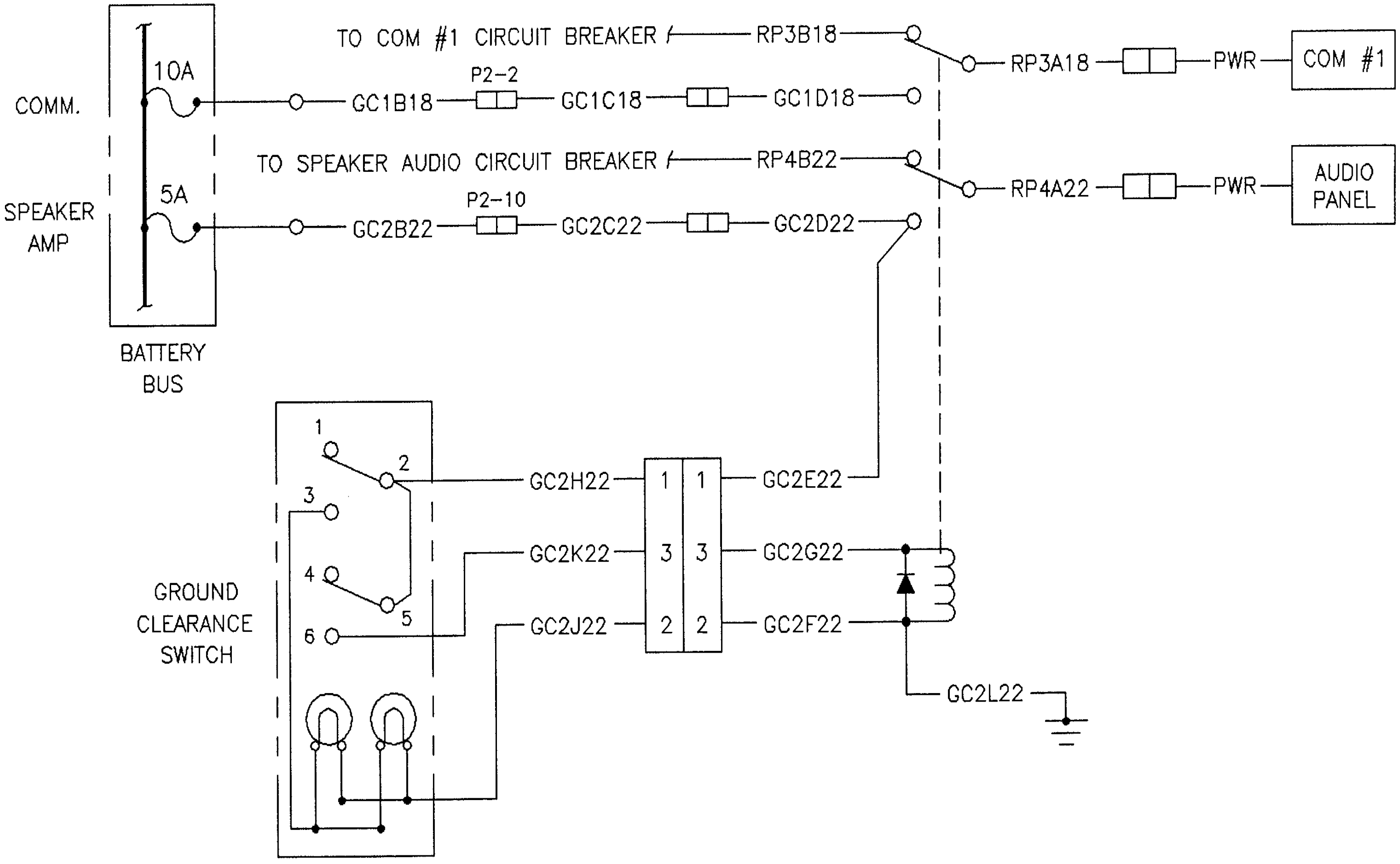


Figure 91-22. Ground Clearance Switch - Seneca IV

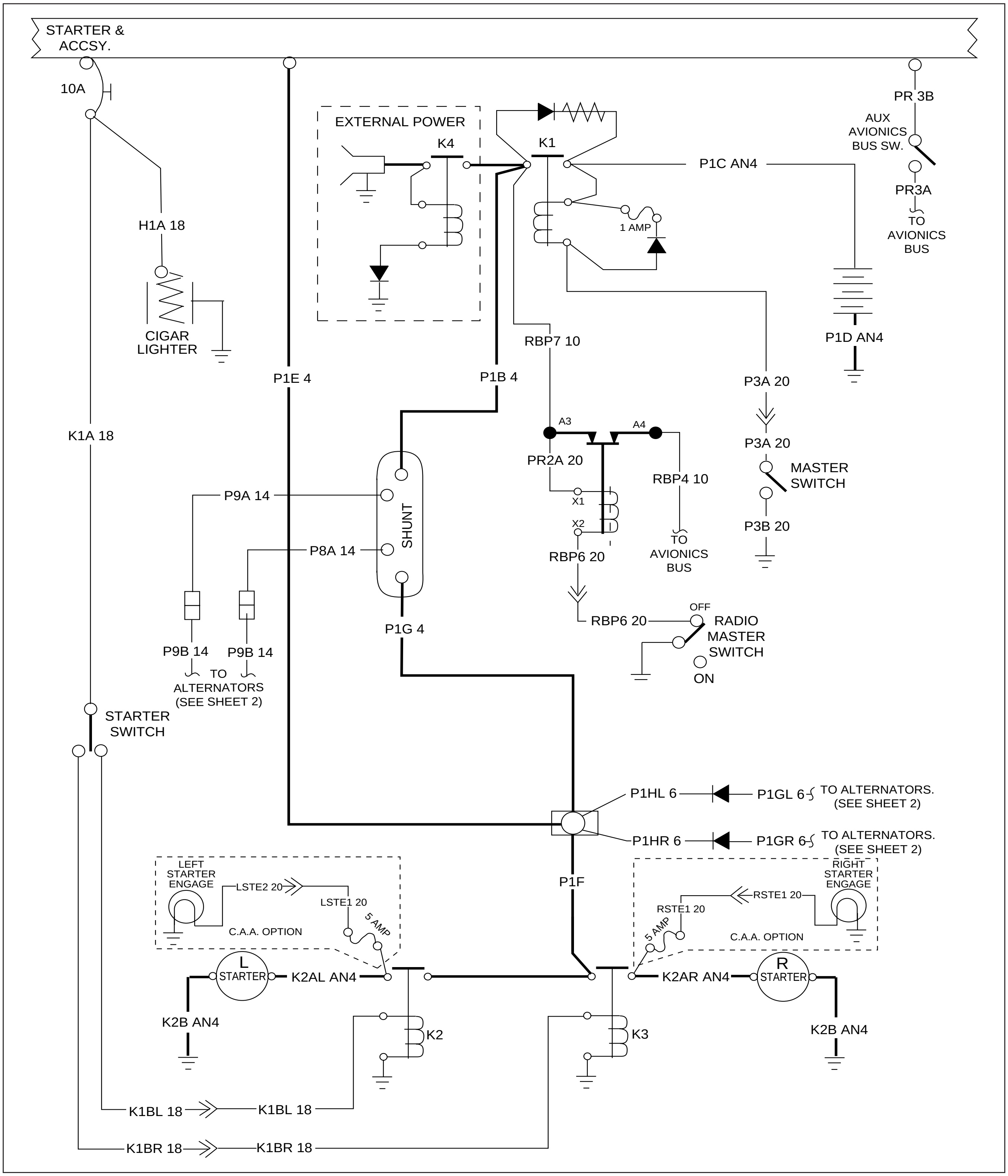


Figure 91-23. Power Distribution - Seneca III (14 Volt System)
(Sheet 1 of 2)

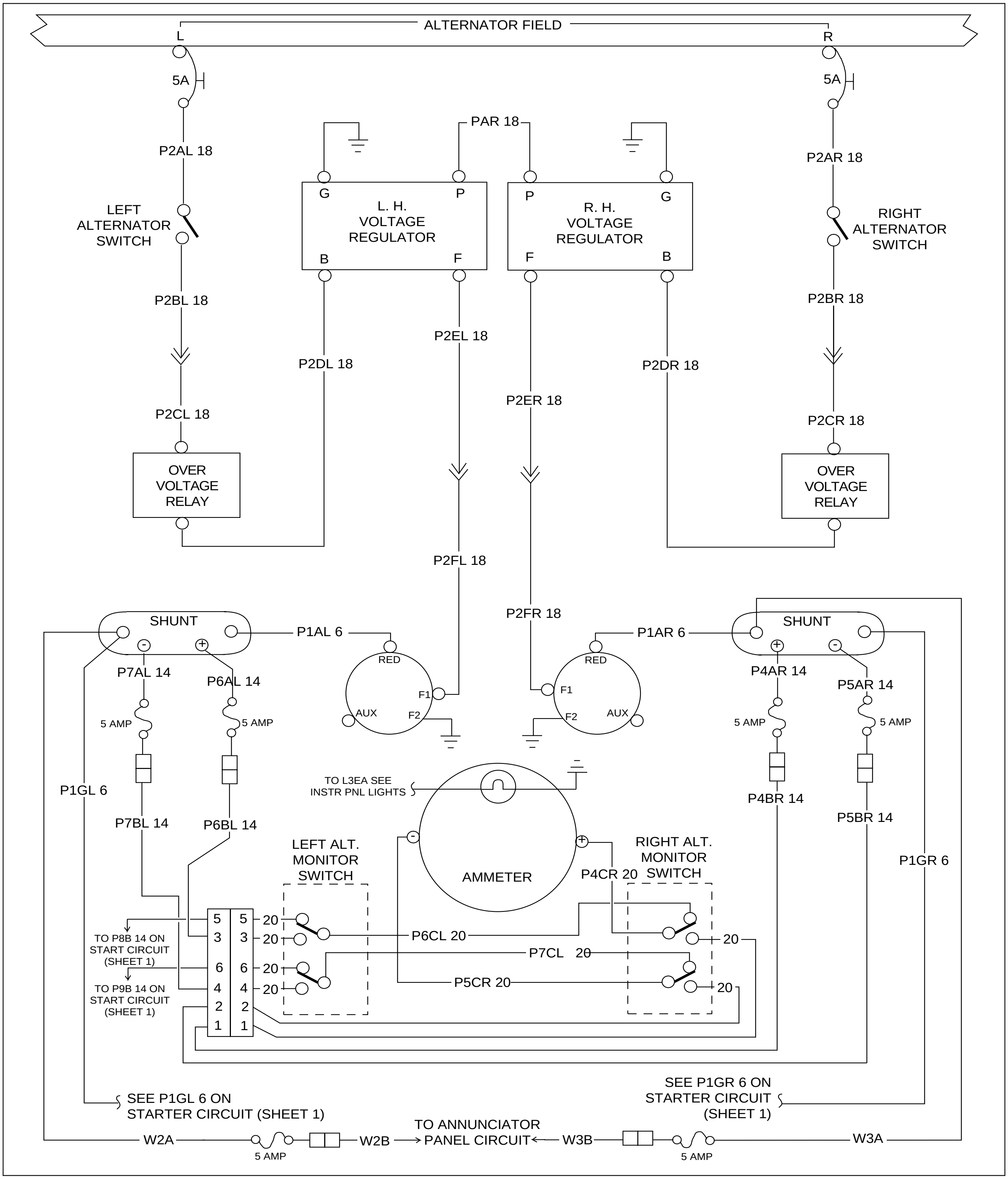


Figure 91-23. Power Distribution - Seneca III (14 Volt System)
(Sheet 2 of 2)

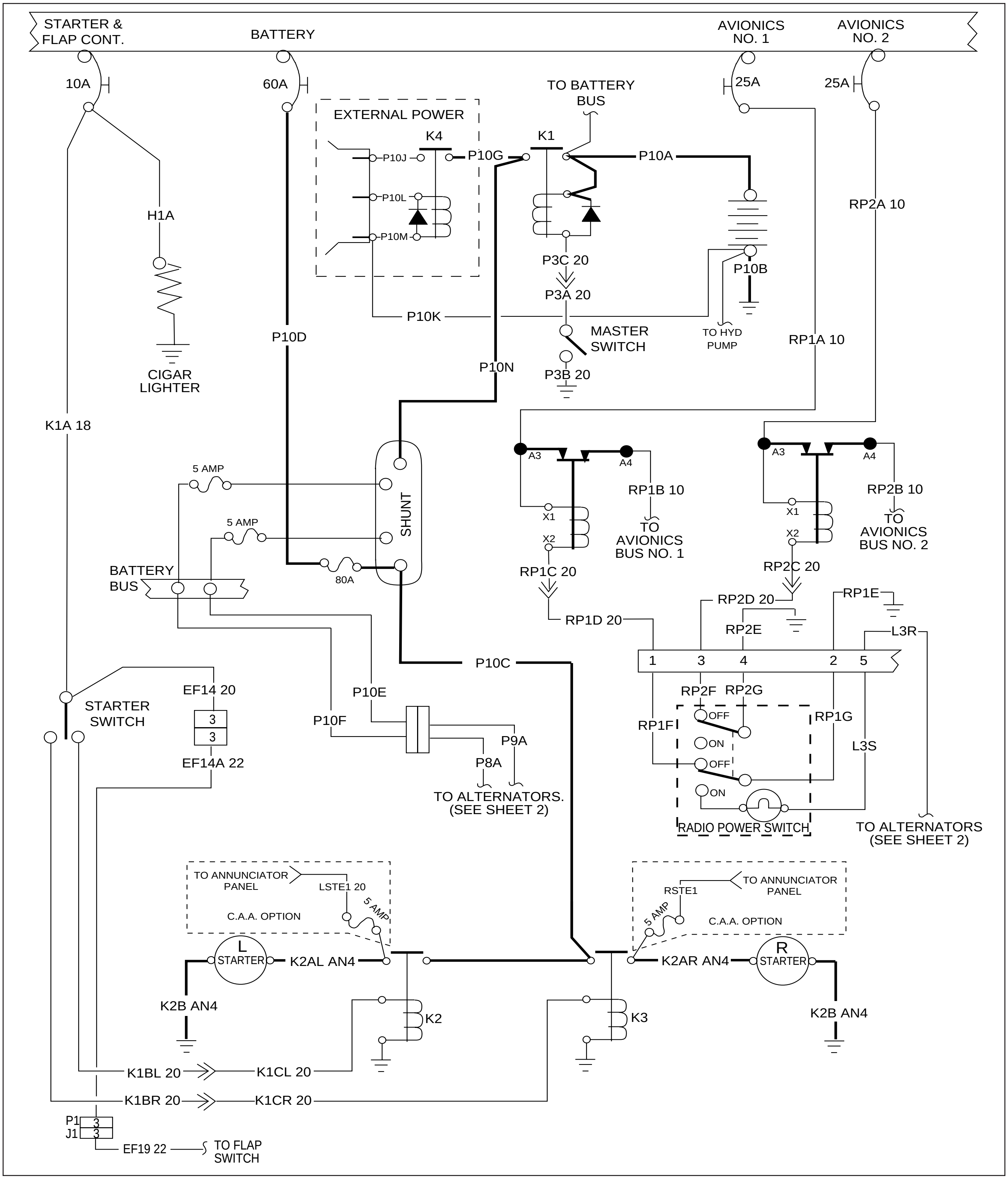


Figure 91-24. Power Distribution - Seneca III (28 Volt System)
(Sheet 1 of 2)

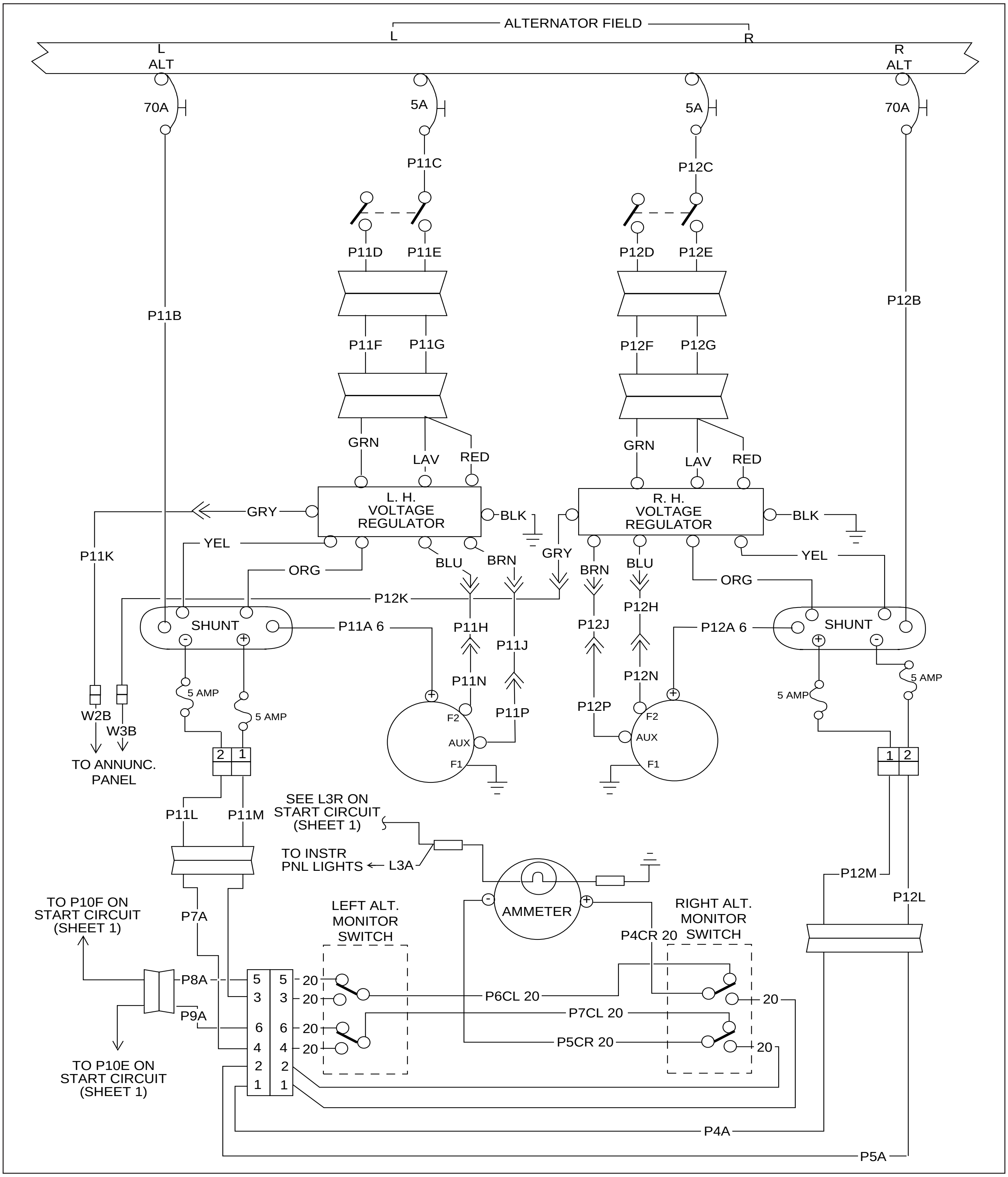


Figure 91-24. Power Distribution - Seneca III (28 Volt System)
(Sheet 2 of 2)

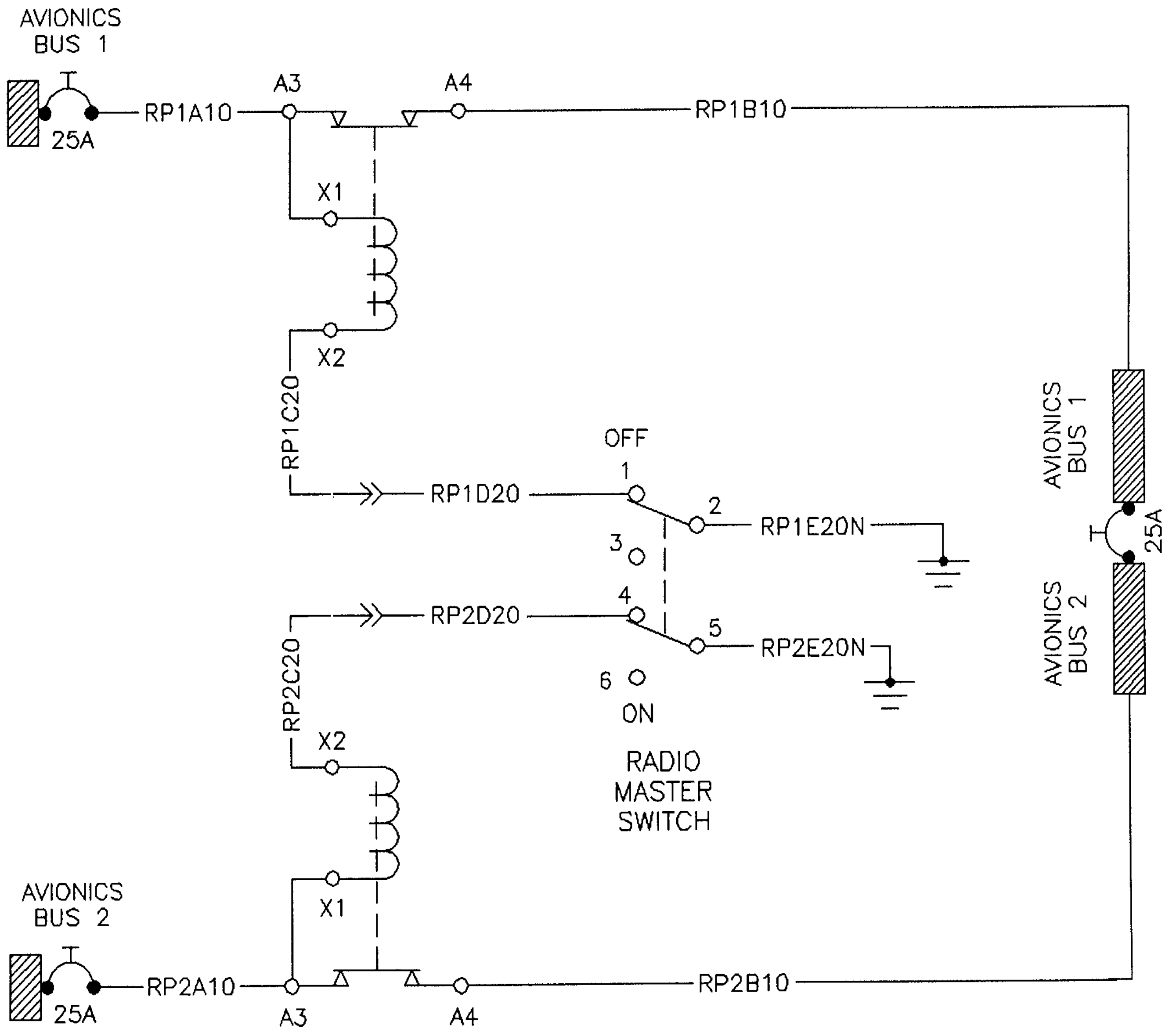


Figure 91-25. Radio Master Switch - Seneca IV

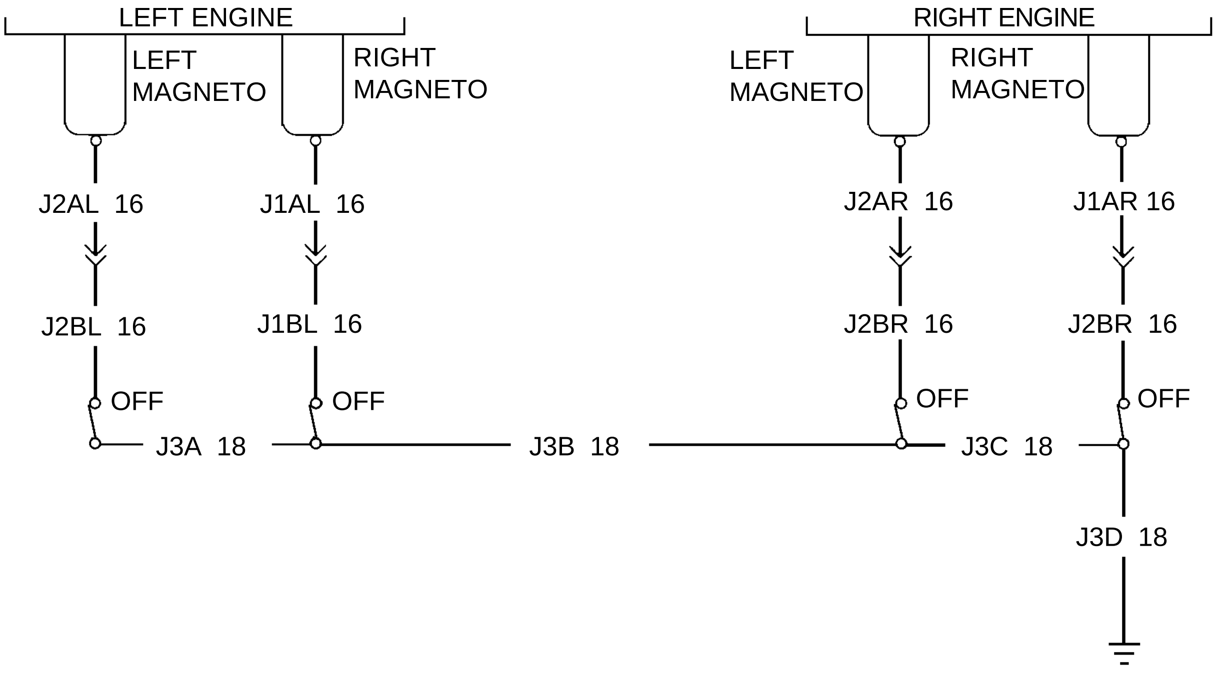


Figure 91-26. Magnetos - Seneca III

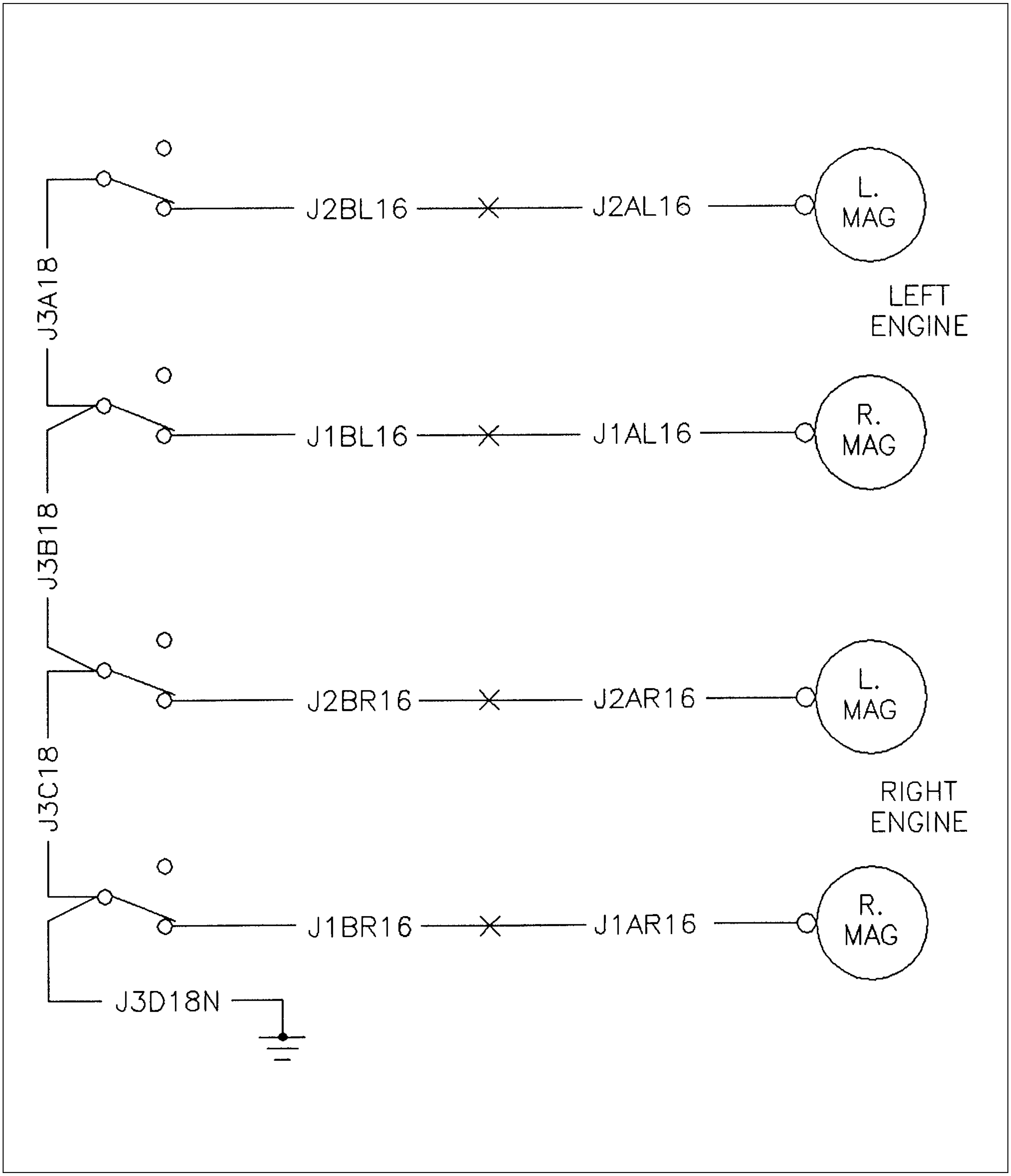


Figure 91-27. Magnetos - Seneca IV

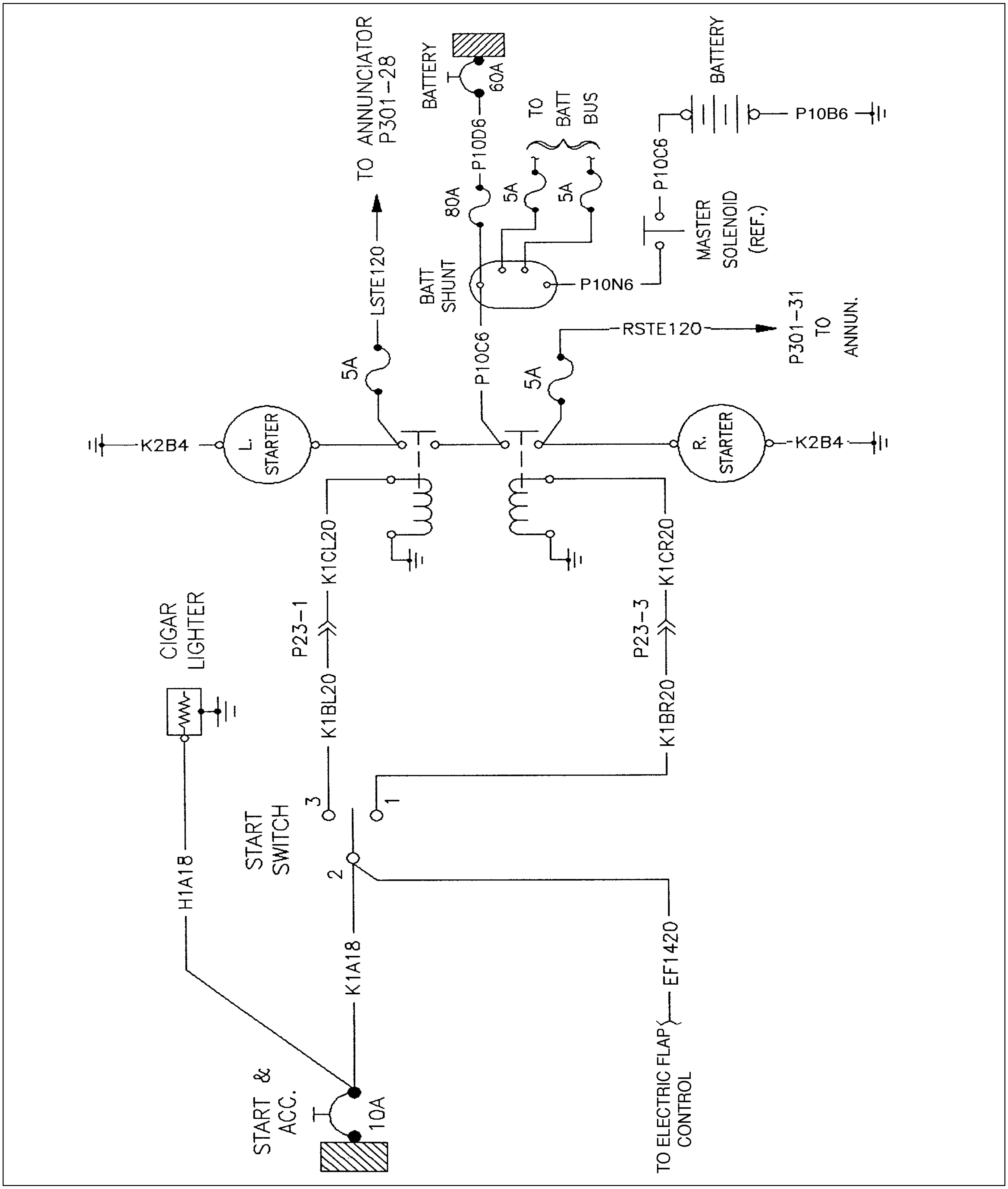
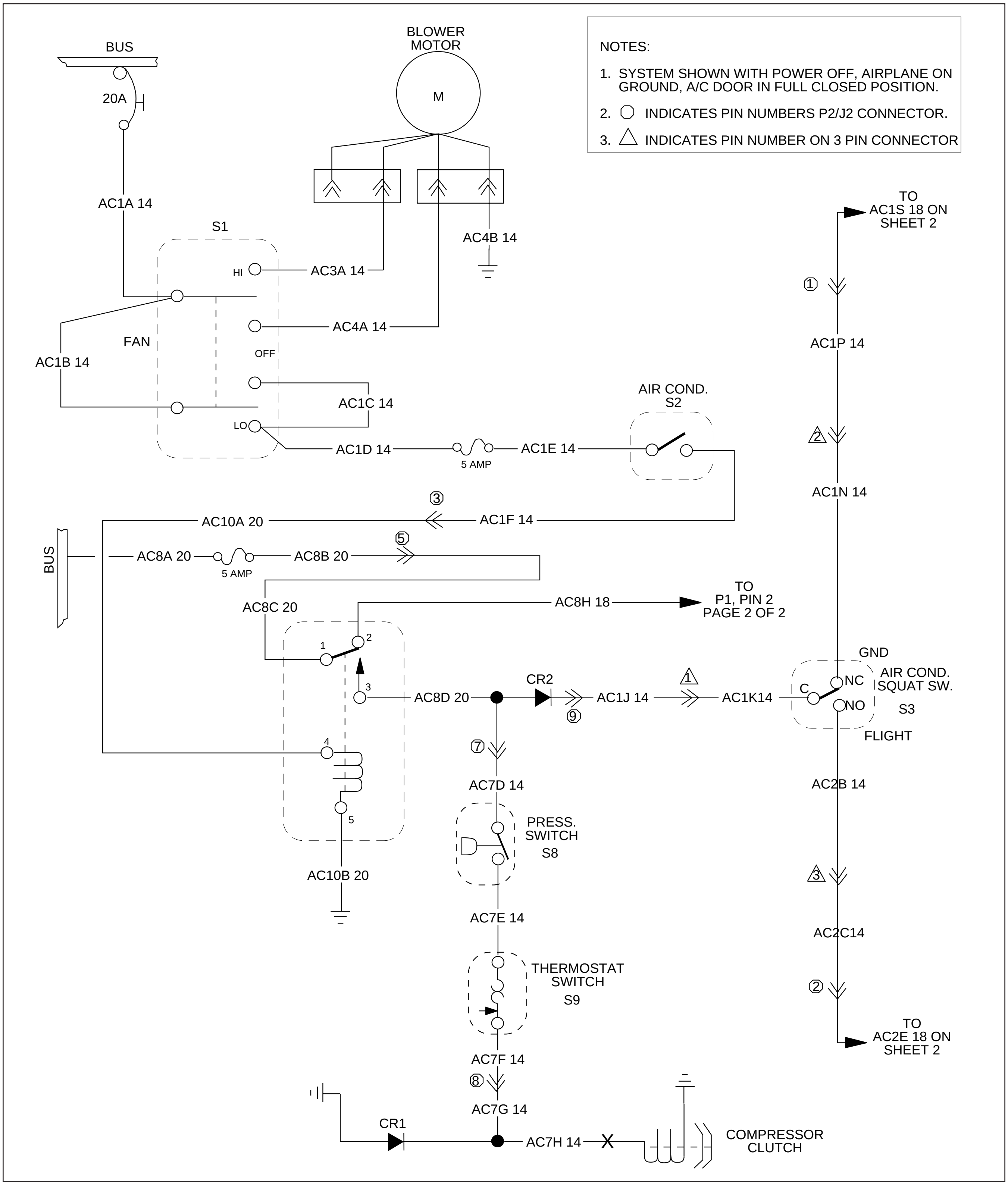


Figure 91-28. Starter and Accessories - Seneca IV



NOTES:

1. SYSTEM SHOWN WITH POWER OFF, AIRPLANE ON GROUND, A/C DOOR IN FULL CLOSED POSITION.
2. ○ INDICATES PIN NUMBERS P2/J2 CONNECTOR.
3. △ INDICATES PIN NUMBER ON 3 PIN CONNECTOR

Figure 91-29. Air Conditioning - Seneca III (14 Volt System)
(Sheet 1 of 2)

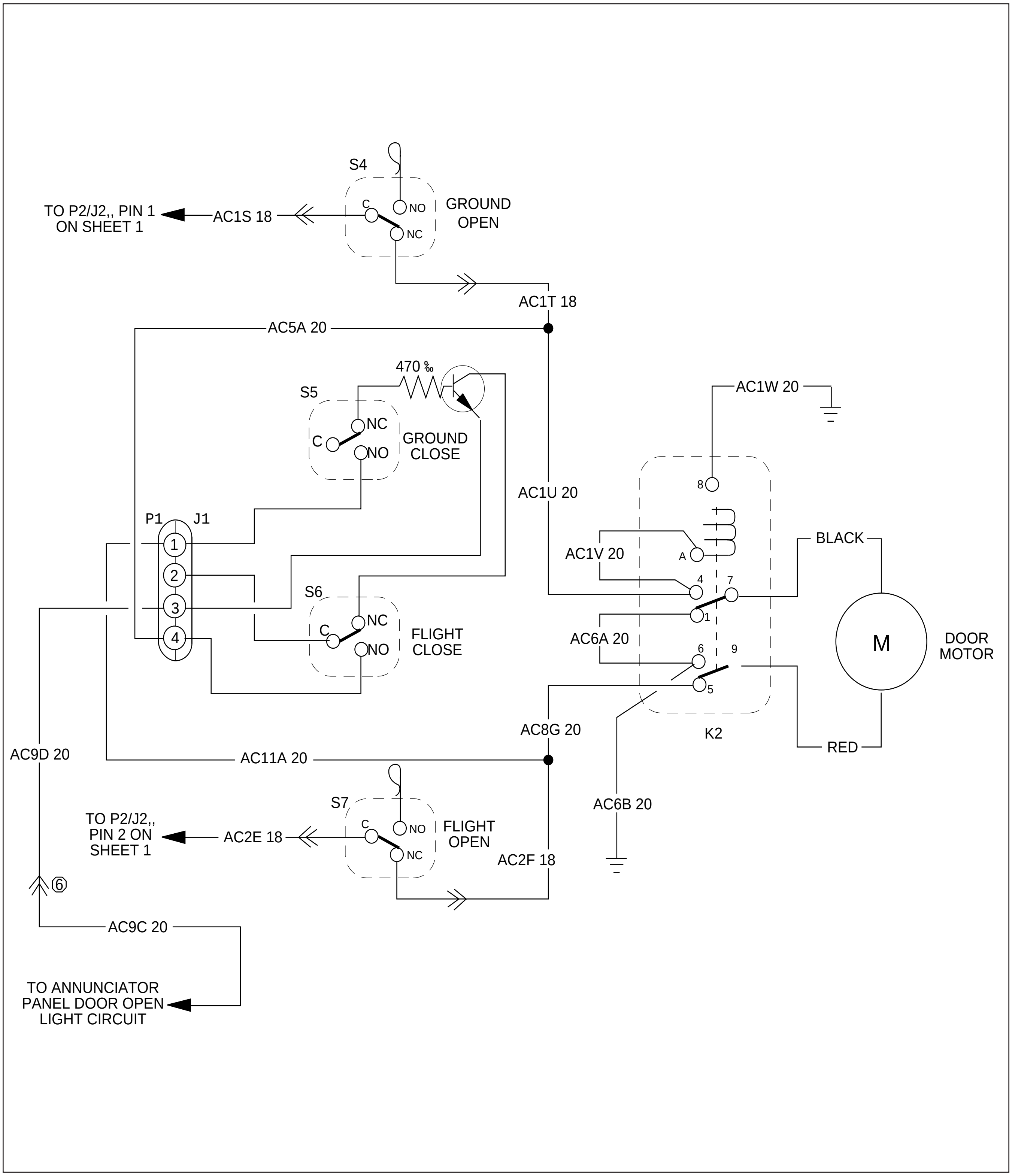
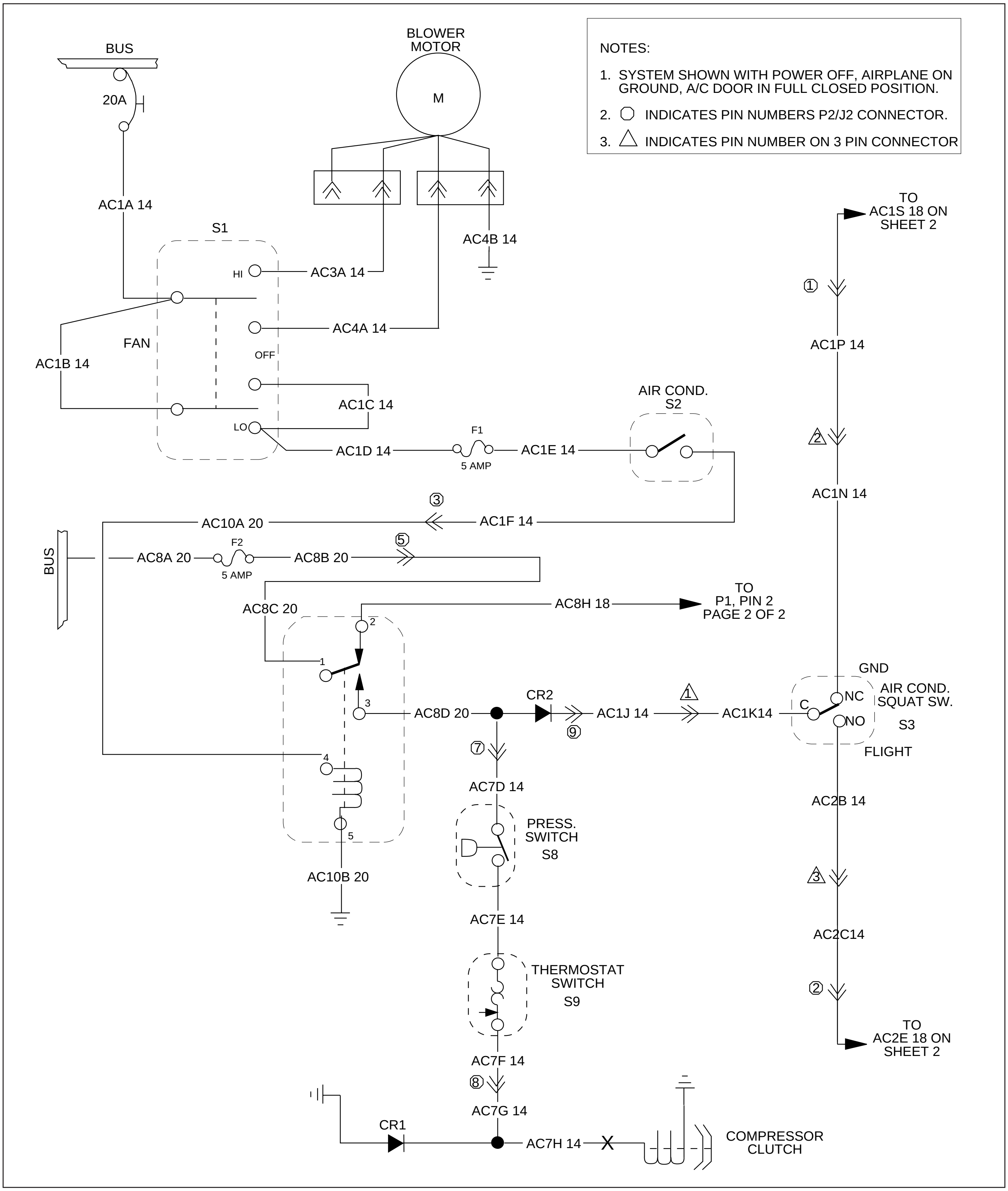


Figure 91-29. Air Conditioning - Seneca III (14 Volt System)
(Sheet 2 of 2)


NOTES:

1. SYSTEM SHOWN WITH POWER OFF, AIRPLANE ON GROUND, A/C DOOR IN FULL CLOSED POSITION.
2. ⬡ INDICATES PIN NUMBERS P2/J2 CONNECTOR.
3. △ INDICATES PIN NUMBER ON 3 PIN CONNECTOR

Figure 91-30. Air Conditioning - Seneca III (28 Volt System)
(Sheet 1 of 2)

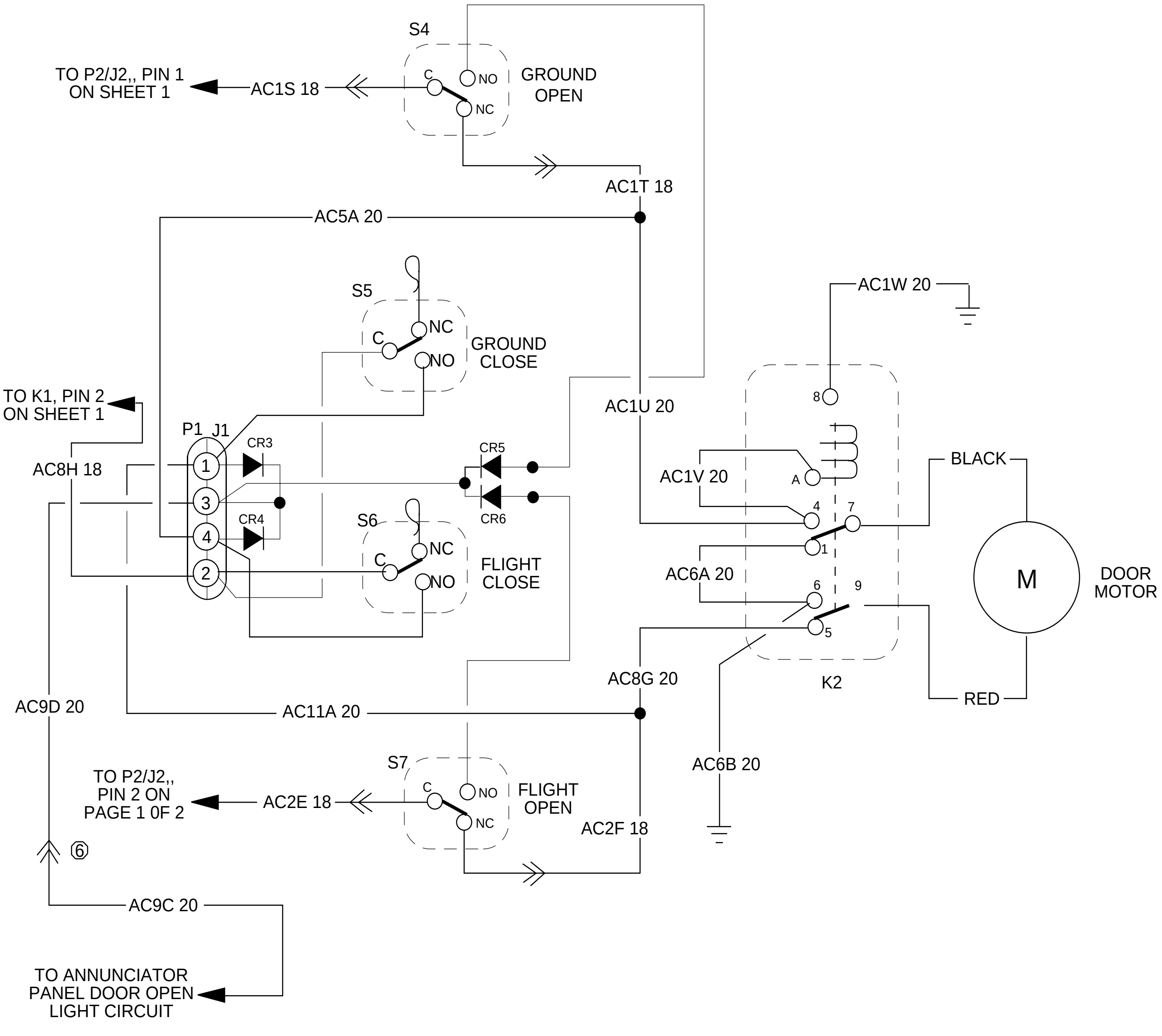


Figure 91-30. Air Conditioning - Seneca III (28 Volt System)
(Sheet 2 of 2)

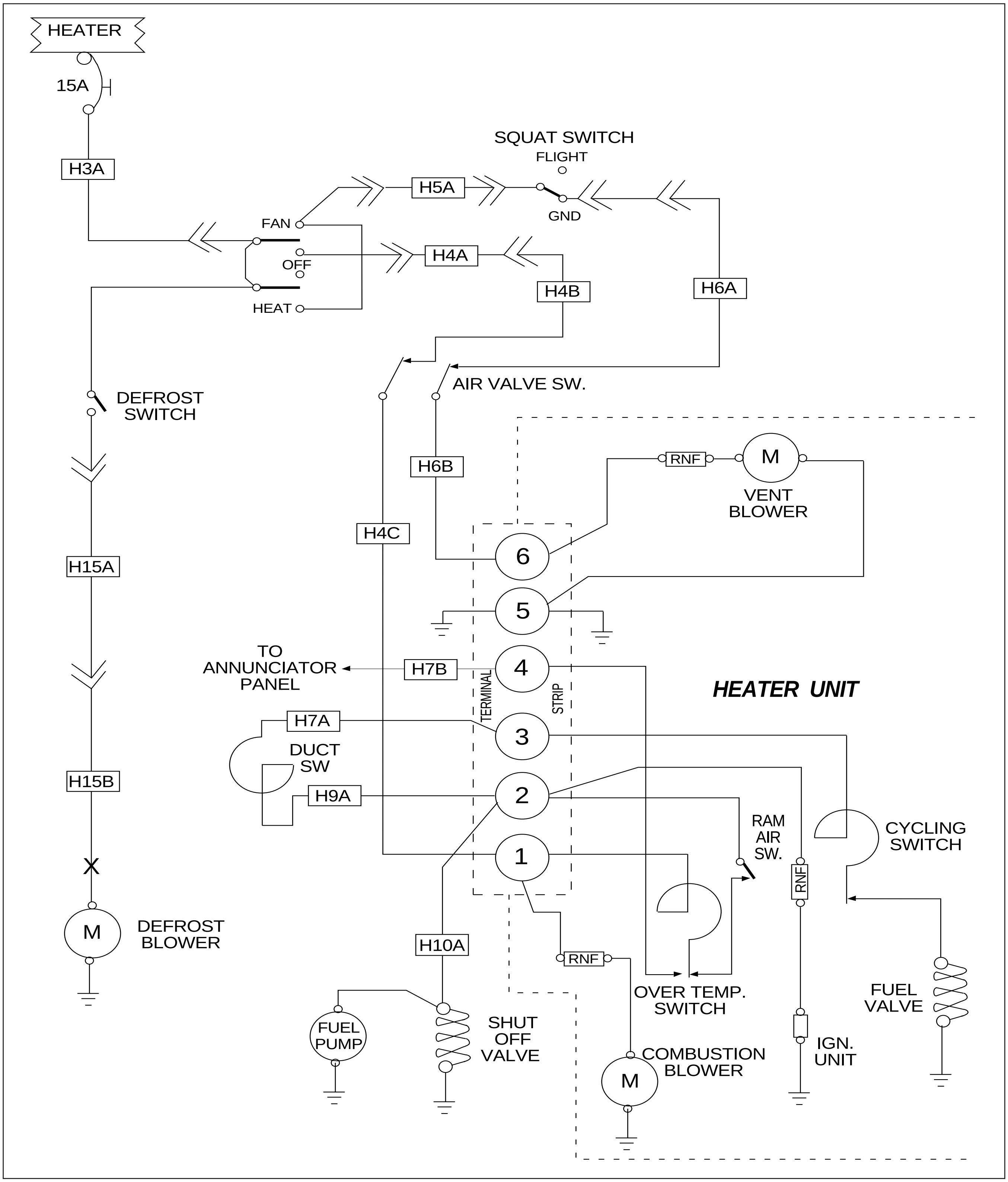


Figure 91-31. Heating and Defrosting - Seneca III (14 Volt System)

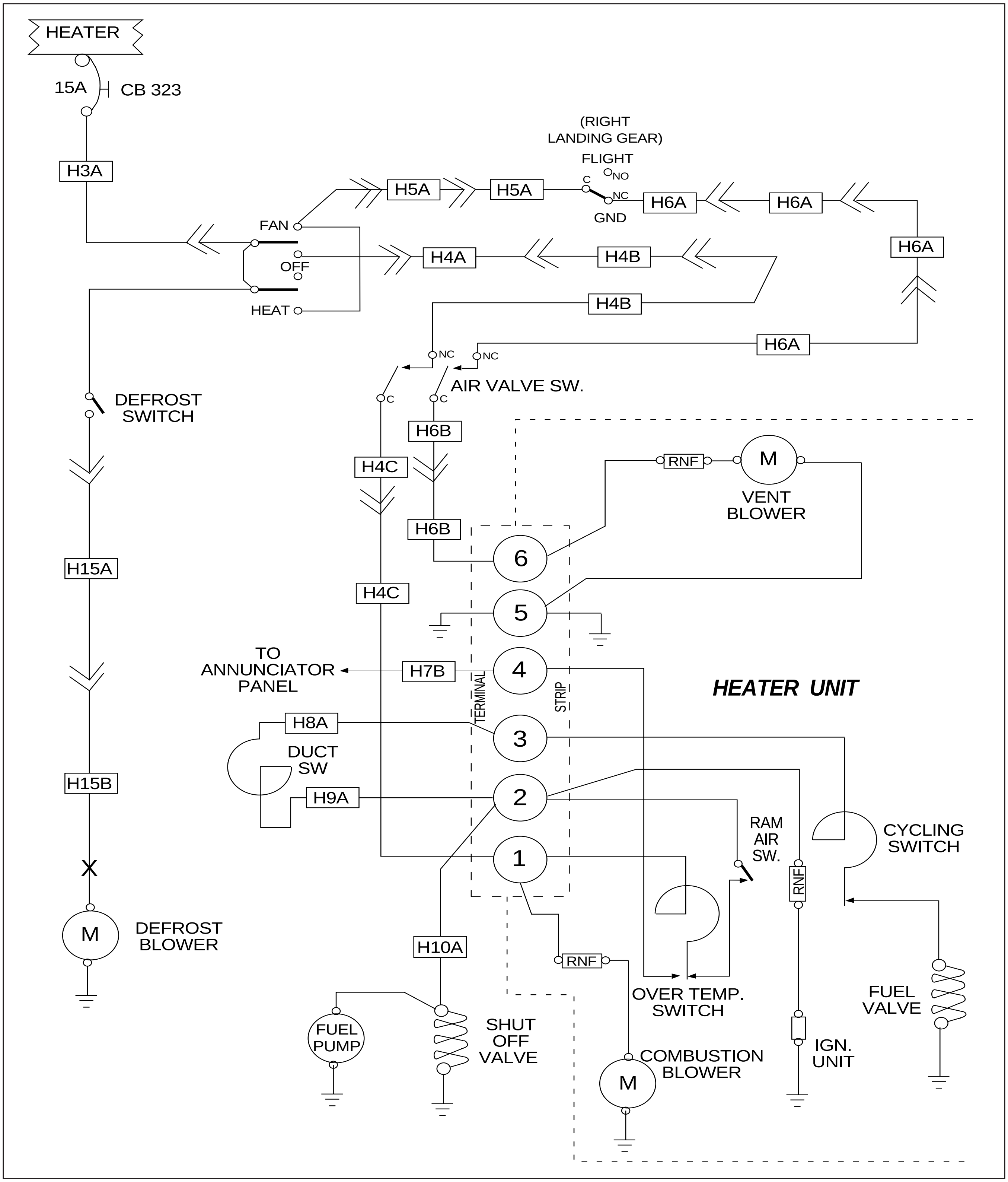


Figure 91-32. Heating and Defrosting - Seneca III (28 Volt System)
(Includes s/n 3448001 thru 3448037)

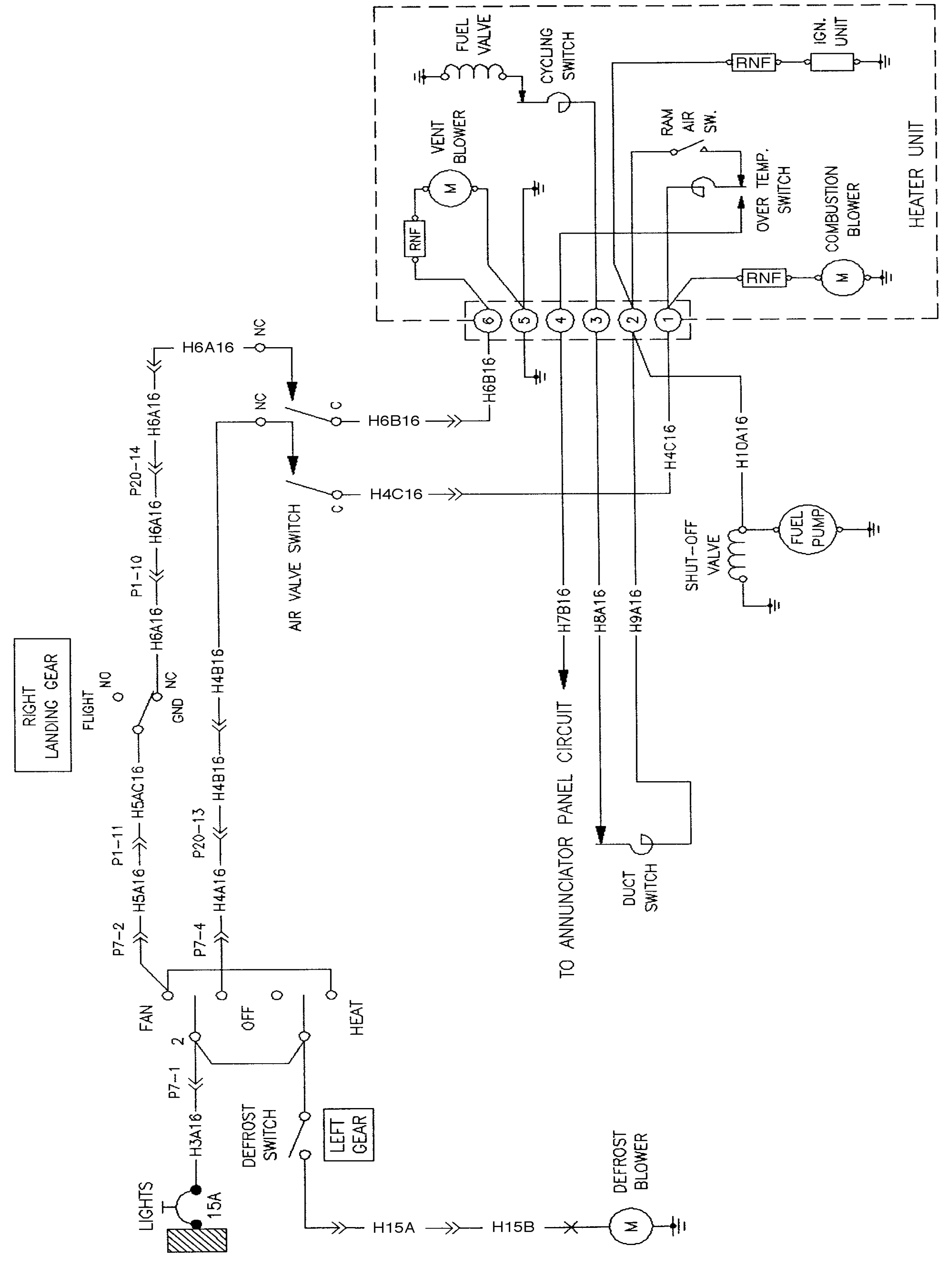


Figure 91-33. Heating and Defrosting - Seneca IV

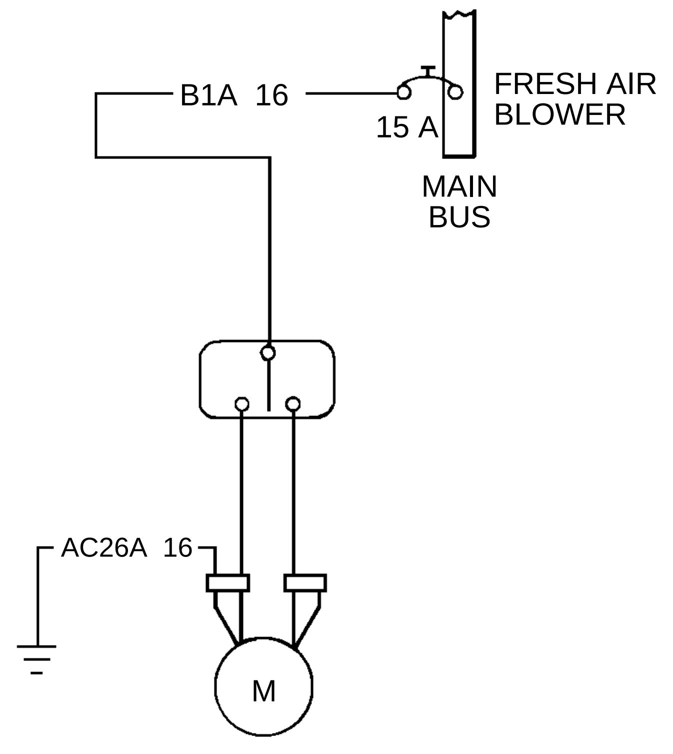


Figure 91-34. Ventilation - Fresh Air - Seneca III (14 Volt System)

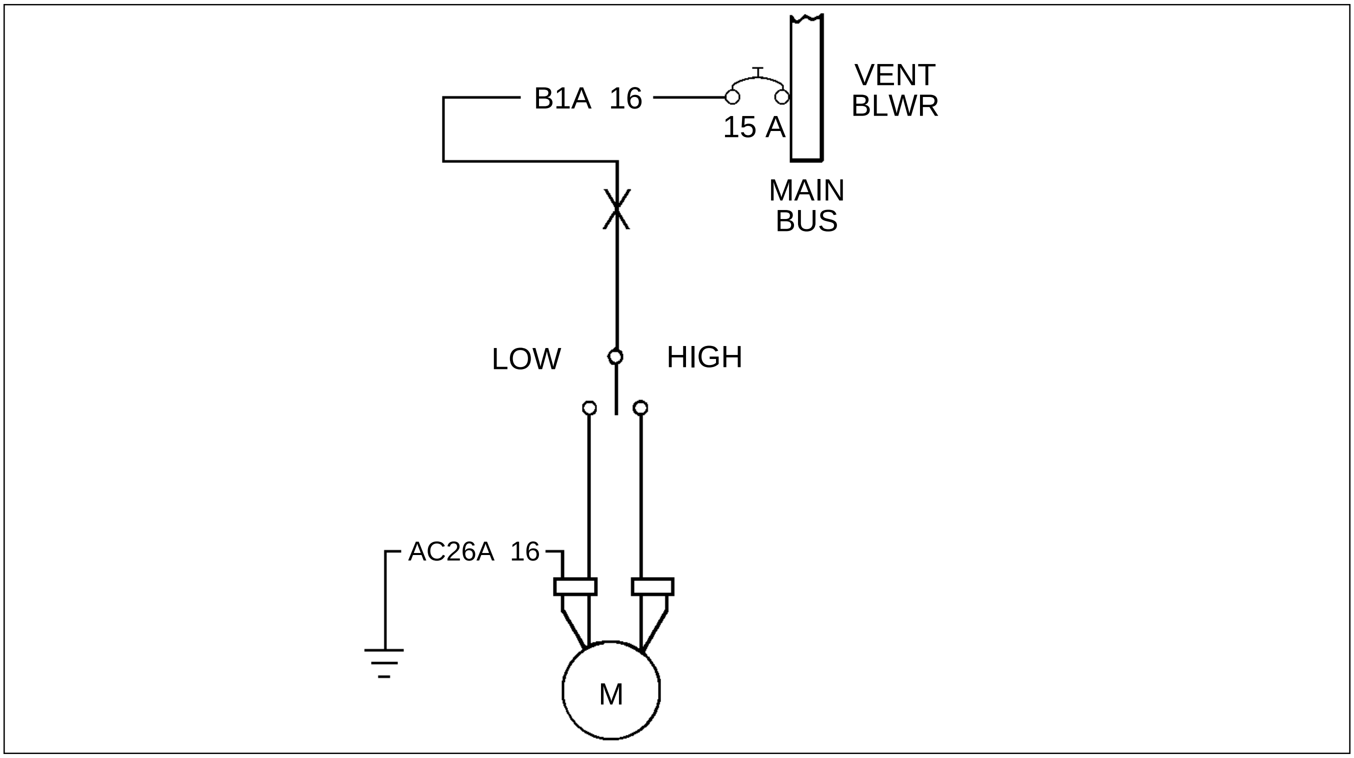


Figure 91-35. Ventilation - Fresh Air - Seneca III (28 Volt System)
(Includes s/n 3448001 thru 3448037)

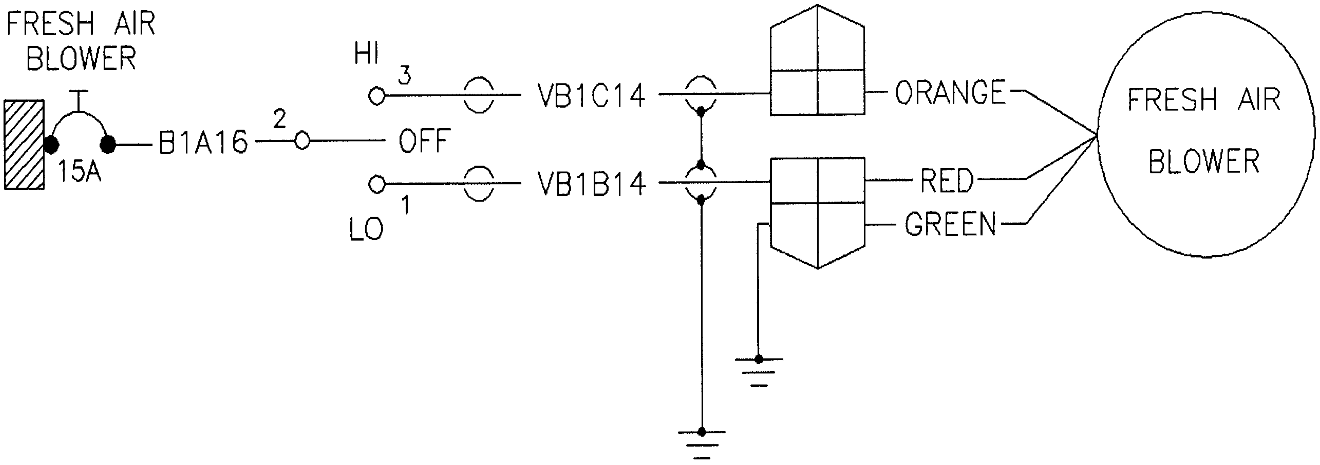


Figure 91-36. Ventilation - Fresh Air - Seneca IV

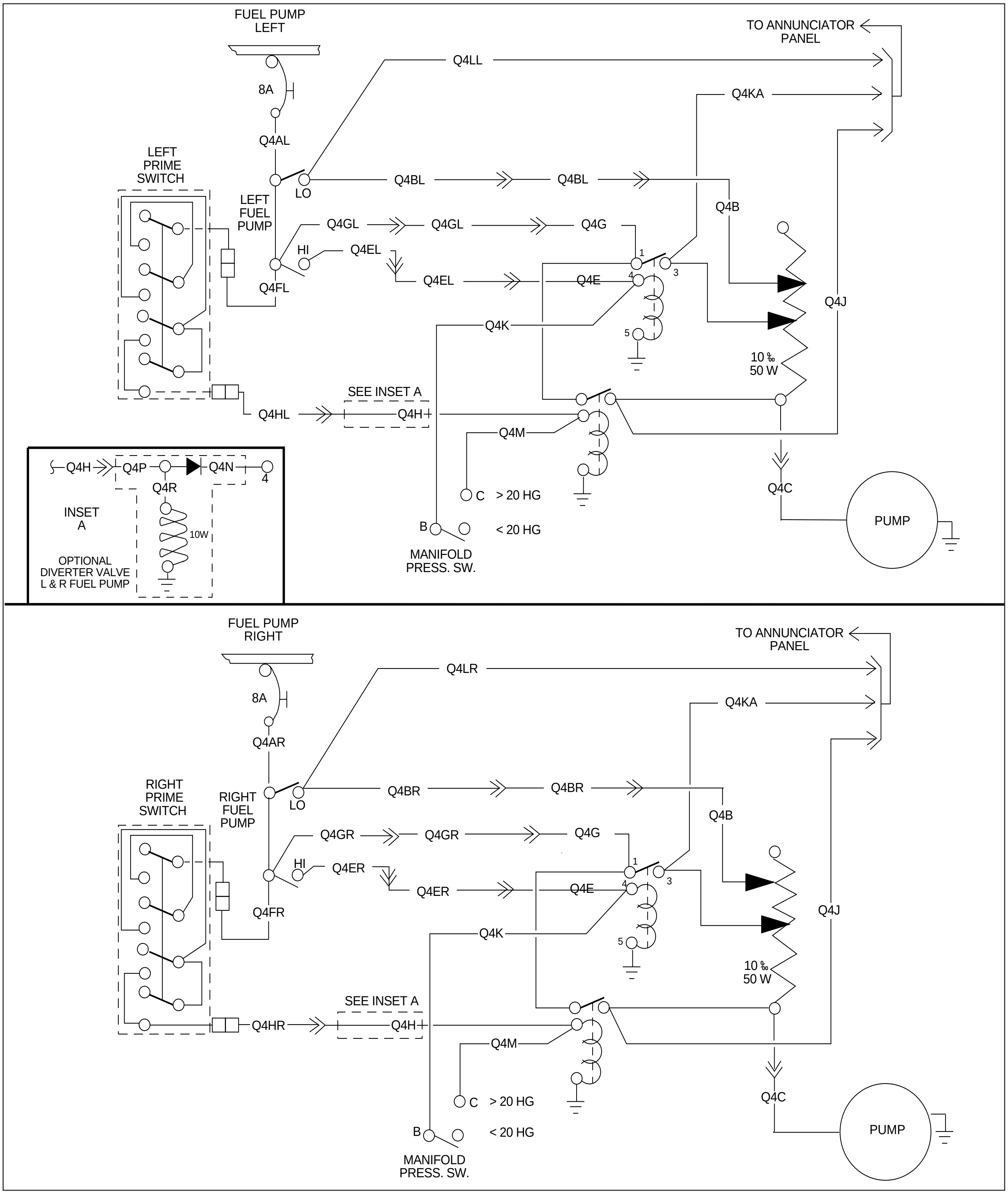


Figure 91-37. Auxiliary Fuel Pumps - Seneca III (14 Volt System)

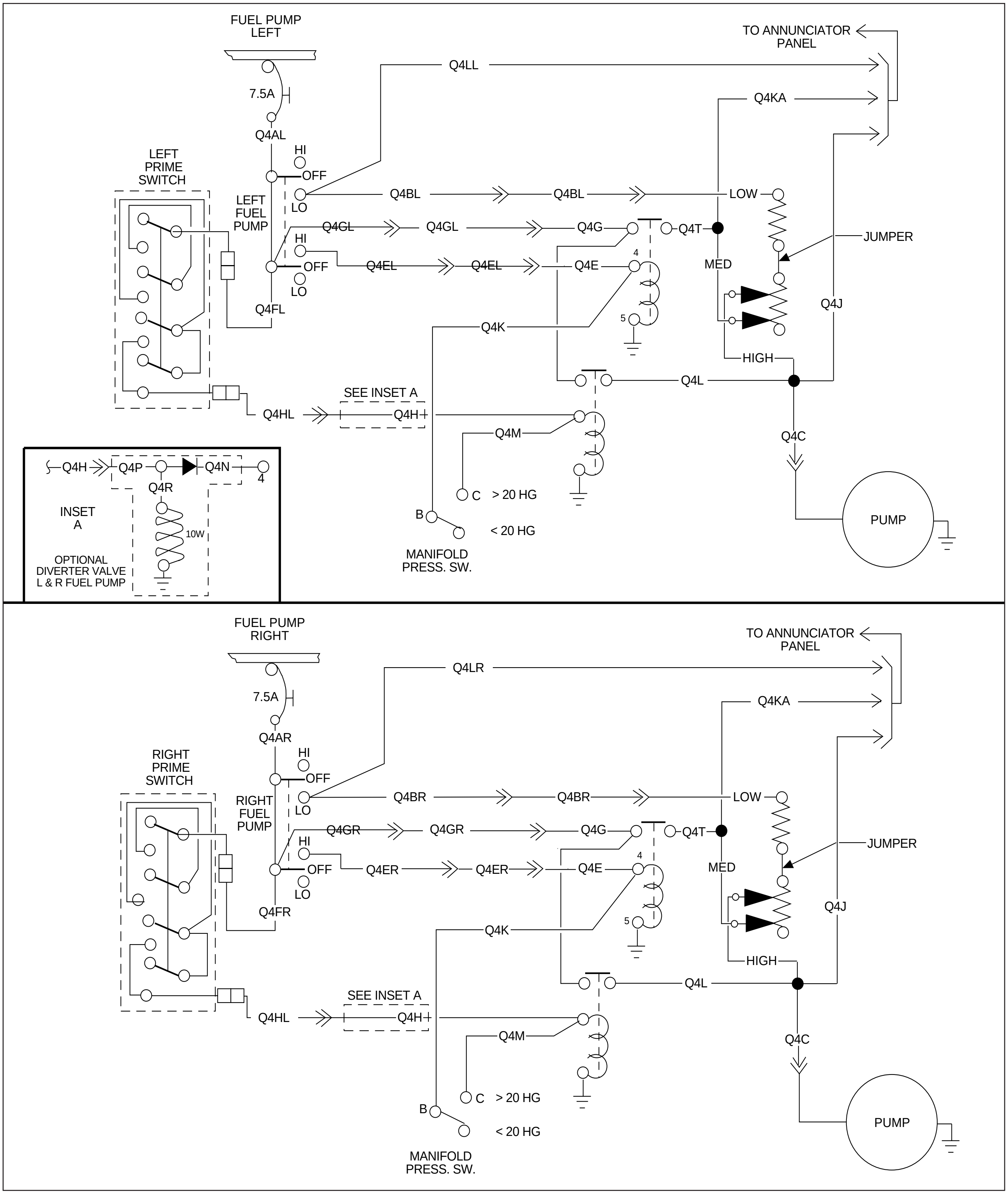


Figure 91-38. Auxiliary Fuel Pumps - Seneca III (28 Volt System)
(Includes s/n 3448001 thru 3448037)

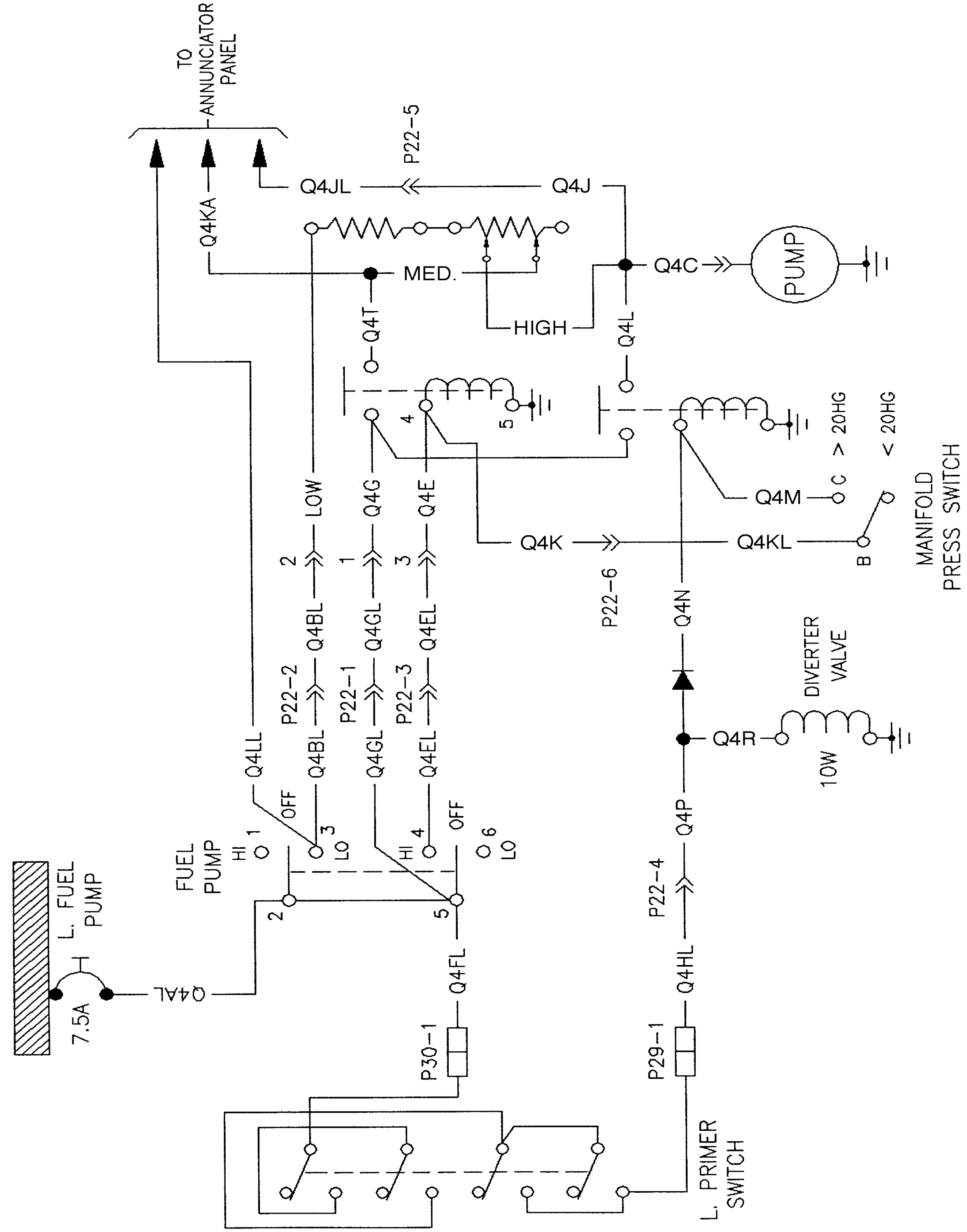


Figure 91-39. Auxiliary Fuel Pump (Left) - Seneca IV

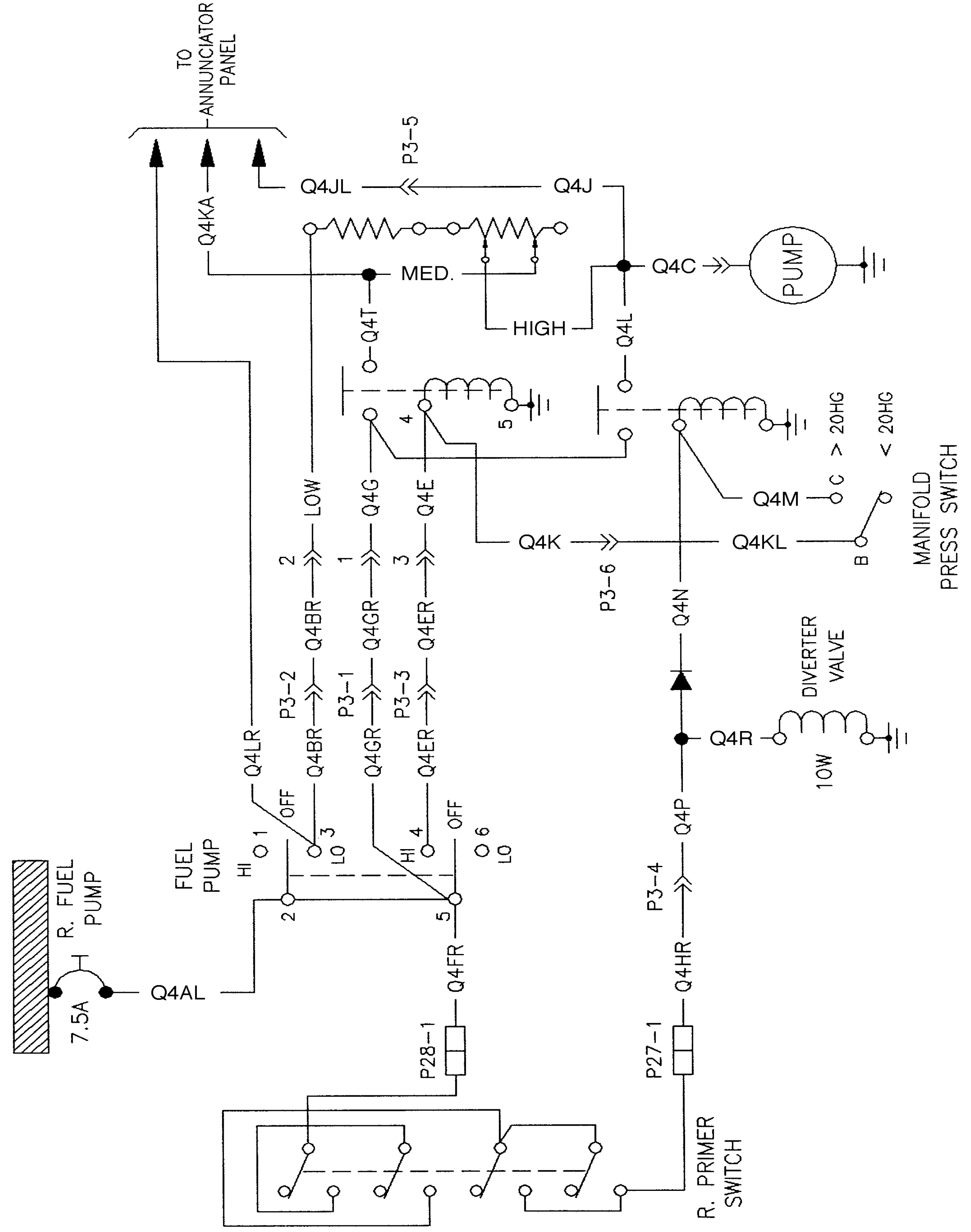


Figure 91-40. Auxiliary Fuel Pump (Right) - Seneca IV

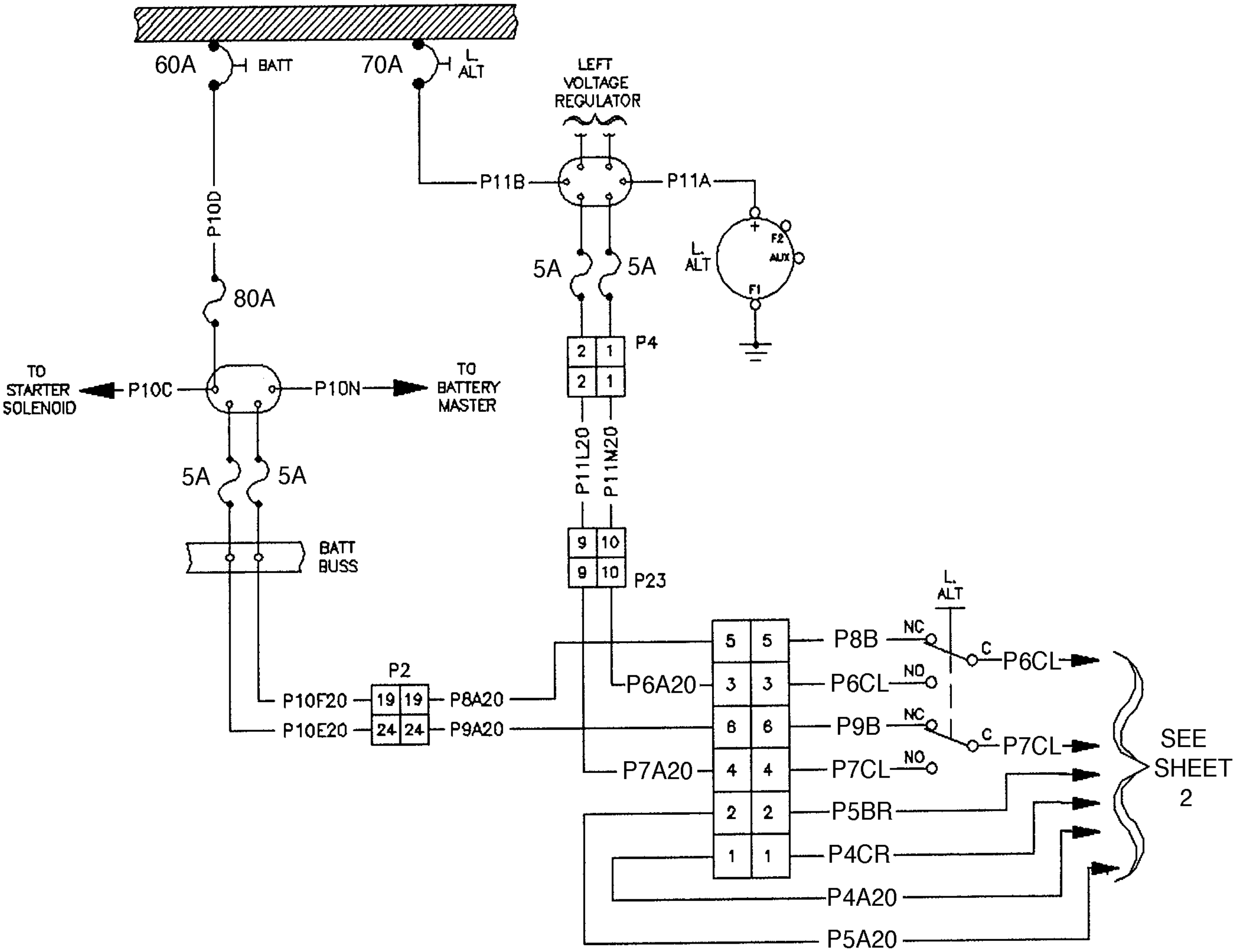


Figure 91-41. Ammeter / Low Voltage Monitor - Seneca IV
(Sheet 1 of 2)

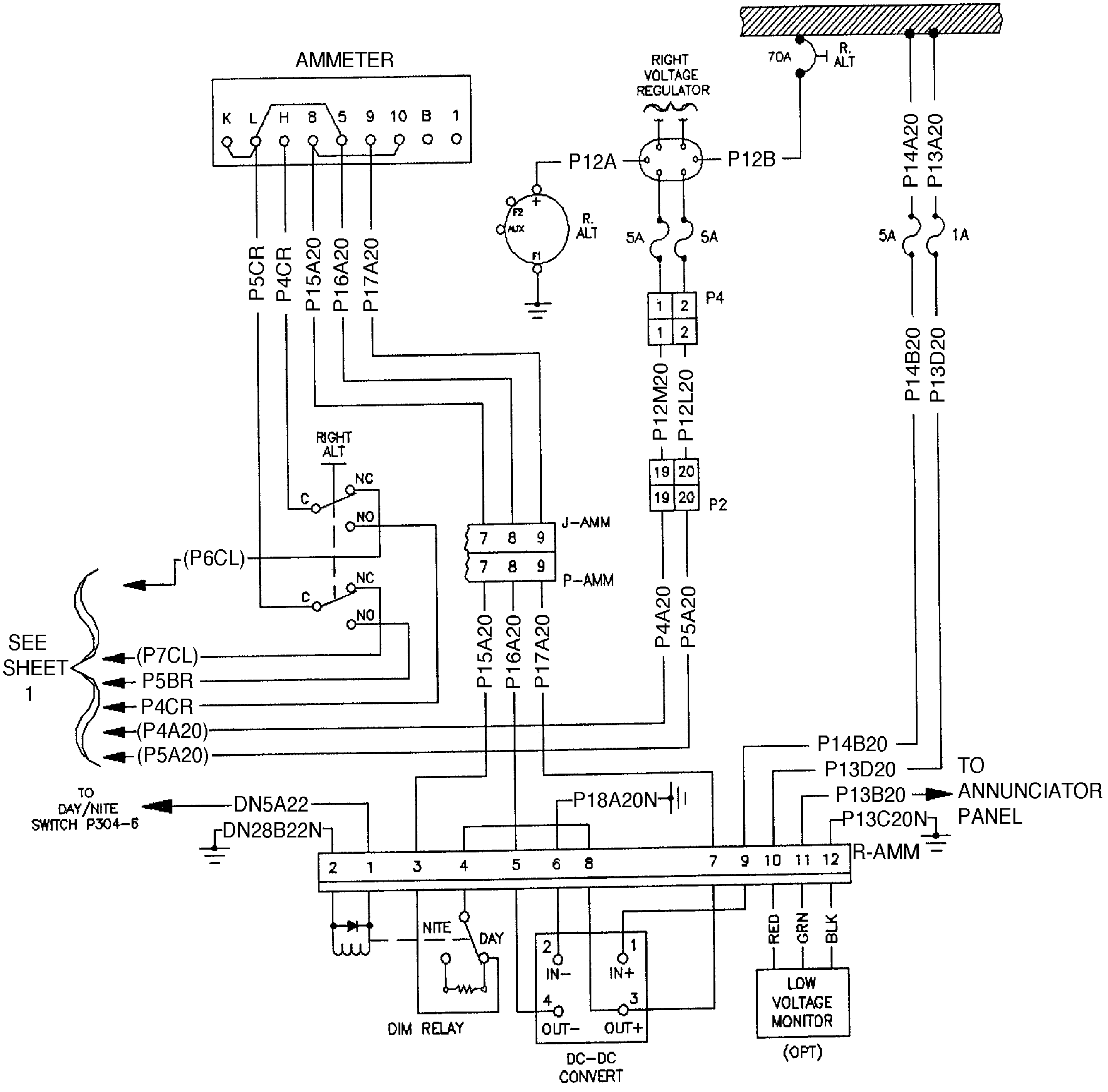


Figure 91-41. Ammeter / Low Voltage Monitor - Seneca IV
(Sheet 2 of 2)

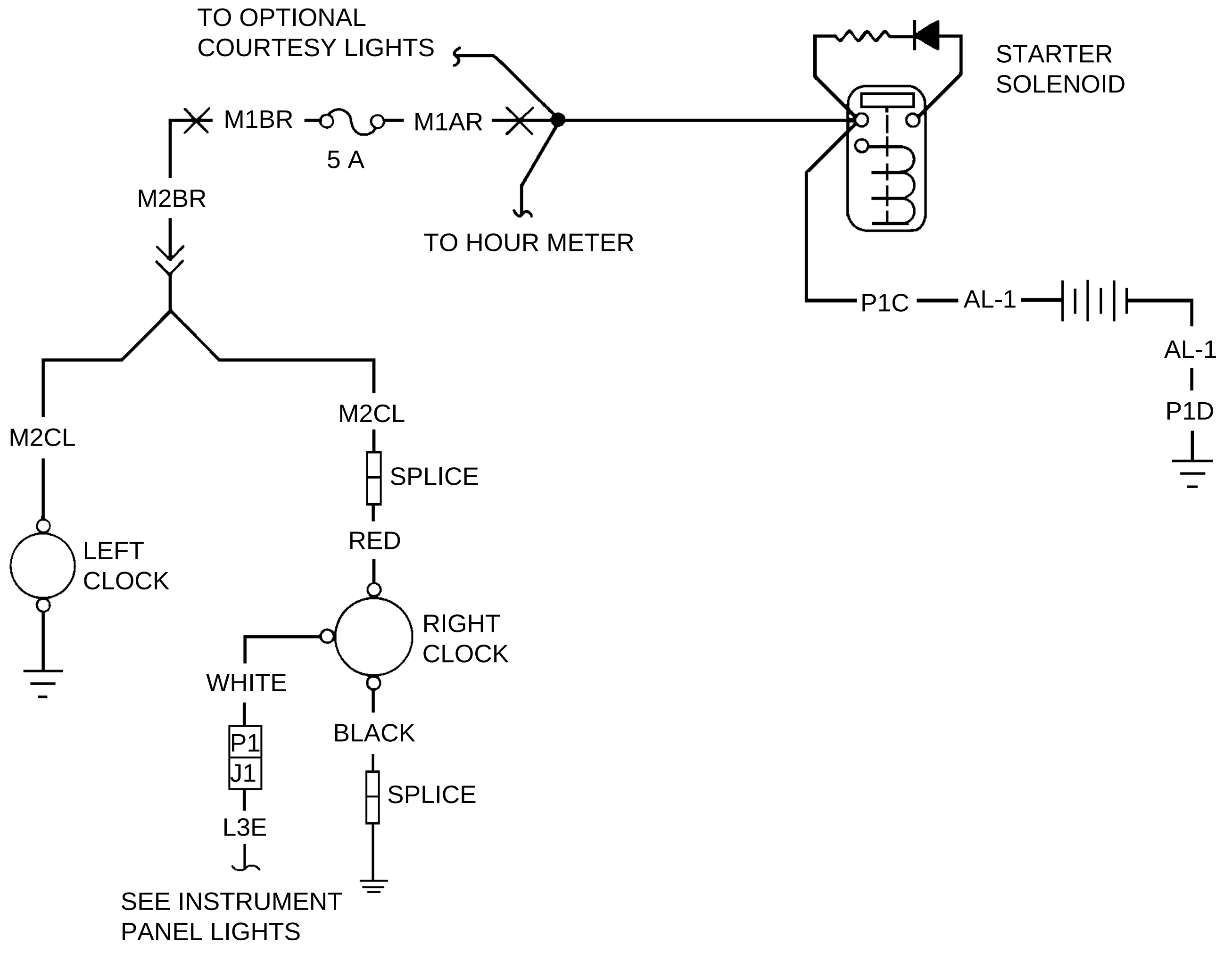


Figure 91-42. Clock - Seneca III (14 Volt System)

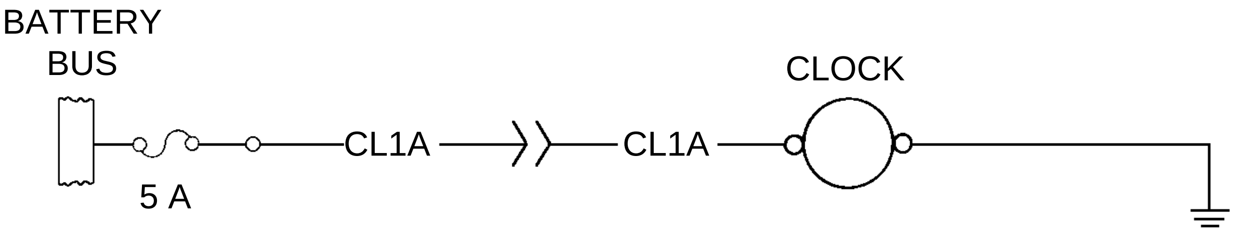


Figure 91-43. Clock - Seneca III (28 Volt System, includes s/n 3448001 thru 3448037))

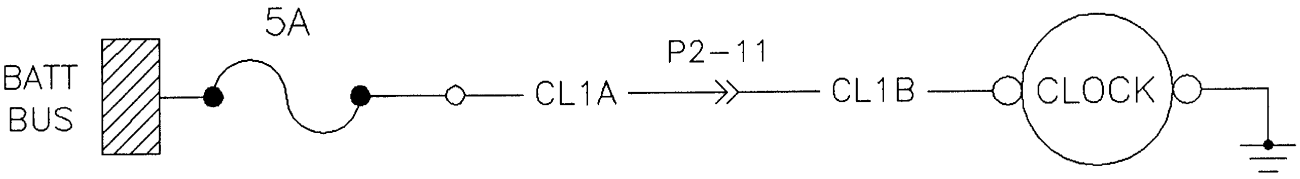


Figure 91-44. Clock - Seneca IV

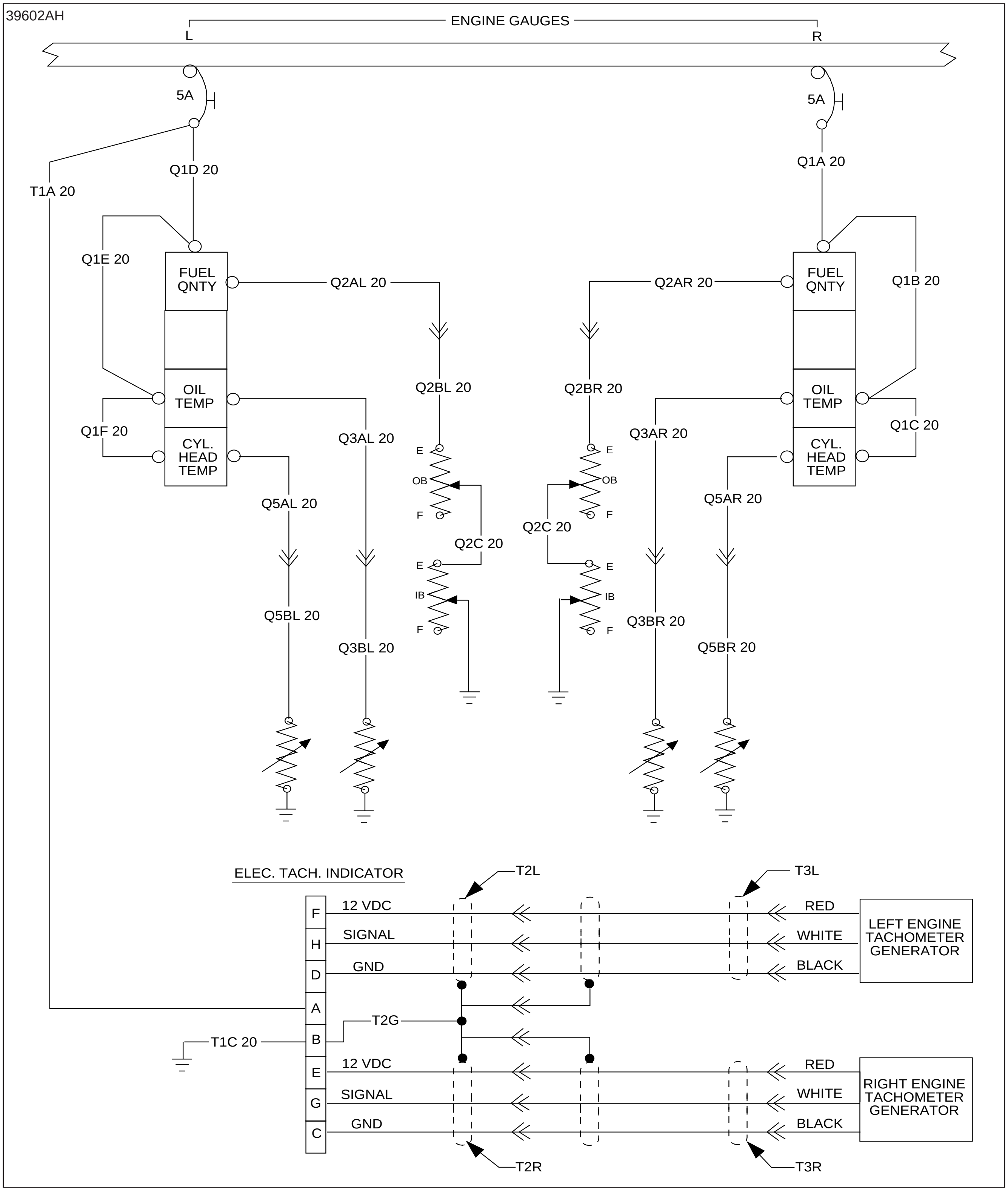


Figure 91-45. Engine Gauges - Seneca III (14 Volt System)

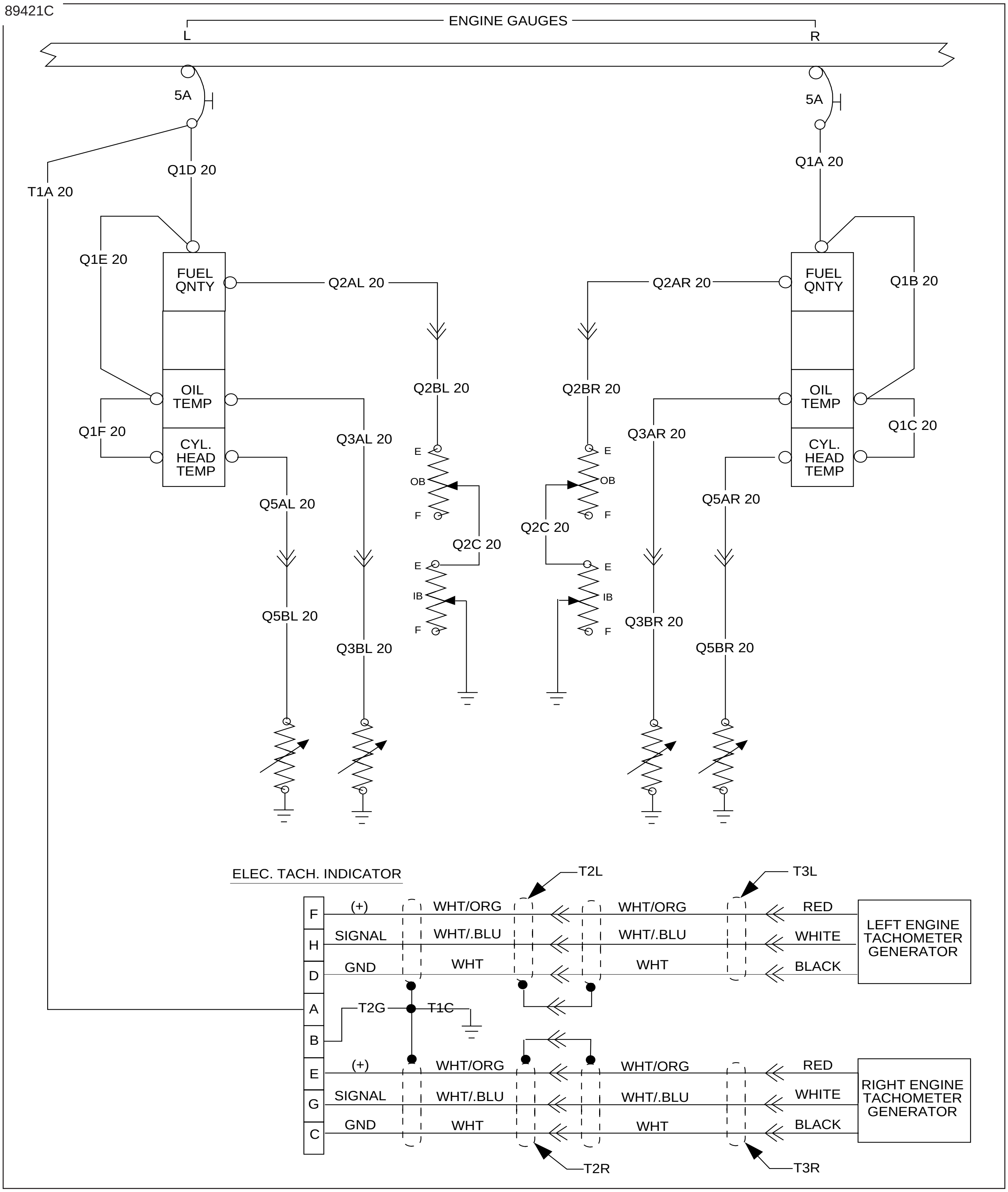


Figure 91-46. Engine Gauges - Seneca III (28 Volt System)
(Includes s/n 3448001 thru 3448037)

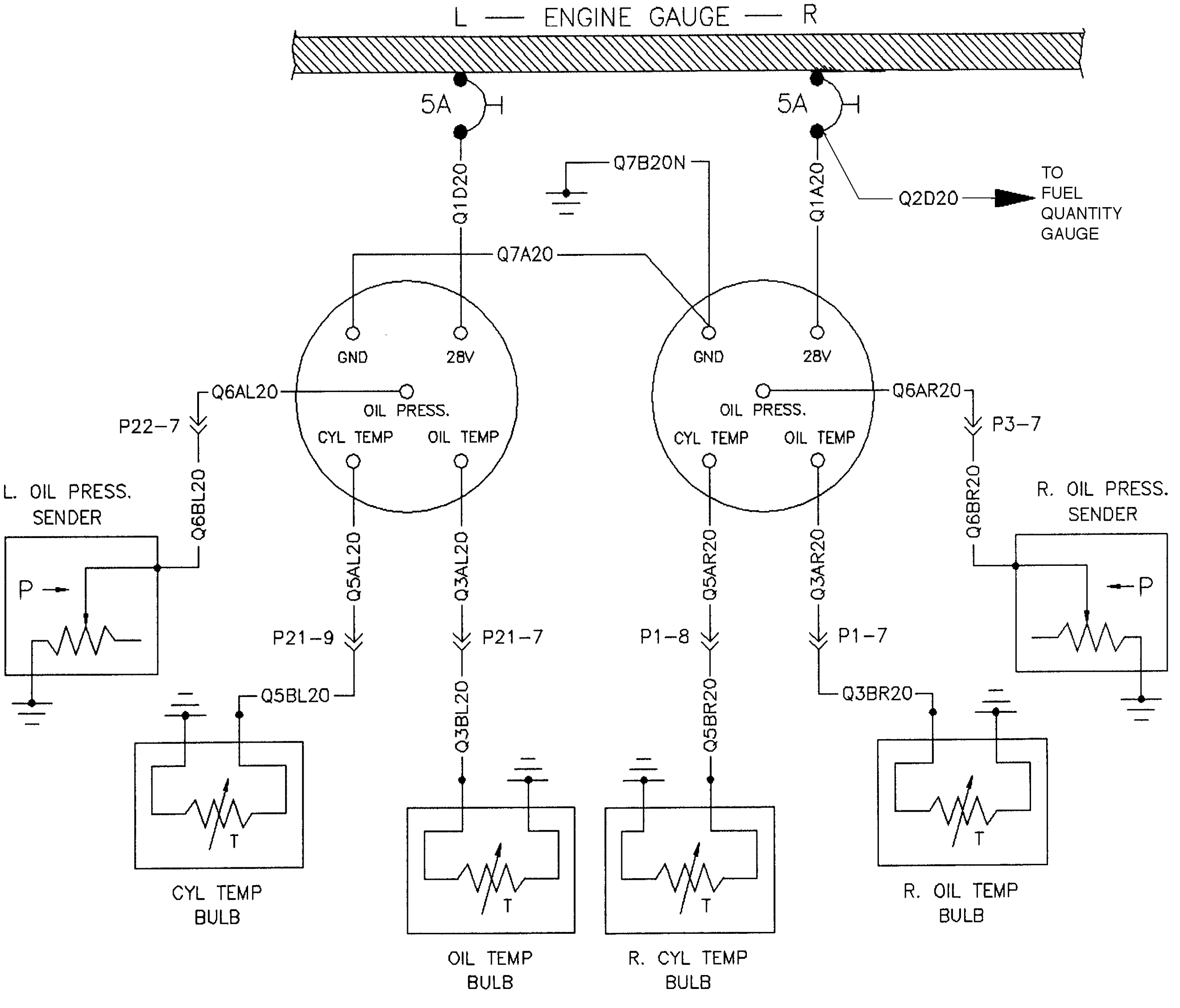


Figure 91-47. Engine Gauges - Seneca IV

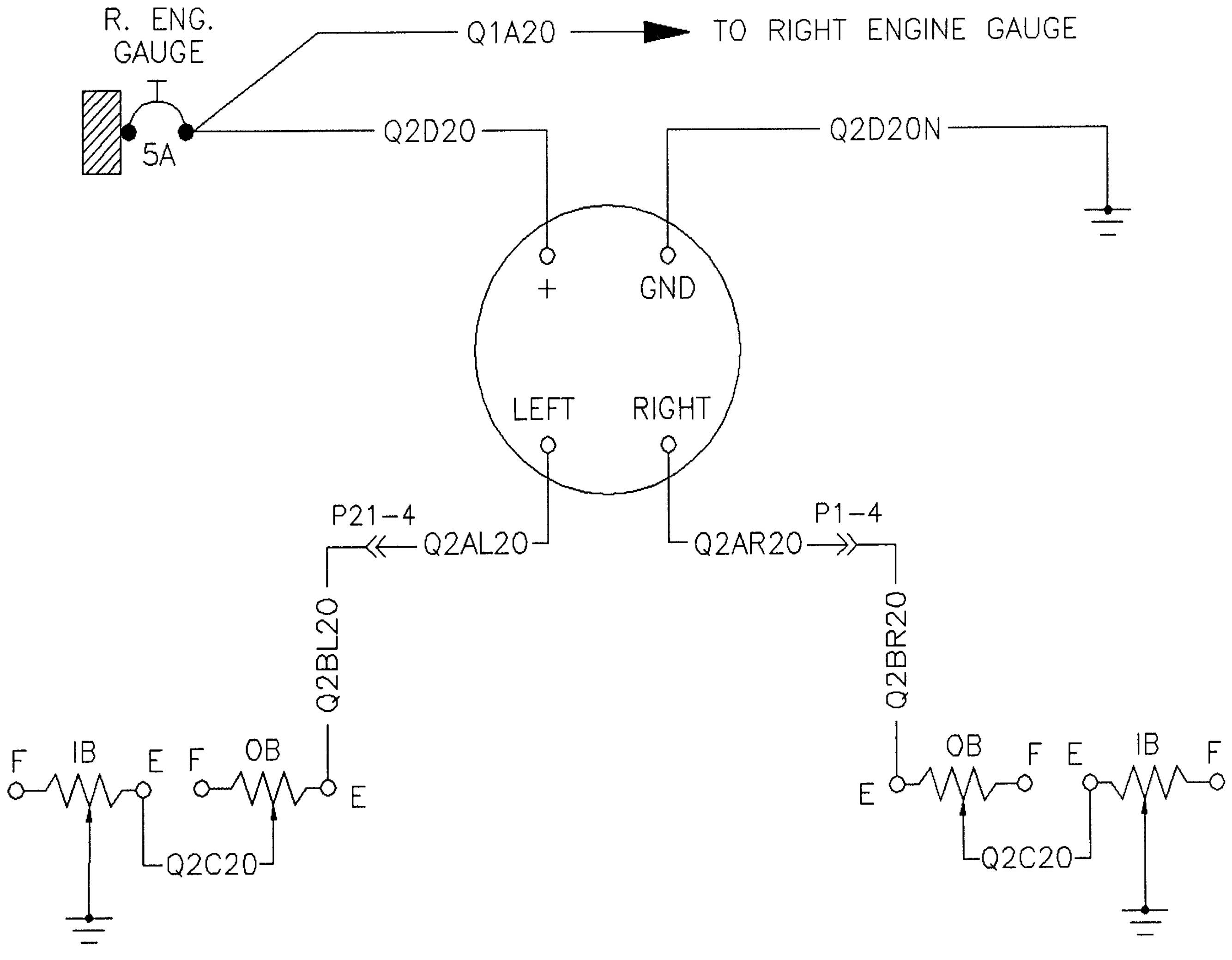


Figure 91-48. Fuel Quantity Gauges - Seneca IV

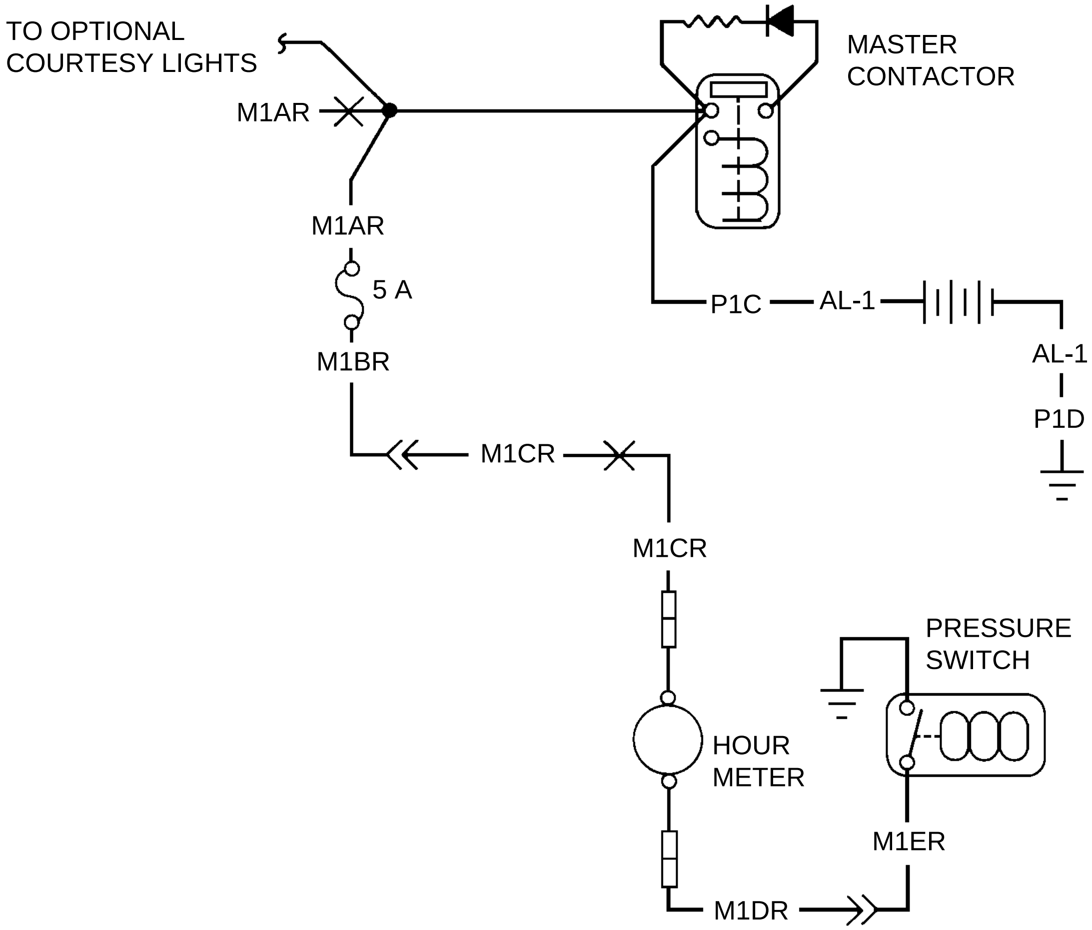


Figure 91-49. Hour Meter - Seneca III (14 Volt System)

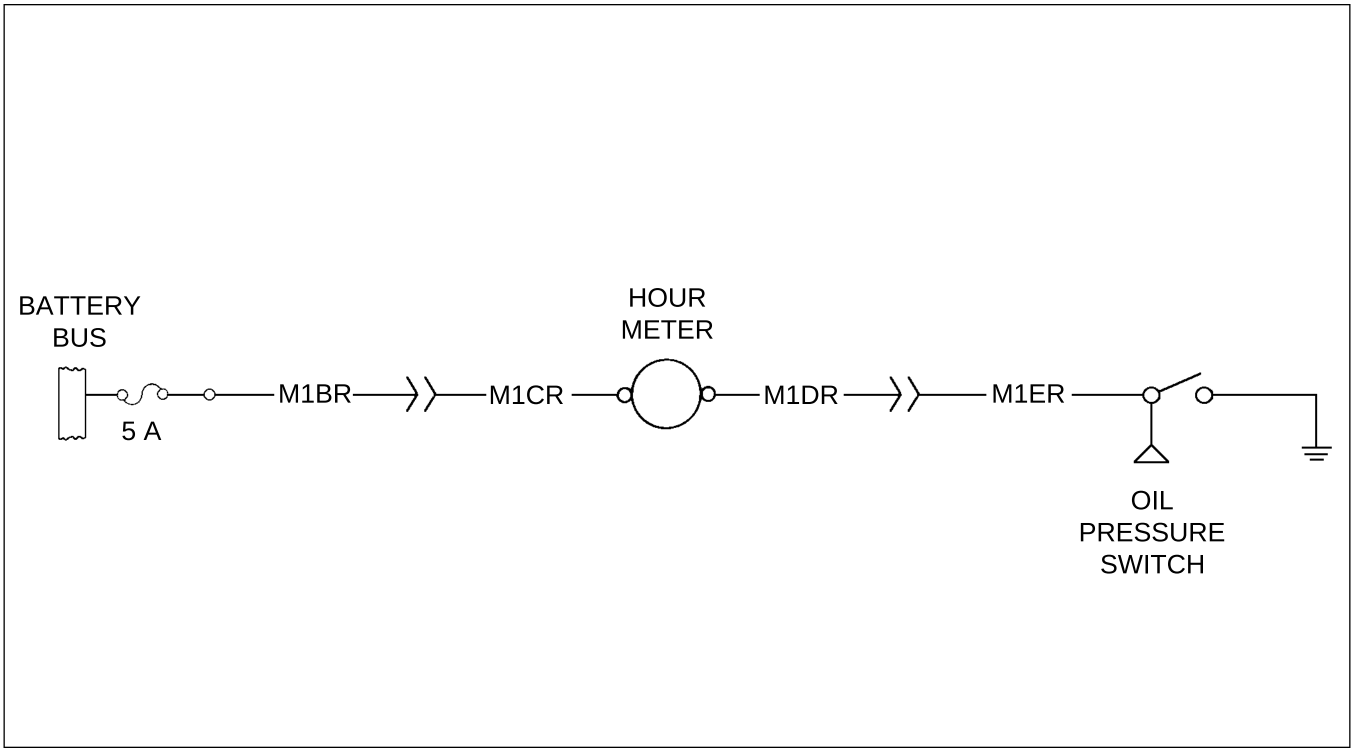


Figure 91-50. Hour Meter - Seneca III (28 Volt System)
(Includes s/n 3448001 thru 3448037)

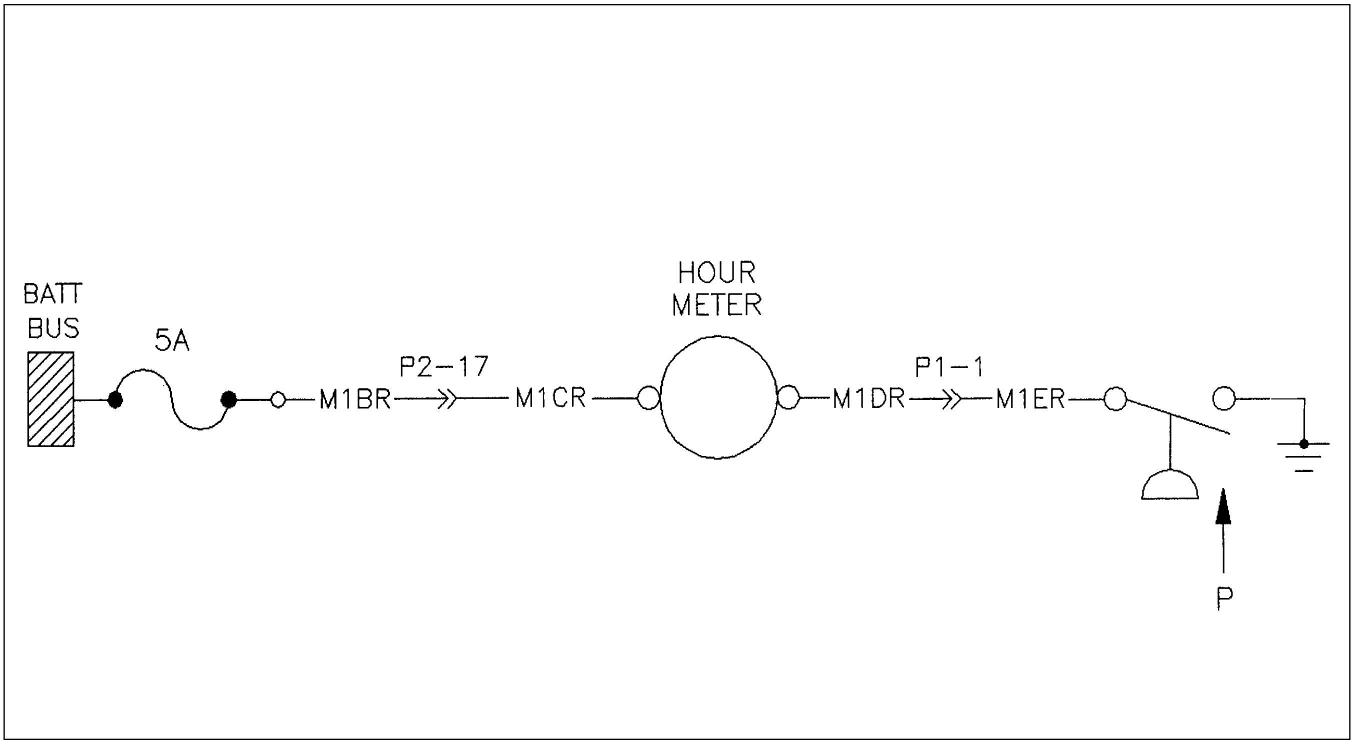


Figure 91-51. Hour Meter - Seneca IV

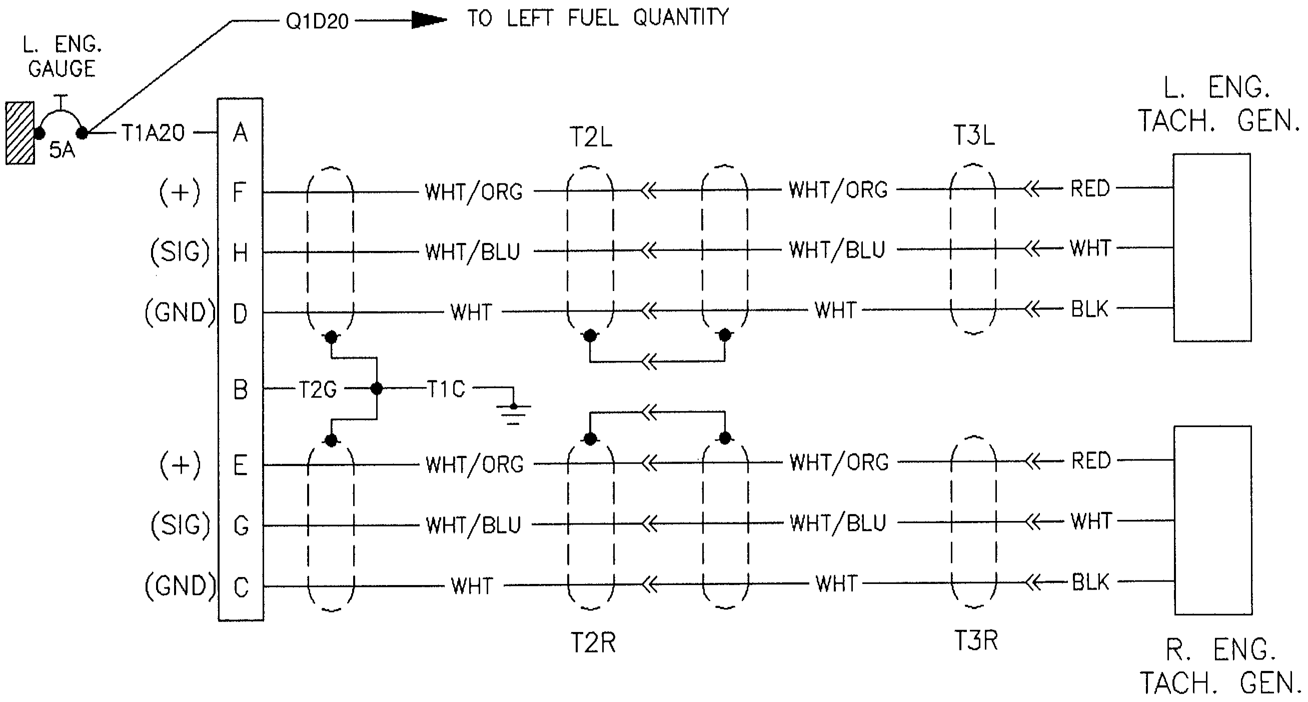


Figure 91-52. Tachometer - Seneca IV

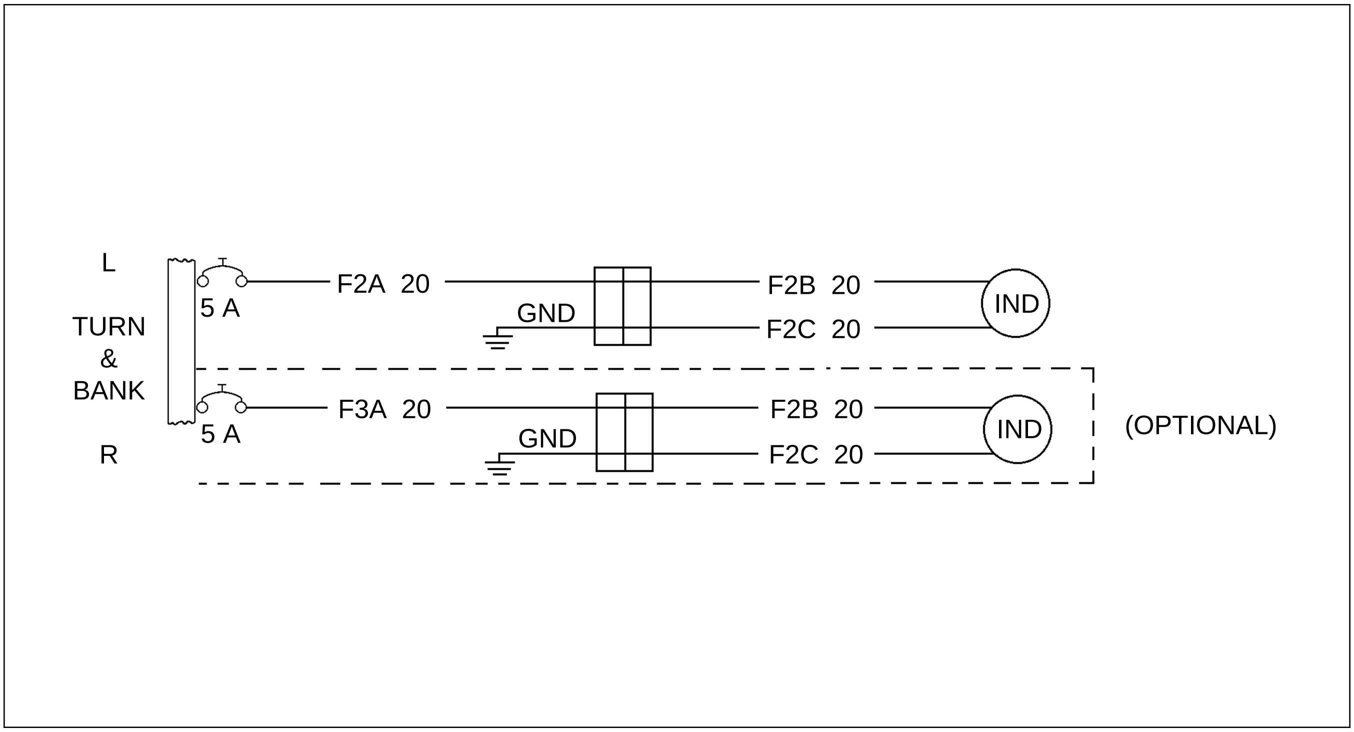


Figure 91-53. Turn and Bank Indicator - Seneca III (14 Volt System)

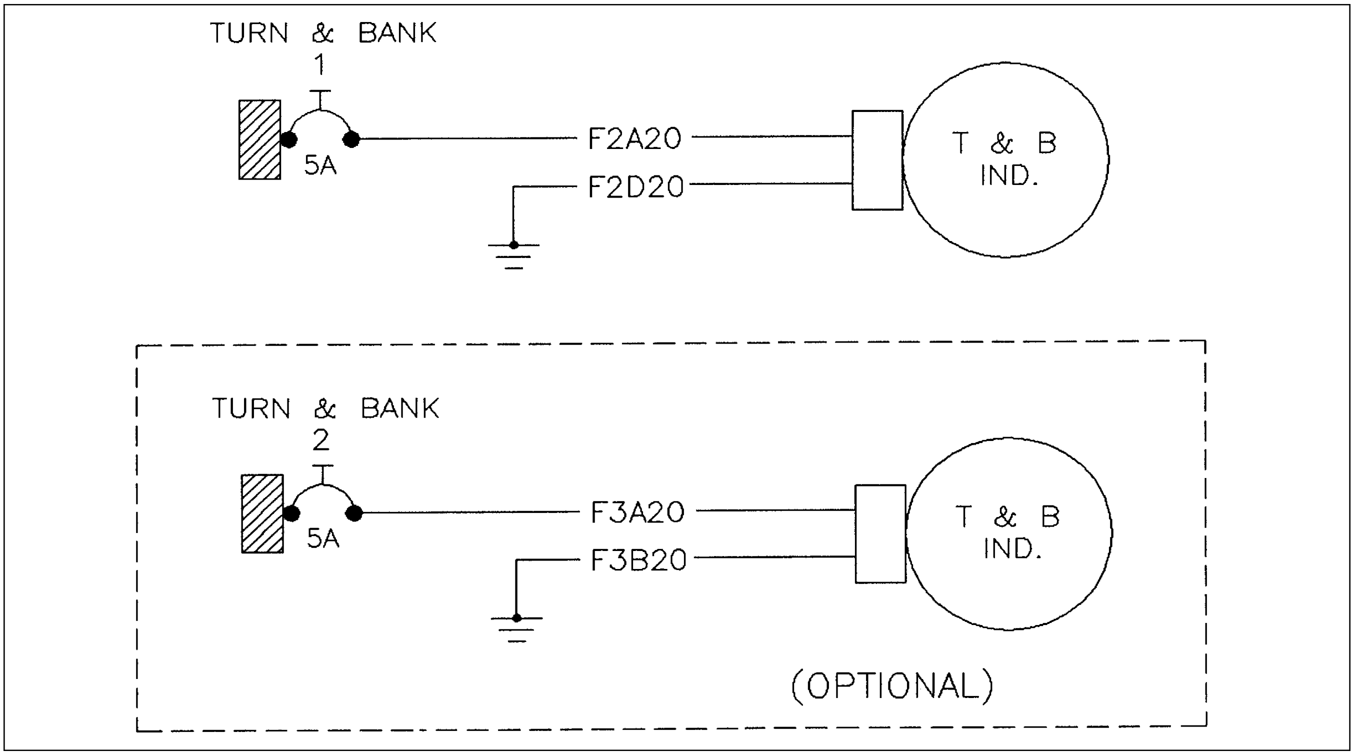


Figure 91-55. Turn and Bank Indicator - Seneca IV

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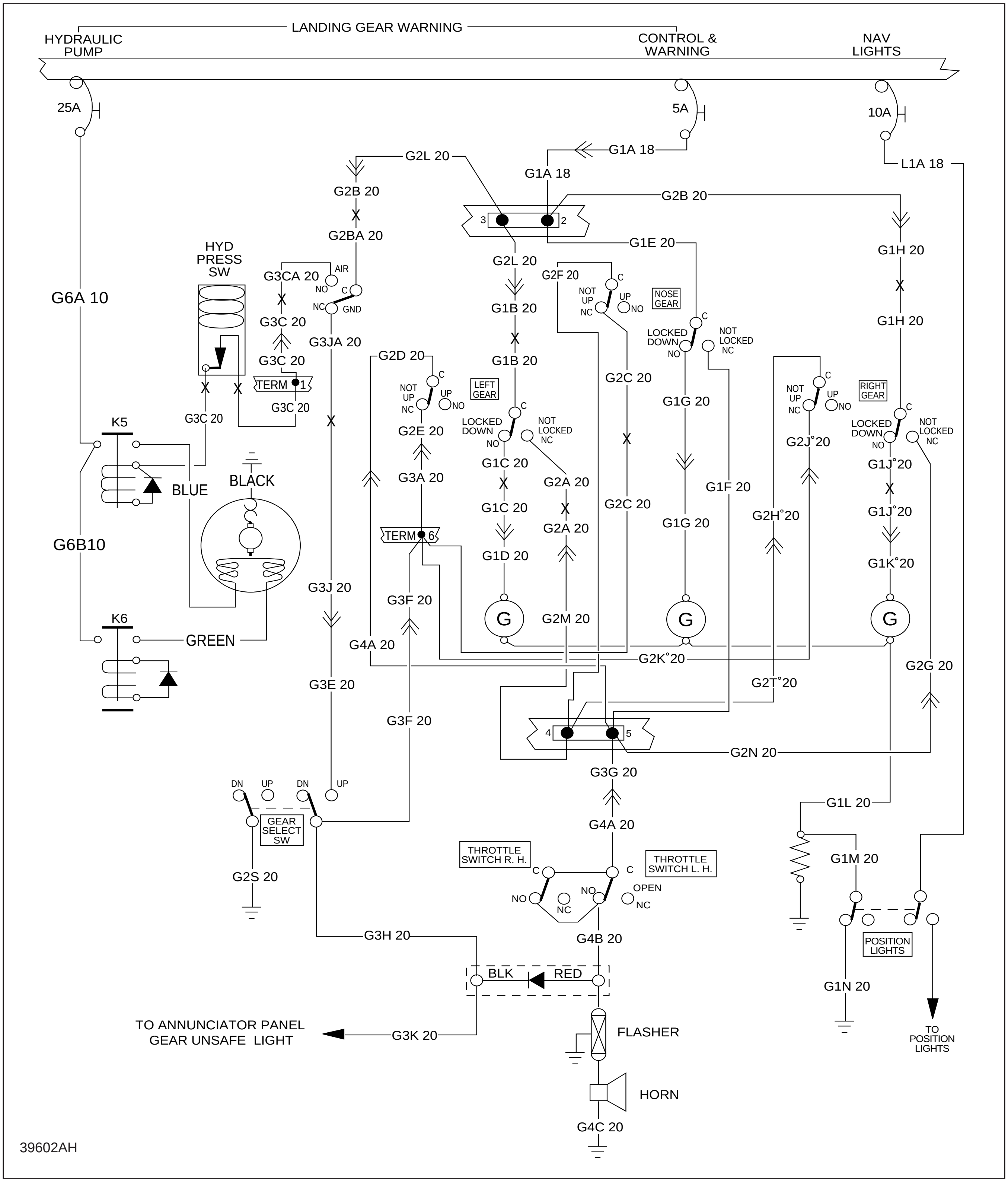


Figure 91-56. Landing Gear Control and Warning - Seneca III (14 Volt System)

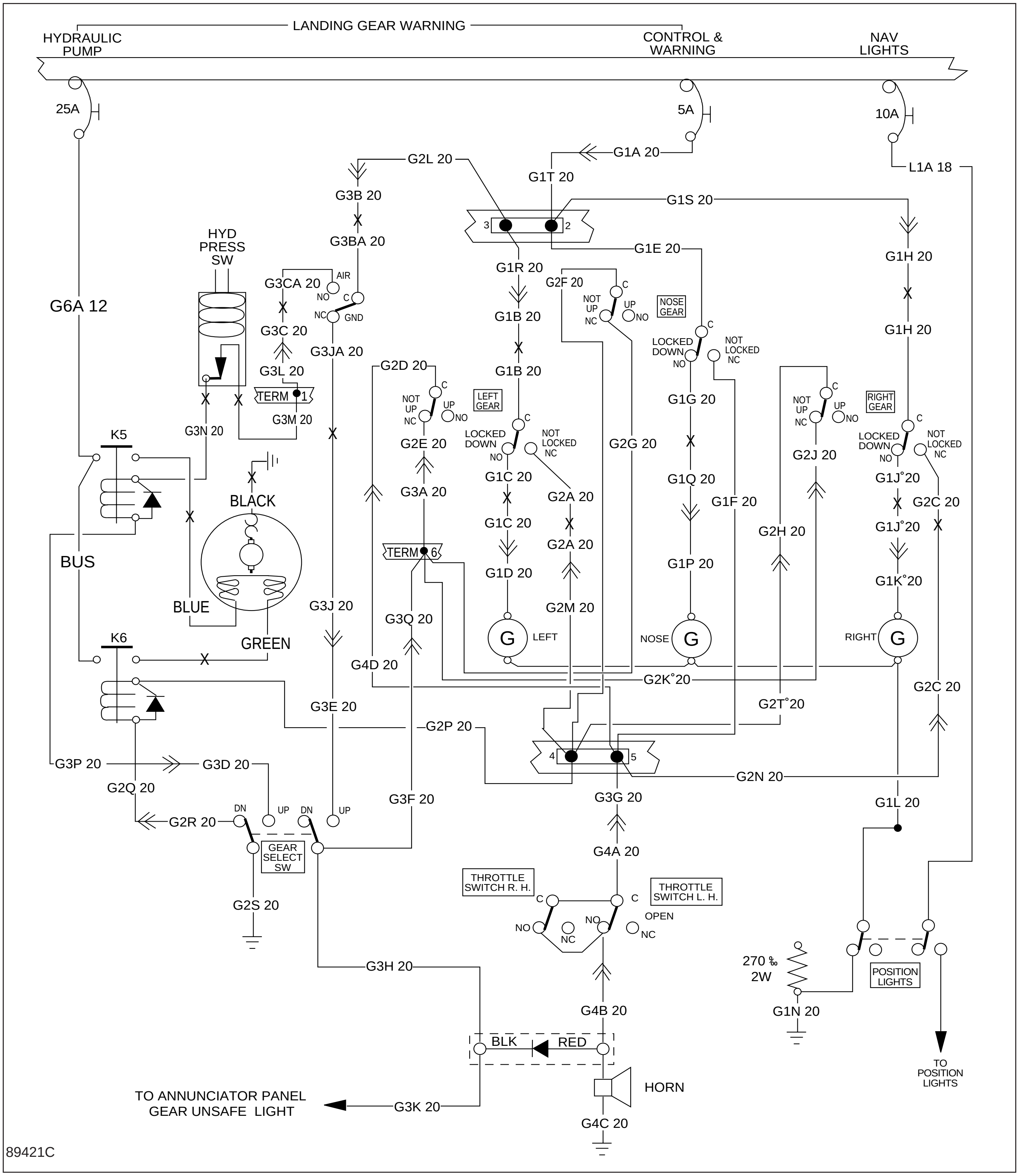


Figure 91-57. Landing Gear Control and Warning - Seneca III (28 Volt System)
(Includes s/n 3448001 thru 3448037)

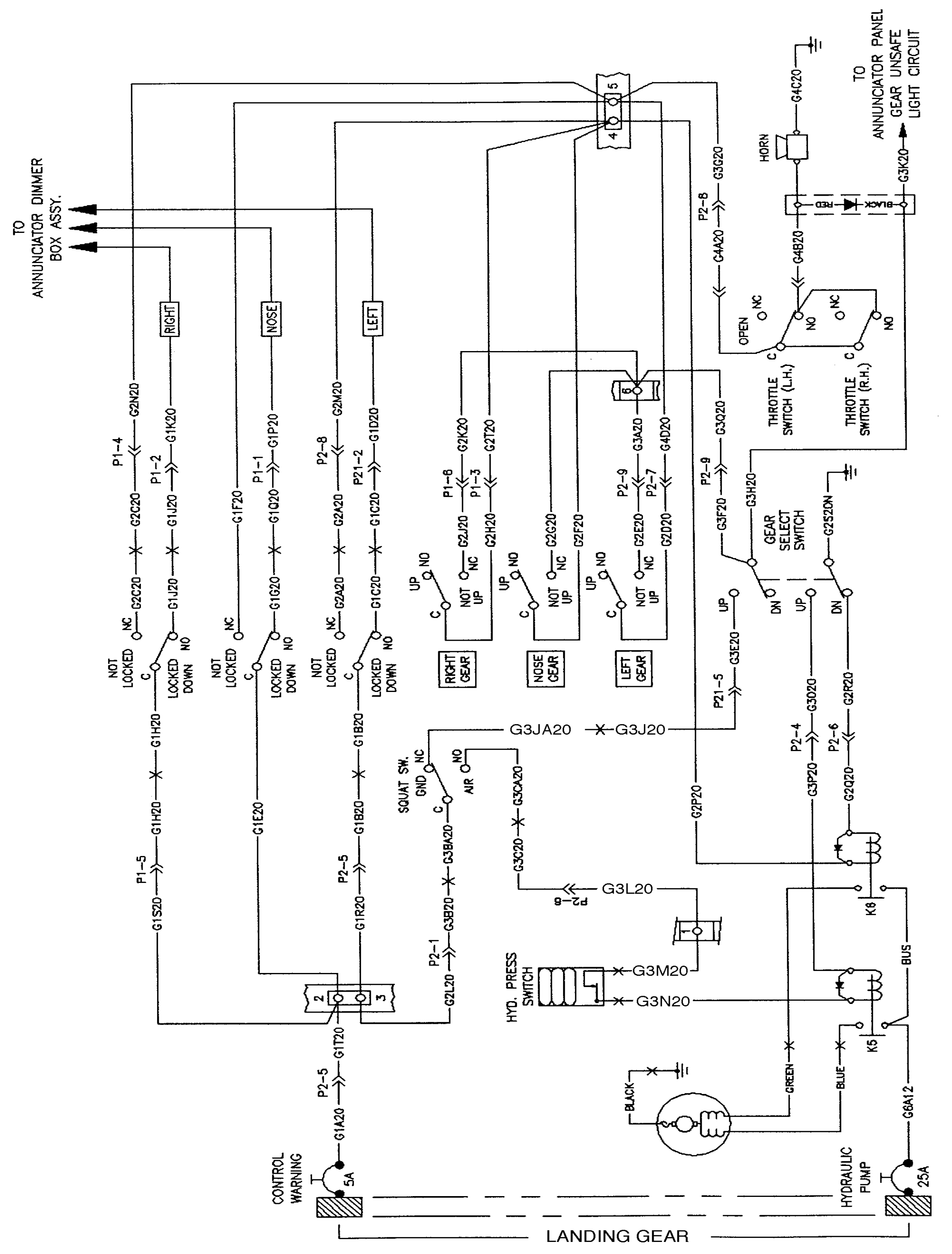


Figure 91-58. Landing Gear Control and Warning - Seneca IV

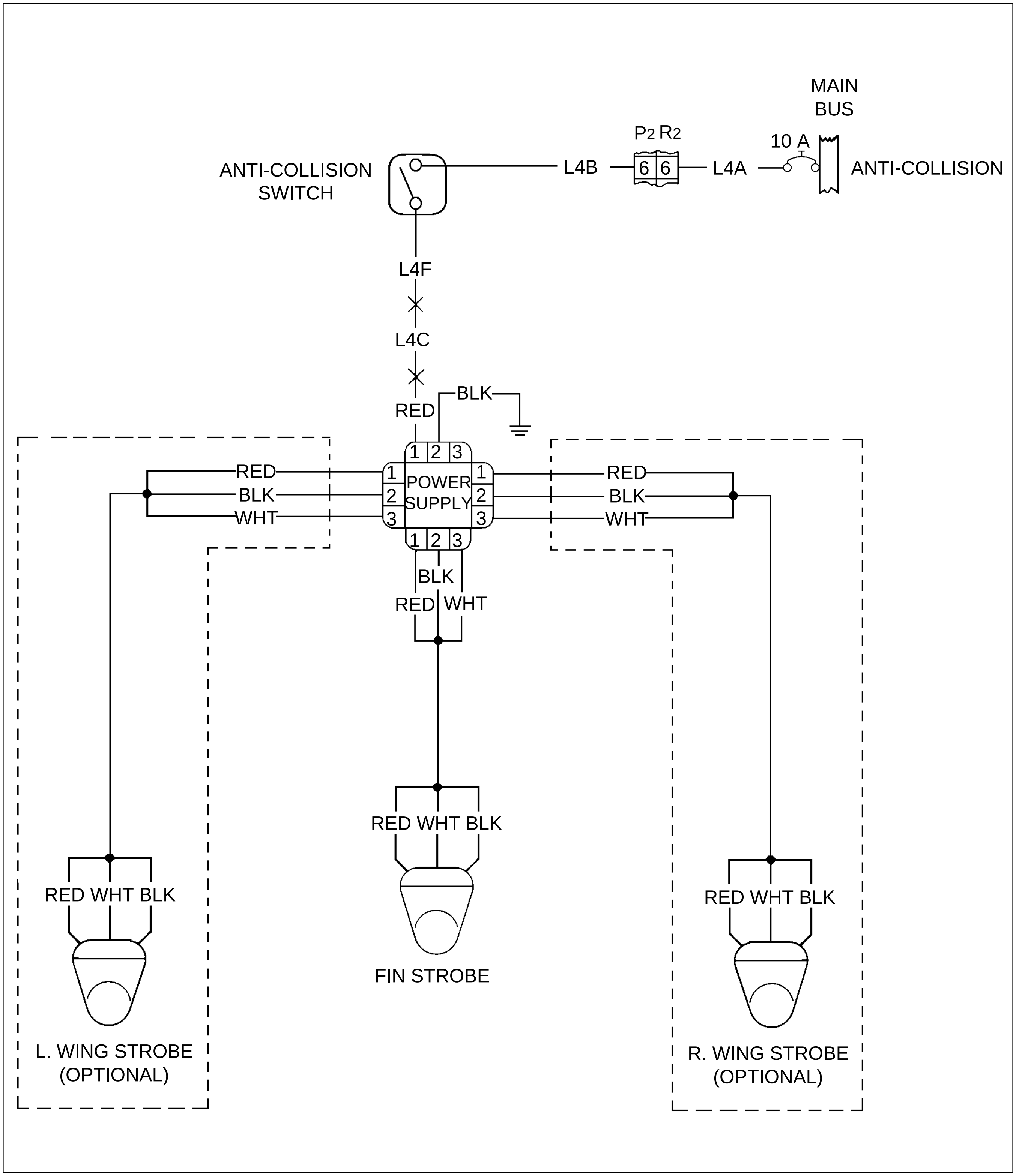


Figure 91-59. Anti-Collision Lights - Seneca III (14 Volt System)

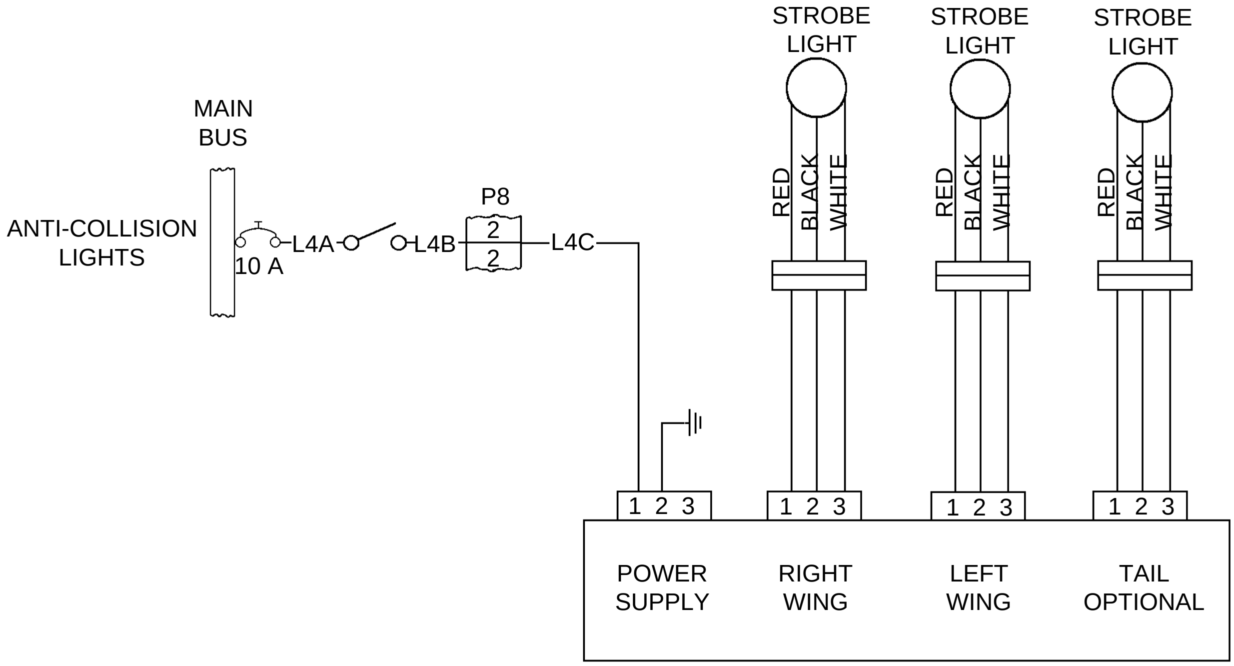


Figure 91-60. Anti-Collision Lights - Seneca III (28 Volt System)
(Includes s/n 3448001 thru 3448037)

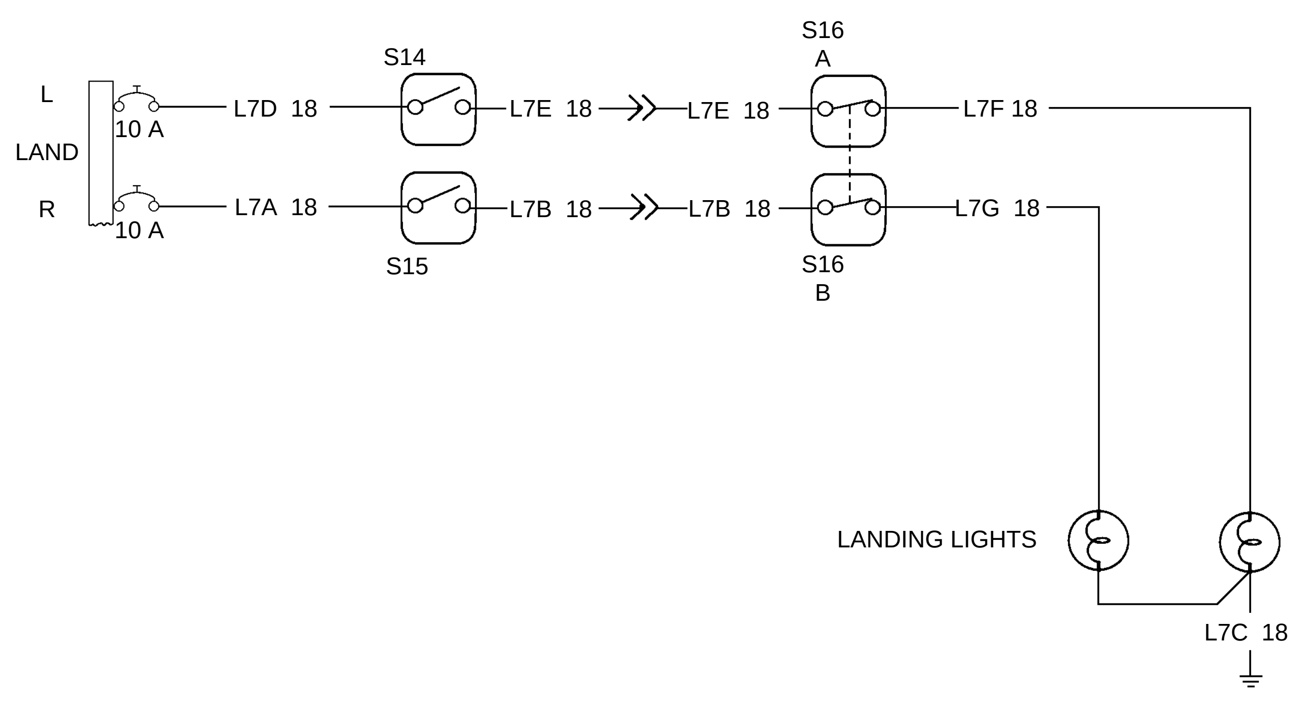


Figure 91-61. Landing Lights - Seneca III (14 Volt System)

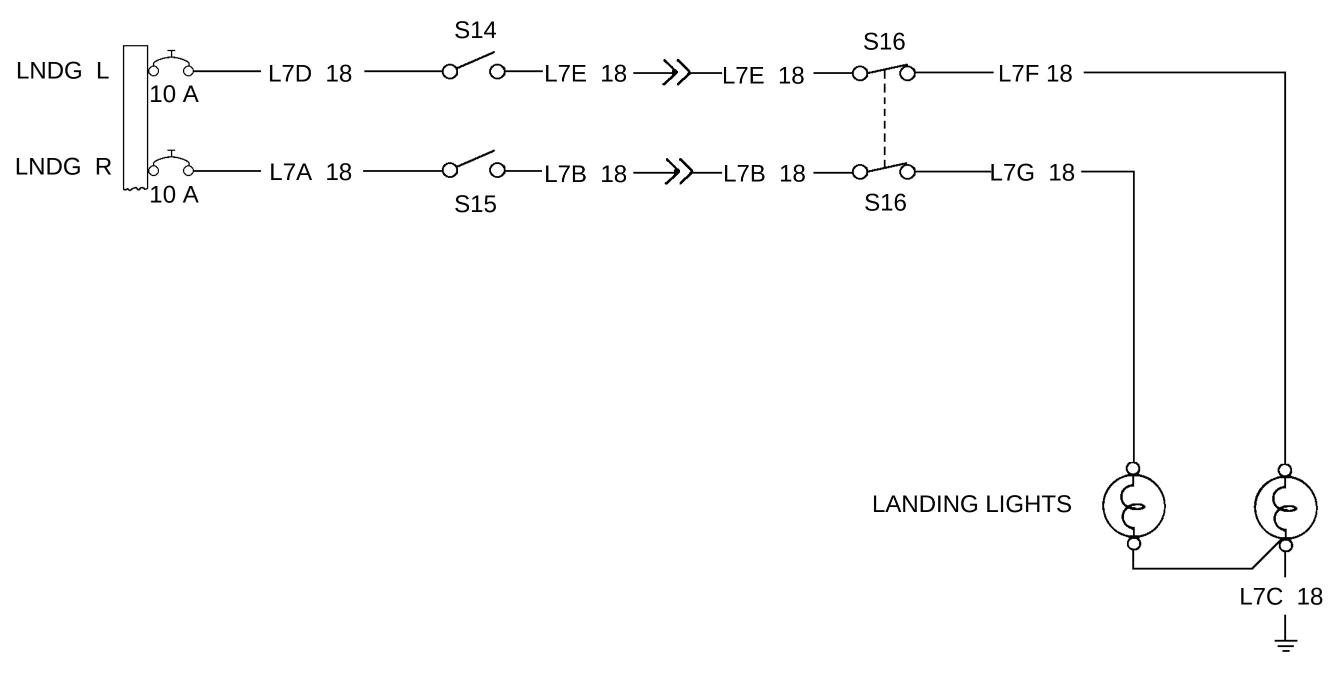


Figure 91-62. Landing Lights - Seneca III (28 Volt System)
(Includes s/n 3448001 thru 3448037)

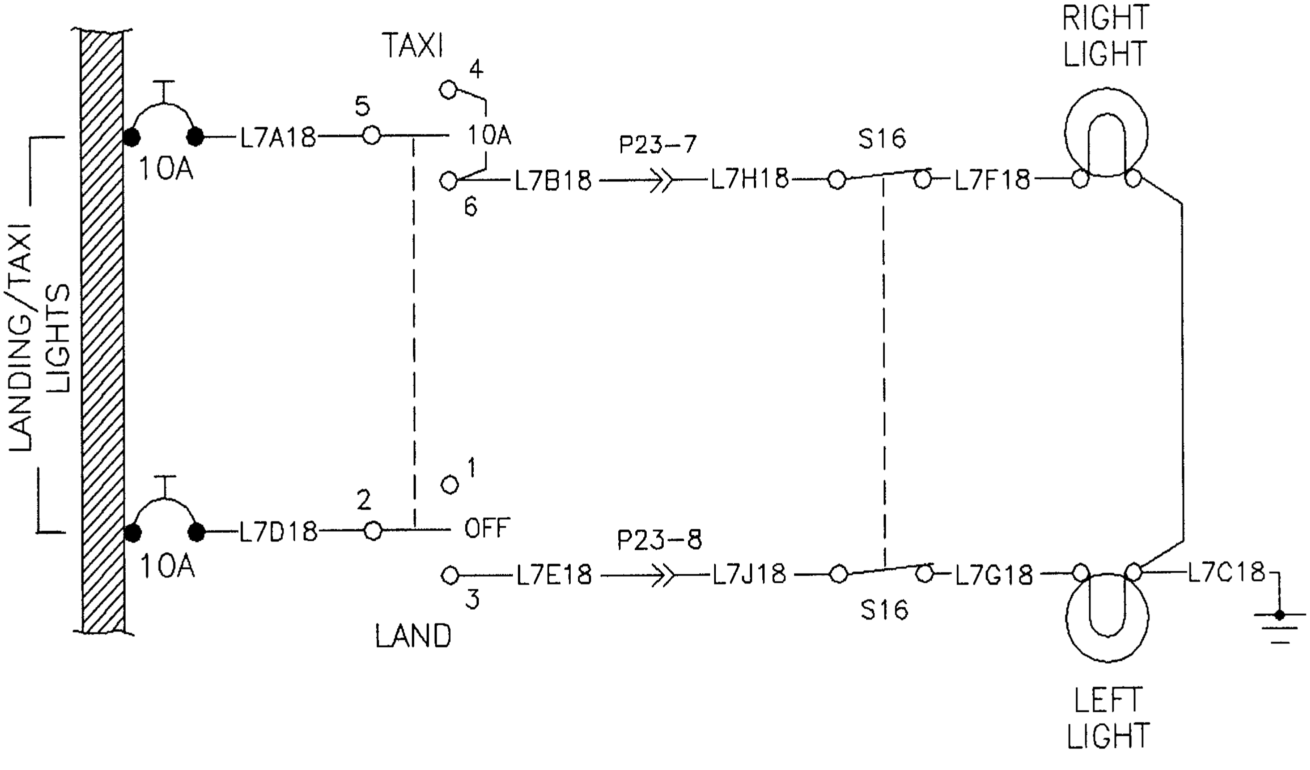
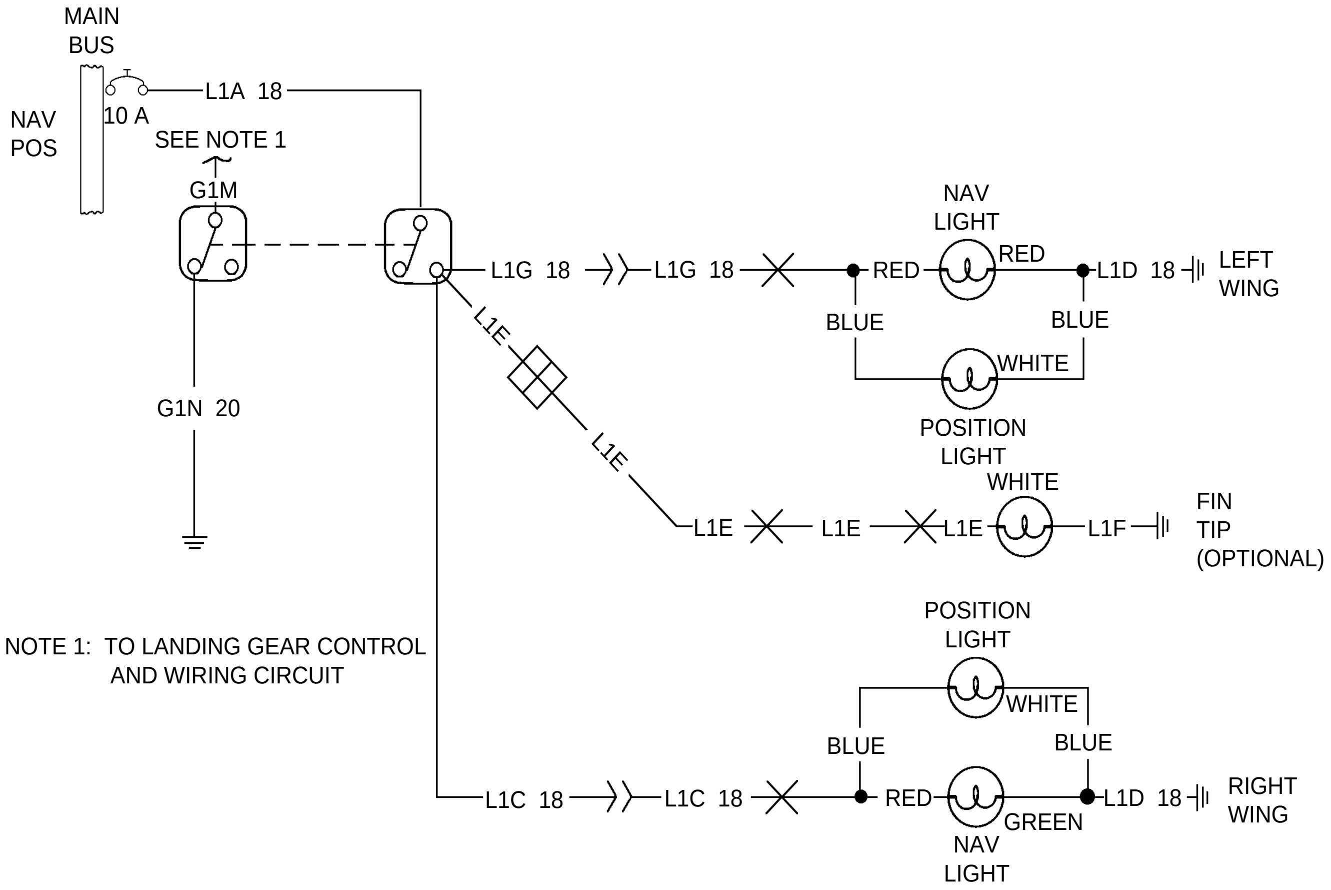
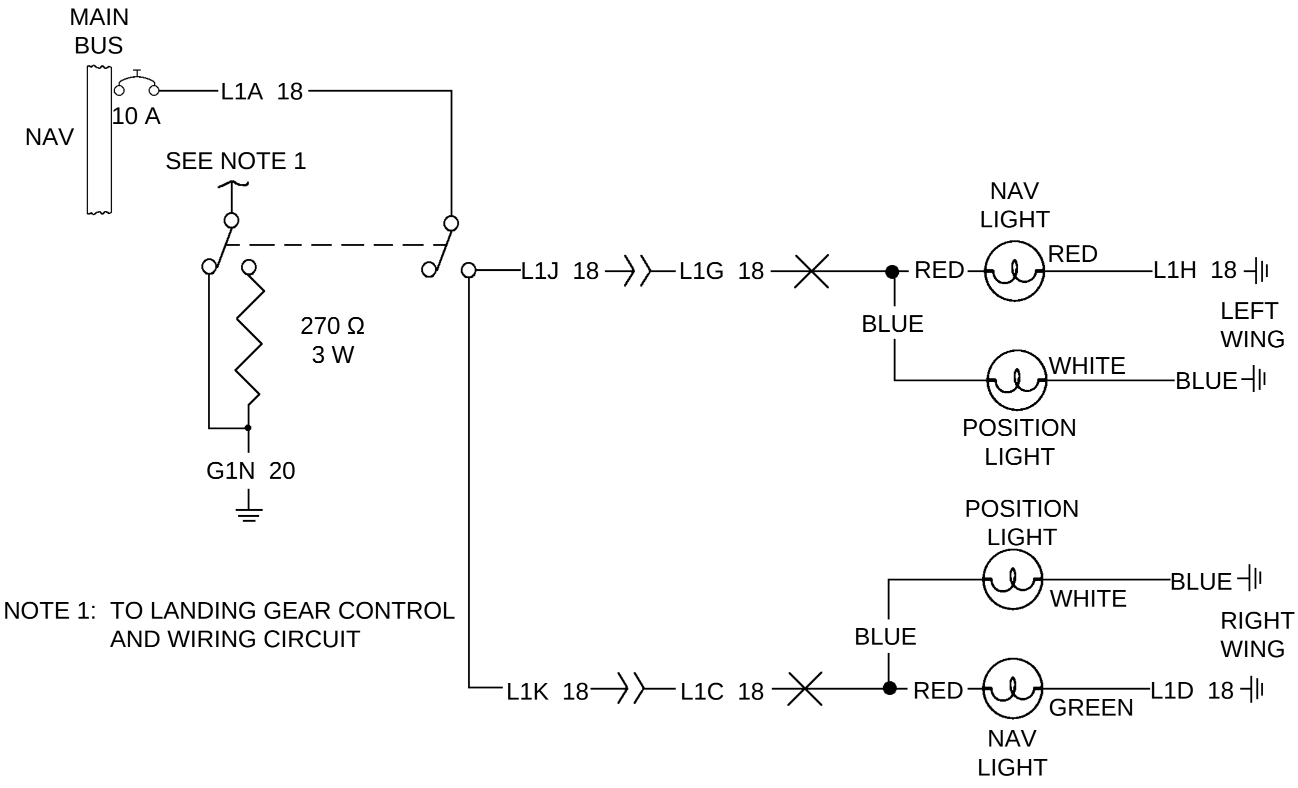


Figure 91-63. Landing / Taxi Lights - Seneca IV



NOTE 1: TO LANDING GEAR CONTROL
AND WIRING CIRCUIT

Figure 91-64. Navigation Lights - Seneca III (14 Volt System)



NOTE 1: TO LANDING GEAR CONTROL AND WIRING CIRCUIT

Figure 91-65. Navigation Lights - Seneca III (28 Volt System)
(Includes s/n 3448001 thru 3448037)

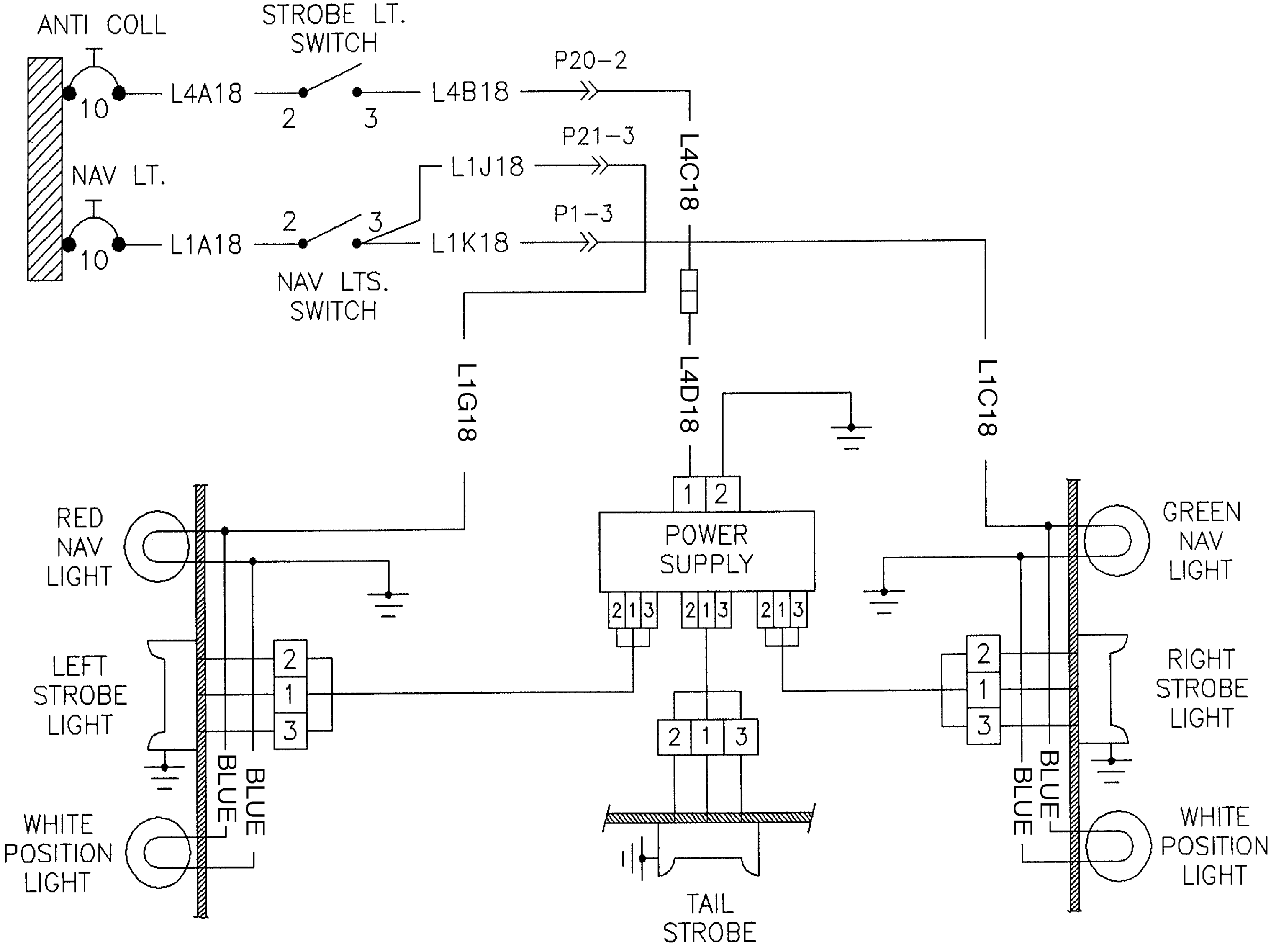


Figure 91-66. Navigation Lights - Seneca IV

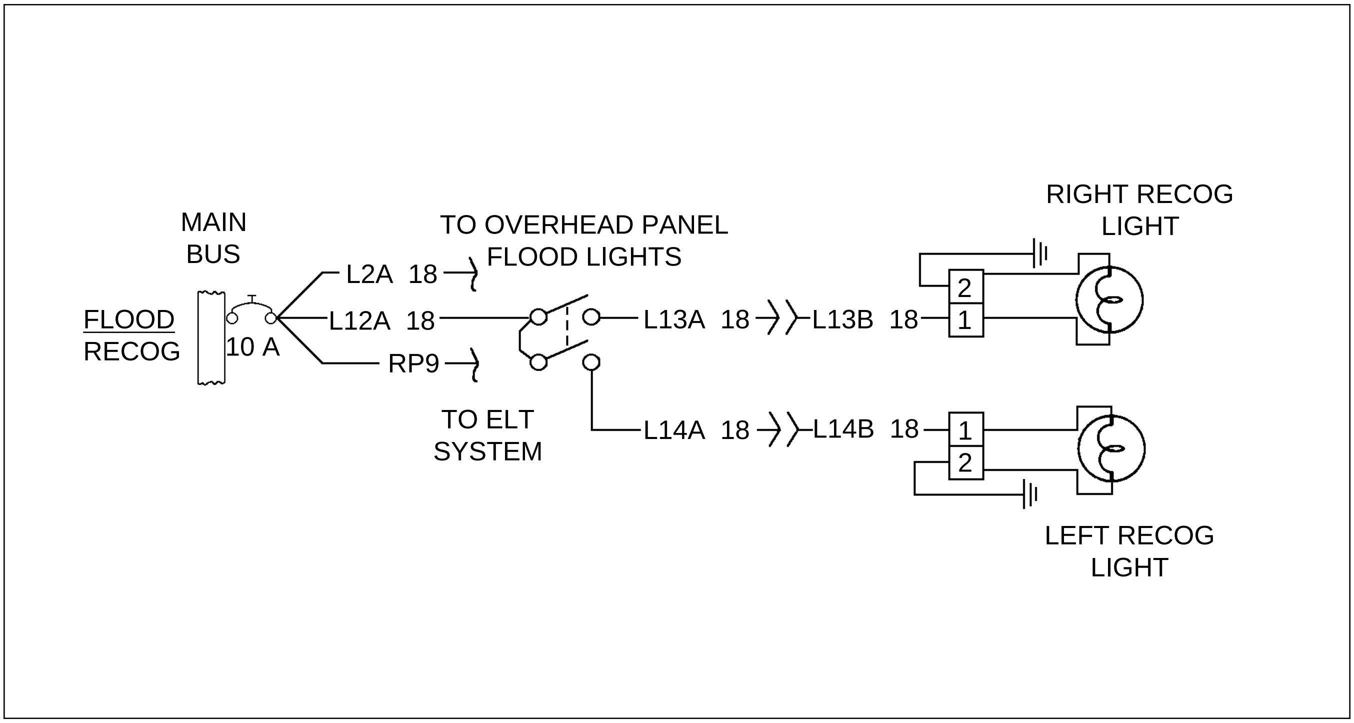


Figure 91-67. Recognition Lights - Seneca III (14 Volt System)

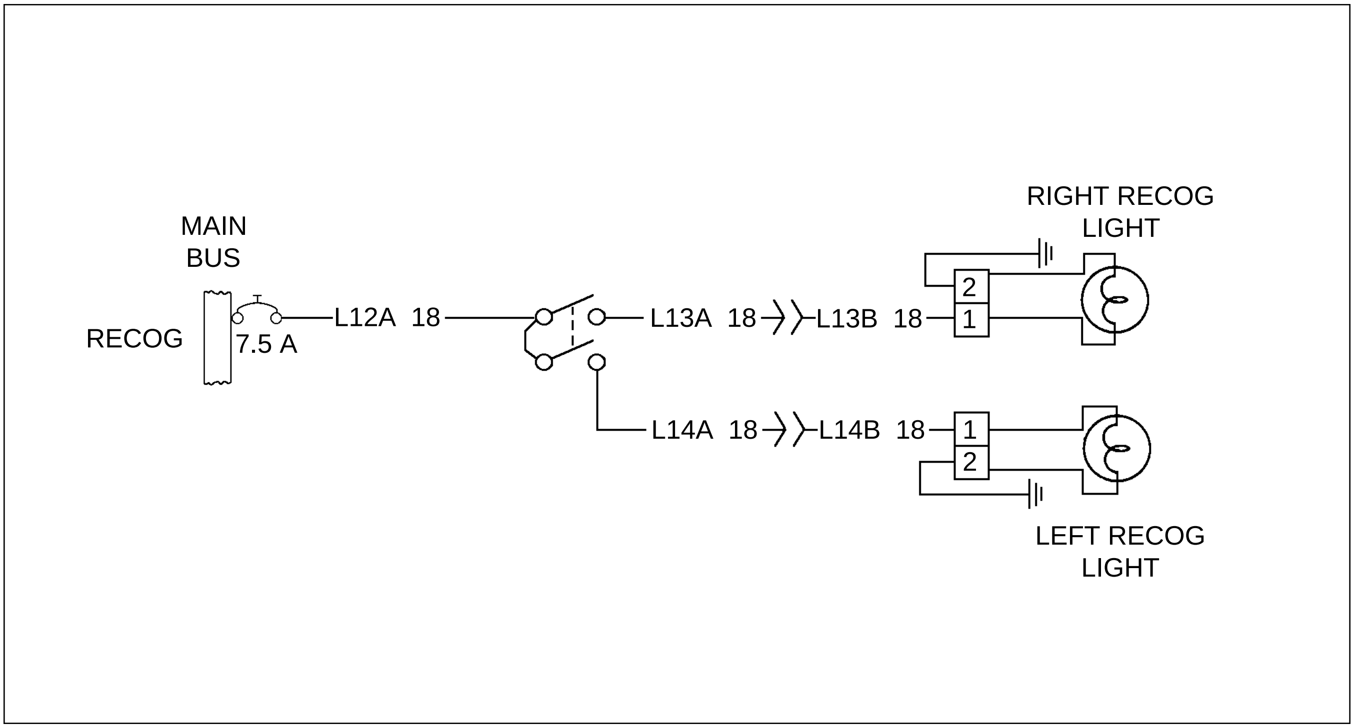


Figure 91-68. Recognition Lights - Seneca III (28 Volt System)
(Includes s/n 3448001 thru 3448037)

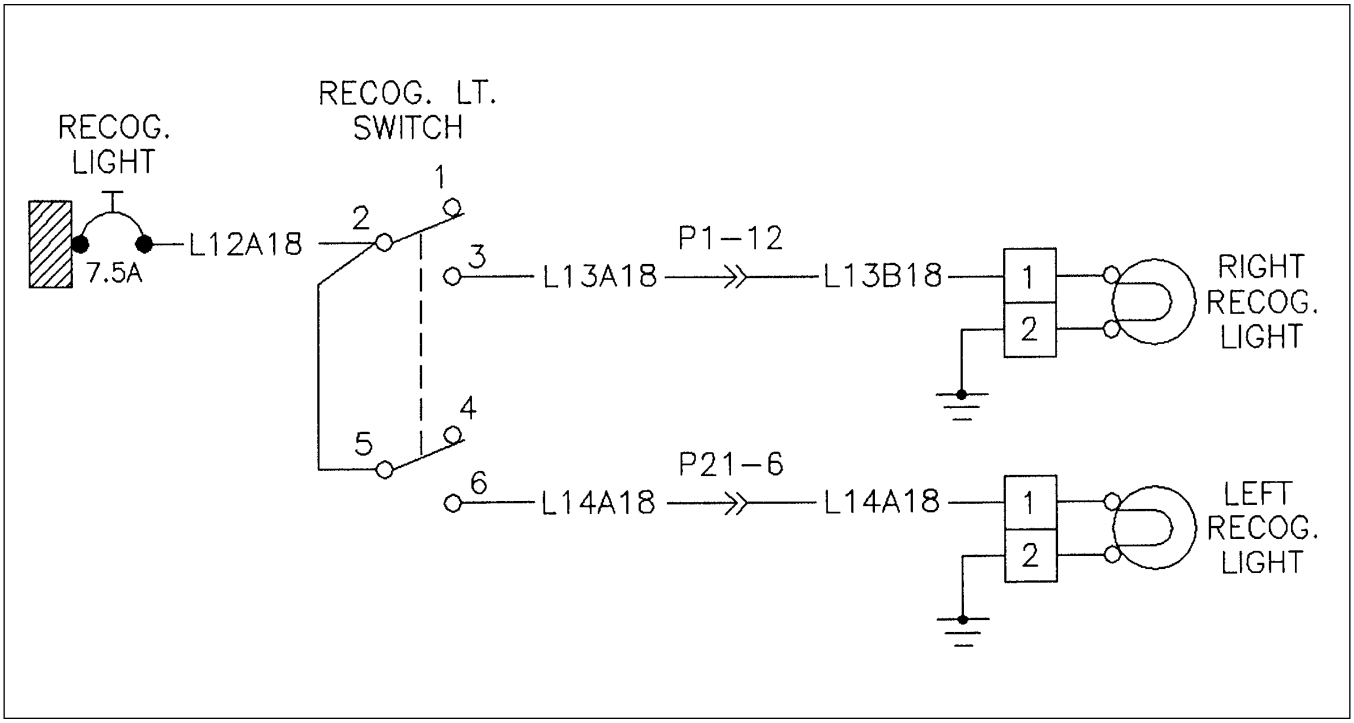


Figure 91-69. Recognition Lights - Seneca IV

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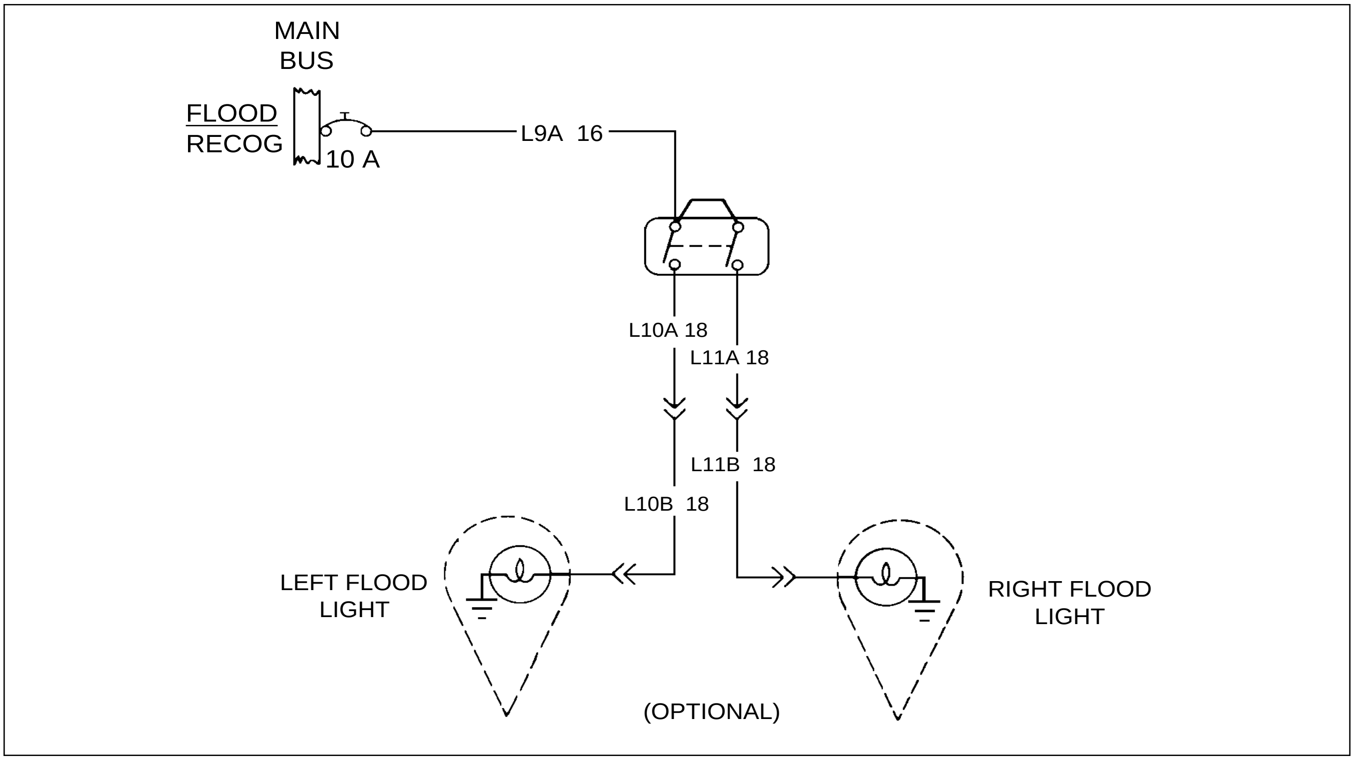

Figure 91-70. Flood Lights - Tail

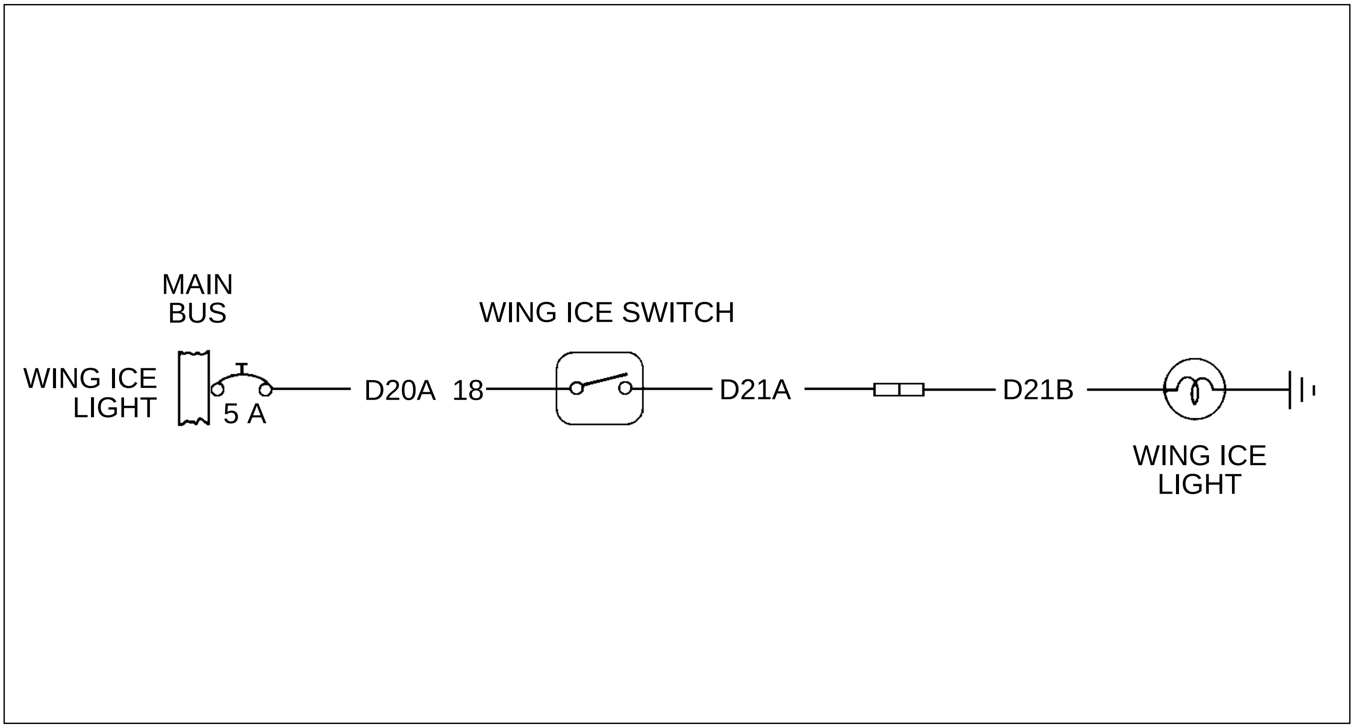

Figure 91-71. Wing Ice Light

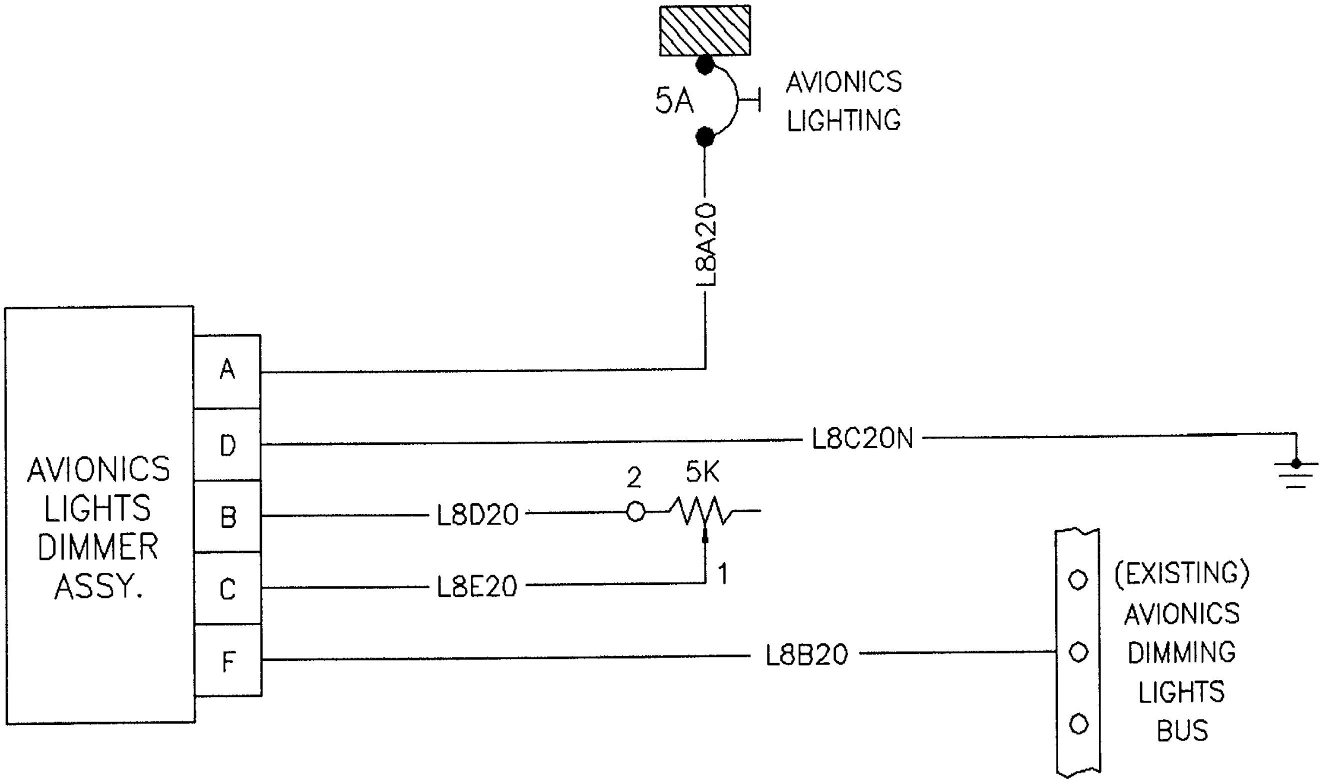

Figure 91-72. Avionics Lights Dimming - Seneca IV

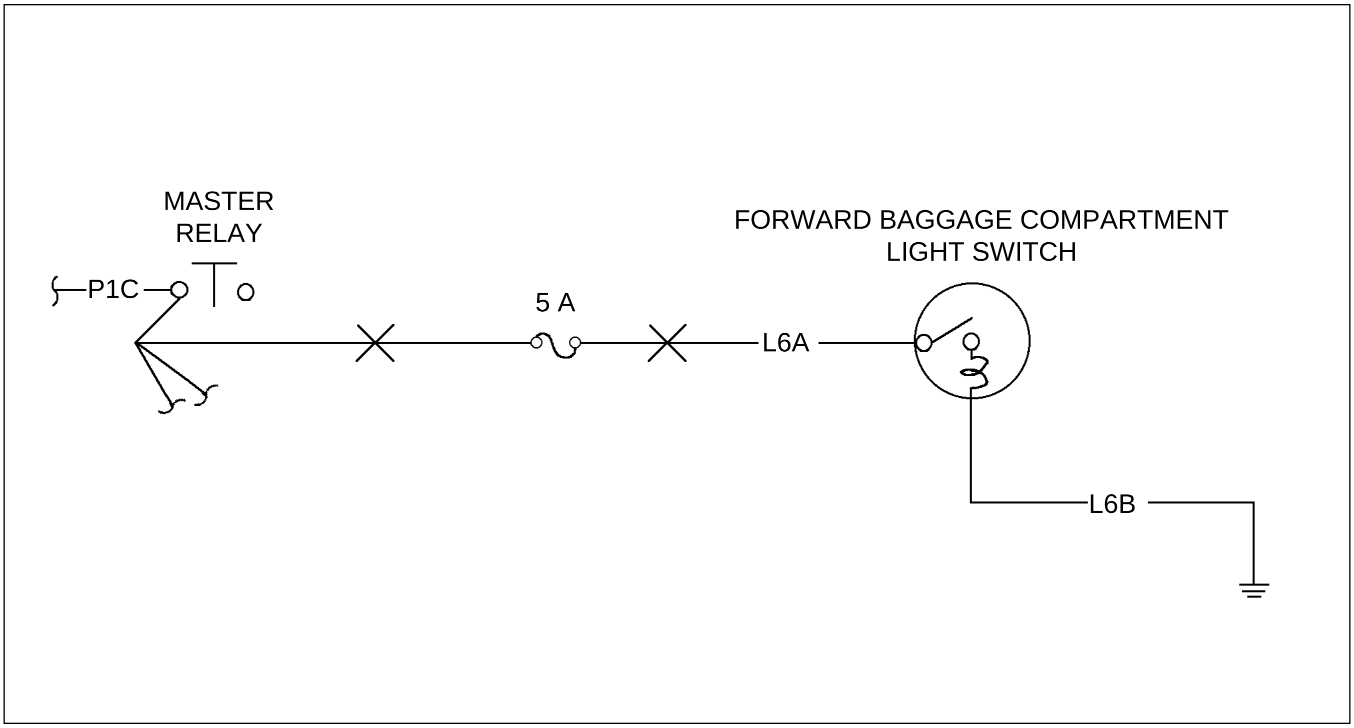

Figure 91-73. Baggage Compartment Light - Seneca III (14 Volt System)

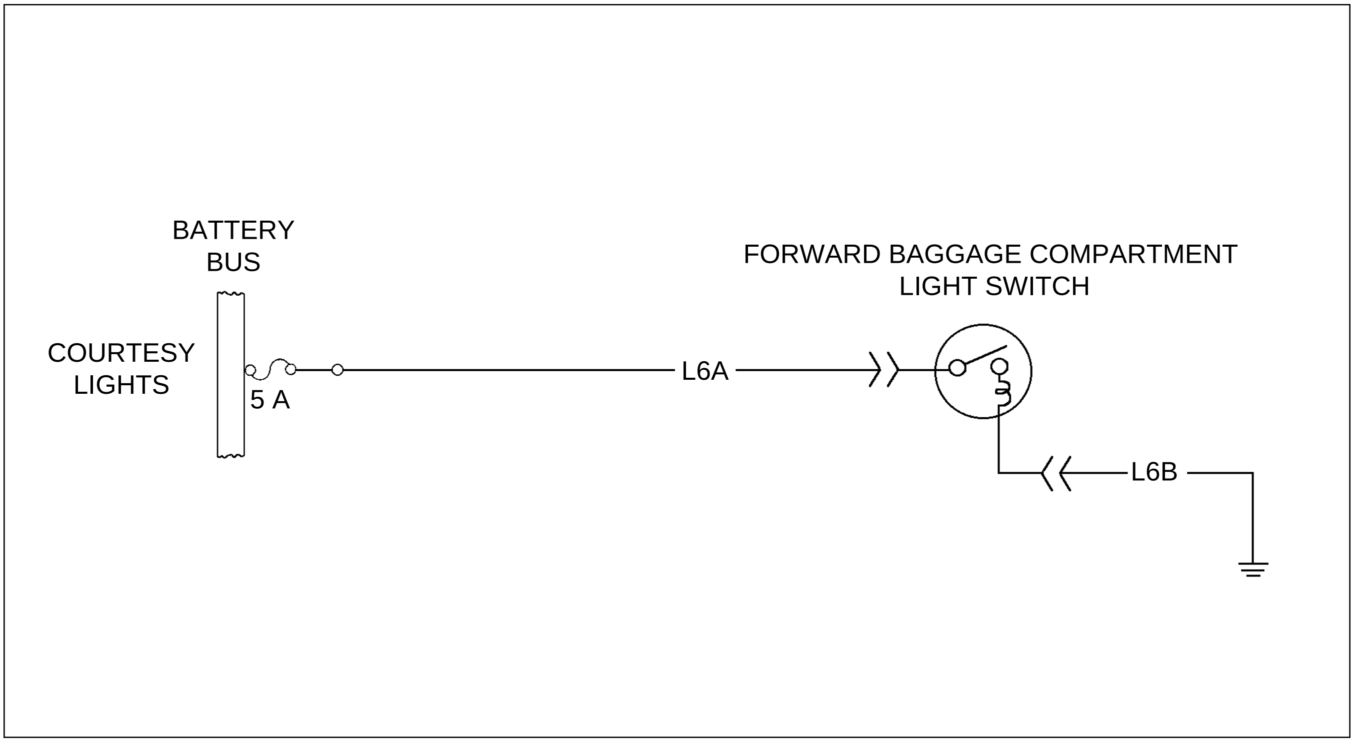

Figure 91-74. Baggage Compartment Light - Seneca III (28 Volt System)
(Includes s/n 3448001 thru 3448037)

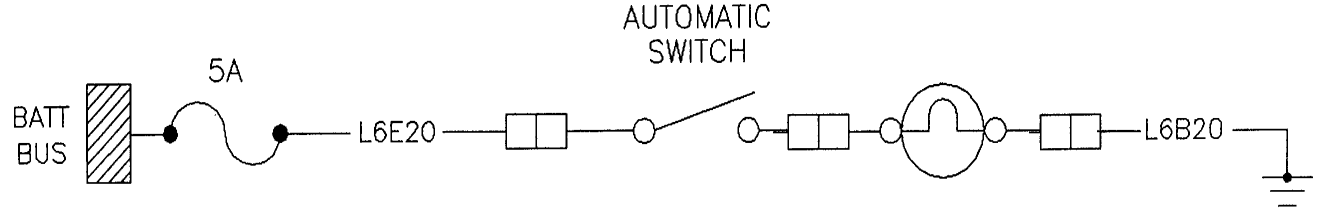

Figure 91-75. Baggage Compartment Light - Seneca IV

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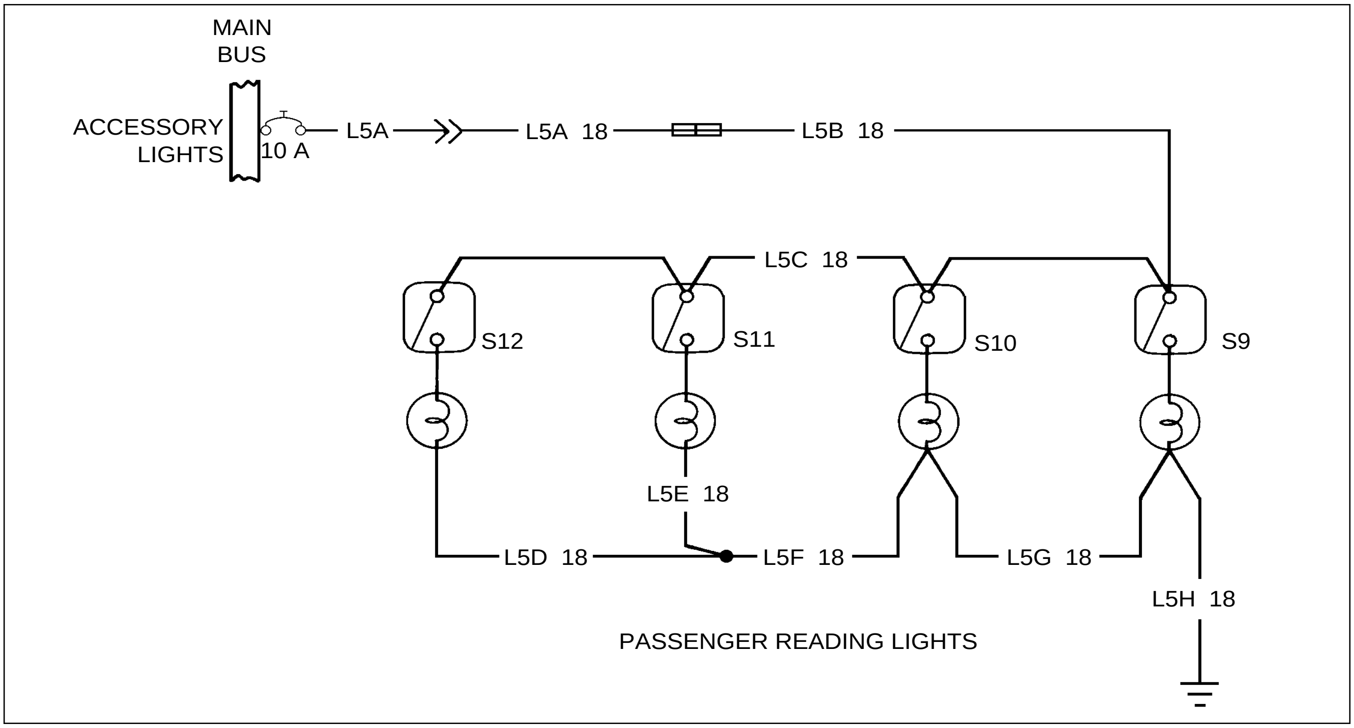

Figure 91-76. Cabin Lights - Seneca III (14 Volt System)

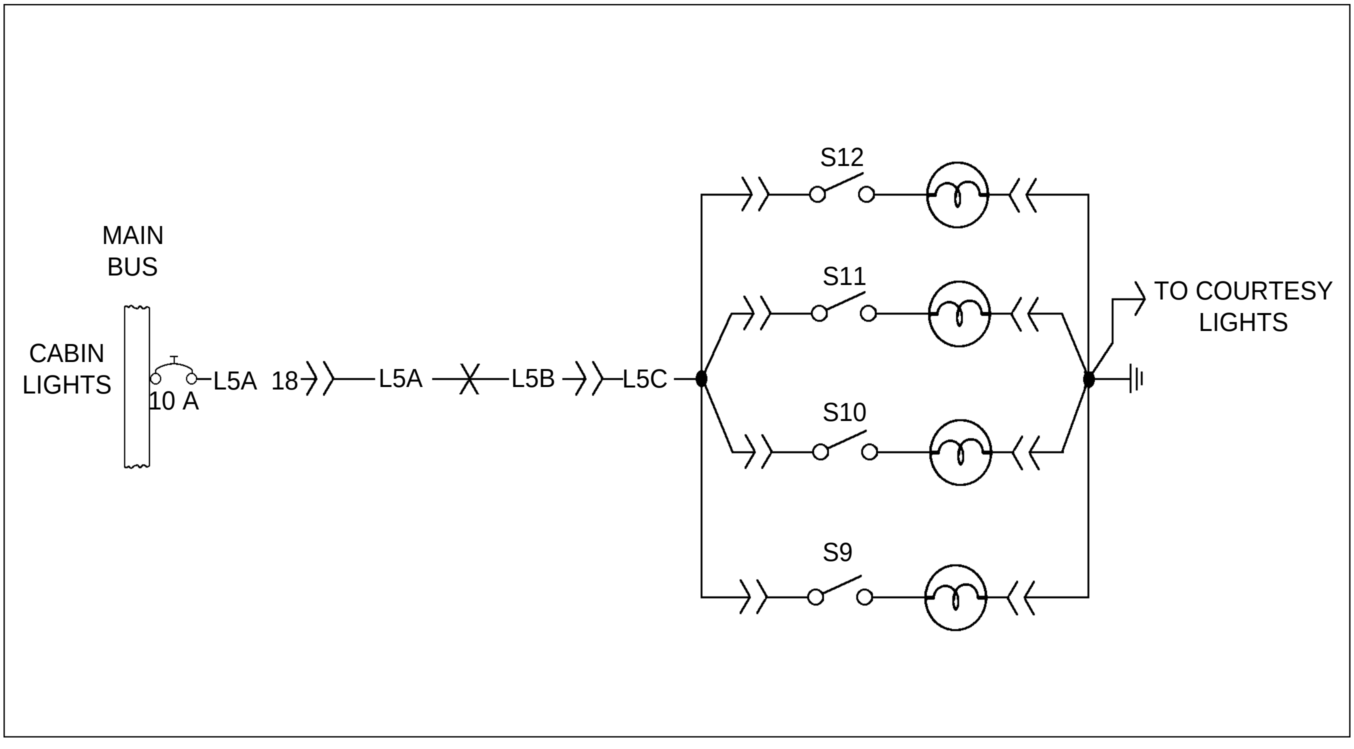

Figure 91-77. Cabin Lights - Seneca III (28 Volt System)
(Includes s/n 3448001 thru 3448037)

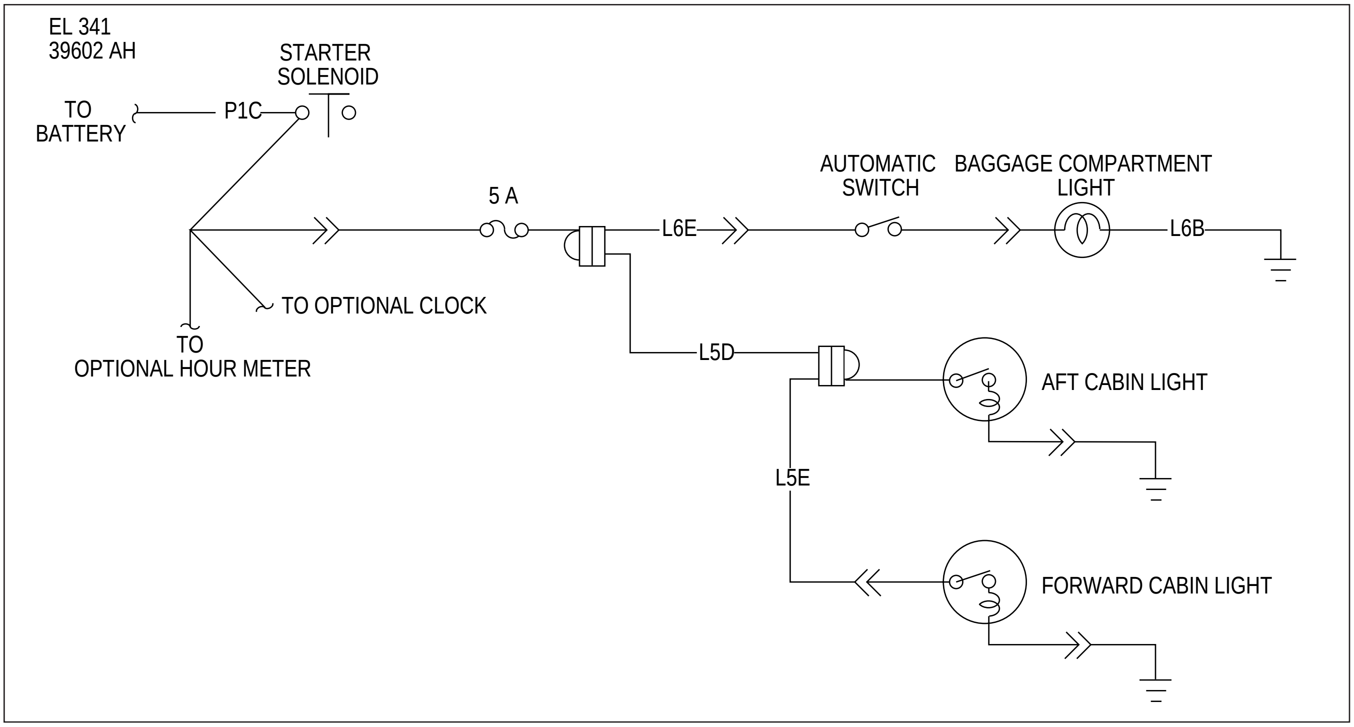

Figure 91-78. Courtesy Lights - Seneca III (14 Volt System)

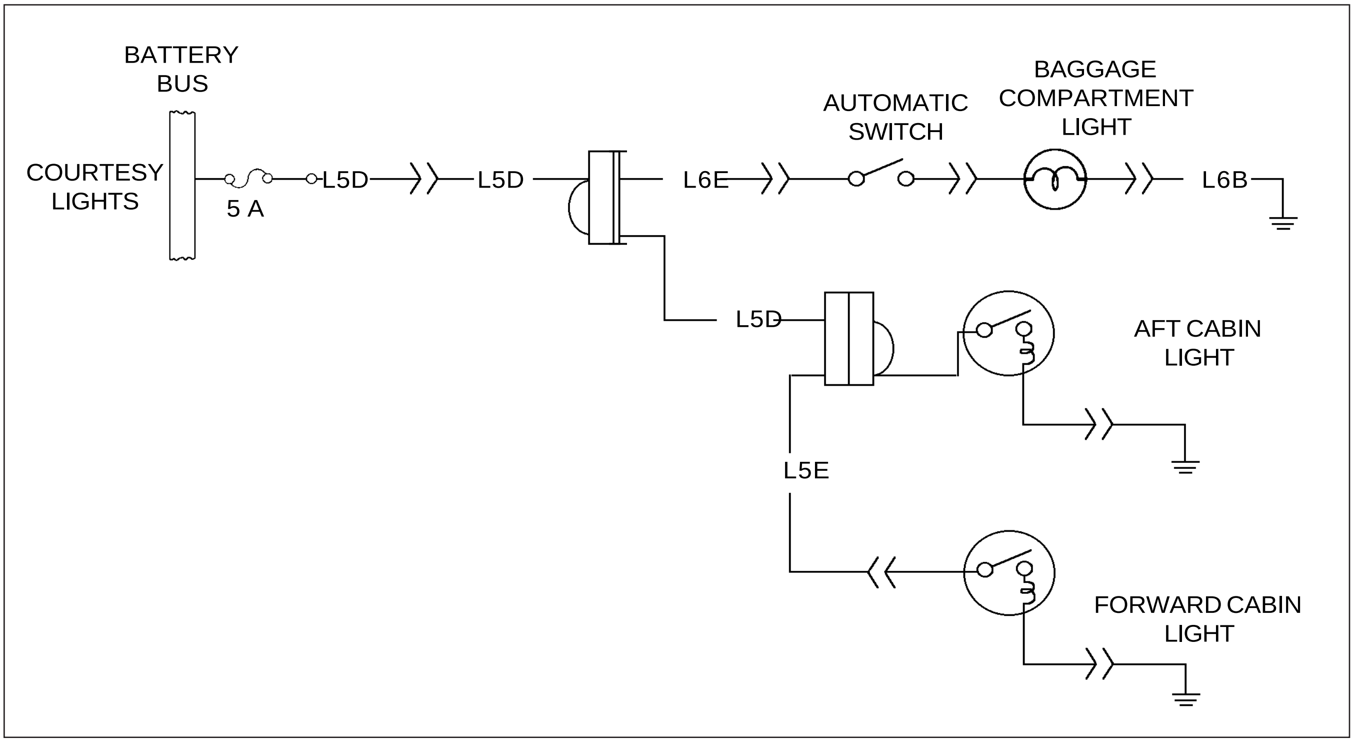

Figure 91-79. Courtesy Lights - Seneca III (28 Volt System)
(Includes s/n 3448001 thru 3448037)

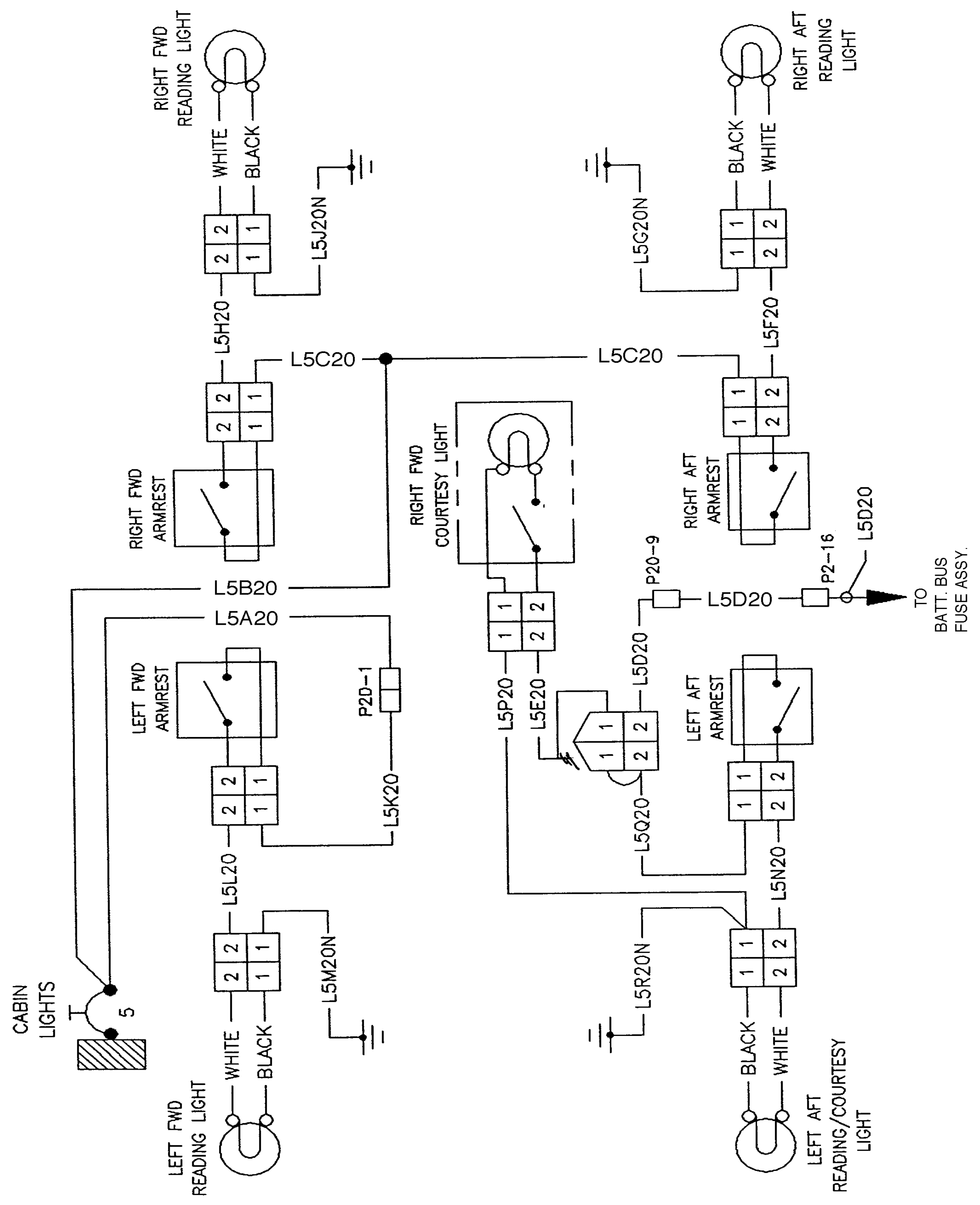

Figure 91-80. Courtesy Lights - Seneca IV

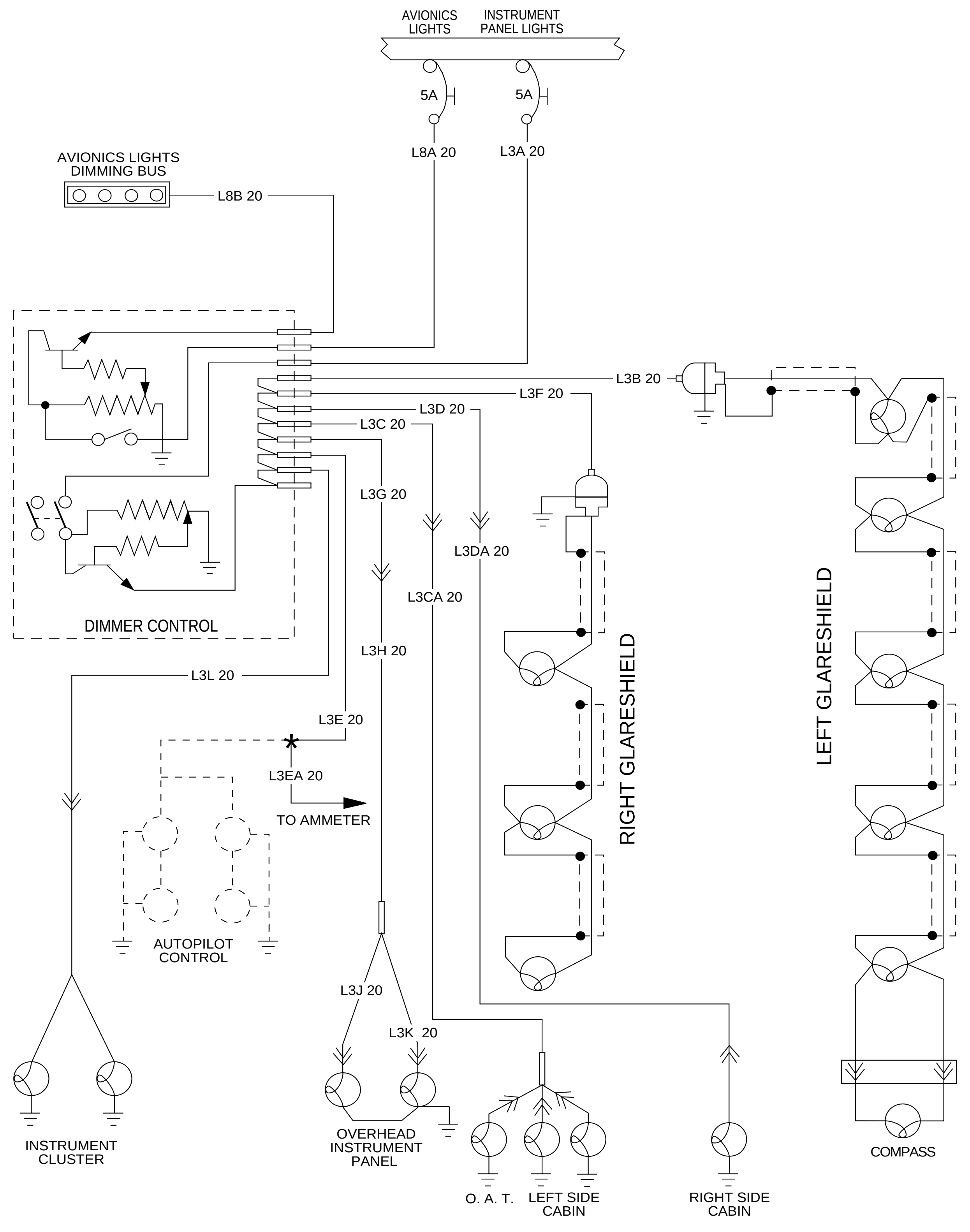

Figure 91-81. Flight Instruments / Avionics Lights - Seneca III (14 Volt System)

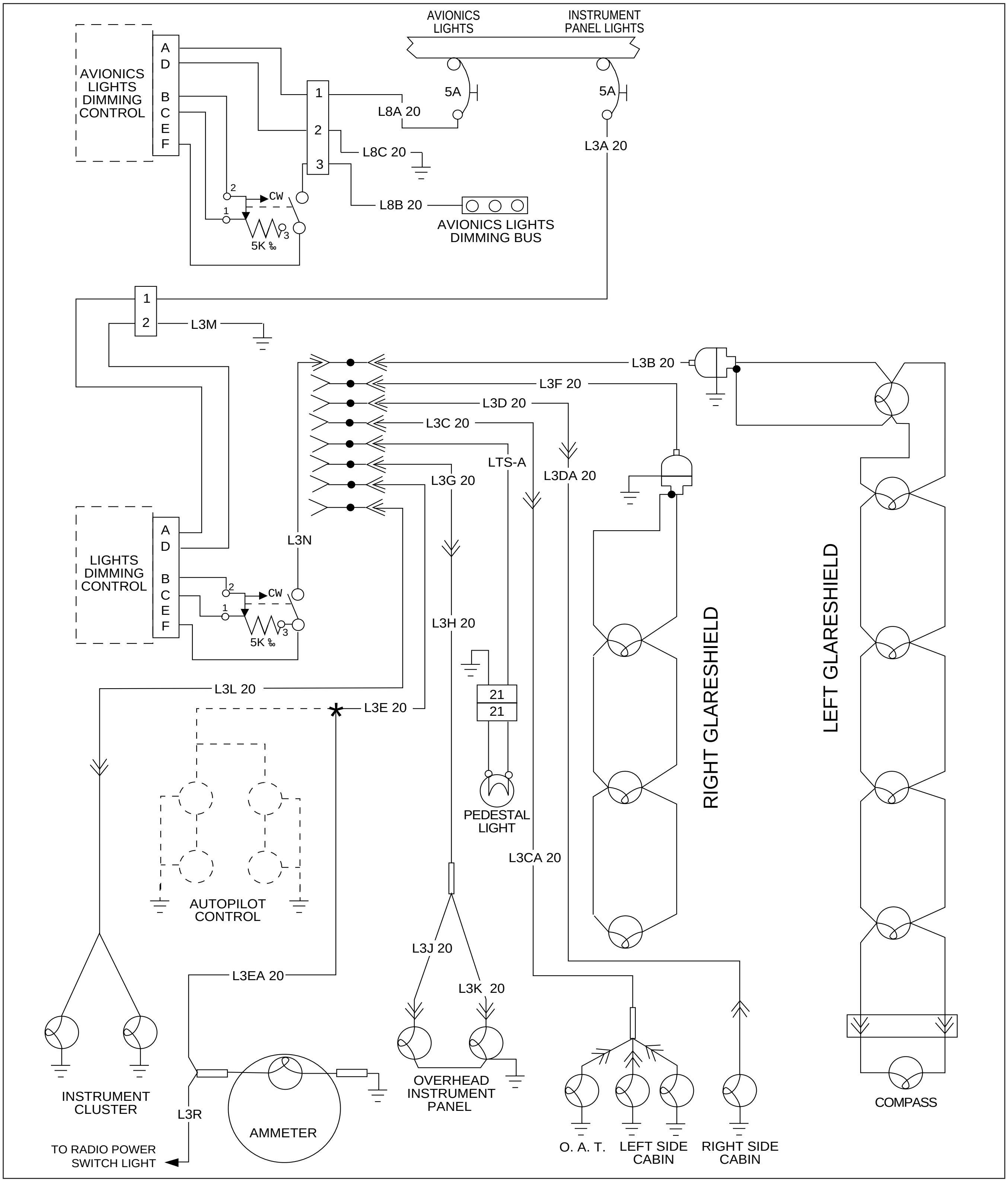

Figure 91-82. Flight Instruments / Avionics Lights - Seneca III (28 Volt System)
(Includes s/n 3448001 thru 3448037)

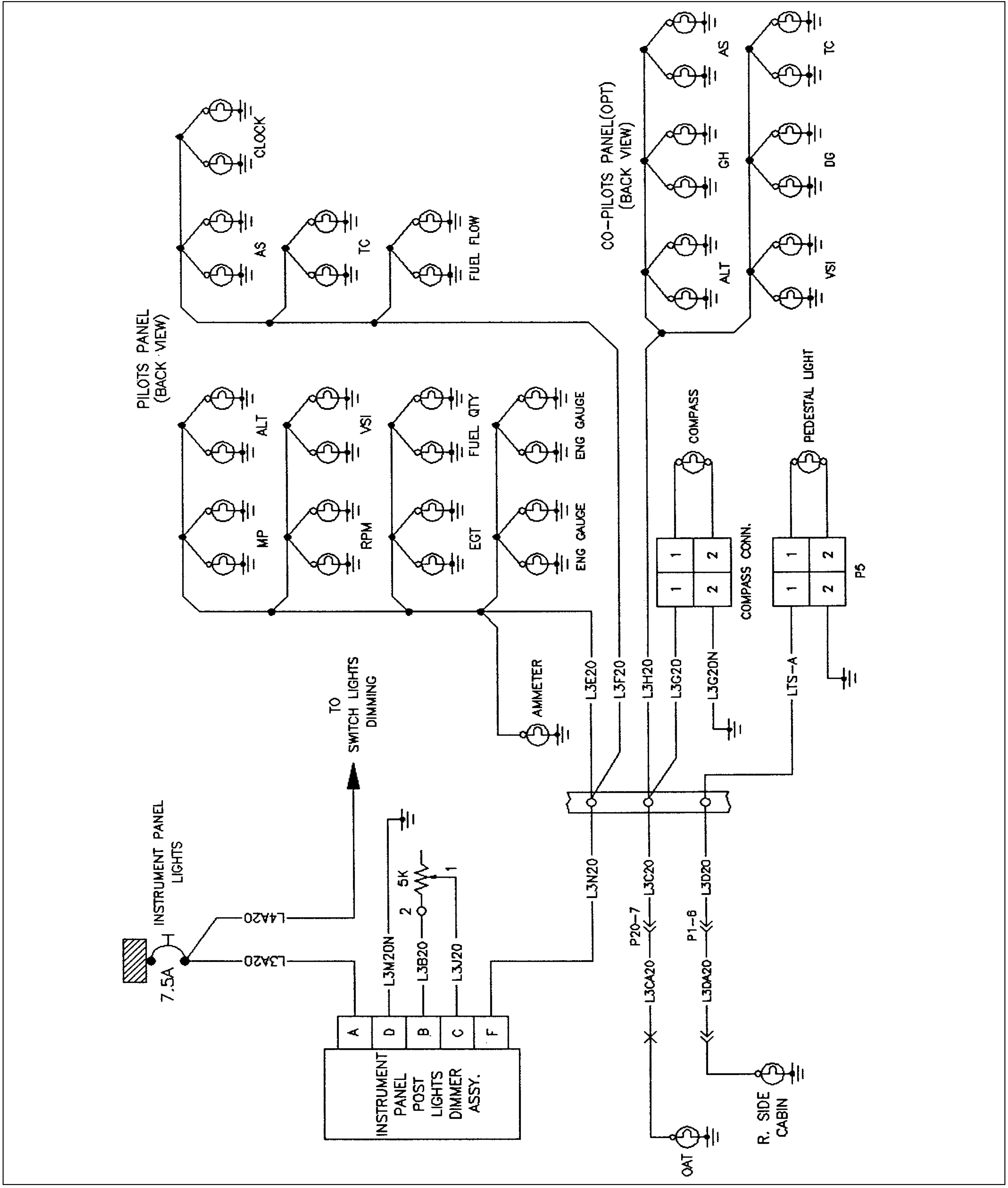

Figure 91-83. Instrument Panel Post Lights - Seneca IV

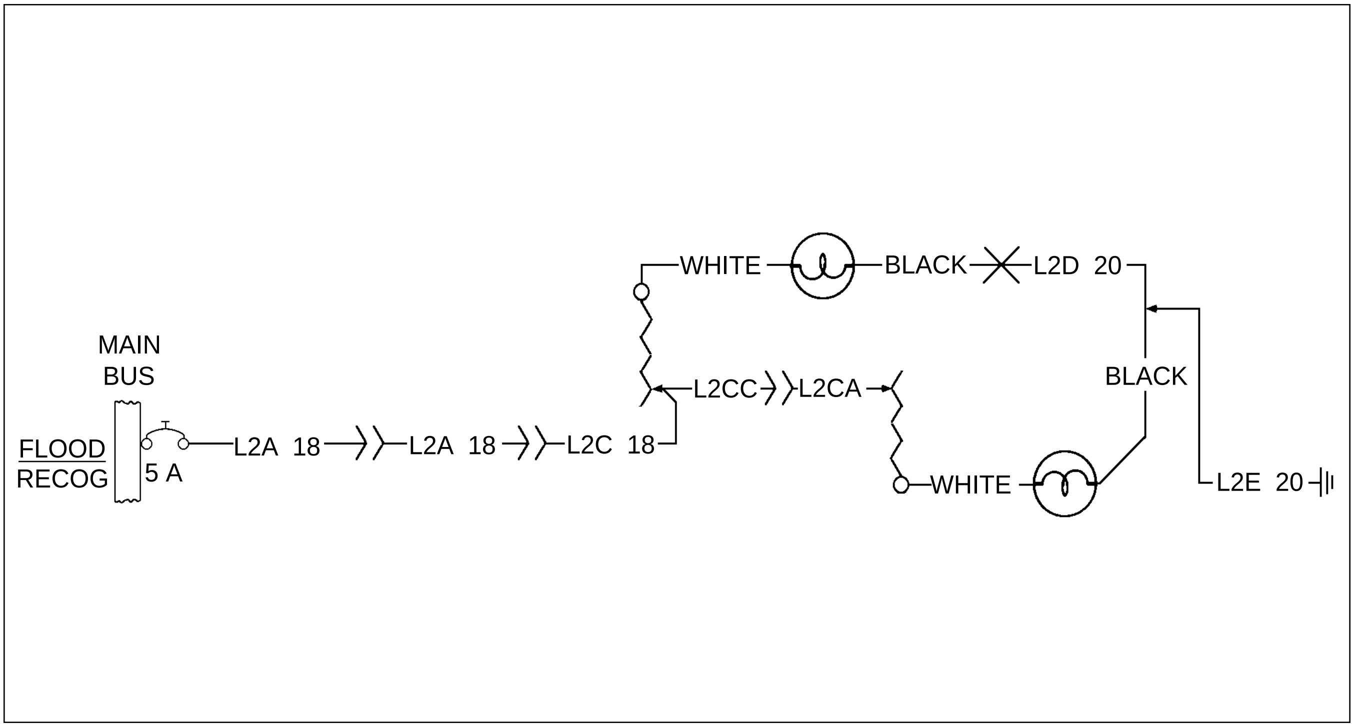

Figure 91-84. Overhead Flood Lights - Seneca III (14 Volt System)

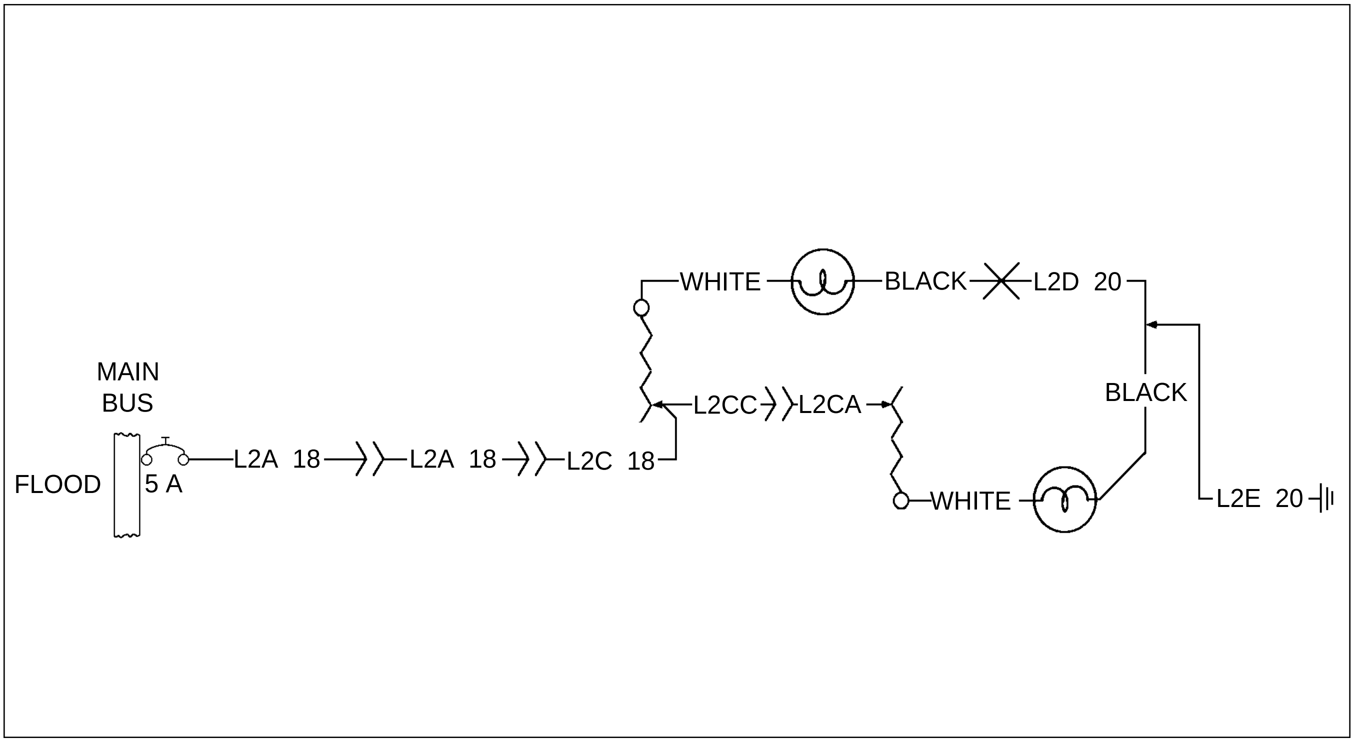

Figure 91-85. Overhead Flood Lights - Seneca III (28 Volt System)
(Includes s/n 3448001 thru 3448037)

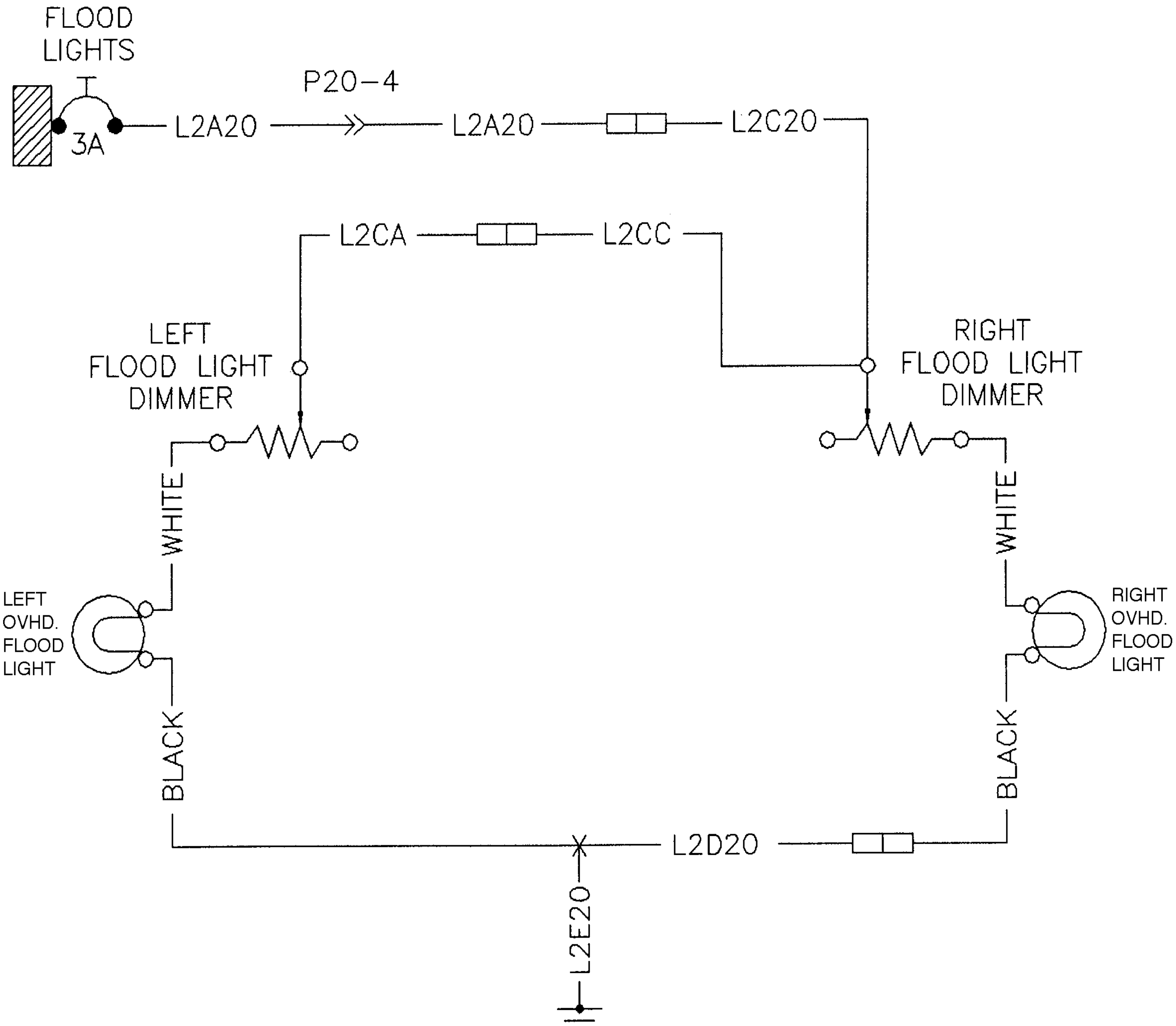

Figure 91-86. Overhead Flood Lights - Seneca IV

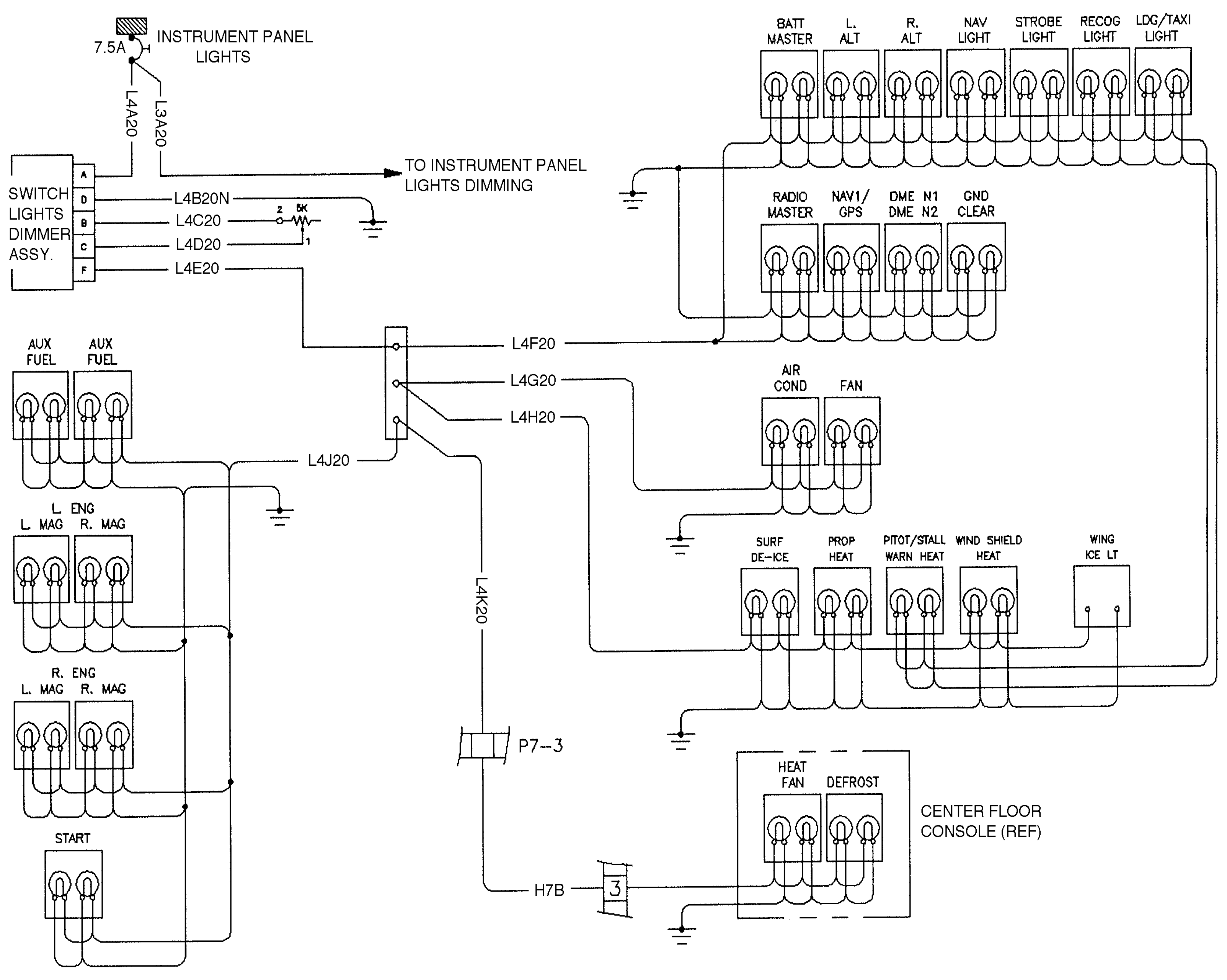

Figure 91-87. Switch Lights Dimming - Seneca IV

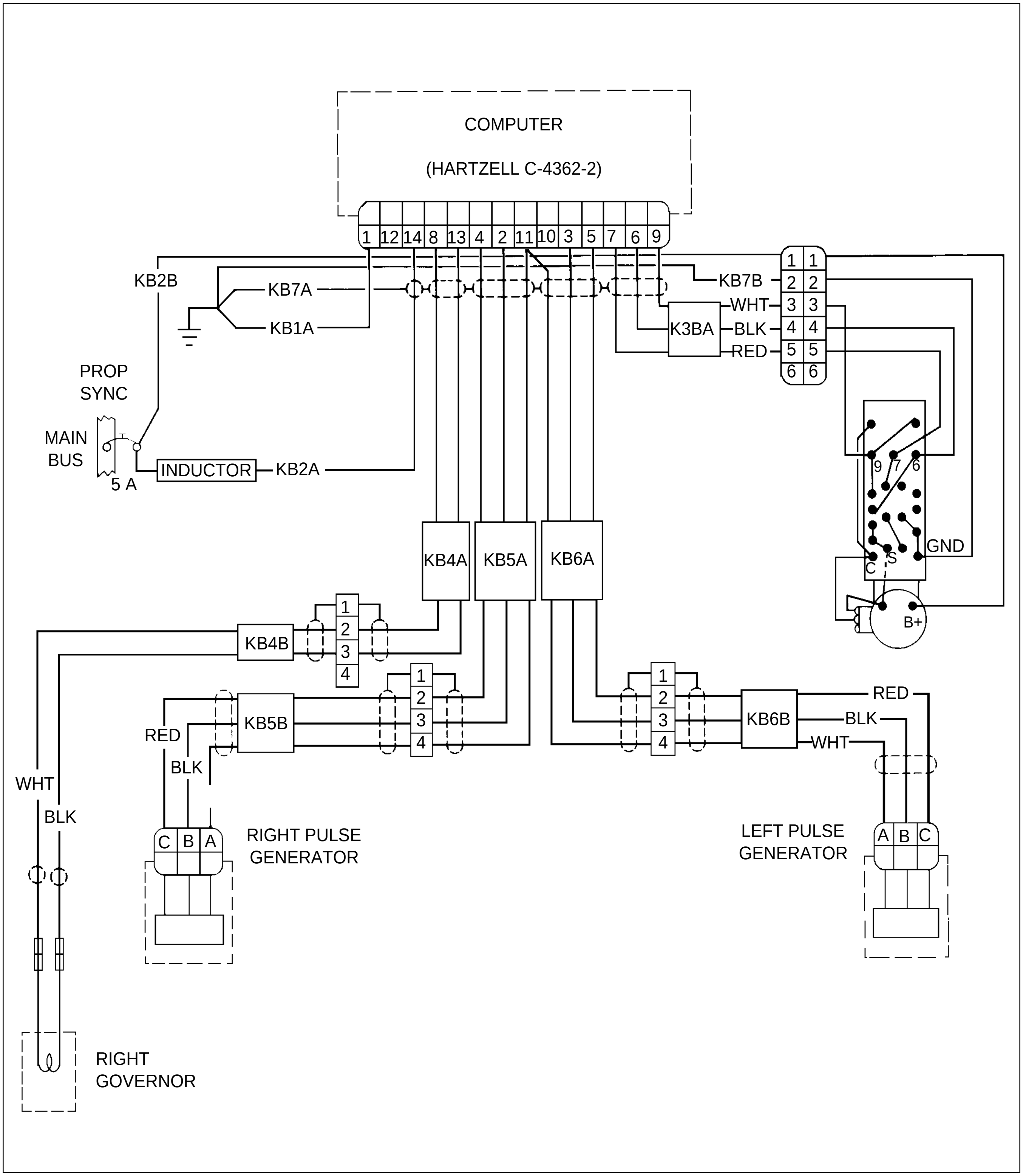

Figure 91-88. Propeller Synchrophaser - Seneca III (14 Volt System)
(Includes s/n 34-8133002 thru 34-8133172)

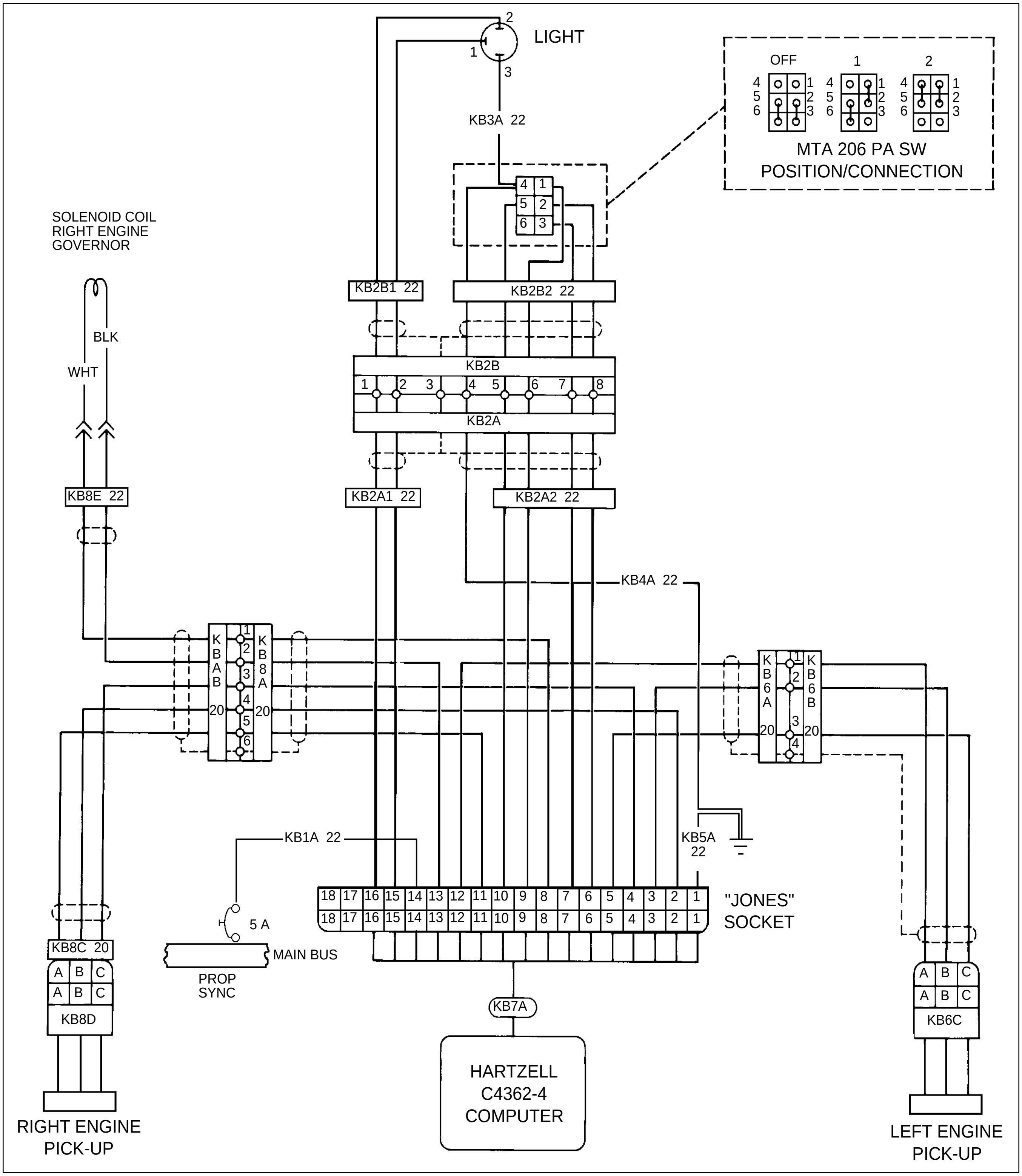

Figure 91-89. Propeller Synchrophaser - Seneca III (14 Volt System)
(Includes s/n 34-8133001, 34-8133173 thru 34-8633031, 3433001 thru 3433208)

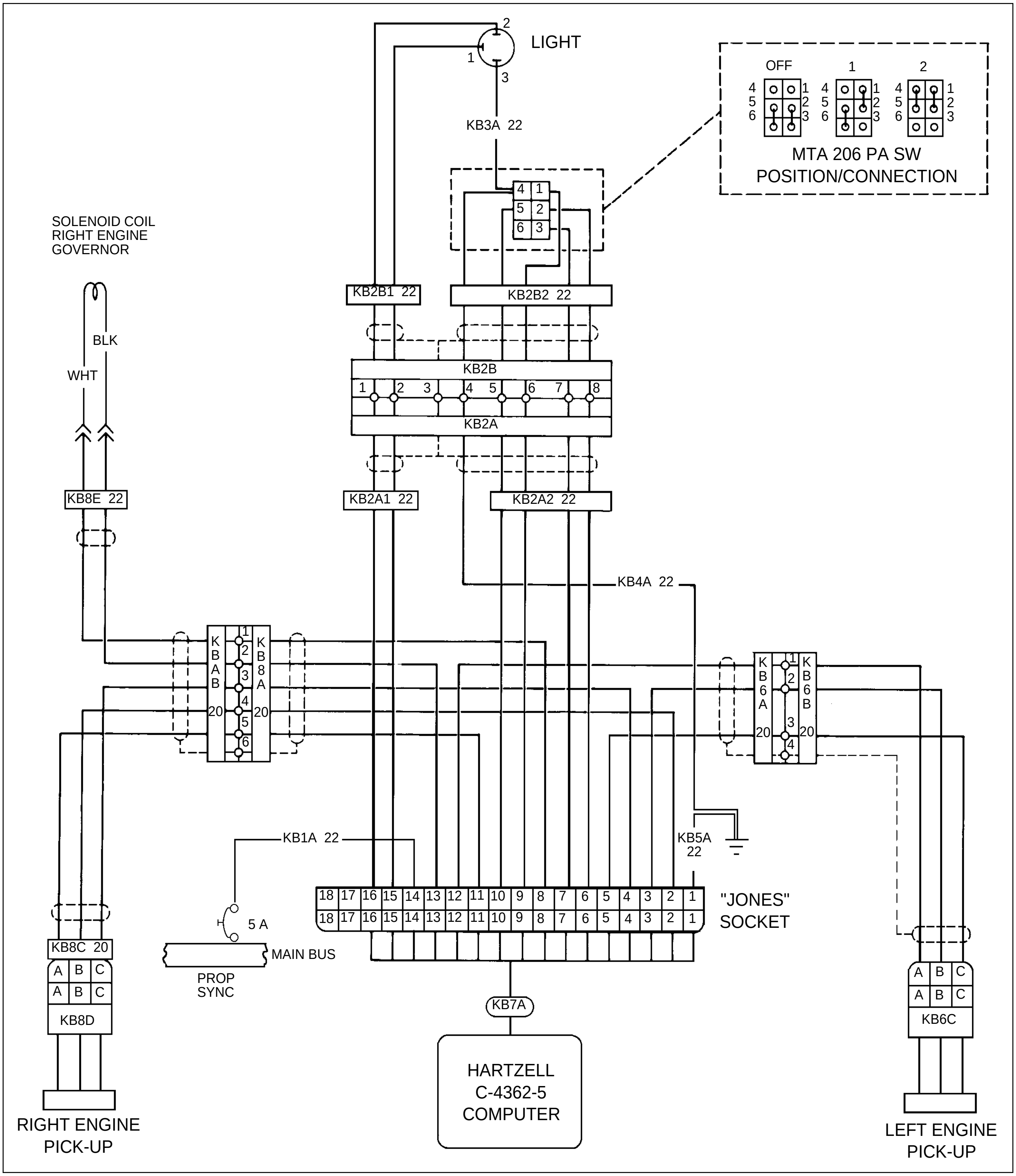

Figure 91-90. Propeller Synchrophaser - Seneca III (28 Volt System)

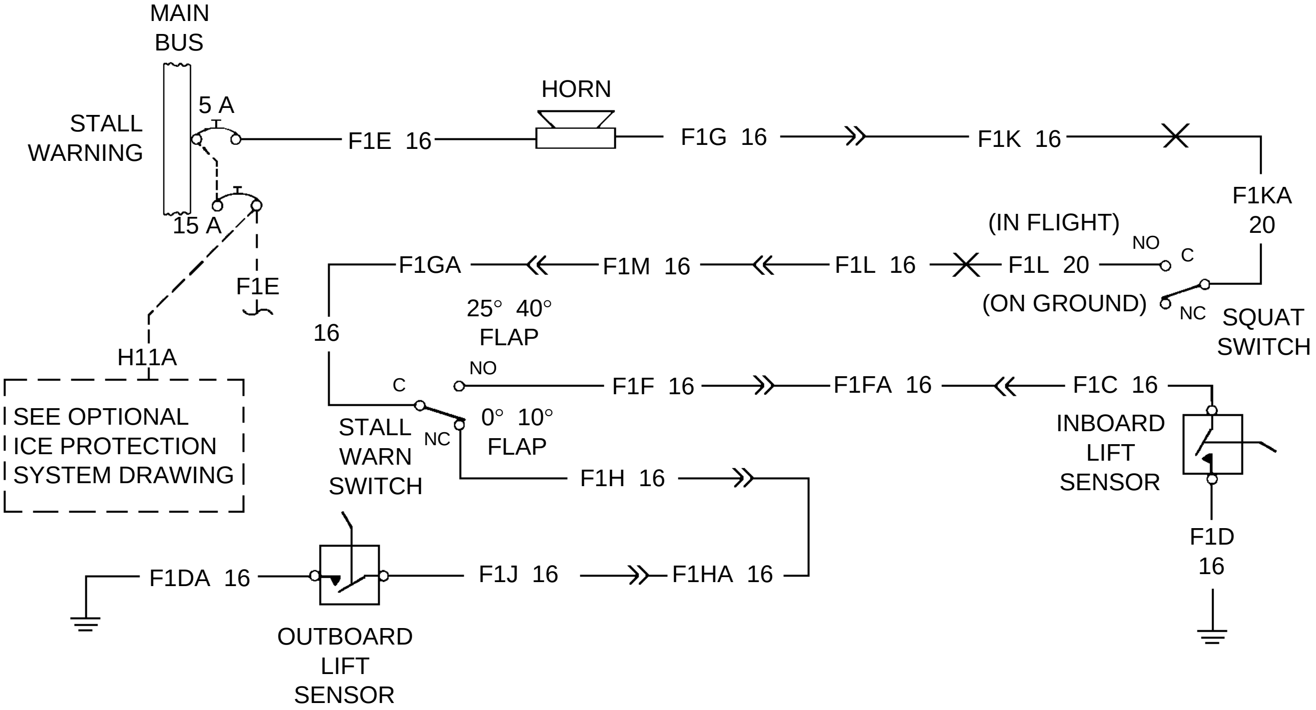

Figure 91-91. Stall Warning - Seneca III (14 Volt System)

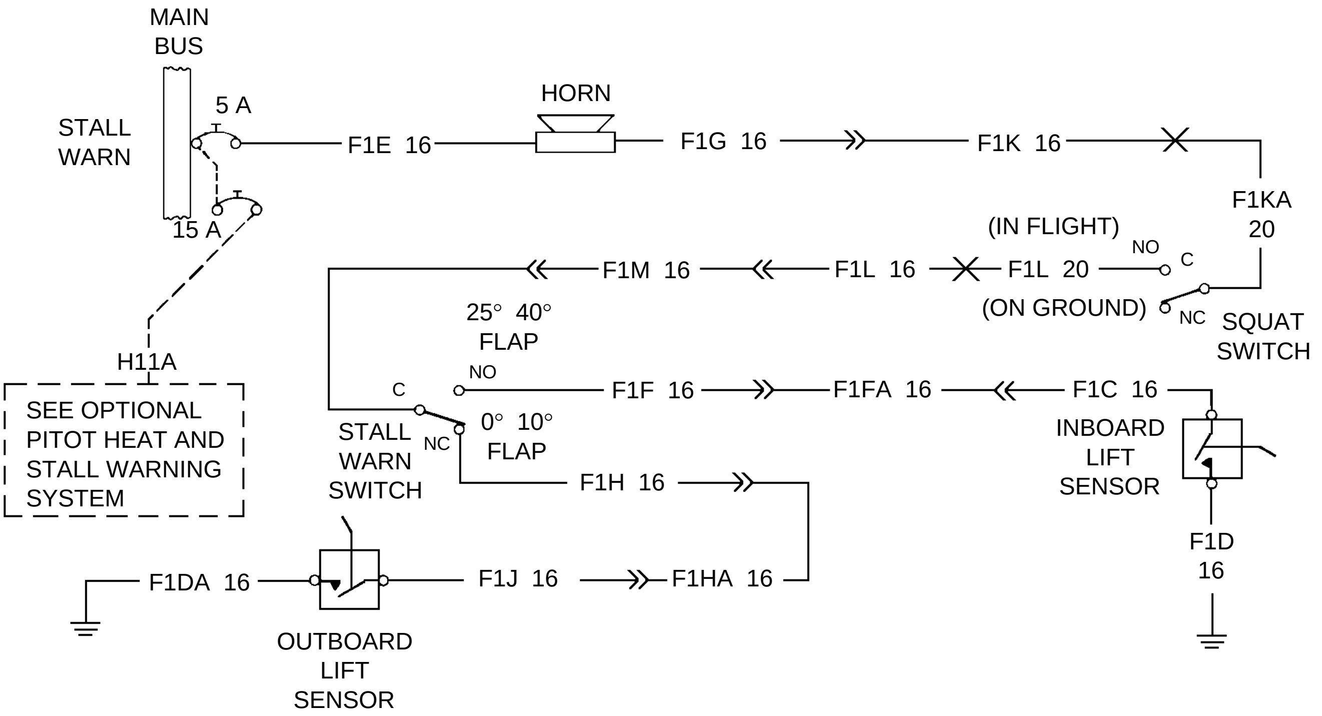

Figure 91-92. Stall Warning - Seneca III (28 Volt System)
(Includes s/n 3448001 thru 3448037)

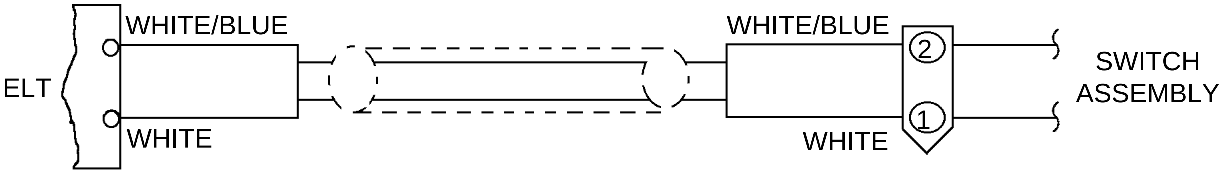

Figure 91-93. Emergency Locator Transmitter - ELT-10

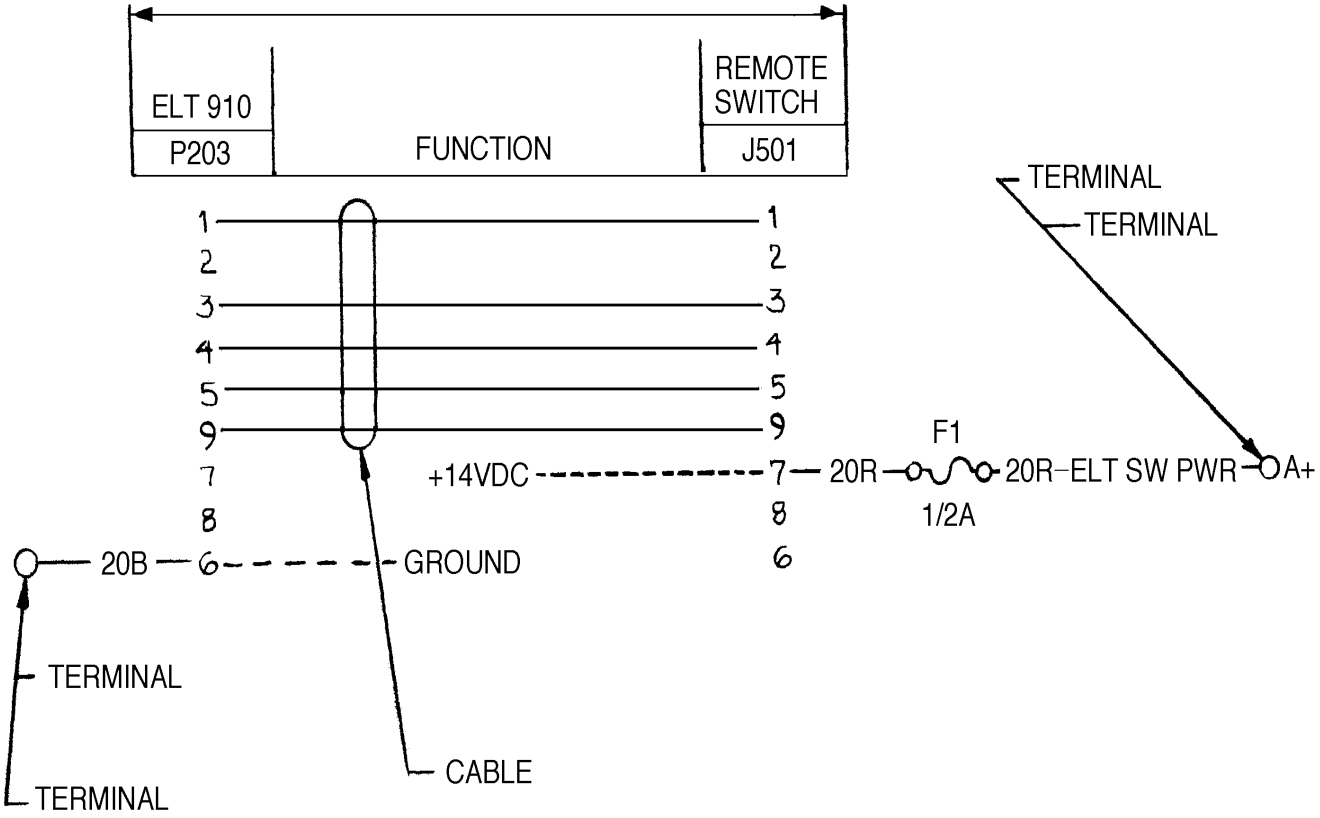

Figure 91-94. Emergency Locator Transmitter - ELT-910 (14 Volt System)

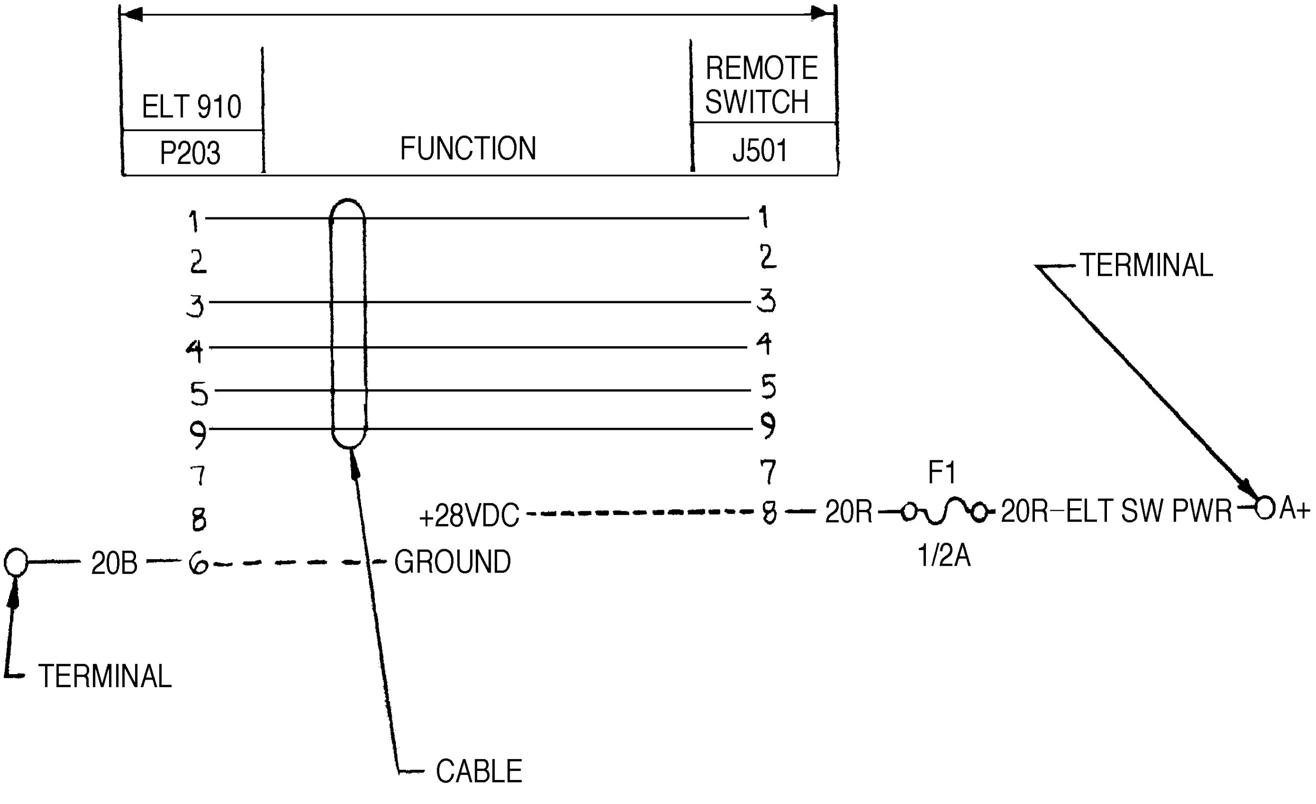

Figure 91-95. Emergency Locator Transmitter - ELT-910 (28 Volt System)

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CHAPTER

95

SPECIAL EQUIPMENT

CHAPTER 95 - SPECIAL EQUIPMENT

TABLE OF CONTENTS/EFFECTIVITY

SPECIAL TOOLS

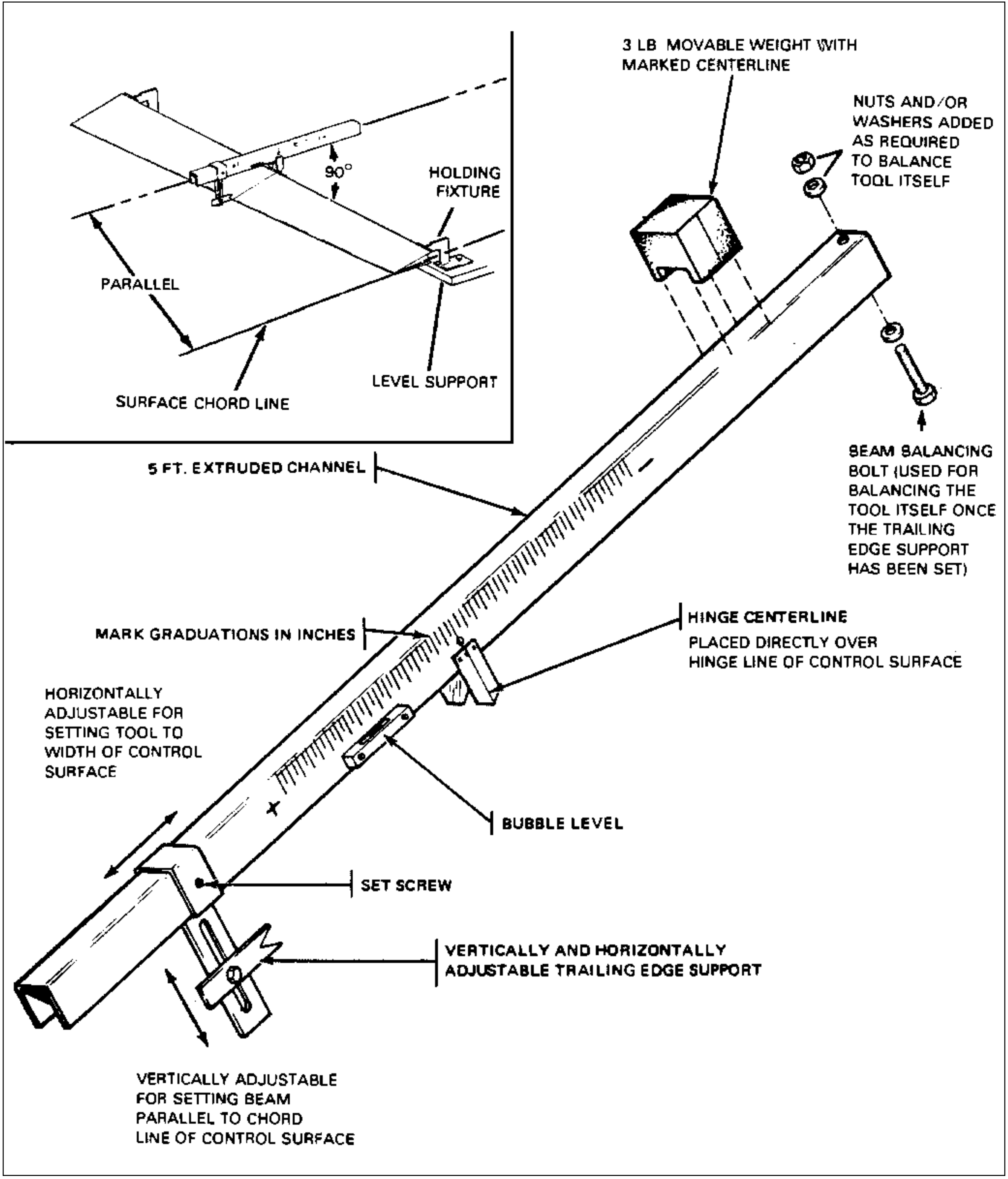
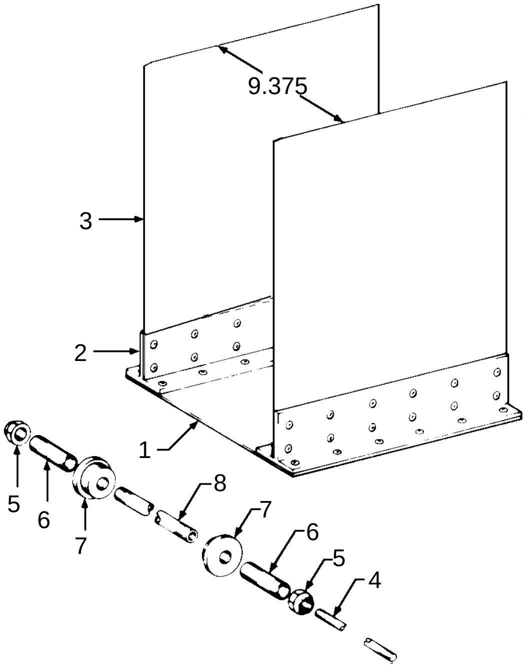


Figure 95-1. Control Surface Balancing Tool



The following list of materials were used in making 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	0.125 2024 T3 clad aluminum alloy
-4	1 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 100	Richlight, phenolic or aluminum
	2 ea.	Bushing	2.240 x 1.37 x 1.00	Richlight, pheonolic 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.	

Figure 95-2. Tire Balancer Fixture

TIRE BALANCER BUILDING INSTRUCTIONS

1. Chamfer top edges of -3 sides, leaving 1/16 inch flat on top inboard edge. Rivet -2 tee's to -3 sides using AN470-AD5 rivets 2" spacing. Use AN426-AD5 rivets 2" 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.
2. The -4 axle must slide through the -8 pipe. The -5 nuts were made by reaming the existing threads in the AN365-624 nuts with an R drill, then tapping with a 1/8-27 pipe tap.
3. The -6 spacers were made from 1/2 inch aluminum tubing. The two lengths of spacers are suitable for balancing most any aircraft wheel.
4. The -7 bushings may be made from one inch Richlite 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. Ream the pilot hole to slide over the -8 pipe threads.
5. The -8 pipe was made from a piece of 1/8 inch black pipe and threaded with 1/8-27 pipe die. Thread 3 inches in from each end of the pipe.

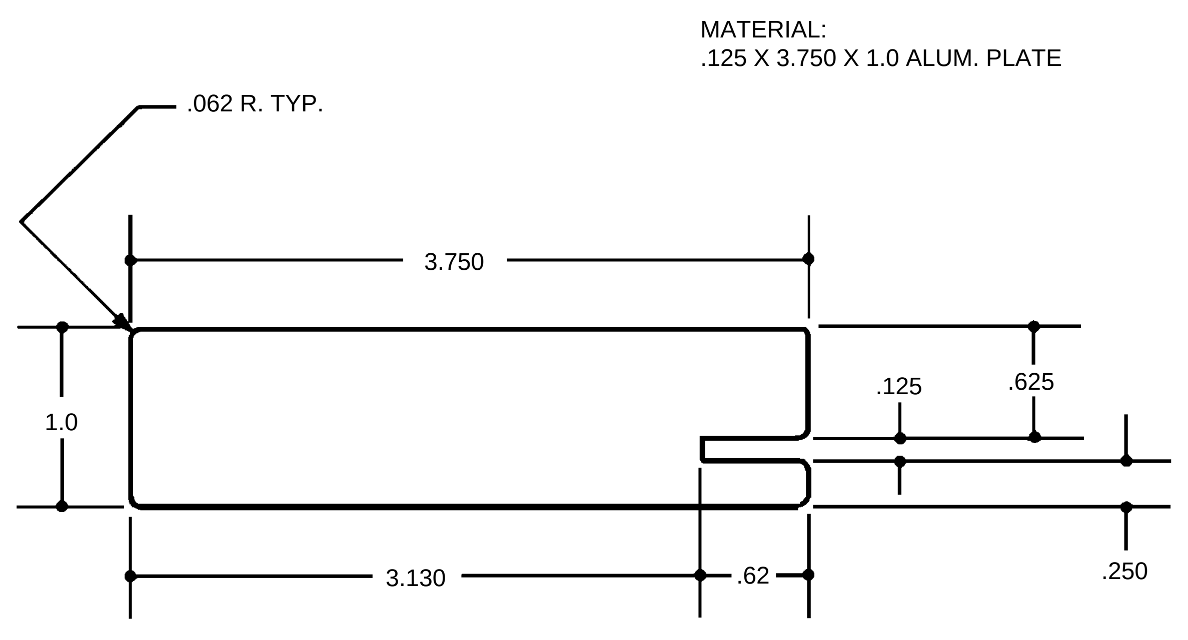
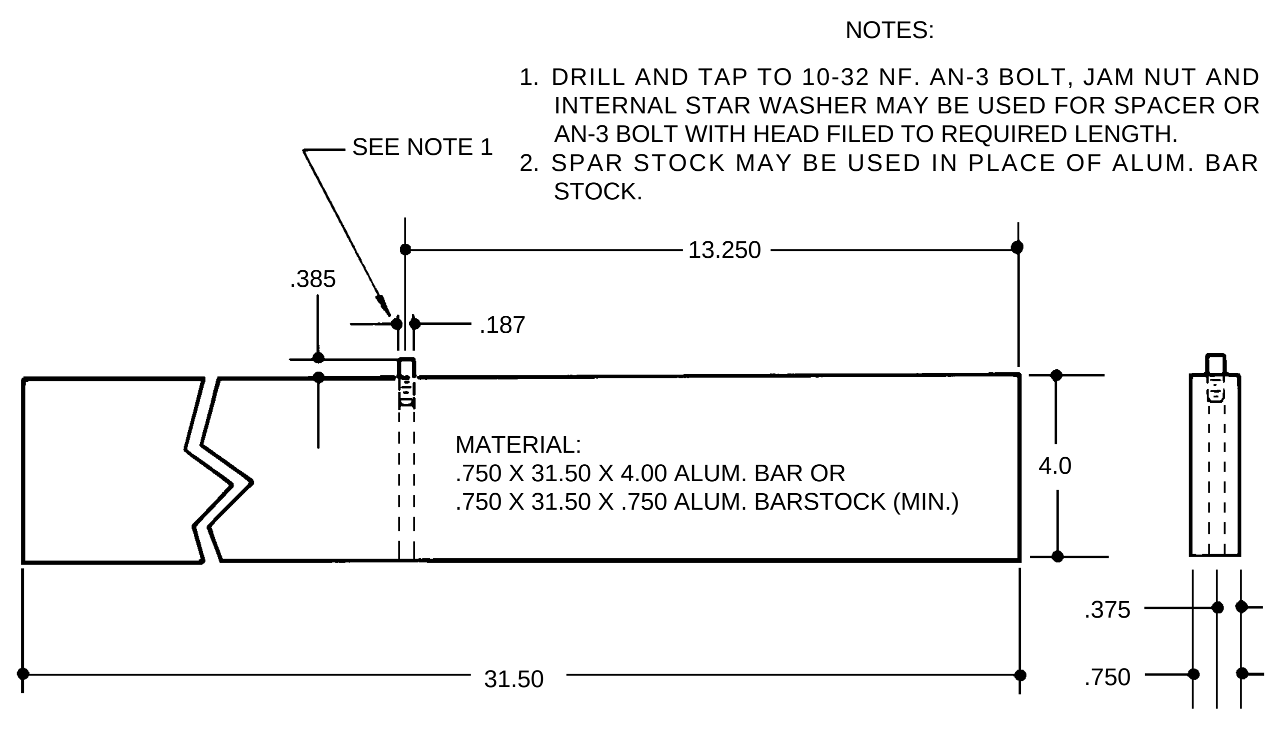

MATERIAL:
.125 X 3.750 X 1.0 ALUM. PLATE

Figure 95-3. Aileron Bellcrank Rigging Tool


NOTES:

1. DRILL AND TAP TO 10-32 NF. AN-3 BOLT, JAM NUT AND INTERNAL STAR WASHER MAY BE USED FOR SPACER OR AN-3 BOLT WITH HEAD FILED TO REQUIRED LENGTH.
2. SPAR STOCK MAY BE USED IN PLACE OF ALUM. BAR STOCK.

MATERIAL:
.750 X 31.50 X 4.00 ALUM. BAR OR
.750 X 31.50 X .750 ALUM. BARSTOCK (MIN.)

Figure 95-4. Aileron and Flap Rigging Tool

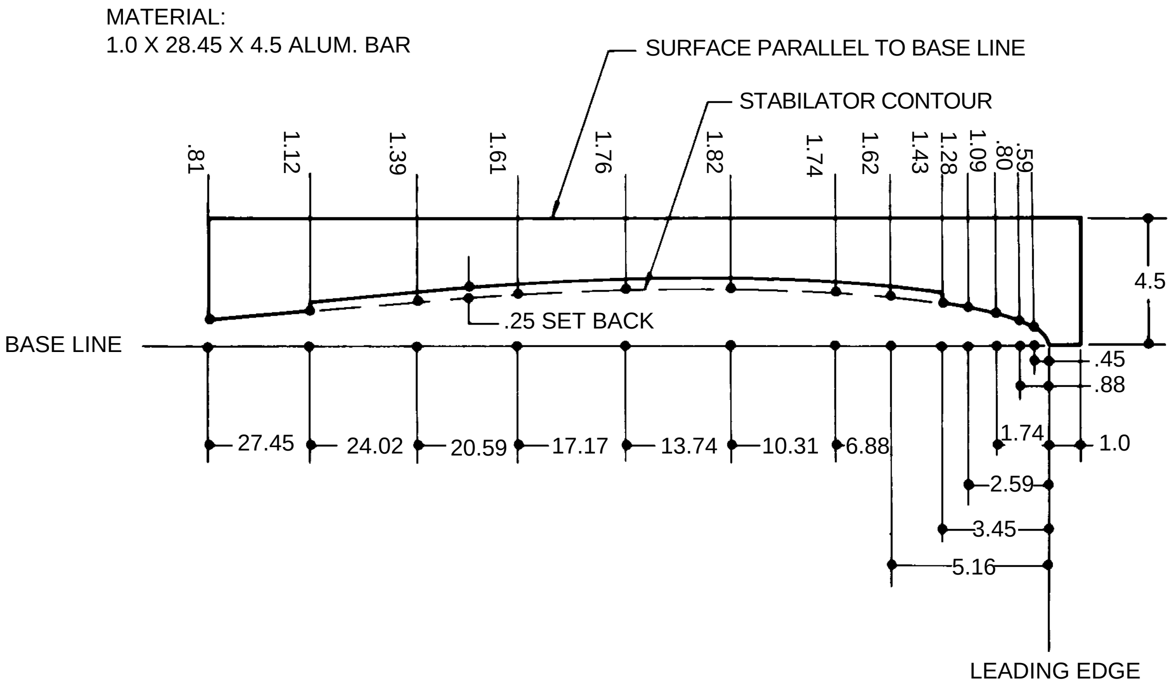


Figure 95-5. Stabilator Rigging Tool

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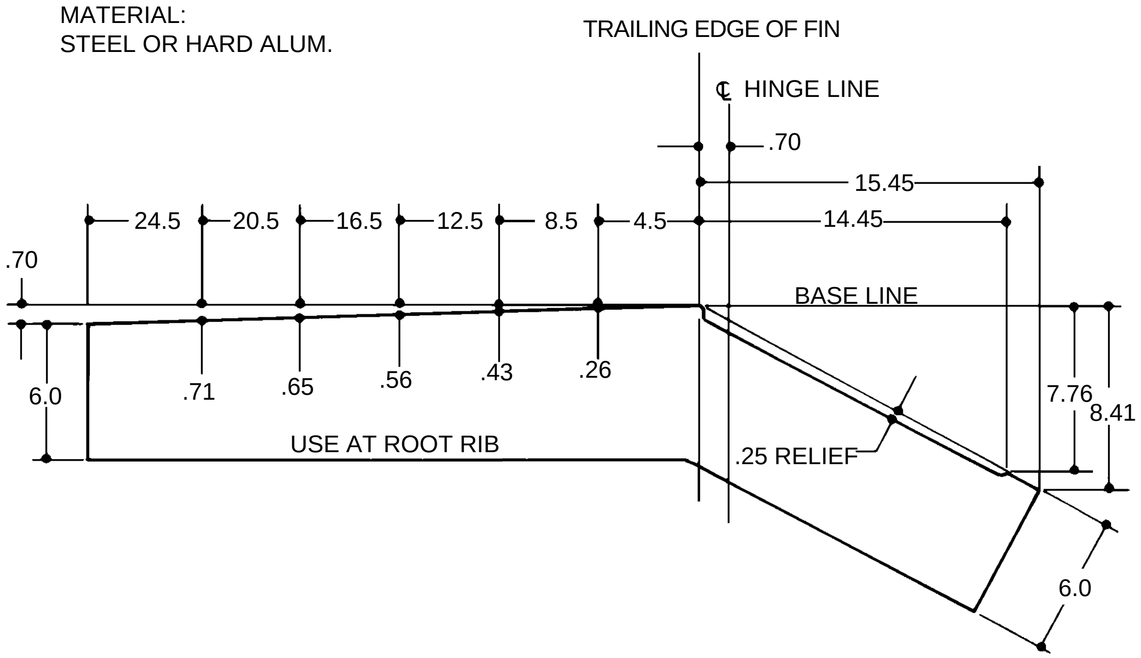
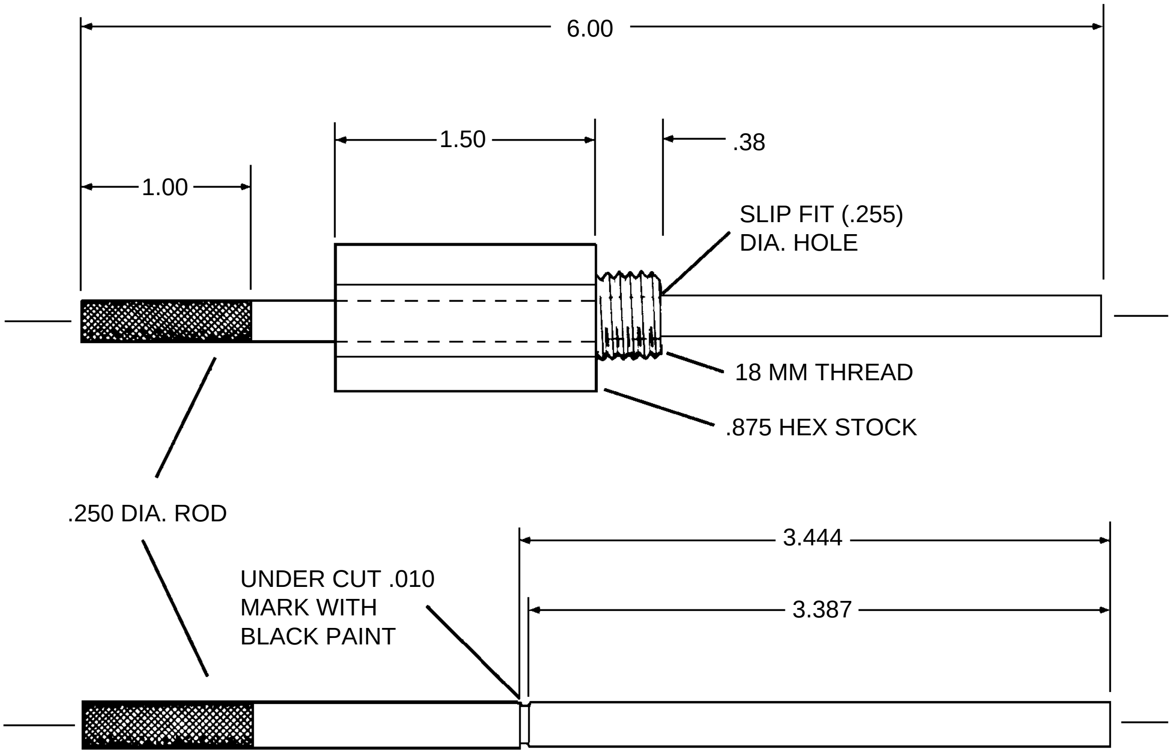


Figure 95-6. Rudder Rigging Tool

GAUGE FOR LOCATING GROUND ELECTRODE IN JANITROL HEATERS



MATERIAL CAN BE SAE TYPE 303, 321 OR ST. OR ALUMINUM - CASE HARDENED

NOTE

THIS TOOL CAN BE PURCHASED FROM PIPER AIRCRAFT CORPORATION UNDER PIPER PART NUMBER 55998-2.

Figure 95-7. Heater Plug Gap Adjustment Tool

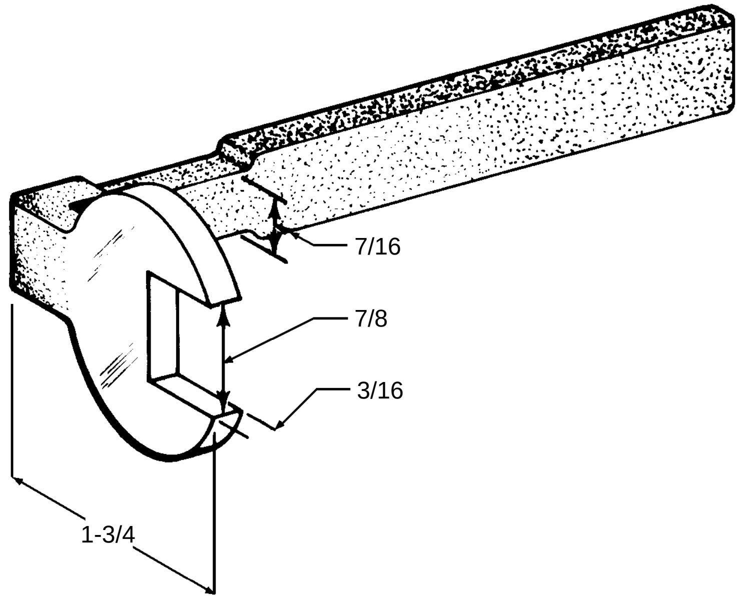


Figure 95-8. Fabricated Tool for Baggage Door Lock

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GRIDS 5G18 THROUGH 5H24
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CHAPTER

5

TIME LIMITS / MAINTENANCE CHECKS

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CHAPTER 5 - TIME LIMITS/MAINTENANCE CHECKS

TABLE OF CONTENTS/EFFECTIVITY

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GENERAL

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 schedule for the PA-44-180 Seminole is 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.

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 Distributors 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. For repair or replacement instructions of those components found to be unserviceable during inspections, refer to the chapter(s) covering the applicable airplane system.

WARNING: GROUND THE APPROPRIATE MAGNETO PRIMARY CIRCUIT (P LEAD), BEFORE PERFORMING ANY MAINTENANCE OPERATION ON EITHER 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 Piper Aircraft Corporation built PA-34-220T Senca III / IV's is provided herein as an Annual / 100 Hour Inspection. A Progressive Inspection Program is available from Piper Distributors in a separate manual form.

Piper inspection programs comply with the 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 this aircraft, utilizing 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.

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 test 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.”

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 is available from Piper Dealers:

P/N 761-753, 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 761-753) referenced above is not a stand-alone document. It constitutes 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.

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 Inspections, 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 various columns, they will be listed as a special inspection in 5-30-00.

(2) Refer to the applicable subject 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 as:

P/N 230-1061, Inspection Report.

NOTE: Service centers conducting Part 91 Annual / 100 Hour Inspections can use the Inspection Report Form (P/N 230-1061), 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/section - 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

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

NATURE OF INSPECTION	Inspection Interval (Hrs)			
	L	R	50	100

A. PROPELLER GROUP

WARNING: 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.

	L	R	50	100
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	O	O		O
10. Check propeller (Hartzell) air pressure	O	O	O	O

B. ENGINE GROUP

WARNING: GROUND APPROPRIATE MAGNETO PRIMARY CIRCUIT BEFORE WORKING ON EITHER ENGINE.

WARNING: REFER TO TELEDYNE CONTINENTAL MOTORS SERVICE BULLETIN 93-12, LATEST REVISION, AND AD 93-10-02 PRIOR TO COMPLETING THIS GROUP.

NOTE: Read Notes 5, 7, and 26 prior to completing this group.

	L	R	50	100
1. Remove engine and nacelle cowls	O	O	O	O
2. Clean and inspect cowling for cracks, distortion, and loose or missing fasteners	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
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
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 7.)	O	O	O	O

5. SCHEDULED MAINTENANCE (continued)

B. ENGINE GROUP (continued)

	NATURE OF INSPECTION	Inspection Interval (Hrs)			
		L	R	50	100
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 8.)	O	O		O
11.	Inspect ignition harness and insulators (high tension leakage and continuity). (See Notes 8 and 17.)	O	O	O	O
12.	Check magneto points for proper clearance (maintain clearance at 0.018 ± 0.006). (See Note 17.)	O	O		O
13.	Inspect magneto for oil seal leakage	O	O		O
14.	Inspect breaker felts for proper lubrication	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.)	O	O		O
17.	Clean injector nozzles as required. (Clean with acetone only.)	O	O	O	O
18.	Inspect induction air box valve and inspect for excessive wear or cracks, replace defective parts	O	O		O
19.	Inspect fuel injector attachments for loose hardware	O	O		O
20.	Inspect engine primer system for operation, security, and leaks. (See Note 24.)	O	O		O
21.	Inspect intake seals for leaks and clamps for tightness	O	O		O
22.	Inspect all air inlet duct hoses (replace as required)	O	O		O
23.	Inspect condition of flexible fuel lines	O	O		O
24.	Inspect fuel system for leaks	O	O		O
25.	Inspect condition and operation of fuel pumps (engine driven and electric)	O	O		O
26.	Inspect pneumatic pumps and lines			O	O
27.	Change vacuum regulator filter	O	O		O
28.	Inspect throttle, alternate air, mixture, and propeller governor controls for security, travel, and operating condition	O	O		O
29.	Inspect exhaust stacks, connections, and gaskets (replace gaskets as required)	O	O	O	O
30.	Inspect breather tubes for obstructions and security	O	O		O
31.	Inspect crankcase for cracks, leaks, and security of seam bolts	O	O		O
32.	Inspect engine mounts for cracks and loose mountings	O	O		O
33.	Inspect rubber engine mount bushings for deterioration (replace as required)	O	O		O
34.	Inspect all engine baffles	O	O		O
35.	Inspect firewall seals	O	O		O

5. **SCHEDULED MAINTENANCE** (continued)

NATURE OF INSPECTION	Inspection Interval (Hrs)			
	L	R	50	100
36. Inspect condition of alternator and starter	O	O		O
37. Inspect all lines, air ducts, electrical leads, and engine attachments for security, proper routing, chafing, cracks, deterioration, and correct installation	O	O	O	O
38. Inspect condition and tension of compressor drive belt	O	O		O
39. Inspect security of compressor mounting	O	O		O
40. Inspect compressor clutch security and condition of wiring	O	O		O
41. Inspect compressor and freon lines for condition and security	O	O		O
42. 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	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	O
5. Inspect all turbo support bracket, 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
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. (Refer to Piper Service Bulletin 872.)			O	O
2. Inspect upholstery for tears				O
3. Inspect seats, seat belts, security brackets and bolts				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 & cylinder leaks				O
7. Inspect control wheels, column, pulleys, bobweight, and cables. (See Note 21.)				O
8. Inspect flap control cable attachment bolt. (Manually operated flaps only.) (See Note 21.) (See Piper Service Bulletin 965.)				O
9. Check landing, navigation, cabin and instrument lights				O
10. Inspect instruments, lines and attachments				O

5. SCHEDULED MAINTENANCE (continued)

NATURE OF INSPECTION	Inspection Interval (Hrs) 50	100
D. CABIN AND COCKPIT GROUP (continued)		
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		O
13. Inspect static system, altimeter and transponder for installation/certification per latest revision of AC43.13-1 and current test/inspection per FAR's 91.411 and 91.413, respectively		O
14. Inspect and test ELT per FAR 91.207. (See Testing ELT, 23-10-00.)		O
15. Inspect operation of fuel selector valves. (See Note 15.)		O
16. Inspect operation of fuel drains		O
17. Inspect condition of heater controls and ducts. (Refer to 21-40-00.)		O
18. Inspect condition and operation of air ducts		O
19. Inspect condition of air conditioning ducts		O
20. Remove and clean air conditioning evaporator filter		O
21. 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 or in 24-30-00	O	O
3. Inspect cabin heater. (See AD 2004-21-05.)		O
4. Inspect electronic installations for security		O
5. Inspect skins, bulkheads, frames, stringers, and longerons for damage		O
6. Inspect antenna mounts for electric wiring security and condition	O	O
7. Check hydraulic pump fluid level. (Fill as required.)		O
8. Inspect hydraulic pump lines for damage and leaks		O
9. Check air conditioning system for Freon leaks. (See Note 18.)		O
10. Check Freon level in sight gauge of receiver-dehydrator. (See Note 18 and 21-50-00.)	O	O
11. Inspect air conditioner condenser air scoop rigging	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 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); and attachment points for missing or worn hardware		O
15. Inspect vertical fin attachments for condition and security		O
16. Inspect vertical fin forward spar attachment steel bracket for corrosion; clean and prime with Dinitrol AV8, if required		O

5. **SCHEDULED MAINTENANCE** (continued)

	NATURE OF INSPECTION	Inspection Interval (Hrs)	
		50	100
17.	Inspect rudder 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
18.	Inspect rudder hinges, horn and attachments for damage and operation		O
19.	Inspect rudder tab hinge bolts for excess wear and free play. (Replace as required.) (See Notes 12 and 21.)		O
20.	Inspect rudder trim mechanism. (See Note 12.)		O
21.	Inspect stabilator 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	O	O
23.	Inspect stabilator attachments. (Refer to Piper Service Bulletin 856.)		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		O
26.	Check all cable tensions (use tensiometer). (See Note 13.)		O
27.	Inspect aileron, rudder, stabilator, and stabilator trim cables, terminals, turnbuckles, guides, fittings, and pulleys for safety, condition, and operation. (See Note 21.)		O
28.	Inspect all control cables, air ducts, electrical leads and attaching parts for security, routing, chafing, deterioration, wear and correct installation. (See Note 21.)		O
29.	Inspect and test ELT per FAR 91.207.		O
30.	Inspect ELT installation and antenna for condition and security. Replace antenna if bent or damaged		O
31.	Lubricate per Lubrication Chart, 12-20-00	O	O
32.	Inspect strobe lights for security and operation		O
33.	Inspect security of autopilot bridle cable clamps. (See Note 21.)		O
34.	Inspect deice system pneumatic valves and lines for condition and security		O
35.	Inspect deice system electrical components, brush blocks, switches, and wiring. (See Piper Service Bulletins 987 and 988.)		O
36.	Reinstall inspection plates and panels		O

5. **SCHEDULED MAINTENANCE** (continued)

NATURE OF INSPECTION	Inspection Interval (Hrs)	
	50	100
F. WING GROUP		
1. Remove inspection plates and fairings		O
2. Inspect 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, rudder, stabilator, and stabilator trim cables, terminals, turnbuckles, guides, fittings, and pulleys for safety, condition, and operation. (See Note 21.)		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 flap 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		O
9. Inspect rear spar wing attachment steel bracket for corrosion; clean and prime with Dinitrol AV8, if required		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 21.)		O
11. Inspect fuel tanks and lines for leaks and water		O
12. Remove, drain, and clean fuel filter bowls and screens	O	O
13. Fuel tanks marked for minimum octane rating		O
14. Inspect fuel tank vents		O
15. Inspect deice system pneumatic valves and lines for condition and security		O
16. Reinstall inspection plates and fairings		O

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 2005-13-16.

1. Inspect main gear trunnion housing for condition. (See Note 22.)		O
2. Check oleo struts for proper extension and evidence of fluid leakage. See Servicing Oleo Struts, 12-20-00	O	O
3. Inspect nose gear steering control and travel		O

5. SCHEDULED MAINTENANCE (continued)

	NATURE OF INSPECTION	Inspection Interval (Hrs) 50	Inspection Interval (Hrs) 100
4.	Put airplane on jacks per 7-10-00		O
5.	Inspect tires for cuts, uneven or excessive wear and slippage		O
6.	Inspect wheel alignment, if required		O
7.	Remove wheels, clean, check and repack bearings		O
8.	Inspect wheels for cracks, corrosion and broken bolts		O
9.	Check tire pressure per 12-20-00	O	O
10.	Inspect brake lining and disc. (Refer to 32-40-00)		O
11.	Inspect brake backing plates		O
12.	Inspect hydraulic lines, electrical leads, and attaching parts for condition and security (i.e. - routing, chafing, damage, wear, etc.)		O
13.	Inspect condition of nose gear centering spring and bungees. (See Note 19.)		O
14.	Inspect gear forks for damage		O
15.	Inspect oleo struts for fluid leaks and scoring		O
16.	Inspect main gear trunnion pin. Replace, if necessary		O
17.	Inspect down locks for operation and adjustment		O
18.	Inspect torque link bolts and bushings. (Rebush as required.)		O
19.	Inspect drag and side brace link bolts. (Replace as required.)		O
20.	Inspect gear doors and attachments for condition and security		O
21.	Inspect gear warning horn and light for operation. (See Note 23.)		O
22.	Retract gear - check operation		O
23.	Retract gear - inspect doors for clearance and operation		O
24.	Inspect operation of squat switch		O
25.	Inspect down lock switches, up switches, and electrical leads for security		O

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

	NATURE OF INSPECTION	Inspection Interval (Hrs) 50	Inspection Interval (Hrs) 100
26.	Inspect nose gear steering control and travel. See Nose Landing Gear, Alignment, 32-20-00		O
27.	Inspect nose and main gear struts, attachments, torque links, retraction links, bolts, and bushings for condition and security. (See Piper S.B. 956.)		O
28.	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
29.	Inspect the nose gear retraction link retention spring (P/N 96178-0) for damage, distortion, or corrosion		O

5. <u>SCHEDULED MAINTENANCE</u> (continued)

G. LANDING GEAR GROUP (continued)

NATURE OF INSPECTION	Inspection Interval (Hrs) 50	Inspection Interval (Hrs) 100
30. 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, steering arm channel and 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
31. Inspect the nose gear drag link center pivot and attachment bolts for condition and security. (Replace as required.)		O
32. 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 27.)		O
33. Inspect the actuator mounting bracket per Nose Landing Gear, 100 Hour Actuator Mounting Bracket Inspection, 32-20-00		O
34. Inspect the bolt and bushing associated with the attachment of the P/N 95712-004 retraction link assembly to the actuator mounting bracket. Replace if "wear grooves" are noted in either the bolt or bushing		O
35. Inspect the AN23-25 stop bolt in the actuator mounting bracket for condition and security		O
36. Lubricate per Lubrication Chart, 12-20-00	O	O
37. Verify proper adjustment of nose gear down lock link by rigging per Nose Landing Gear, Installation and Rigging, 32-20-00		O
38. 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.

NATURE OF INSPECTION	50	100
39. Remove airplane from jacks		O

H. SPECIAL INSPECTIONS

See 5-30-00.

5. **SCHEDULED MAINTENANCE** (continued)

NATURE OF INSPECTION	Inspection Interval (Hrs)			
	L	**R**	**50**	**100**
I. OPERATIONAL INSPECTION				
NOTE: Refer to Note 16 prior to making operational inspections.				
1. Check fuel pump and fuel tank selector	O	O	O	O
2. Check fuel quantity, pressure and flow readings	O	O	O	O
3. Check oil pressure and temperature	O	O	O	O
4. Check alternator output	O	O	O	O
5. Check manifold pressure	O	O	O	O
6. Check carburetor air	O	O	O	O
7. Check parking brake			O	O
8. Check vacuum gauge			O	O
9. Check gyros for noise and roughness			O	O
10. Check cabin heater operation. (See Note 14.)			O	O
11. Check magneto switch operation	O	O	O	O
12. Check magneto RPM variation	O	O	O	O
13. Check throttle and mixture operation	O	O	O	O
14. Check propeller smoothness	O	O	O	O
15. Check propeller governor action	O	O	O	O
16. Check engine idle	O	O	O	O
17. Check electronic equipment operation. (Refer to Chapter 23 for ELT check.)			O	O
18. Check air conditioner compressor clutch operation			O	O
19. Check air conditioner compressor scoop operation			O	O
20. Check operation of flight controls and flaps			O	O
21. Check operation of autopilot, including pitch trim and manual electric trim.			O	O
J. GENERAL				
1. Aircraft conforms to FAA specification			O	O
2. All FAA Airworthiness Directives complied with			O	O
3. All Manufacturers' Service Letters and Bulletins complied with			O	O
4. Check for proper flight manual			O	O
5. Aircraft papers in proper order			O	O

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 Section are to the appropriate 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 manufacture’s operator’s manual (X30583) for this airplane. Any changes issued to the engine manufacturer’s maintenance documentation shall supersede or supplement the inspections outlined herein.
6. Not used.
7. Refer to Teledyne Continental Motors Service Bulletin M86-6, latest revision.
8. For high altitude operations (12,000 feet and up), more frequent ignition system maintenance is required.
9. Not used.
10. Not used.
11. Not used.
12. Refer to Chapter 55 for allowable rudder tab and trim free play.
13. Maintain cable tensions as specified in Chapter 27.

5. **SCHEDULED MAINTENANCE** (continued)

K. NOTES (continued)

14. Not used.
15. Refer to Piper Service Bulletin 712.
16. Refer to Pilot's Operating Handbook, Flight Manual, or appropriate flight manual supplement for preflight and flight check, and for intended function in all modes.
17. Refer to latest revision of Bendix Service Bulletin 612 for inspection and magnetos and ignition harness.

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

18. Compressor oil level need not be check unless a Freon leak has developed and recharging is required.
19. 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.
20. Not used.
21. Examine cables for broken strands by wiping a cloth along the length of the cable. Visually inspect the cable thoroughly for damage not detected by the cloth. Replace damaged cables. See Control Cable Inspection, 27-00-00.

CAUTION: IF TIME-IN-SERVICE FOR MAIN GEAR TRUNNION ASSEMBLIES OTHER THAN P/N'S 39486-014 (LEFT) AND 39486-015 (RIGHT) (EACH EMBOSSED WITH FORGING NUMBER 02599-2) CANNOT BE DETERMINED, THEN THOSE MAIN GEAR TRUNNION ASSEMBLIES MUST BE REPLACED BEFORE FURTHER FLIGHT.

22. In all Seneca III's and Seneca IV's S/N's 3448038 and 3448039, for airplanes which have not installed new main landing gear trunnion assemblies P/N's 39486-014 (Left) and 39486-015 (Right) (each embossed with forging number 02599-2) per Piper Service Bulletin No. 787C; and, have accumulated 500 hours time-in-service on one or both of the installed main landing gear trunnion assemblies: perform Main Gear Trunnion Assembly Dye-Penetrant Inspection, 32-10-00, on one or both trunnion assemblies, as required.
23. See Piper Service Bulletin 938.
24. See Piper Service Bulletin 905.
25. Not used.
26. In Seneca III S/N's 34-8133001 thru 34-8633021 only, verify compliance with Bendix Service Bulletin 629 per Piper Vendor Service Publication No. 69.
27. Verify compliance with Piper Service Bulletin No. 1113.

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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:

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

Unless otherwise indicated, these inspections are to be repeated at each occurance 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 10 Hours

☐ In all Seneca III's and Seneca IV's S/N's 3448038 and 3448039, for airplanes which have not installed new main landing gear trunnion assemblies P/N's 39486-014 (Left) and 39486-015 (Right) (each embossed with forging number 02599-2) per Piper Service Bulletin No. 787C; and, have accumulated 2000 hours time-in-service on one or both of the installed main landing gear trunnion assemblies: perform Main Gear Trunnion Assembly Dye-Penetrant Inspection, 32-10-00, on one or both trunnion assemblies, as required.

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 500 Hours

☐ Remove propeller; remove sludge from propeller and crankshaft.

☐ Replace the nose gear drag link bolt AN7-35 or NAS6207-50D every 500 hours.

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.

☐ Beginning at 2000 hours and each 1000 hours thereafter, inspect the nose gear trunnion (P/N 95723-005/ -006) 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.

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 1800 Hours

☐ Each 1800 hours, twelve (12) years, or as specified in the latest revision of Teledyne Continental Motors SIL98-9, overhaul or replace engine.

(a) Overhaul or replace magnetos at engine overhaul, or as specified by the magneto manufacturer.

(b) Overhaul or replace dry-air pressure pump at engine overhaul, or as specified by the pump manufacturer.

(c) Replace engine-driven fuel pumps at engine overhaul or each twelve (12) years, whichever comes first.

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.

☐ 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.)

☐ Overhaul or replace Hartzell propeller governors each 2400 hours or at engine overhaul. (Verify TBO in latest revision of Hartzell Service Letter No. 61.)

Each 2500 Hours

☐ In all Seneca III's and Seneca IV's S/N's 3448038 and 3448039, for airplanes which have not installed new main landing gear trunnion assemblies P/N's 39486-014 (Left) and 39486-015 (Right) (each embossed with forging number 02599-2) per Piper Service Bulletin No. 787C: replace each main landing gear trunnion assembly upon accumulating 2500 hours time-in-service.

2. PER CALENDAR YEAR

Each Thirty (30) Days

☐ Check propeller (Hartzell) air pressure.

☐ Inspect battery, box or shelf, and cables. Flush box as required and fill battery per instructions on box or in 24-30-00.

☐ 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.

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.)

☐ Inspect Janitrol combustion heater each 24 months or 100 hours, whichever comes first, per AD 2004-21-05 and latest revision of Janitrol Maintenenance and Overhaul Manual, P/N 24E25-1.

Each Five (5) 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.)

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.

Each Twelve (12) Years

☐ Each 1800 hours, twelve (12) years, or as specified in the latest revision of Teledyne Continental Motors SIL98-9, overhaul or replace engine.

(a) Overhaul or replace magnetos at engine overhaul, or as specified by the magneto manufacturer.

(b) Overhaul or replace dry-air pressure pump at engine overhaul, or as specified by the pump manufacturer.

(c) Replace engine-driven fuel pumps at engine overhaul or each twelve (12) years, whichever comes first.

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 SYTEM BEFORE CONDUCTING THIS INSPECTION.

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

B. OPERATION IN HIGH SALT OR HIGH HUMIDITY ENVIRONMENT

Item	Inspection	Inspection Interval
☐ 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.
☐ 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.
☐ 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.
☐ Instruments and Wiring.	Inspect for proper seal of cases and corrosion.	100 Hours.
☐ 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
☐	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
☐	Landing Gear.	Inspect for cracks, attachment, damage, cleanliness and lubrication.	100 Hours.
☐	Wheels.	Inspect for cracks, damage, chipped rims; bearings for damage, corrosion and lubrication.	100 Hours.
☐	Tires.	Inspect for cuts, wear, inflation and deterioration.	Daily.
☐	Wheel Wells.	Inspect for foreign material, damage and corrosion.	100 Hours.
☐	Brakes.	Inspect for damage, foreign material, cracks and overheating.	Daily.
☐	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
☐	Propeller.	Hartzell Propellers - refer to the inspection requirements in the latest revision of the appropriate Hartzell Owner's Manual. McCauley Propellers - see latest revision of: McCauley SB 177.	Each occurrence, before further flight.
☐	Engine.	See latest revisions of appropriate Teledyne-Continental Service Bulletins and Overhaul Manual.	Each occurrence, before further flight.
☐	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 check alternator and voltage regulator(s) (see 24-30-00).	Each occurrence, before further flight.
☐	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.
☐	System Components.	Inspect instrumentation, hydraulic, vacuum, pitot/static, and fuel systems, for damage and correct operation.	Each occurrence, before further flight.
☐	Static Wicks.	Replace.	Each occurrence, before further flight.

1. LIGHTNING STRIKE (cont.)

	Item	Inspection	Inspection Interval
☐	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.

2. ENGINE OVERSPEED, OVERTEMP, LOSS OF OIL, OR SUDDEN STOPPAGE

	Item	Inspection	Inspection Interval
☐	Engine.	See latest revisions of appropriate Teledyne-Continental Service Bulletins and Overhaul Manual.	Each occurrence, before further flight.
☐	Propeller.	Hartzell Propellers - refer to the inspection requirements in the latest revision of the appropriate Hartzell Owner's Manual. McCauley Propellers - see latest revision of: McCauley SB 176 for stoppages/strikes; McCauley SL 1998-23 for overspeed.	Each occurrence, before further flight.
☐	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 Maintenance Manual procedures. If there are any questions regarding repairs or procedures, contact your Piper Distributor's Service Advisor (DSA).
D. Inspect the following items closely to determine the extent of damage:

	Item	Inspection	Inspection Interval
☐	Landing Gear Struts. (Not required for severe turbulence.)	Cracks, signs of overstress deformation, loose or damaged trunnion mounts. Axles for cracks, bending or flat spots. Damaged oleos and seals, hydraulic leaks and landing gear alignment.	Each occurrence, before further flight.

3. **SEVERE TURBULENCE, HARD OR OVERWEIGHT LANDING** (cont.)

	Item	Inspection	Inspection Interval
☐	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.
☐	Wheel Wells and Landing Gear attach points. (Not required for severe turbulence.)	Buckling, cracks, overstress, wing skin buckling, actuator and side brace damage and condition. Inspect landing gear attachment and drag link bolts (magnetic particle method.)	Each occurrence, before further flight.
☐	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.
☐	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.
☐	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.
☐	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
☐	Flap torque tube/pushrod.	Inspect for distortion. Replace as required.	Each occurrence, before further flight.
☐	Flaps.	Inspect for damage to the skin and attach points. Replace as required.	Each occurrence, before further flight.

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
☐	Airframe.	Clean silt and contaminants from airframe.	If immersed, each event, before further flight.
☐	Tubular Structures. (i.e. - Engine Mounts, etc.)	Check for internal corrosion. Clean and represerve as required.	If immersed, each event, before further flight.
☐	Wings.	Inspect to ensure that contaminants are cleaned from fuel cell areas.	If immersed, each event, before further flight.
☐	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.
☐	Control Surfaces.	Remove surface, clean and check all bearings - relube or replace as necessary. Rebalance before installation.	If immersed, each event, before further flight.
☐	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.

5. **FLOOD DAMAGE, IMMERSION IN WATER** (cont.)

	Item	Inspection	Inspection Interval
☐	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.
☐	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.
☐	Engine.	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. 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. Test electrical components and fuel metering devices in accordance with manufacturer's instructions to determine fitness for future use. Reassemble engine using new seals, gaskets, stressed bolts, nuts and crankshaft sludge tubes.	If immersed, each event, before further flight.
☐	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.
☐	Propeller.	Inspect and repair as necessary in an authorized propeller shop.	If immersed, each event, before further flight.

5. **FLOOD DAMAGE, IMMERSION IN WATER** (cont.)

Item	Inspection	Inspection Interval
☐ Electrical Systems.	Replace all circuit breakers and switches. Replace all solenoids, relays and master contactors. Replace battery. Disassemble all connectors; clean and inspect for corrosion. Replace all corroded or pitted connectors. Inspect for wire corrosion at connector. Check all harness assemblies for entrapped contaminants. Clean and check for short circuits. Remove electric motors and electric pumps. 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. Clean and check voltage regulators and overvoltage relays. Replace as necessary Clean and check all strobe light power supplies. Refer to appropriate maintenance manual. Replace all fuel senders, etc. Clean, inspect and check heated pitot systems.	If immersed, each event, before further flight.
☐ Autopilot System. (If Installed.)	Bench test in accordance with appropriate maintenance manual. Pay particular attention to clutch settings.	If immersed, each event, before further flight.

5. **FLOOD DAMAGE, IMMERSION IN WATER** (cont.)

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

5. **FLOOD DAMAGE, IMMERSION IN WATER** (cont.)

	Item	Inspection	Inspection Interval
☐	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.
☐	Avionics Systems.	Replace avionics. Clean and inspect antennas and connectors.	If immersed, each event, before further flight.
☐	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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