AIRPLANE SERVICE MANUAL

CARD 1 OF 4

PA-34-200

(S/N's 34-7250001 THRU 34-7450220)

PIPER AIRCRAFT CORPORATION

PART NUMBER 753-817 October 30, 2003

Published by
Technical Publications

2926 Piper Drive
Vero Beach, Florida 32960
U.S.A.

Member
General Aviation
Manufacturers Association

AEROFICHE REVISION STATUS

Revisions to this Service Manual 753-817 originally issued April 5, 1971 are as follows:

Revision	Publication Date	Aerofiche Card Effectivity
ORG710405	April 5, 1971	N/A
CR720613	June 13, 1972	N/A
CR031030 *	October 30, 2003	1, 2, 3, & 4

*** COMPLETE REISSUE OF SERVICE MANUAL 753-817**

This is a complete reissue of this publication. Accordingly, replace your existing Aerofiche Card Set (i.e. - Cards 1 and 2) with this set (i.e. - Cards 1, 2, 3, and 4) dated 10/30/03.

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

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INTRODUCTION

LIST OF EFFECTIVE PAGES

SECTION	PAGE	DATE	SECTION	PAGE	DATE
Intro-List of	1	Oct 30/03			
Effective Pages	2	Oct 30/03			
Intro-Table of Contents	1	Oct 30/03			
	2	Oct 30/03			
Introduction	1	Oct 30/03			
	2	Oct 30/03			
	3	Oct 30/03			
	4	Oct 30/03			
	5	Oct 30/03			
	6	Oct 30/03			
	7	Oct 30/03			
	8	Oct 30/03			
	9	Oct 30/03			
	10	Oct 30/03			
Index	1	Oct 30/03			
	2	Oct 30/03			
	3	Oct 30/03			
	4	Oct 30/03			
	5	Oct 30/03			
	6	Oct 30/03			

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TABLE OF CONTENTS

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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-34-200 Seneca Service Manual constitutes the Instructions for Continued Airworthiness. Section I contains the Airworthiness Limitations and the Inspection Program is in Section III.

2. GENERAL.

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

Genuine PIPER parts are produced and inspected under rigorous procedures to insure airworthiness and suitability for use in PIPER airplane applications. Parts purchased from sources other than PIPER, even though identical in appearance, may not have had the required tests and inspections performed, may be different in fabrication techniques and materials, and may be dangerous when installed in an airplane.

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

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

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

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

3. EFFECTIVITY.

This maintenance manual is effective for PA-34-200 Seneca airplane serial numbers 34-7250001 thru 34-7450220.

This encompasses the following model years:

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

Model Year	Serial Numbers
1972	34-7250001 thru 34-7250360
1973	34-7350001 thru 34-7350353
1974	34-7450001 thru 34-7450220

4. SERIAL NUMBER EXPLANATION.

Example: 34 72 50 001

TYPE CERTIFICATE DESIGNATION — 34

MODEL YEAR — 72

MODEL CODE — 50
50 = PA-34-200 SENECA

SEQUENCE NUMBER — 001

5. ASSIGNMENT OF SUBJECT MATERIAL.

This publication is divided into logical subject groupings based on aircraft system or task function. Refer to paragraph 14, Section Index Guide, for a complete breakdown and list. The material is arranged in ascending numerical sequence.

6. PAGINATION.

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

7. AEROFICHE EFFECTIVITY.

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

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

First number is the Aerofiche card number.
Letter is the horizontal row reference per card
Second number is the vertical column reference per card.

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

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

(1) A complete Introduction containing the Section Index Guide for all fiche in this set.

(2) A complete subject Index for all fiche in this set.

8. IDENTIFYING REVISED MATERIAL.

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

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

Example.

9. INDEXING.

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

10. LIST OF EFFECTIVE PAGES.

Each Section has a List of Effective Pages preceding the Table of Contents to identify the effective revision date for each page in that section.

11. WARNINGS, CAUTIONS AND NOTES.

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

12. ACCIDENT/INCIDENT REPORTING.

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

13. SUPPLEMENTARY PUBLICATIONS.

The following publications/sources provide servicing, overhaul and parts information for the PA-34-200 airplanes and their various components. Use them to supplement this manual.

A. PIPER PUBLICATIONS:

(1)	Parts Catalog:	P/N 753-816
(2)	Periodic Inspection Report:	P/N 230-208
(3)	Progressive Inspection Manual (50 Hour):	P/N 230-208
(4)	Autopilot Service Manuals	See Section XII

B. VENDOR PUBLICATIONS:

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

(1) ALTERNATOR:

Vendor Address: Electro Systems, Inc.
Airport Complex
P. O. Box 273
Fort Deposit, Alabama 36032
http://www.kellyaerospace.com/index.htm/

PH: - (888) 461-6077

(2) AUTOPILOT:

See Section XII, Autoflight.

(3) BATTERY:

Vendor Address: GILL Batteries
(A Division of
Teledyne Continental Motors,
see listing under Magnetos, below)
http://www.gillbatteries.com

PH: - (800) 456-0070

(4) BRAKES AND WHEELS:

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

(5) ENGINE:

Vendor Address:	Textron Lycoming 652 Oliver Street Williamsport, PA 17701 http://www.lycoming.textron.com/main.html	PH - (717) 323-6181 FAX - (717) 327-7101
Overhaul Manual:	DIRECT DRIVE MODELS - P/N 60294-7	
Parts Catalog:	IO-540- ..... - K1G5, ... ENGINES - P/N PC-615 TIO-540-AH1A ENGINES - P/N PC-615-12	
Operators Handbook:	O-540, IO-540 SERIES - P/N 60297-10 TIO-540 Series - P/N 60297-23	

NOTE: The above Lycoming publications can be ordered as a set on CD-ROM from Avantext. See www.avantext.com or PH - (800) 998-8857.

(6) FIRE EXTINGUISHER (PORTABLE):

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

(7) FUEL PUMP:

Vendor Address:	Weldon Pumps P.O. Box 46579 640 Golden Oak Parkway Oakwood Village, Ohio 44146 http://www.weldonpumps.com/index.html	PH: - (440) 232-2282 FAX - (440) 232-0606

(8) COMBUSTION HEATER:

Vendor Address:	Electro Systems, Inc. (See listing under Alternator, above.)	PH: - (334)-227-0152

(9) HI-LOK FASTENERS AND TOOLS:

Vendor Address:	Hi-Shear Corporation 2600 Skypark Drive Torrance, California 90509	PH: - (213) 326-8110

(10) LANDING GEAR ACTUATOR, EXTENSION AND RETRACTION:

Vendor Address:	Parker Hannifin Corp Aircraft Wheel and Brake Division 1160 Center Road Avon, Ohio 44011 http://www.parker.com/cleveland/	PH: - (800) 272-5464
Component Maintenance Manual:	(Effective for P/N's 96860-002 and 96860-003 only.) CMSFA232-5 (011-00504)	

(11) LIGHTS - NAVIGATION, STROBE, AND STANDBY/MAP LIGHTS:

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

(12) MAGNETOS:

Vendor Address:	Teledyne Continental Motors P.O. Box 90 Mobile, AL 36601 http://www.tcmlink.com	PH: - (334-438-3411, ext. 8392) FAX - (334-433-2325
Service Support Manual:	S1200 Series Magnetos, P/N X42001-1	
or, if installed:		
Vendor Address:	Slick Aircraft Products Unison Industries Attn: Subscription Dept. 530 Blackhawk Park Ave. Rockford, IL 61104 http://www.unisonindustries.com/index4.html	PH - (815) 965-4700 FAX - (815) 965-2457
Installation, Operation and Maintenance Instructions:	F1100 MASTER SERVICE MANUAL, 4300/6300 SERIES MAGNETO MAINTENANCE AND OVERHAUL MANUAL - L-1363	

(13) PNEUMATIC DEICE SYSTEM:

Vendor Address:	De-Icing and Specialty Systems Goodrich Corporation 1555 Corporate Woods Parkway Uniontown, Ohio 44685-8799	PH - (330) 374-3040 FAX - (330) 374-2290
Technical Assistance:	Email: dssd.support@goodrich.com http://www.deicingsystems.goodrich.com/	PH - (800) 334-2377 (330) 374-3743 FAX - (330) 374-2290
Black Standard Pneumatic De-Icer Installation, Maintenance and Repair Manual:	ATA 30-10-31	

(14) PROPELLER:

Vendor Address:	Hartzell Propeller Inc. One Propellor Place Piqua, OH 45356-2634 http://www.hartzellprop.com/index2.htm	PH - (937) 778-4379 FAX - (937) 778-4321
Standard Practices:	Manual No. 202A	
Overhaul and Maintenance:	Manual No. 117D	
Aluminum Blade Overhaul:	Manual No. 133C	
Propeller Owner's Manual and Logbook:	Manual No. 115N	

(15) PROPELLER DEICE SYSTEM:

Vendor Address:	See Pneumatic Deice System, above.
Installation and Maintenance Manual for Prop De-Icing Systems:	ATA 30-60-02
Removal and Installation Manual, Standard and FASTprop™ Electrothermal Propeller De-Icers:	ATA 30-60-07

(16) PROPELLER GOVERNOR:

Vendor Address:	Hartzell Propeller Inc. One Propellor Place Piqua, OH 45356-2634 http://www.hartzellprop.com/index2.htm	PH - (937) 778-4379 FAX - (937) 778-4321
Governor Maintenance:	Manual No. 130B	

(17) VACUUM PUMPS: (For service replacement, Tempest Dry Air Pumps, only.)

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

(18) VACUUM REGULATORS:

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

(19) VOLTAGE REGULATOR:

Vendor Address: See listing under Alternator, above.

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14 SECTION INDEX GUIDE.

GRIDS 1A18 THRU 1A24
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A

B

C

D

E

E (cont.)

F

H

I

J

L

GRIDS 1B6 THRU 1B24
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SECTION

I

AIRWORTHINESS LIMITATIONS

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SECTION I

LIST OF EFFECTIVE PAGES

SECTION	PAGE	DATE	SECTION	PAGE	DATE
I-List of	1	Oct 30/03			
Effective Pages	2	Oct 30/03			
I-Table of Contents	1	Oct 30/03			
	2	Oct 30/03			
I	1	Oct 30/03			
	2	Oct 30/03			

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SECTION I - AIRWORTHINESS LIMITATIONS

TABLE OF CONTENTS

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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.

The following limitations related to fatigue life of the airplane and its components have been established with respect to the PA-34-200 Seneca airplane:

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

A. P/N 400-274 (AN7-35) bolt;

B. P/N 407-591 (AN960-716L) washer, as applicable;

C. P/N 407-568 (AN 960-716) washer, as applicable;

D. P/N 404-396 (AN 320-7) nut; and

E. P/N 424-085 cotter pin.

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

2. INSPECTIONS.

Refer to Section III for Piper's recommended Inspection Program.

3. LIFE LIMITED PARTS MARKING AND DISPOSITION.

14 CFR Part 45.16, Marking of Life Limited 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 are defined in paragraph 1, above.

A. Parts that are removed prior to attaining the required time and/or cycles in service defining the useful life , 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 effect part structural integrity, i.e., no surface deformation such as vibration/etching allowed.

B. Parts that have accumulated the life limit shall be dispositioned 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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SECTION

II

HANDLING AND SERVICING

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SECTION II

LIST OF EFFECTIVE PAGES

SECTION	PAGE	DATE	SECTION	PAGE	DATE
II-List of	1	Oct 30/03	II (cont.)	36	Oct 30/03
Effective Pages	2	Oct 30/03		37	Oct 30/03
				38	Oct 30/03
II-Table of Contents	1	Oct 30/03		39	Oct 30/03
	2	Oct 30/03		40	Oct 30/03
				41	Oct 30/03
II	1	Oct 30/03		42	Oct 30/03
	2	Oct 30/03		43	Oct 30/03
	3	Oct 30/03		44	Oct 30/03
	4	Oct 30/03		45	Oct 30/03
	5	Oct 30/03		46	Oct 30/03
	6	Oct 30/03		47	Oct 30/03
	7	Oct 30/03		48	Oct 30/03
	8	Oct 30/03		49	Oct 30/03
	9	Oct 30/03		50	Oct 30/03
	10	Oct 30/03		51	Oct 30/03
	11	Oct 30/03		52	Oct 30/03
	12	Oct 30/03		53	Oct 30/03
	13	Oct 30/03		54	Oct 30/03
	14	Oct 30/03		55	Oct 30/03
	15	Oct 30/03		56	Oct 30/03
	16	Oct 30/03		57	Oct 30/03
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	31	Oct 30/03			
	32	Oct 30/03			
	33	Oct 30/03			
	34	Oct 30/03			
	35	Oct 30/03			

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SECTION II - HANDLING AND SERVICING

TABLE OF CONTENTS

SECTION II - HANDLING AND SERVICING

TABLE OF CONTENTS (continued)

HANDLING AND SERVICING

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

1. INTRODUCTION. This section contains routine handling and servicing procedures that are most frequently encountered. Frequent reference to this section will aid the individual by providing information such as the location of various components, ground handling procedures, routine service procedures and lubrication. When any system or component requires service other than the routine procedures as outlined in this section, refer to the appropriate section for that component.

2. DIMENSIONS. The principal airplane dimensions are shown in Figure 1 and are listed in Table I.

3. 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, wing station or buttock line (BL), and water line (WL) designations is frequently employed in this manual. (Refer to Figure 2.) Fuselage stations, buttock lines, and water lines 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.

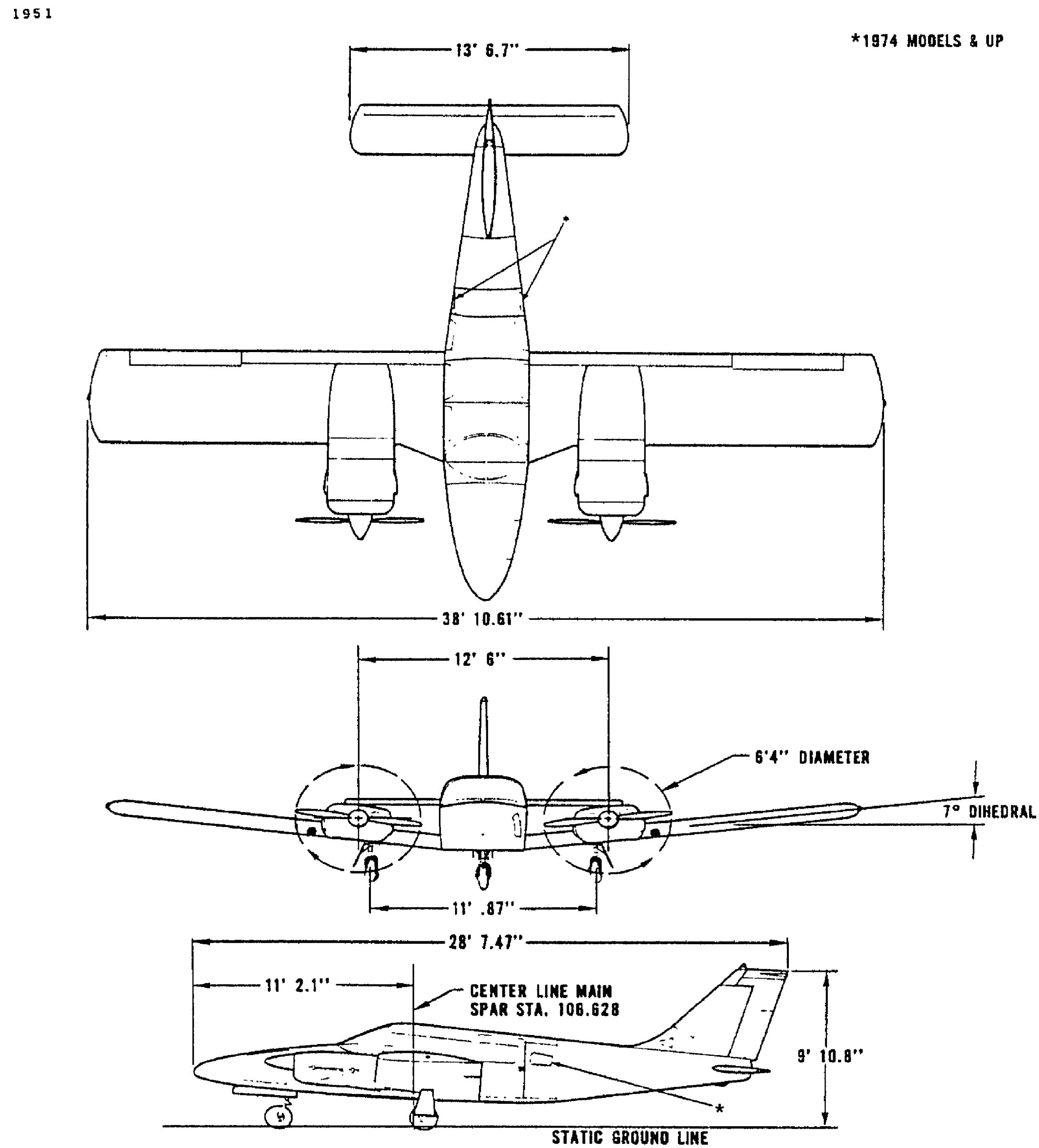
4. WEIGHT AND BALANCE DATA. When figuring various weight and balance computations, the empty, static and gross weight, and center of gravity of the airplane may be found in the Weight and Balance Form of the Airplane Flight Manual.

5. SERIAL NUMBER PLATE. The serial number plate is located on the left side of 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.

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

6. ACCESS AND INSPECTION PROVISIONS. The access and inspection provisions for the airplane area shown in Figure 3. The component to be serviced or inspected through each opening is identified in the illustration. All access plates and panels are secured by either metal fasteners or screws. To enter the aft section of the fuselage, remove the rear baggage compartment upholstery panel by removing the attachment screws.

7. TOOLS AND TEST EQUIPMENT. Because of the simplicity and easy accessibility of components, few special tools outside normal shop tools will be required. Tools that are required may be fabricated from dimensions given in the back of the section that pertains to a particular component or are listed in the back of the PA-34 Parts Catalog, P/N 753-816.



Three View
Figure 1

TABLE I (Sheet 1 of 4)
LEADING PARTICULARS

MODEL	**PA-34-200**
ENGINE	
Manufacturer	Lycoming
Model- Left	IO-360-C1E6 (CW)
Model - Right	LIO-360-C1E6 (CCW)
FAA Type Certificate	TC1E10
Rated Horsepower	200 HP
Rated Speed	2700 RPM
Fuel Consumption, Cruise	
75% Rated Power (Both Engines)	20.6 GPH
65% Rated Power (Both Engines)	18.3 GPH
Propeller Drive Ratio	1:1
Propeller Shaft Rotation - Left Engine	Clockwise (CW)
Propeller Shaft Rotation - Right Engine	Counterclockwise (CCW)
Bore (Inches)	5.125
Stroke (Inches)	4-375
Displacement (Cu. In.)	361
Compression Ratio	8.7:1
Weight (With starter and alternator)	350 Lbs.
Dimensions:	
Height	19.48 In.
Width	34.25 In.
Length	33.65 In.
Oil, SAE Number	See Lubrication Chart
Oil Sump Capacity	8 U.S. Quarts
Oil Consumption. Max. (Qt./Hr.)	.21
Fuel, Aviation Grade, Minimum Octane	100/130 *
Fuel Injector	RSA-5AD1
Magnetos, Scintilla:	
Left (Left Engine)	S4LN-1227
Right (Left Engine)	S4LN-1209
Left (Right Engine)	S4RN-1227
Right (Right Engine)	S4RN-1209
or,	
Magnetos, Slick:	
Left (Left Engine)	4372
Right (Left Engine)	4370
Left (Right Engine)	4374
Right (Right Engine)	4302
Magneto Drive, Ratio to Crankshaft	1.5:1
Magneto Drive, Rotation	
Left Engine	CW
Right Engine	CCW
Magneto Timing	25° BTC
Magneto Point Clearance, Scintilla (Main)	0.016 ± .003
Magneto Point Clearance, Scintilla (Retard)	0.016 ± .006
Magneto Point Clearance, Slick	Use “E” Gap Method

* See latest revision of Lycoming Service Instruction 1070M.

TABLE I (Sheet 2 of 4)
LEADING PARTICULARS

MODEL	PA-34-200
ENGINE (cont.)	
Spark Plugs (Shielded):	
AC	SR-86
Champion	REM-38E
Spark Plug Gap Setting	See Lycoming Service Instruction 1042F
Firing Order	1—3—2—4
Tachometer Drive, Ratio to Crankshaft	0.500: 1
Tachometer Drive, Rotation	
Left Engine	CW
Right Engine	CCW
Starter - Prestolite (12-volt)	
Left Engine	MZ-4206
Right Engine	MZ-4216
Starter Gear Ratio	16.55:1 (CW)
Starter Drive, Ratio to Crankshaft	16.556:1
Starter Drive, Rotation	
Left Engine	CCW
Right Engine	CW
Alternator - Prestolite (60 amp)	ALY-6408
Alternator Voltage Regulator, Electro Delta Inc.	VR710
Alternator Overvoltage Relay, WICO	X16799B
Alternator Drive, Ratio to Crankshaft	3.250:1
Alternator Drive Rotation	
Left Engine	CW
Right Engine	CCW
Vacuum Pump Drive, Ratio to Crankshaft	1.300:1
Vacuum Pump Drive, Rotation	
Left Engine	CCW
Right Engine	CW
Propeller Governor Drive, Ratio to Crankshaft	0.866:1
Propeller Governor Drive, Rotation:	
Left Engine	CW
Right Engine	CCW
Fuel Pump Drive, Rotation:	
Left Engine	Plunger
Right Engine	Plunger

TABLE I (Sheet 3 of 4)
LEADING PARTICULARS

MODEL	**PA-34-200**
PROPELLER	
Manufacturer	Hartzell
Hub and Blade Model:	
Right Engine	HC-C2YK-2( )LE/JC7666A-0 HC-C2YK-2( )LEU/JC7666A-0 (1) HC-C2YK-2( )LEF/FJC7666A-0 HC-C2YK-2( )LEFU/FJC7666A-0 (1) HC-C2YK-2CLG(F)/(F)JC7666A (2) HC-C2YK-2CLGU(F)/(F)JC7666A (1 & 2)
Left Engine	HC-C2YK-2( )E/C7666A-0 HC-C2YK-2( )EU/C7666A-0 (1) HC-C2YK-2( )EF/FC7666A-0 HC-C2YK-2( )EFU/FC7666A-0 (1) HC-C2YK-2CG(F)/(F)C7666A (2) HC-C2YK-2CGU(F)/(F)C7666A (1 & 2)

NOTE: HC-( )2YR-( ) propeller hubs may be substituted for the HC-( )2YK-( ) propeller hubs called out above per Hartzell Standard Practices Manual No. 202A.

Diameter	76 In.
Diameter, Minimum	74 In.
Blade Angle, Low Pitch (3)	13.5°
Blade Angle, Feather (3)	79° - 81°
Governor Control	Hartzell
Governor Model:	
Left Engine	F-6-18A
Right Engine	F-6-18AL

(1) Feather assist spring propellers. See also Parts Catalog, P/N 753-816.
(2) Includes damper. If used, dampers must be installed on both left and right propellers.
(3) Measurement taken at 30 inch station.

FUEL SYSTEM	
Fuel Tank	49 Gal/Wing
Total Capacity (Both Wings)	98 Gal.
Total Usable Fuel	93 Gal.

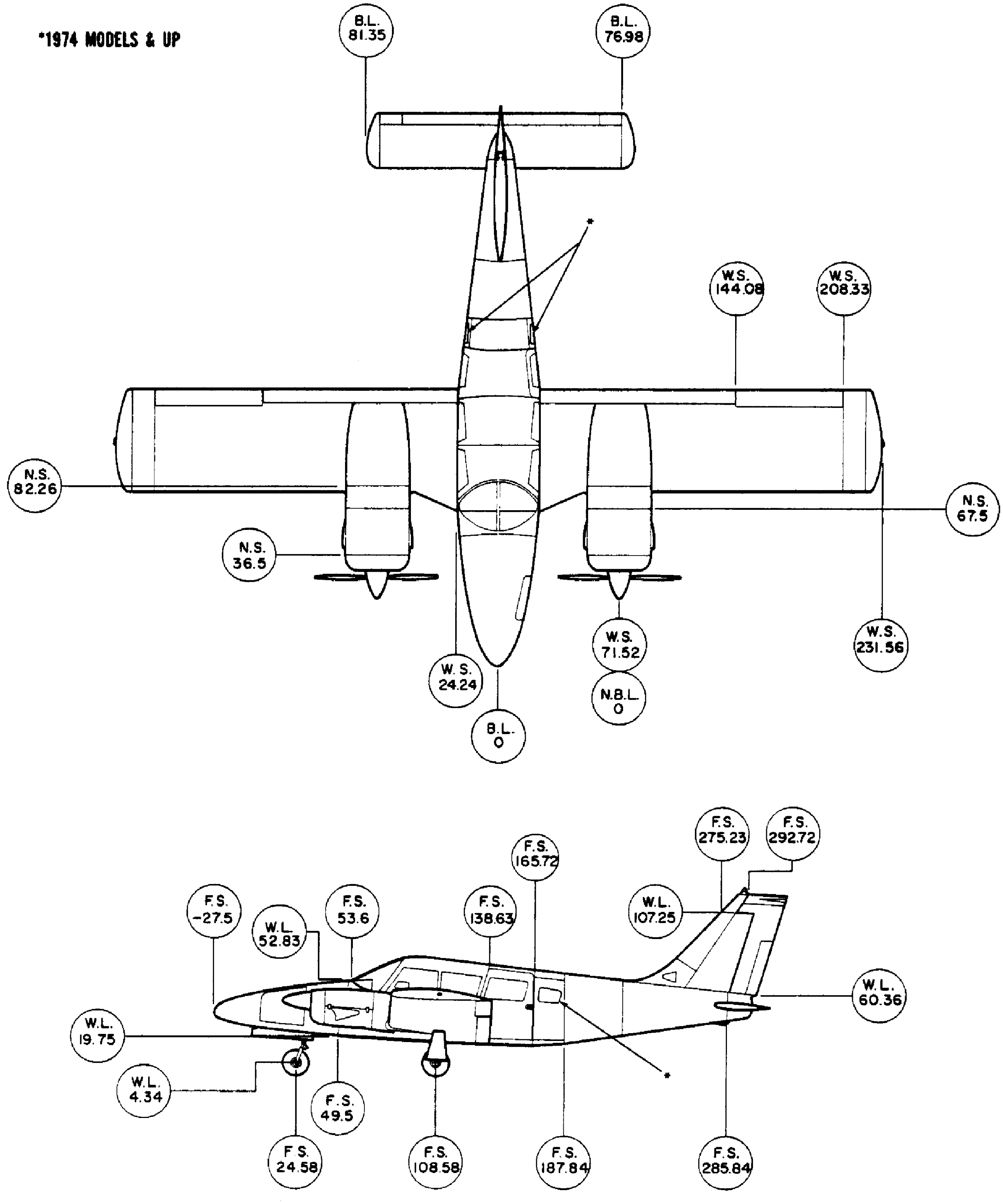
TABLE I (Sheet 4 of 4)
LEADING PARTICULARS

MODEL	PA-34-200
LANDING GEAR	
Type	Fully Retractable
Shock Strut Type	Air-Oil Oleo
Fluid Required (Struts, Brakes & Hydraulic System)	MIL-H-5606
Strut Exposure (Exposure under static load):	
Nose	2.60 ± .25 In.
Main	3.60 ± .25 In.
Wheel Tread	11.1 Ft.
Wheel Base	7 Ft.
Nose Wheel Travel	21° left, 21° right 27° left, 27° right (1)
Turning Radius (Minimum):	
Nose Wheel	19.5 Ft.
Wing Tip	37.7 Ft.
Wheel, Nose	Cleveland, 6:00 x 6 (2)
Wheel, Main	Cleveland, 6:00 x 6 (2)
Brake Type	Cleveland 30-65, Double Disc
Tires, Nose	6:00 x 6 (6 ply)
Tires, Main	6:00 x 6 (8 ply)
Tire Pressure, Nose	31 psi @ Gross Weight
Tire Pressure, Main	53 psi @ Gross Weight

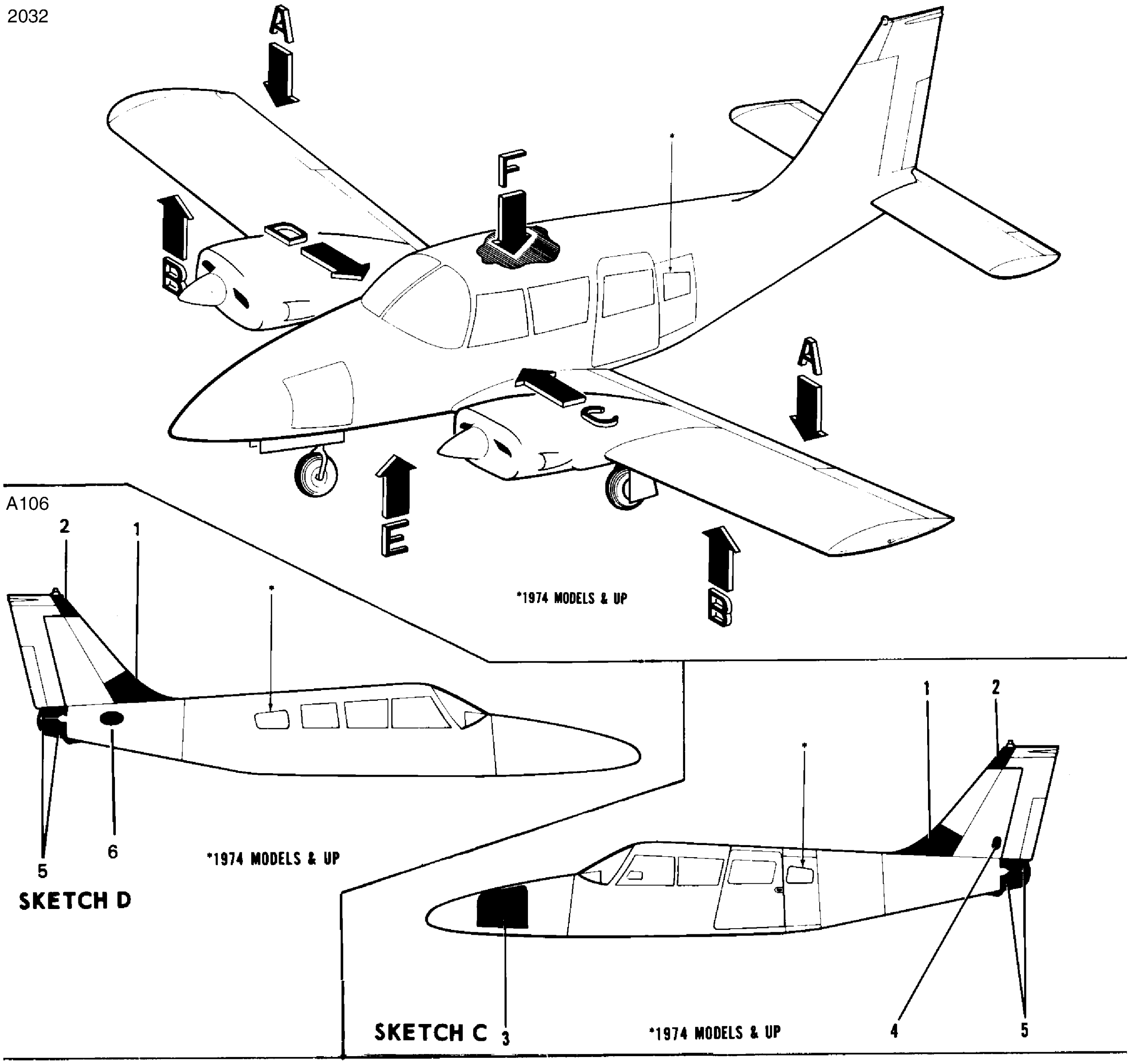
(1) 1974 models only.

(2) Refer to parts catalog for wheels and brakes part numbers and vendors.

Control Surfaces and Cable Tensions - Refer to Section V, Table I.



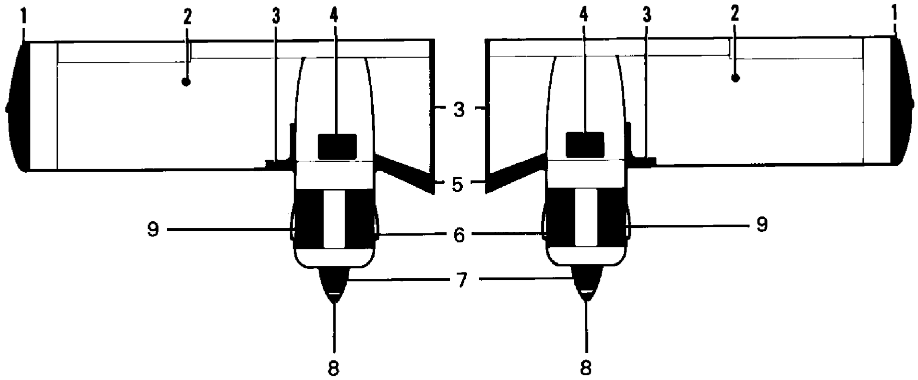
Station Reference Lines
Figure 2



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

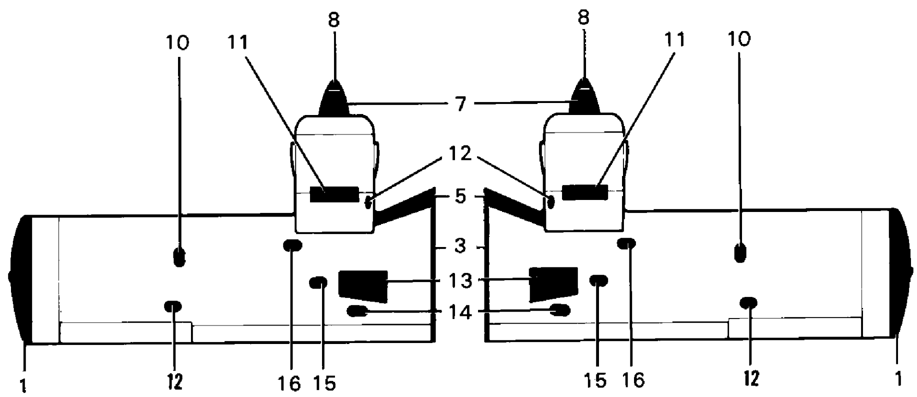
Access Plates and Panels
Figure 3 (Sheet 1 of 2)

A323



SKETCH A

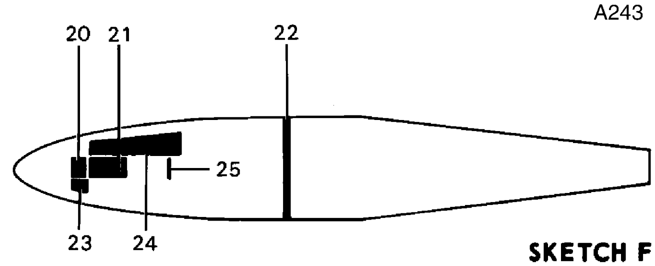
A328



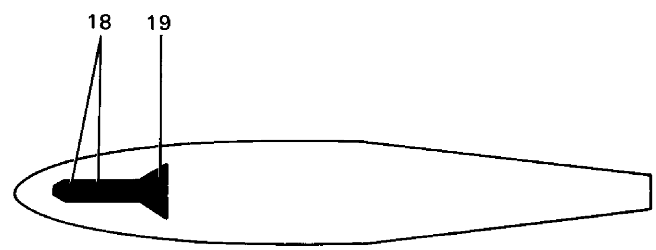
SKETCH B

1. WING TIP
2. CAP, FUEL TANK ASS'Y.
3. FAIRING
4. ELECTRIC FUEL BOOST PUMP
5. LINES, WIRES, CABLES
6. COWL, INBOARD
7. SPINNER, PROPELLER
8. PROPELLER RECHARGE VALVE
9. COWL OUTBOARD
10. FUEL SENDER
11. COWL FLAP
12. FUEL FILTER DRAIN
13. DOOR, MAIN GEAR, LANDING
14. COVER, GEAR ATTACHMENT FITTING
15. ELECTRIC WIRING
16. FUEL VALVE
17. COVER, BELLCRANK AND CONTROL CABLE
18. DOOR, NOSE GEAR, LANDING
19. HYDRAULIC PRESSURE SWITCH, NOSE GEAR ACTUATING CYLINDER AND LIMIT SWITCH VOLTAGE REGULATORS AND OVERVOLTAGE RELAYS
20. BATTERY
21. NOSE LANDING GEAR
22. MAIN SPAR
23. EXTERNAL POWER PLUG
24. RADIO
25. BRAKE RESERVOIR

A243

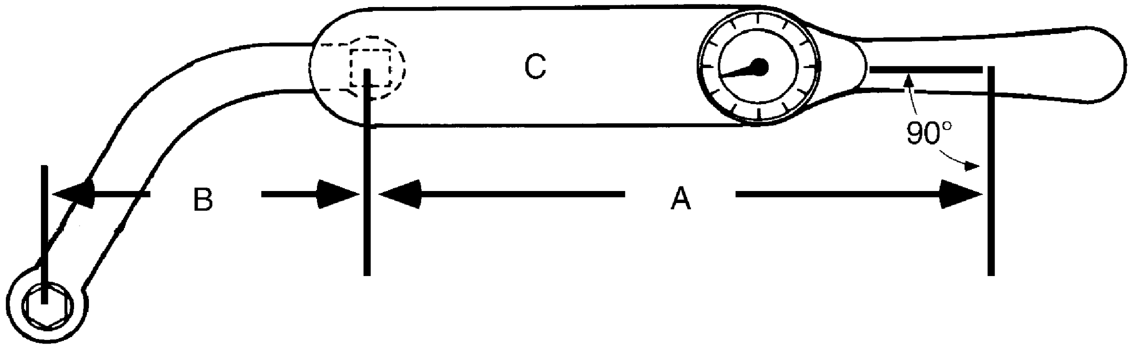


SKETCH F



SKETCH E

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



Torque Wrench Formula
Figure 4

8. 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 4.)

T = Torque desired at the part.

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

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

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

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

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

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

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

TABLE II (Sheet 1 of 2)
RECOMMENDED NUT TORQUES

TORQUES: The importance of correct application can not be overemphasized. Undertorque can result in unnecessary wear of nuts and bolts as well as the parts they are holding together. When insufficient pressures are applied, uneven loads will be transmitted throughout the assembly which may result in excessive wear or premature failure due to fatigue. Overtorque can be equally damaging because of failure of a bolt or nut from overstressing the threaded areas. The following procedures should be followed to assure that the correct torque is applied:

1. Self-Locking Fasteners - Add the friction torque from Chart “A” for sizes 8 through 7/16 to the recommended torque from Chart “B” to get the final torque. This would be the actual reading on the torque wrench. To determine friction drag torque for sizes 1/2 through 1 1/4, turn the nut fully on to the bolt and determine the torque required to turn the nut. Add this friction drag torque to the torque given in Chart “B”.
2. Castellated and Non-Self Locking Nuts - Use only the torque given in Chart “B”. Unless otherwise specified, when castellated nuts are used with a cotter pin on moving joints, do not torque the nut. Turn the nut onto the bolt until proper grip is established and alignment with the cotter pin hole is achieved. Then install the cotter pin.

GENERAL REQUIREMENTS.

1. Calibrate the torque wrench periodically to assure accuracy. Recheck frequently.
2. Ascertain that the bolt and nut threads are clean and dry (unless otherwise specified by the manufacturers.) If the bolt or nut is required to be lubricated prior to tightening, the torque range should be reduced 50 percent.
3. Use a bolt long enough to prevent bearing loads on the threads. The complete chamfer or end radius of the bolt or screw must extend through the nut.
4. Unique torques specified in the text of this manual supercede the torques given in Charts “A” and “B”.
5. Refer o the latest revision of Lycoming Service Table Limits, SSP1776, for torques on parts used on Lycoming engines.
6. A maximum of two AN960 washers may be added under bolt heads or nuts to correct for variations in material thickness within the tolerances permitted.
7. Self-Locking Fasteners - Limitations of the use of self-locking nuts, bolts and screws including fasteners with non-metallic inserts are as follows:
   - A. Fasteners incorporating self-locking devices shall not be reused if they can be run-up using only fingers. They may be reused if hand tools are required to required to run them up providing there is no obvious damage to the self-locking device prior to installation.
   - B. Bolts 5/16 inch diameter and over with cotter pin holes may be used with self-locking nuts. Nuts with non-metallic locking devices may be used in this application only if the bolts are free from burrs around the cotter pin hole.
   - C. Do not use self-locking nuts at joints which subject either the nut or bolt to rotate.
   - D. Never tap or rethread self-locking fasteners. Do not use nuts, bolts or screws with damaged threads or rough ends.

CHART A

BOLT SIZE	FRICTION DRAG TORQUE (IN. -LB.)
8 (course thread)	15
10	18
1/4	30
5/16	60
3/8	80
7/16	100

CHART B

COARSE THREAD SERIES

BOLTS
Steel Tension

AN 3 THROUGH AN 20
AN 42 THROUGH AN 49
AN 73 THROUGH AN 81
AN 173 THROUGH AN 186
MS 20033 THROUGH MS 20046
MS 20073
MS 20074
AN 509 NK9
MS 24694
AN 525 NK525
MS 27039

NUTS

	Steel Tension		Steel Shear	
	AN 310 AN 315 AN 363 AN 365 NAS 1021 MS 17825 MS 21045 MS 20365 MS 20500 NAS 679		AN 320 AN 364 NAS 1022 MS 17826 MS 20364	
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

TABLE II (Sheet 2 of 2)
RECOMMENDED NUT TORQUES

FINE THREAD SERIES

	BOLTS Steel Tension				BOLTS Steel Tension				BOLTS Aluminum			
	AN 3 THRU AN 20 AN 42 THRU AN 49 AN 73 THRU AN 81 AN 173 THRU AN 186 MS 20033 THRU MS 20046 MS 20073 MS 20074 AN 509 NK9 MS 24694 AN 525 NK525 MS 27039				MS 20004 THRU MS 20024 NAS 144 THRU NAS 158 NAS 333 THRU NAS 340 NAS 583 THRU NAS 590 NAS 624 THRU NAS 644 NAS 1303 THRU NAS 1320 NAS 172 NAS 174 NAS 517 Steel shear bolt NAS 464				AN 3DD THRU AN 20DD AN 173DD THRU AN 186DD AN 509DD AN 525D MS 27039D MS 24694DD			
	NUTS Steel Tension		NUTS Steel Shear		NUTS Steel Tension		NUTS Steel Shear		NUTS Alum. Tension		NUTS Alum. Shear	
	AN 310 AN 315 AN 363 AN 365 NAS 1021 MS 17825 MS 21045 MS 20365 MS 20500 NAS 679		AN 320 AN 364 NAS 1022 MS 17826 MS 20364		AN 310 AN 315 AN 363 AN 365 MS 17825 MS 20365 MS 21045 NAS 1021 NAS 679 NAS 1291		AN 320 AN 364 NAS 1022 MS 17826 MS 20364		AN 365D AN 310D NAS 1021D		AN 320D AN 364D NAS 1022D	
Nut-bolt size	Torque Limits in-lbs.		Torque Limits in-lbs.		Torque Limits in-lbs.		Torque Limits in-lbs.		Torque Limits in-lbs.		Torque Limits in-lbs.	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
8-36	12	15	7	9					5	10	3	6
10-32	20	25	12	15	25	30	15	20	10	15	5	10
1/4-28	50	70	30	40	80	100	50	60	30	45	15	30
5/16-24	100	140	60	85	120	145	70	90	40	65	25	40
3/8-24	160	190	95	110	200	250	120	150	75	110	45	70
7/16-20	450	500	270	300	520	630	300	400	180	280	110	170
1/2-20	480	690	290	410	770	950	450	550	280	410	160	260
9/16-18	800	1,000	480	600	1,100	1,300	650	800	380	580	230	360
5/8-18	1,100	1,300	660	780	1,250	1,550	750	950	550	670	270	420
3/4-16	2,300	2,500	1,300	1,500	2,650	3,200	1,600	1,900	950	1,250	560	880
7/8-14	2,500	3,000	1,500	1,800	3,550	4,350	2,100	2,690	1,250	1,900	750	1,200
1-14	3,700	4,500	2,200	3,300	4,500	5,500	2,700	3,300	1,600	2,400	950	1,500
1-1/8-12	5,000	7,000	3,000	4,200	6,000	7,300	3,600	4,400	2,100	3,200	1,250	2,000
1-1/4-12	9,000	11,000	5,400	6,600	11,000	13,400	6,600	8,000	3,900	5,600	2,300	3,650

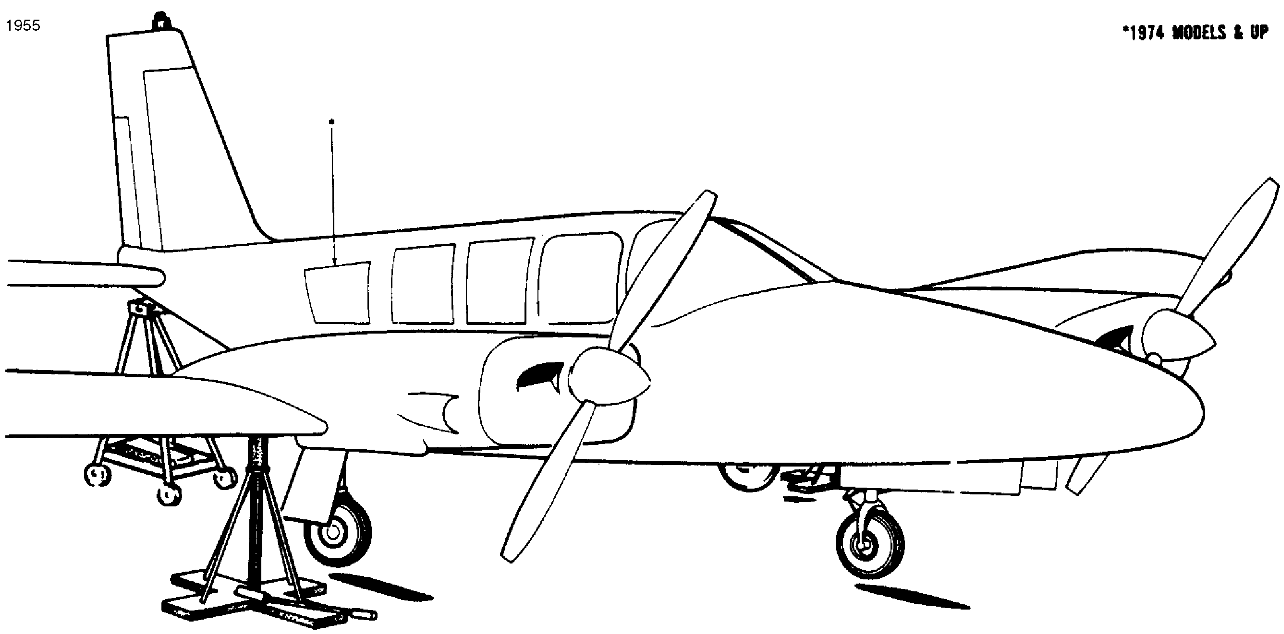
CAUTION: DO NOT OVERTORQUE FITTINGS.

TABLE III
FLARE FITTING TORQUE VALUES

TORQUE — INCH-POUNDS						
TUBING OD INCHES	ALUMINUM - ALLOY TUBING FLARE - AND 10061 OR AND 10078		STEEL TUBING FLARE AND 10061		HOSE END FITTING AND HOSE ASSEMBLIES	
	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
1/8	———	———	———	———	———	———
3/16	———	———	90	100	70	100
1/4	40	65	135	150	70	120
5/16	60	80	180	200	85	180
3/8	75	125	270	300	100	250
1/2	150	250	450	500	210	420
5/8	200	350	650	700	300	480
3/4	300	500	900	1000	500	850
1	500	700	1200	1400	500	1150
1-1/4	600	900	———	———	———	———
1-1/2	600	900	———	———	———	———
1-3/4	———	———	———	———	———	———
2	———	———	———	———	———	———

NOTE: When flared fittings are being installed, ascertain that the male threads are properly lubricated. Torque the fittings in accordance with Table III.

8a. TORQUE REQUIREMENTS. The torque values given in Table II are derived from oil-free cadmium-plated threads and are recommended for all airframe installation procedures where torqueing is; required, unless otherwise noted in sections where other values are stipulated. Engine torque values are found in the latest revision of Lycoming Special Service Publication No. 1776 (i.e. - SSP-1776), and propeller torque values are found in Section VIII.



Jacking
Figure 5

9. STEP, HANDHOLD, AND WALKWAYS. A fixed handhold is located on the right side of the fuselage, above and aft of the second window. The walkway is made up of a non-skid material which is in turn bonded to the wing surface.

   CAUTION: IN ORDER TO AVOID DAMAGE TO THE WING SURFACE WALK ONLY ON THE WALKWAY.

10. GROUND HANDLING.

11. INTRODUCTION TO GROUND HANDLING. Ground handling covers all essential information governing the handling of the airplane while on the ground. This includes jacking, weighing, leveling, mooring, parking, towing and taxiing. When the airplane is handled in the manner described in the following paragraphs, damage to the airplane and its equipment will be prevented.

12. JACKING. Jack the airplane as specified to perform various service operations. Proceed as follows:

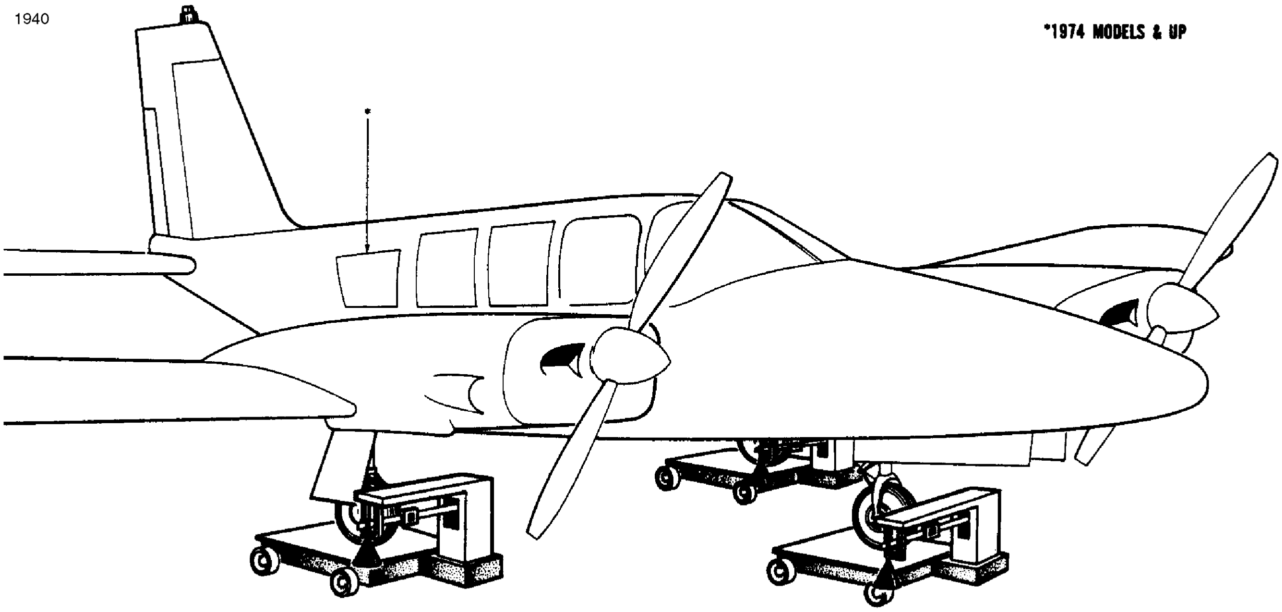
    a. Place the jacks under the jack pads on the wing front spar.

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

    b. Attach a tail support to the tail skid. Place approximately 500 pounds of ballast on the support to hold the tail down. (Refer to Figure 5.)

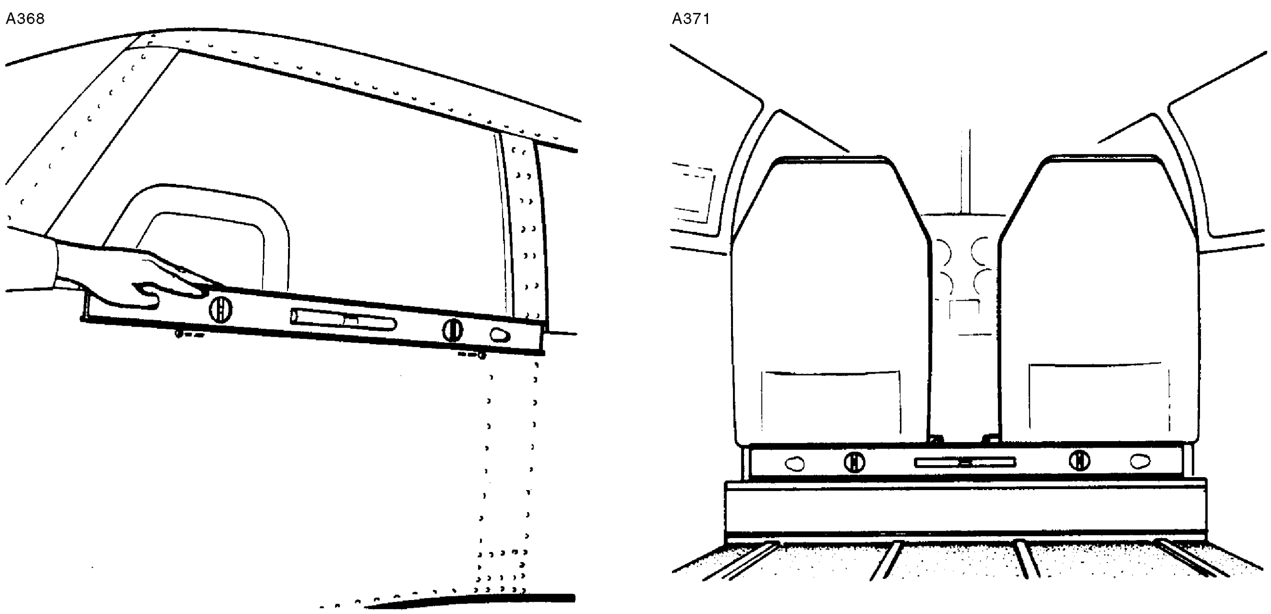
       CAUTION: IF THE PURPOSE FOR PLACING THE AIRPLANE ON JACKS IS TO SERVICE THE HYDRAULIC SYSTEM, THE FREE-FALL VALVE KNOB SHOULD BE PULLED FULL OUT FROM THE INSTRUMENT PANEL. (REFER TO SECTION VI, PARAGRAPH 1.)

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



Weighing
Figure 6

13. WEIGHING. (Refer to Figure 6.) The airplane may be weighed by the following procedure:
    a. Position a scale and ramp in front of each of the three wheels.
    b. Secure the scales from rolling forward and tow the airplane up onto the scales. (Refer to Towing, Paragraph 18.)
    c. Remove the ramp so as not to interfere with the scales.
    d. If the airplane is to be weighed for weight and balance computations, level the airplane per instructions given in paragraph 14.



LONGITUDINALLY LATERALLY

Leveling
Figure 7

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

   a. To longitudinally level the airplane, partially withdraw the two leveling screws located immediately below the left front side window. (Refer to Figure 7.) Place a spirit level on these screw heads and deflate the nose wheel tire or adjust the jacks until the bubble of the level is centered.

   b. To laterally level the airplane, place a spirit level across the baggage compartment floor along the rear bulkhead (refer to Figure 7) and deflate the tire on the high side of the airplane or adjust either jack until the bubble of the level is centered.

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

   a. Head the airplane into the wind, if possible.

   b. Block the wheels.

   c. Lock the aileron and stabilator controls using the control lock pin provided.

   CAUTION: USE SQUARE OR BOWLINE KNOTS. DO NOT USE SLIP KNOTS.

   d. Secure tie-down ropes to the wing tie-down rings and the tail skid at approximately 45 degree angles to the ground. When using rope constructed of non-synthetic material, leave sufficient slack to avoid damage to the airplane when the ropes contract due to moisture.

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

16. LOCKING AIRPLANE. The right cabin door is provided with a key lock on the outside. The cabin door lock and nose baggage compartment door lock use the same key.

17. PARKING. When parking the airplane, insure 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 as in paragraph 15.

    a. To park the airplane, head it into the wind, if possible.

    b. Set the parking brake by pulling back the brake lever and depressing the knob attached to the left side of the handle. Then release the handle. To release the parking brakes, pull back on the brake lever to disengage the catch mechanism. Then allow the handle to swing forward.

       NOTE: Care should be taken when setting brakes that are overheated or during cold weather when accumulated moisture may freeze the brakes.

    c. The aileron and stabilator controls may be locked by using the control wheel lock.

    CAUTION: DO NOT TURN THE NOSE GEAR BEYOND ITS TRAVEL LIMITS (SEE TABLE 1). ESPECIALLY WHEN TOWING WITH POWER EQUIPMENT, THIS WILL EASILY DAMAGE THE NOSE GEAR RETRACTION, EXTENSION, AND STEERING MECHANISMS.

    CAUTION: DO NOT PUSH ON THE TRAILING EDGE OF THE AILERON, WHEN MOVING THE AIRCRAFT FORWARD BY HAND. THIS WILL CAUSE THE AILERON CONTOUR TO CHANGE RESULTING IN AN OUT-OF-TRIM CONDITION.

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

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

19. TAXIING. Before attempting to taxi the airplane, ground personnel should be checked out by a qualified pilot or other responsible person. Engine starting and shut-down 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.

    a. Taxi forward a few feet and apply brakes to determine their effectiveness.

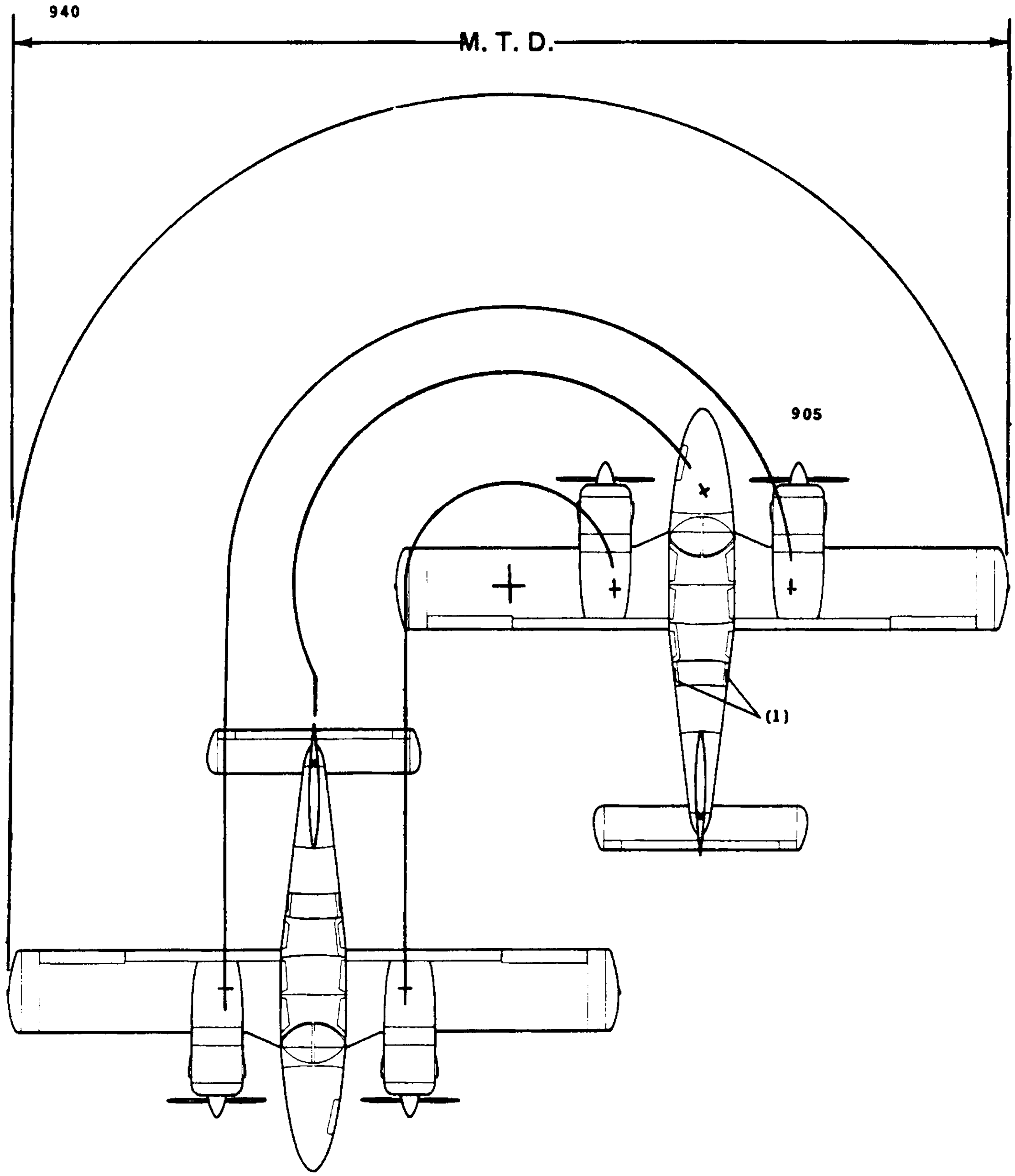
    b. Taxi with propellers set in low pitch, high RPM setting.

    c. While taxiing, make slight turns to ascertain the effectiveness of steering.

    d. Observe wing clearances when taxiing near buildings or other stationary objects. If possible, station a guide outside the airplane to observe.

    e. When taxiing on uneven ground, look for holes and ruts.

    f. Do not operate the engines at high RPM when running up or taxiing over ground containing loose stones, gravel or any loose material that may cause damage to the propeller blades.



MINIMUM TURNING DISTANCE (M. T. D.) 75.5 FT., 66.4 FT. (1)

(1) 1974 MODELS AND UP.

Turning Distance
Figure 8

20. EXTERNAL POWER RECEPTACLE.

CAUTION: TURN MASTER SWITCH OFF BEFORE INSERTING OR REMOVING PLUG.

20a. OPERATION OF EXTERNAL POWER RECEPTACLE. The external power receptacle is located on the left side of the nose section. When using external power for starting or operation of any of the airplane's equipment, the master switch must be ON.

NOTE: When using a 12-volt battery for external power starting and the airplane's battery is nearly depleted, the instructions given in Section XI must be followed.

21. SERVICING.

22. INTRODUCTION TO SERVICING. Servicing the airplane includes the replenishment of fuel, oil, hydraulic fluid, tire pressures, lubrication requirements and other items required to completely service the airplane.

23. INDUCTION AIR FILTER.

a. The filter should be cleaned daily when operating in dusty conditions. If any holes or tears are noticed, the filter must be replaced immediately.

CAUTION: NEVER WASH THE FILTER ELEMENT IN ANY LIQUID OR SOAK IT IN OIL. NEVER ATTEMPT TO BLOW OFF DIRT WITH COMPRESSED AIR.

b. Remove the filter element and shake off loose dirt by rapping on a hard flat surface, being careful not to damage or crease the sealing ends.

c. The filter housing can be cleaned by wiping with a clean cloth soaked in a suitable dry type solvent. When the housing is dry reinstall and seal the filter element.

24. FUEL SYSTEM.

25. SERVICING FUEL SYSTEM. At intervals of 50 hours or 90 days, whichever comes first, clean the screens and bowls of the gascolators. Remove and clean the filters in accordance with the instructions outlined in Section VIII. Additional service information may also be found in Section VIII. Inspection intervals of the various fuel system components may be found in Section III.

26. FILLING FUEL TANKS. The fuel tanks of each wing are filled through a single filler located on the forward slope of the wing. at the outboard tank. Each wing tank has a capacity of 24.5 U.S. gallons. The two 24.5 gallon tanks of each wing are interconnected, therefore giving a total capacity of 49 U.S. gallons of fuel per wing.

a. Observe all required safety precautions for handling gasoline.

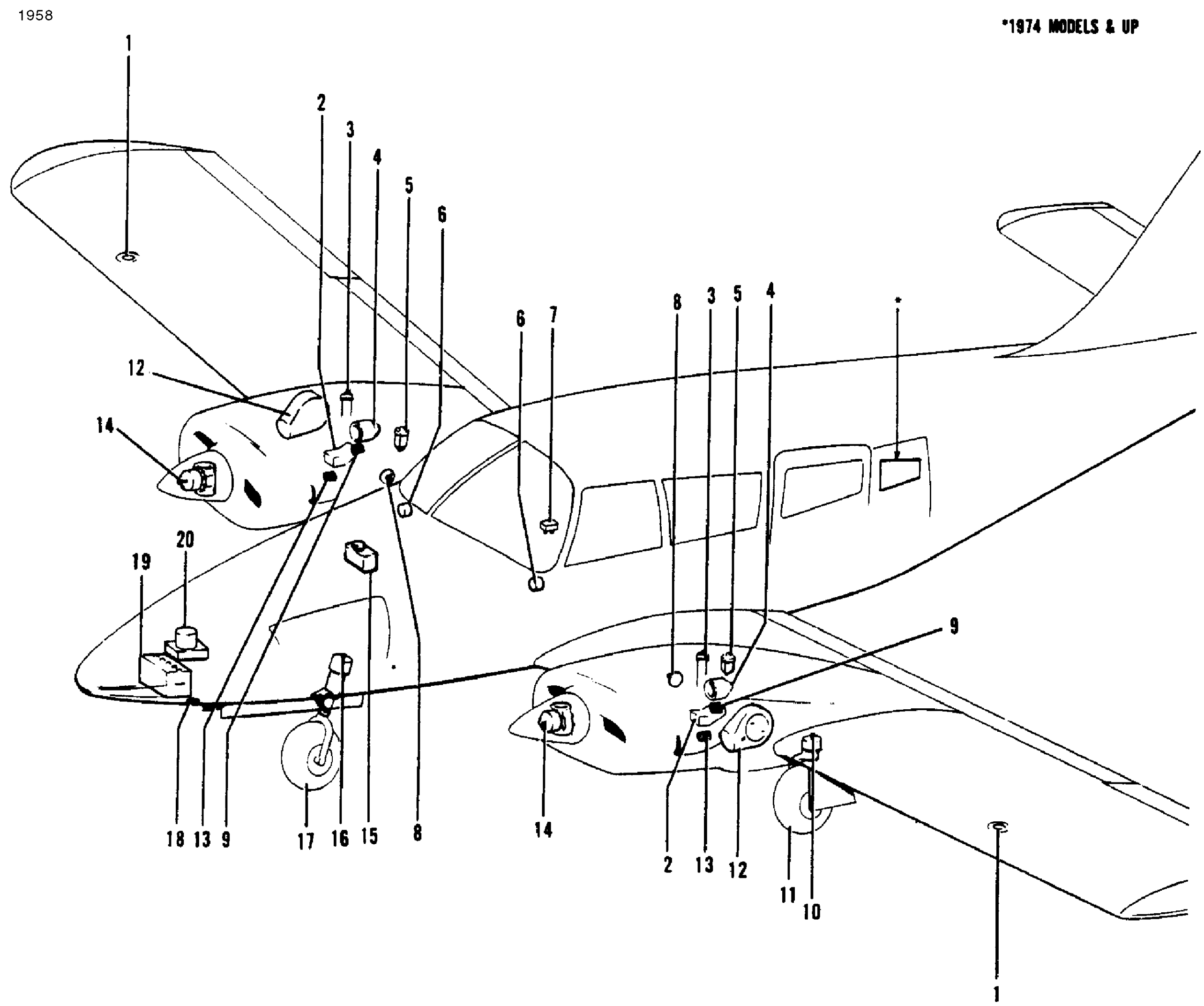
b. Fill tanks with fuel as specified on the placard adjacent to the filler neck (see Table I).

CAUTION: ASSURE THAT THE ADDITIVE IS DIRECTED INTO FLOWING FUEL STREAM. THE ADDITIVE FLOW SHOULD START AFTER AND STOP BEFORE THE FUEL FLOW. DO NOT PERMIT THE CONCENTRATED ADDITIVE TO COME IN CONTACT WITH THE AIRCRAFT PAINTED SURFACES OR THE INTERIOR SURFACES OF THE FUEL TANKS.

SOME FUELS HAVE ANTI-ICING ADDITIVES PRE-BLENDED IN THE FUEL AT THE REFINERY, SO NO FURTHER BLENDING SHOULD BE PERFORMED.

FUEL ADDITIVE CANNOT BE USED AS A SUBSTITUTE FOR A PREFLIGHT DRAINING OF THE FUEL SYSTEM DRAINS.

NOTE: The PA-34-200 aircraft is approved for operation with an anti-icing additive in the fuel. When an anti-icing additive is used it must meet the specification MIL-1-27686, must be uniformly blended with the fuel while refueling, must not exceed 15% by volumn of the refueled quantity, and to ensure its effectiveness should be blended at not less than 10% by volume (one and one hay liquid ozs. per ten gallon of fuel would be within the range). A blender supplied by the additive manufacturer should be used Except for the information contained in this section, the manufacturer's mixing or blending instructions should be carefully followed.



1. FUEL FILLERS
2. FUEL INJECTORS
3. ENGINE OIL FILL AND CHECK
4. ENGINE OIL FILTERS
5. FUEL FILTERS
6. INSTRUMENT AIR FILTERS
7. FUEL SYSTEM DRAINS
8. GASCOLATOR DRAINS
9. ENGINE OIL PRESSURE SCREEN
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

Service Points
Figure 9

27. DRAINING MOISTURE FROM FUEL SYSTEM. To facilitate draining the fuel system gascolators, lines and tanks of moisture and foreign matter, drains are incorporated in the bottom of the systems lowest point (see Figure 10 for 100 Hour Inspection) and the inboard end of each fuel tank.

28. DRAINING FUEL SYSTEM. The bulk of the fuel may be drained from the system by opening the valve at the inboard end of each fuel tank. Push up on the arms of the drain valve and turn counter-clockwise to hold the drain in the open position. The remaining fuel in the system may be drained through the gascolators and the two drains located on the lower right side of the fuselage inboard to the flaps.

29. BRAKE SYSTEM.

30. SERVICING BRAKE SYSTEM. The brake system incorporates a hydraulic fluid reservoir through which the brake system is periodically serviced. Fluid is drawn from the reservoir by the brake cylinders to maintain the volume of fluid required for maximum braking efficiency. Spongy brake pedal action is often an indication that the brake fluid reservoir is running low on fluid. Instructions for filling the reservoir are given in paragraph 31. When found necessary to accomplish repairs to any of the brake system components, or to bleed the system, these instructions may be found in Section VII.

31. FILLING BRAKE CYLINDER RESERVOIR. The brake cylinder reservoir should be filled to the level marked on reservoir, with the fluid specified in Table I. The reservoir, located on the center of the bulkhead in the nose baggage 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 Section VII.

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.

33. OLEO STRUTS.

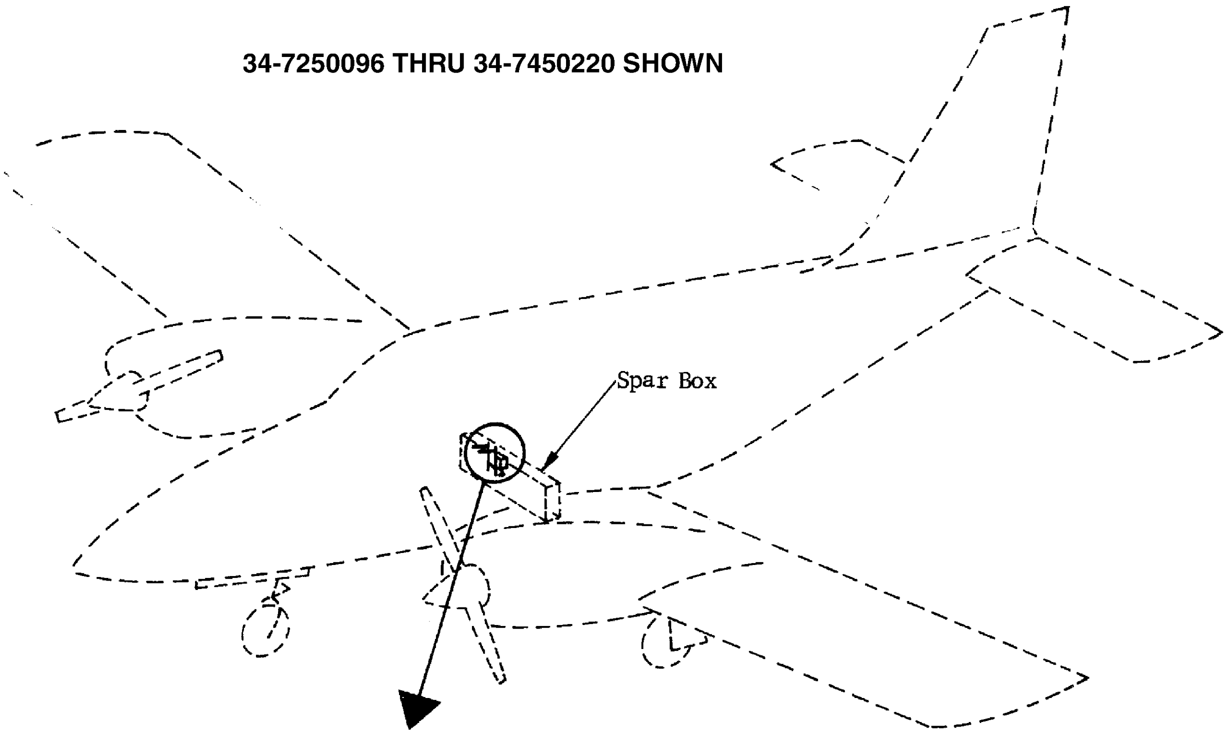
CAUTION: DO NOT EXCEED THESE TUBE EXPOSURES.

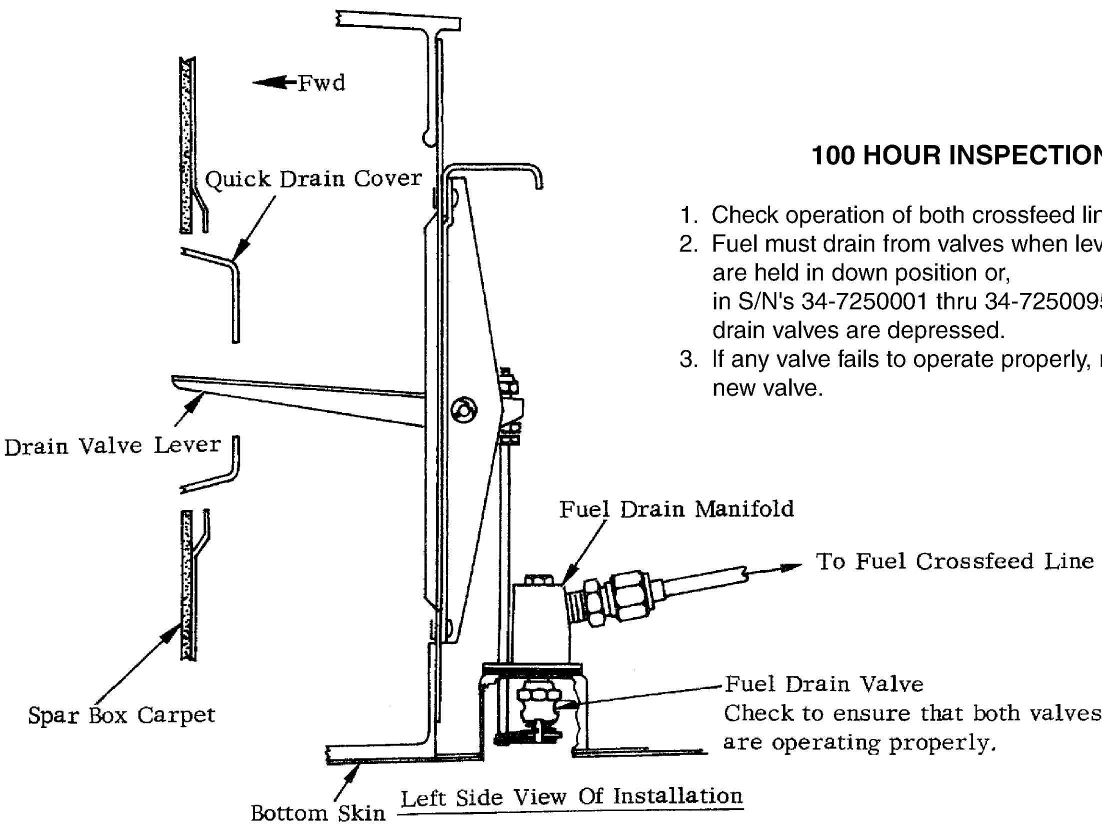
34. Servicing OLEO STRUTS. The air-oil type oleo strut should be maintained at proper strut piston tube exposures for best oleo action. The nose gear strut must have approximately 2.60 ±.25 inches of piston tube exposed, while the main gear strut requires approximately 3.60 ± .25 inches of tube exposure. 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.

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 as described in Paragraph 36. 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 as described in Paragraph 35 or 35a. For repair procedures of the landing gear and/or oleo struts, refer to Section VII of this manual.

34-7250096 THRU 34-7450220 SHOWN





100 HOUR INSPECTION

1. Check operation of both crossfeed line drain valves.
2. Fuel must drain from valves when levers (shown) are held in down position or, in S/N's 34-7250001 thru 34-7250095, when quick drain valves are depressed.
3. If any valve fails to operate properly, replace with new valve.

Fuel Drain Valve 100 Hour Inspection
Figure 10

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: DIRT AND FOREIGN PARTICLES COLLECT AROUND THE FILLER PLUGS OF THE LANDING GEAR STRUTS, THEREFORE, BEFORE ATTEMPTING TO REMOVE THESE PLUGS, THE AREA AROUND THE FILLER PLUGS SHOULD BE CLEANED WITH COMPRESSED AIR AND/OR WITH A QUICK DRYING SOLVENT.

35. 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:

a. Raise the airplane on jacks. (Refer to Paragraph 12.)

b. Place a pan under the gear to catch spillage.

c. Relieve air pressure from the strut housing chamber by removing the cap from the air valve and depressing the valve core.

d. There are two methods by which the strut chamber may be filled, and these are as follows:

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 to 45 foot-pounds.

Method II:

1. Remove the filler plug from the top of the nose gear strut housing.
2. Raise the strut piston tube until it is fully compressed.
3. Pour hydraulic fluid from a clean container through the filler opening until it reaches the bottom of the filler plug hole. (Air pressure type oil container may be helpful.)
4. Install the filler plug finger tight and extend and compress the strut two or three times to remove air from the housing.
5. Remove the filler plug; raise the strut to full compression and fill with fluid if needed.
6. Reinstall filler plug and torque to 45 foot-pounds.

e. 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.

f. Clean off any overflow of fluid and inflate the strut as described in Paragraph 36.

g. Check that fluid is not leaking around the strut piston at the bottom of the housing.

35a. 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.

Method I. Addition of small amount of fluid:

1. Raise the airplane on jacks. (Refer to Paragraph 12.)
2. Place a pan under the gear to catch any spillage.
3. Relieve the air pressure from the strut housing chamber by removing the cap from the air valve and depressing the valve core.
4. Remove the valve core from the filler plug and allow the filler plug to remain installed.
5. With the piston tube extended, fill the strut with the approved type hydraulic fluid.
6. 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.

7. 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.
8. 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.
9. Reinstall the air valve core in the filler plug and the plug in the strut housing and torque to 45 foot-pounds.
10. 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.
11. Clean off any overflow of fluid and inflate the strut as described in Paragraph 36.
12. Remove the aircraft from jacks and check strut exposure per Paragraph 34.

Method II. Filling completely empty struts:

1. Proceed with Steps I through 3 of Method I.
2. Remove the filler plug at the top inboard side of the main gear housing and fully extend the piston.
3. Pour 17 ± 1 ounces of MIL-H-5606 hydraulic fluid through the plug hole, using a syringe or pump oil can.
4. Proceed with Steps 9 through 12 of Method I.

36. INFLATING OLEO STRUTS. After making certain that an oleo strut has sufficient fluid, attach a strut pump to the air valve and inflate the oleo strut. The strut should be inflated (i.e. - Main = 250 psi; Nose = 150 psi; ± 10%) until the correct inches of piston is exposed with normal static load (empty weight of the airplane plus full fuel and oil) on the gear. (Refer to Paragraph 34.) Rock the airplane several times to ascertain that the gear settles back to the correct strut position. (If a strut pump is not available, the airplane may be raised and line pressure from a high pressure air system used. Lower the airplane and while rocking it, let air from the valve to bring the strut down to the proper extension. (Before capping the valve, check for valve core leakage.)

36a. SERVICING STEERING BUNGEES. At the specified frequency, according to the Lubrication Chart, the steering bungees must be serviced as follows:

a. Remove the access panels located in the forward baggage compartment.

b. Clamp the rudder pedals in the neutral position as shown in Figure 11, Section V.

c. Remove the nut, washers and bolt that secures the steering bungee and the steering arm.

d. Remove the clamp that secures the boot, on the frame at station 49.50, to the bungee.

e. Within the fuselage, disconnect the bungee from the rudder pedal arm by removing the nut, washer and bolt.

f. Remove the steering bungee from the aircraft.

g. Cut the safety wire from the bungee retainer.

h. Carefully remove the retainer and release the spring.

i. Apply Aero Lubriplate to the spring and mounting hardware.

j. Compress the spring into the bungee tube and install the retainer securing with MIL-W-6713 Type 316 safety wire.

k. Ascertain that the measurement taken between the facing sides of the washers at the rod end is 13.71 inches.

l. With the nose gear in the neutral position, install the steering bungee into position. The web must be in the vertical position. (Refer to Figure 2, Section VII.)

m. Install the bolt, washers and nut that secures the bungee to the steering arm.

n. Install the bolt, washer and nut that secures the bungee to the rudder pedal arm.

o. Install the boot clamp.

p. Repeat this procedure for the other steering bungee.

q. Align the nose gear per Alignment of Nose Landing Gear, Section VII.

r. Remove the rudder pedal clamps and check the operation of the steering bungees.

s. Install the access panels in the forward baggage compartment with the attachment hardware.

37. TIRES. The tires should be maintained at the pressure specified in Table I. 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.

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

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

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

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

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

(1) Tire growth in the first 12 to 24 hours after inflation will result in a seemingly severe pressure drop. Simply inflate, wait for another 24 hours, then check pressure. It will probably be within specs.

(2) Make sure that initial inflation is to recommended operating pressure to ensure full tire growth.

(3) It is normal for tubeless tires to show a small amount of pressure leakage throughout the life of the tires.

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

(1) Clean oil and grease from all tire surfaces.

(2) Apply single heavy coat using brush at 0.4 - 0.5 fluid ounces per square foot. Cover surface completely and evenly; allow to dry for 5 - 10 minutes.

(3) Apply second coat per step 2; allow to dry for 20 - 30 minutes before handling.

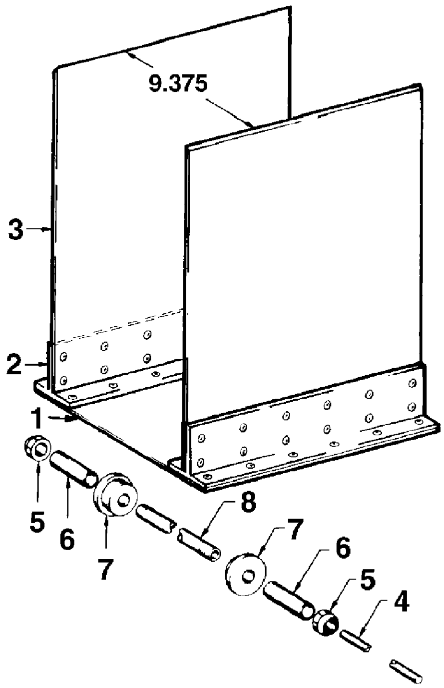
(4) Remove agent on wheel assembly with cleaning solvent.

(5) Apply as conditions dictate.

38. TIRE BALANCE.

Proper balancing is critical for the life of aircraft tires. If a new tire is balanced upon installation it will usually remain balanced for the life of the tire without having any shimmy or flat spots. An inexpensive balancer can be made that will balance almost any tire for light aircraft. See Figure 11 for balancer details. Balance the tire as follows:

(1) Mount tire and tube (if one is used) on wheel, but do not install the securing bolts. Install wheel bearings in wheel; then, using the -7 bushings, -6 spacers, and -5 nuts, (refer to Figure 11) install the wheel-tire assembly on the pipe. Secure the nuts finger-tight so that the wheel halves touch each other. Be sure the bolt holes are aligned. Insert the axle through the pipe and place the wheel in the center of the balancer. Make sure the axle is only on the chamfered edges of the balancer and that it is at 90° to the sides of the balancer.



USE THE FOLLOWING LIST OF MATERIALS TO MAKE THE BALANCER

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

Wheel Balancer
Figure 11

(2) Release the tire. If it is out of balance it will rotate, coming to rest with the heaviest point on the bottom. Tape a one-half (1/2) ounce patch across top center of the tire. Rotate the tire 45° and release it again. If the tire returns to the same position, add a one (1) ounce patch and again rotate the tire and release it. Continue this procedure until the tire is balanced.

(3) When balance is attained, put a chalk mark on the sidewall directly below the patch. Use one mark for each half ounce of weight needed. Mark the valve stem location on the tire and the opposite wheel half to assure reassembly in the same position. Remove the wheel from the balance stand, break it down and clean the inside of the tire with toluol. Apply a coat of patch cement to both the patch and the inside center of the tire in line with the chalk marks. When the cement has dried, install the patches making certain they are on the center line of the tire and aligned with the chalk marks on the sidewall. Burnish the patches to remove trapped air, etc.

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

39. HYDRAULIC SYSTEM.

40. SERVICING 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 Section VI of this manual.

41. SERVICING HYDRAULIC PUMP/RESERVIOR. 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 and position 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.

42. BATTERY.

43. SERVICING 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 Section XI.

44. CLEANING.

45. CLEANING ENGINE COMPARTMENTS. Before cleaning the engine compartments, place a strip of tape on the magneto vents to prevent any solvent from entering these units.

a. Place a pan under the engines to catch waste.

CAUTION: DO NOT SPRAY SOLVENT INTO THE ALTERNATOR, STARTER, AIR INTAKE, ALTERNATE AIR INLETS OR VACUUM PUMP DRIVE AREA.

b. With the engine cowlings removed, spray or brush the engines 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.

c. Allow the solvent to remain on the engine from five to 10 minutes, then rinse the engine clean with additional solvent and allow to dry.

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

d. Remove the protective covers from the filter and magnetos.

e. Lubricate controls, bearing surfaces, etc., per Figure 12, Lubrication Chart.

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

a. Place a pan under the gear to catch waste.

b. Spray or brush the gear area 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. Do not brush micro switches.

c. Allow the solvent to remain on the gear from 5 to 10 minutes, then rinse the gear with additional solvent and allow to dry.

d. Remove the cover from the wheel and remove the catch pan.

e. Lubricate the gear per Lubrication Chart.

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

a. Flush away loose dirt with water.

b. Apply cleaning solution with a rag, sponge or soft bristle brush.

c. To remove stubborn oil and grease, use a cloth dampened with naptha.

d. Where exhaust stains exist, allow solution to remain on the surface longer.

e. Any good automotive wax may be used to preserve the painted surfaces. Soft cleaning cloths or a chamois should be used to prevent scratches when cleaning or polishing. A heavier coating of wax on the leading surfaces will reduce the abrasion problems in these areas.

48. CLEANING WINDSHIELD AND WINDOWS.

a. Remove dirt, mud. etc., from exterior surfaces with clean water.

b. Wash with mild soap and warm water or an aircraft plastic cleaner. Use a soft cloth or sponge using a straight rubbing motion. Do not harshly rub surfaces.

c. Remove oil and grease with a cloth moistened with kerosene.

NOTE: Do not use gasoline, alcohol, benzene, carbon tetrachloride, thinner, acetone, or window cleaning sprays.

d. After cleaning plastic surfaces, apply a thin coat of hard polishing wax. Rub lightly with a soft cloth. Do not use a circular motion.

e. A severe scratch or mar in plastic can be removed by using jeweler's rouge to rub out the scratch. Smooth both sides and apply wax.

f. To improve visibility through windshield and windows during flight through rain, a rain repellent such as REPCON should be applied to the windshield and windows. The surface of the windshield and windows treated becomes so smooth that water beads up and readily flows off the surface. Apply this product in accordance with the manufacturer's instructions. (Refer to Table V.)

49. CLEANING HEADLINER, SIDE PANELS AND SEATS.

a. Clean headliner, side panels and seats with a stiff bristle brush and vacuum where necessary.

CAUTION: SOLVENT CLEANERS REQUIRE ADEQUATE VENTILATION.

b. Soiled upholstery, except leather, may be cleaned by using an approved air type cleaner or foam upholstery cleaner. Carefully follow the manufacture's instructions. Avoid soaking or harsh rubbing.

c. Leather material should be cleaned with saddle soap or mild soap and water.

50. CLEANING CARPETS. Use a small whisk broom or vacuum to remove dirt. For soiled spots, use a non-inflammable dry cleaning fluid. Floor carpets may be removed and cleaned like any household carpet.

51. LUBRICATION.

52. OIL SYSTEM. (ENGINE.)

53. SERVICING OIL SYSTEM. The engine oil level should be checked before each flight and changed after each 50 hours of engine operation. During oil change, the oil screen(s) should be removed and cleaned, and when installed, the oil filter cartridge replaced. Intervals between oil changes can be increased as much as 100% on engines equipped with full flow (cartridge type) oil filters provided the element is replaced each 50 hours of operation. The engine manufacturer does not recommend oils by brand names. Use a quality brand Aviation Grade Oil of the proper season viscosity. For information on the use of detergent oil, refer to paragraph 59.

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

54. FILLING OIL SUMP. The oil sump should normally be filled with oil to the mark on the engine dipstick. The quantity of oil required for the engines may be found in Table I. The specified grade of oil may be found in the Lubrication Chart or on the right 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 with dipstick.

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

56. 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.

57. OIL SCREEN. (PRESSURE.) The oil pressure screen, located in a housing on the accessory case of the engine, between the magnetos, 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. When reinstalling the screen, it is recommended that a new gasket be used. Ascertain that the screen fits flush with the base surface of the screen housing. Position housing on mounting pad and install attachment bolts. Torque bolts within 50 to 70 inch pounds.

NOTE: The oil screen (pressure), above, and the oil filter (full flow), below, installations are mutually exclusive. I.E. - if a full flow cartridge-type oil filter is installed, there is no oil screen (pressure).

58. OIL FILTER. (FULL FLOW.)

a. The oil filter element 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.

b. Before discarding the filter element, remove the outer perforated paper cover, and using a sharp knife, cut through the folds of the element at both ends, close to the metal caps. Then, carefully unfold the pleated element and 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 particle or 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.

c. After the element has been replaced, tighten the attaching bolt within 20 to 25 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.

59. RECOMMENDATIONS FOR CHANGING OIL. (Refer to latest revision of Lycoming Service Instruction No. 1014 and Service Bulletin No. 480.)

a. In engines that have been operating on straight mineral oil for several hundred hours, a change to additive oil should be made with a degree of caution, since the cleaning action of some additive oils will tend to loosen sludge deposits and cause plugged oil passages. When an engine has been operating on straight mineral oil and is known to be in excessively dirty condition, the switch to additive or compounded oil should be deferred until after the engine is overhauled.

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

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

60. WINTERIZATION PLATE. For winter operations there is a Winterization Plate Kit available. When the ambient temperature is 50°F or less, the plate is installed on the inlet opening of the oil cooler plenum chamber. When the plate is not being used it can be stored in the nose baggage compartment.

GRIDS 1D22 THRU 1D24
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61. 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 insure the maximum efficiency and utmost service of all moving parts. Lubrication instructions regarding the locations, time intervals, and type of lubricants used may be found in Figure 12, Lubrication Chart. To insure the best possible results from the application of lubricants, the following precautions should be observed:

   a. Use recommended lubricants. Where general purpose lubricating oil is specified, but unavailable, clean engine oil may be used as a satisfactory substitute.

   b. Check the components to be lubricated for evidence of excessive wear and replace them as necessary.

   c. 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.

62. APPLICATION OF OIL. Whenever specific instructions for lubrication of mechanisms requiring lubrication are not available, observe the following precautions:

   a. Apply oil sparingly, never more than enough to coat the bearing surfaces.

   b. Do not oil control cables.

   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.

   c. 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.

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

   a. Where a reservoir is not provided around a bearing, apply the lubricant sparingly and wipe off any excess.

   b. 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.

   c. 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.

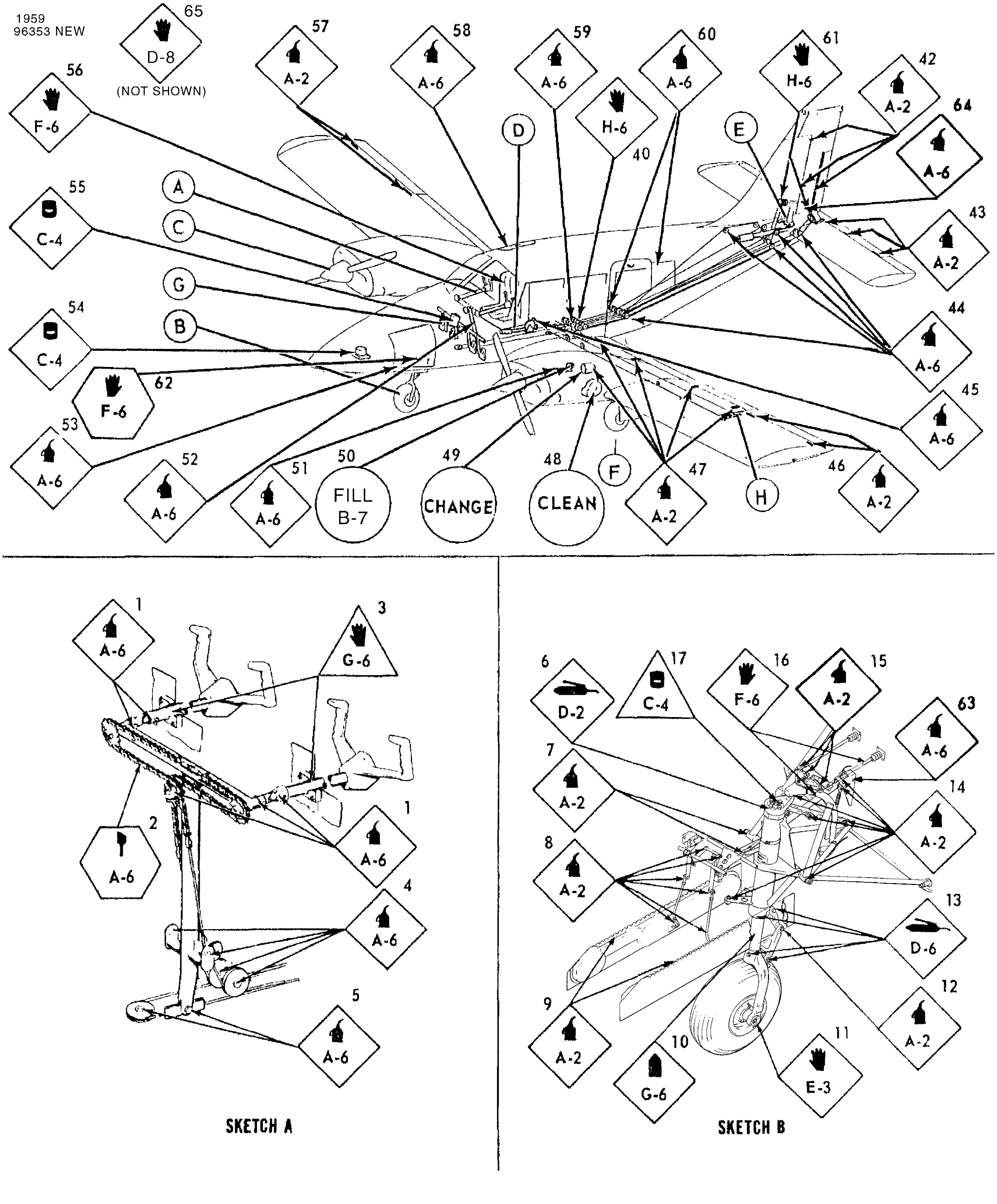
64. LUBRICATION CHART. (See Figure 12.) Each part of the airplane to be lubricated, is indicated by an item number which is keyed to the legend. Adjacent to each item number is a frequency symbol which indicates the lubrication interval. Application symbols within the frequency symbols show how the lubrication is applied. Also within the frequency symbol is a type of lubricant code letter and a special instructions code number which indicate the specific lubricant and application instructions for each individual component.

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

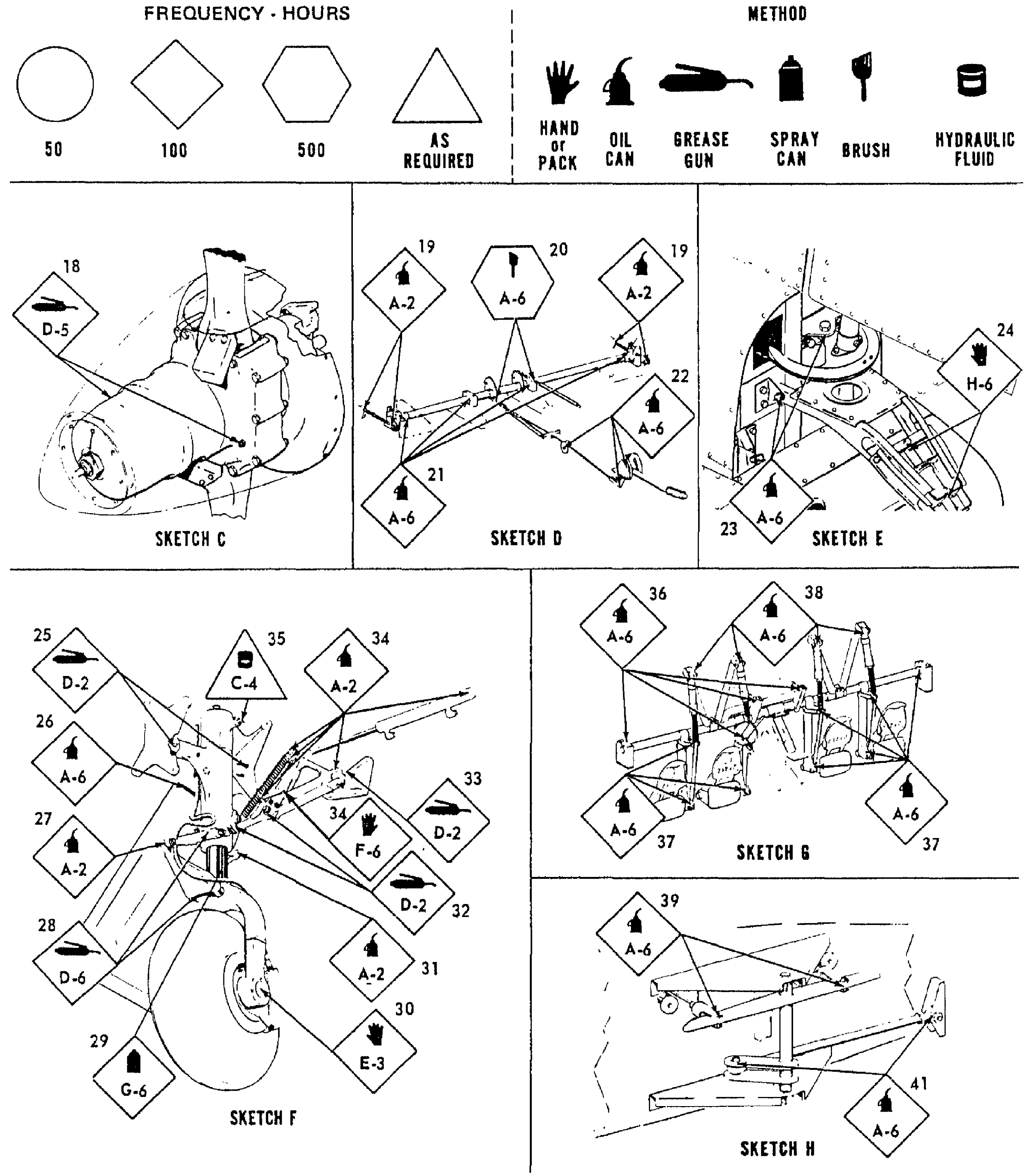
LEGEND

1. CONTROL COLUMN FLEX JOINT, SPROCKET AND O-RING
2. AILERON AND STABILATOR CONTROL CHAIN
3. O-RING CONTROL SHAFT BUSHING
4. TEE BAR PIVOT POINTS, AILERON AND STABILATOR CONTROL PULLEYS
5. STABILATOR CONTROL ROD AND IDLER PULLEY
6. NOSE GEAR STRUT HOUSING
7. NOSE GEAR PIVOT POINT AND HYDRAULIC CYLINDER ROD END
8. NOSE GEAR DOOR RETRACTION MECHANISM
9. NOSE GEAR DOOR HINGES
10. EXPOSED OLEO STRUT (NOSE)
11. NOSE WHEEL BEARINGS
12. NOSE GEAR TORQUE LINK ASSEMBLY
13. NOSE GEAR TORQUE LINK ASSEMBLY AND STRUT HOUSING
14. NOSE GEAR PIVOT POINT, DRAG LINK ASSEMBLY, DOWNLOCK AND CYLINDER ASSEMBLY, STEERING ROLLER AND CENTERING SPRING PIVOT POINTS
15. STEERING BELLCRANK PIVOT POINTS AND ROD ENDS
16. NOSE GEAR ROLLER TRACK AND BUNGEE
17. NOSE GEAR OLEO STRUT FILLER POINT
18. PROPELLER ASSEMBLY
19. FLAP CONTROL ROD END BEARINGS
20. FLAP RETURN AND TENSION CHAIN
21. FLAP TORQUE TUBE BEARING BLOCK
22. FLAP HANDLE PIVOT POINT LOCK MECHANISM AND CABLE PULLEY
23. RUDDER SECTOR AND STABILATOR TRIM PIVOT POINTS
24. STABILATOR TRIM SCREW
25. MAIN GEAR PIVOT POINTS
26. MAIN GEAR DOOR HINGE
27. MAIN GEAR TORQUE LINKS
28. MAIN GEAR TORQUE LINKS (SEE NOTE 5)
29. EXPOSED OLEO STRUT (MAIN)
30. MAIN GEAR WHEEL BEARINGS
31. MAIN GEAR DOOR CONTROL ROD ENDS
32. MAIN GEAR SIDE BRACE LINK ASSEMBLY
33. UPPER SIDE BRACE SWIVEL FITTING
34. MAIN GEAR DOWNLOCK ASSEMBLY RETRACTION FITTING AND CYLINDER ATTACHMENT POINTS
35. OLEO STRUT FILLER POINT (MAIN GEAR)
36. RUDDER TUBE CONNECTIONS, TUBE CABLE ENDS AND STEERING ROD ENDS
37. BRAKE ROD ENDS
38. TOE BRAKE ATTACHMENTS
39. AILERON BELLCRANK CABLE ENDS
40. AILERON BELLCRANK PIVOT POINTS
41. AILERON CONTROL ROD END BEARINGS
42. RUDDER HINGE AND TAB HINGE BEARINGS
43. STABILATOR TRIM TAB HINGE PINS
44. CONTROL CABLE PULLEYS
45. TRIM CONTROL WHEELS - STABILATOR AND RUDDER
46. AILERON HINGE PINS
47. FLAP HINGE BEARINGS AND ALTERNATE AIR DOORS
48. INDUCTION AIR FILTERS
49. CARTRIDGE TYPE OIL FILTERS
50. ENGINE OIL SUMP (8 QTS. CAPACITY)
51. GOVERNOR CONTROLS
52. CONTROL QUADRANT CONTROLS
53. FORWARD BAGGAGE DOOR HINGE AND LATCH PINS
54. HYDRAULIC PUMP RESERVOIR
55. BRAKE RESERVOIR
56. PILOT AND COPILOT SEAT ADJUSTMENT
57. AILERON HINGE PINS
58. MAIN DOOR HINGES AND LATCH MECHANISM
59. CONTROL CABLE PULLEYS
60. BAGGAGE AND REAR DOOR HINGES AND LATCH MECHANISM
61. RUDDER AND STABILATOR TRIM SCREWS
62. LATCH MECHANISM
63. LINK BUSHING
64. ARM BUSHING
65. CONTROL CABLES

Lubrication Chart
Figure 12 (Sheet 1 of 5)



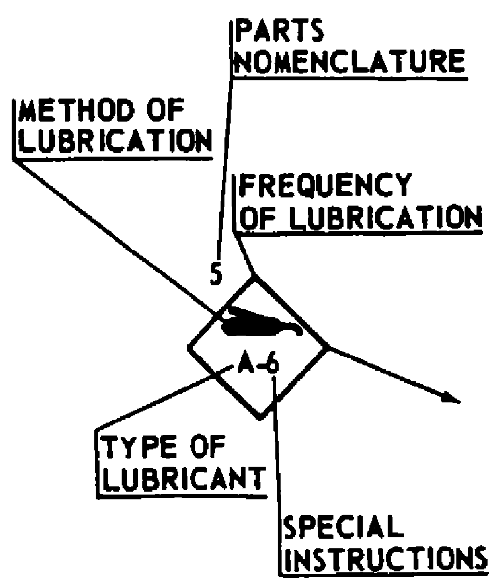
Lubrication Chart
Figure 12 (Sheet 2 of 5)



Lubrication Chart
Figure 12 (Sheet 3 of 5)

TYPE OF LUBRICANT

LUBRICANT CODE	SPECIFICATION	AIR TEMPERATURE	LUBRICANT
A	MIL-PRF-7870C		LUBRICATING OIL, GENERAL PURPOSE, LOW TEMPERATURE
B	MIL-L-22851	ALL	SAE 15W50 OR 20W50
	(ASHLESS DISPERSANT)	ABOVE 80°F (27°C)	SAE 60
		ABOVE 60°F (16°C)	SAE 40 OR 50
		30° TO 90°F (-1° TO 32°C)	SAE 40
		0° TO 70°F (-18° TO 21°C)	SAE 30, 40, OR 20W40
		0° TO 90°F (-18° TO 32°C)	SAE 20W50 OR 15W50
		BELOW 10°F (-12°C)	SAE 30 OR 20W30
	MIL-L-6082	ABOVE 80°F (27°C)	SAE 60
	(MINERAL OIL)	ABOVE 60°F (16°C)	SAE 50
		30° TO 90°F (-1° TO 32°C)	SAE 40
		0° TO 70°F (-18° TO 21°C)	SAE 30
		0° TO 90°F (-18° TO 32°C)	SAE 20W50
		BELOW 10°F (-12°C)	SAE 20
C	MIL-H-5606		HYDRAULIC FLUID, PETROLEUM BASE
D	MIL-G-23827		GREASE, AIRCRAFT AND INSTRUMENT, GREASE AND ACTUATOR SCREW
E			TEXACO MARFAX ALL PURPOSE GREASE OR MOBIL MOBIL GREASE 77 (OR MOBIL EP2 GREASE)
F	MIL-G-7711		GREASE - LUBRICATION, GENERAL PURPOSE, AIRCRAFT
G			DRY LUBRICANT # MS-122 (PURCH)
H			AERO LUBRIPLATE OR MAG-1 (PURCH) FISKE BROS. REFINING CO.



Lubrication Chart
Figure 12 (Sheet 4 of 5)

CAUTIONS

1. DO NOT USE HYDRAULIC FLUID WITH A CASTOR OIL OR ESTER BASE.
2. DO NOT OVER-LUBRICATE COCKPIT CONTROLS.
3. DO NOT APPLY LUBRICANT TO RUBBER PARTS.
4. DO NOT OIL CONTROL CABLES.

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. BEARING AND BUSHINGS - CLEAN EXTERIOR WITH A DRY TYPE SOLVENT BEFORE LUBRICATING.
3. WHEEL BEARINGS - DISASSEMBLE AND CLEAN WITH A DRY TYPE SOLVENT. ASCERTAIN THAT GREASE IS PACKED BETWEEN THE BEARING ROLLER AND CONE. DO NOT PACK GREASE IN WHEEL HOUSING.
4. OLEO STRUTS, HYDRAULIC PUMP RESERVOIR AND BRAKE RESERVOIR - FILL PER INSTRUCTIONS ON UNIT OR CONTAINER, OR REFER TO SERVICE MANUAL.
5. PROPELLER - REMOVE ONE OF THE TWO GREASE FITTINGS FOR EACH BLADE. APPLY GREASE THROUGH FITTING UNTIL FRESH GREASE APPEARS AT HOLE OF REMOVED FITTING.
6. LUBRICATION POINTS - WIPE ALL LUBRICATION POINTS CLEAN OF OLD GREASE, OIL, DIRT, ETC. BEFORE LUBRICATING.
7. SEE LATEST REVISION OF LYCOMING SERVICE INSTRUCTION NO. 1014 AND SERVICE BULLETIN NO. 480.
8. APPLY A FILM OF GREASE ON CONTROL CABLES WHERE THEY PASS OVER/THROUGH PULLEYS/GUIDES.

NOTES

1. PILOT AND PASSENGER SEATS - LUBRICATE TRACK ROLLERS AND STOP PINS AS REQUIRED (TYPE OF LUBRICANT "A").
2. WHEEL BEARINGS REQUIRE CLEANING AND REPACKING AFTER EXPOSURE TO AN ABNORMAL QUANTITY OF WATER.
3. FUEL SYSTEM - SERVICE REGULARLY - FUEL PUMP STRAINER INJECTOR SCREEN - FILTER BOWL - QUICK DRAIN UNIT.
4. BATTERY - FLUID LEVEL & CONDITION CHECK EVERY 25 HOURS.
5. GREASE HOLES REQUIRE A NEEDLE TYPE ADAPTER ON THE GREASE GUN NOZZLE.

Lubrication Chart
Figure 12 (Sheet 5 of 5)

65. CONSUMABLE MATERIALS.

See Table V.

66. VENDOR CONTACT INFORMATION.

See Table VI.

67. CONVERSION TABLES.

The following charts contain various conversion data that may be useful when figuring capacities, lengths, temperatures, and various weights and measures from the English system to the metric system or back again:

Table VII, Decimal Conversions

Table VIII, Temperature Conversion

Table IX, Weights and Measures Conversion

Table X, Metric Conversion

Table XI, Drill Sizes

TABLE IV
THREAD LUBRICANTS

Line	Lubricant
Brakes	MIL-H-5606

WARNING: DO NOT PERMIT MIL-T-5544 ANTI-SIEZE COMPOUND TO ENTER SYSTEM. APPLY TO FITTING THREADS ONLY.

Line	Lubricant
Air Conditioning Refrigerant	MIL -T-5544, Anti-Seize Compound
Fuel	MIL -T-5544, Anti-Seize, Graphite Patrolatum
Landing Gear Air Valve	6PB Parker
Oil	MIL-G-6032, Lubrication Grease (Gasoline and Oil Resistant)
Pitot and Static	TT-A-580 (JAN-A-669). Anti-Seize Compound (White Lead Base)

CAUTION: LUBRICATE ENGINE FITTINGS ONLY WITH THE FLUID CONTAINED IN THE PARTICULAR LINE.

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TABLE V (Sheet 1 of 8)
CONSUMABLE MATERIALS

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
ABS-Solvent/ Cements		Solarite, #11 Series	Solar Compounds Corp.
Adhesive		EC 801 EC 807 EC 1357 Scotch Grip 210	Minnesota Mining and Manufacturing Adhesive Coating and Sealers Division
	Neoprene Rubber	3M EC 1300L	
Anti-Galling Solution	MIL-A-907	Ease-Off	Taxacone Company
Anti-Seize Compound (Graphite Petrolatum)	MIL-T-5544	Armite Product	Armite Laboratories
		Anti-Seize Compound	Exxon Oil Company
		Royco 44	Royal Lubricants Co.
Anti-Seize Compound (White Lead Base)	TT-A-580 (JAN-A-669)	Armite Product	Armite Laboratories
Anti-Seize Thread Compound “HIGH TEMPERATURE”		Fel-Pro C5-A	Fel-Pro Incorporated
Buffing and Rubbing Compounds		Automotive Type DuPont #7	DuPont Company
		Ram Chemical #69	Ram Chemicals
Compound for Polishing		Mirror Glaze	Mirror Bright Polish Co., Incorporated
Plexiglas Polish and Cleaner	P-P-560	Part Number 403D	Permatex Co., Inc. Kansas City, Kansas 66115
Corrosion Retardant Compounds	MIL-C-16173 D (Piper P/N 197-508)	LPS-3 Heavy Duty Rust Inhibitor	Holt Lloyd Corp.
	(Piper P/N 197-509)	Metal Parts Protector Protector Flex	Chemi-Cap. Chemical Packaging Corp.
Cleaners		Fantastic Spray	Local Supplier
		Perchlorethylene	
		VM&P Naphtha (Lighter Fluid)	
Deicer Boot Surface Coatings		AgeMaster® No. 1	Goodrich
Dry Lubricant	MIL-L-60326	MS-122-6075	Local Supplier
		MS-122DF (PTFE)	Miller-Stephenson

TABLE V (Sheet 2 of 8)
CONSUMABLE MATERIALS

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Epoxy Patching Compound		Solarite #400	Solar Compounds Corp.
Gasket Cement		Permatex No. 2	Permatex Company, Inc.
Grease, Actuator		2196-74-1	Dukes Astronautics Co.
Grease, Aircraft Instrumentation, Gear and Actuator Screw (Temp. Range - (100°F to +250°F)	MIL-G-23827A (See Note 1)	Supermil Grease No. A72832	Amoco
		Royco 27A	Royal Lubricants Co.
		Shell 6249 Grease	Shell Oil Company
		RR-28	Socony Mobil Oil Co.
		Castrolease A1	Burmah-Castrol LTD.
		Low-Temp. Grease E.P.	Texaco Incorp.
		5114 E.P. Grease AV55	Standard Oil of Calif.
		Aeroshell Grease 7 Aeroshell Grease 33 Braycote 627S	Shell Oil Company
		Mobil Grease 27	Mobil Oil Corporation
		B.P. Aero Grease 31B	B.P. Trading Limited
Grease, Aircraft Instrumentation, Gear and Actuator Screw (Temp. Range - 65°F to +250°F)	MIL-G-3278	Unitemp E.P.	Texaco Incorporated
		RPM Aviation Grease 5, Supermil Grease No. 8723	Standard Oil of Calif.
		Aeroshell Grease 7A	Shell Oil Corporation
		Royco 78	Royal Lubricants Company
		L-1212	Sinclair Refining Co.
		1916 Uni-Temp Grease	California Texas Oil Corporation

TABLE V (Sheet 3 of 8)
CONSUMABLE MATERIALS

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Grease, Ball and Roller Bearing	MIL-G-18709	Regal ASB-2 Formula TG-10293	Texaco Incorporated
		Andok B	Exxon Company, U.S.A.
		Code 1-20481, Darina Grease 1 XSG-6213	Shell Oil Company
		Code 71-501, Darina Grease 2 XSG-6152	
		Code 71-502, Alvania Grease 2 XSG-6151	
		Code 71-012, Cyprina Grease 3 XSG-6280	
		Code 71-003	
Grease, General Purpose Wide Temperature	MIL-G-81322	Marfax All Purpose	Texaco Incorporated
		Aeroshell No. 6	Shell Oil Company
		Mobil Grease 77 or Mobilux EP2	Mobil Oil Corporation
		Shell Alvania EP2	Shell Oil Company
		Royco 22	Royal Lubricants Company
		Mobil Grease 28	Mobil Oil Corporation
		Aeroshell No. 22	Shell Oil Company
Grease, High Temperature	MIL-G-3545C	High Temp. Grease, Marfak All Purpose	Texaco Incorporated
		Shellaire Grease HT	Shell Oil Company
		Alvania E.P. Grease 2	
		Aeroshell Grease 5	
		Grease 77, Mobilux E.P. 2	Mobil Oil Corporation
		Royco 45A	Royal Lubricants Co.
		L-1231	Sinclair Refining Company

TABLE V (Sheet 4 of 8)
CONSUMABLE MATERIALS

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Grease, Aircraft General Purpose	MIL-G-7711	Regal AFB2 Regal Starfak Premium	Texaco Incorporated
		PED 3040	Standard Oil of Calif.
		Aeroshell Grease 6	Shell Oil Company
		Royco II	Royal Lubricants Company
Grease, Lubricating, Molybdenum Disulfide, Low and High Temperature	MIL-G-21164	Aeroshell Grease No. 17	Shell Oil Company
		Royco 64C	Royal Lubricants Co.
		Castrolease MSA (c)	Burmah Castrol LTD.
Grease, Lubricating, Plug Valve, Gasoline and Oil Resistant	MIL-G-6032	Royco 32	Royal Lubricant Company
		Castrolease PV	Burmah Castrol LTD.
		Parker Fuel Lube 44	Parker Seal Company
		B.P. Aero Grease 32	B.P. Trading Limited
		L-237	Lehigh Tenneco Chemicals Co., Inc.
		Rockwell 950	Rockwell International
Grease, Waterproof, High and Low Temperature		Aero Lubriplate	Fiske Brothers Refining Company
“Hot Melt” Adhesive Polyamids and “Hot Melt” Gun.	Stick Form 1/2 in. diameter, 3 in. long		Sears, Roebuck and Company or most hardware stores.

TABLE V (Sheet 5 of 8)
CONSUMABLE MATERIALS

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Hydraulic Fluid	MIL-H-5606	Brayco 756D	Bray Oil Company
		TL-5874	Texaco Incorporated
		PED 3565	Standard Oil Company of California
		Aircraft Hydraulic Oil AA	Texaco Incorporated
		RPM Aviation Oil No. 2 Code PED 2585 PED 3337	Standard Oil Company of California
		3126 Hydraulic oil (uniuisyo)	Exxon Company U.S.A
		Aeroshell Fluid 4, SL-7694	Shell Oil Company
		Aero HF	Mobil Oil Corporation
		Royco 756, 756A and 756B	Royal Lubricants Co.
Isopropyl Alcohol	Fed. Spec. TT-I-735		Local Supplier
Kevlar		Kevlar	Kevlar Special Products
Loctite	MIL-S-22473 Grade AA	Loctite 290	Loctite Corporation
	MIL-S-22473 Grade H and HV	Loctite 222	
Methylethylketone	Fed. Spec. TT-M-261		Local Supplier
Molybdenum Disulfide	MIL-M-7866	Molykote-Type G (Paste)	Dow Corning Corp.
		Molykote - Type 2 (Powder)	

TABLE V (Sheet 6 of 8)
CONSUMABLE MATERIALS

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Oil Lubricating, General Purpose, Low Temperature	MIL-L-7870	Caltex Low Temp. Oil	Caltex Oil Products Company
		Sinclair Aircraft Orbit Lube	Sinclair Refining Company
		1692 Low Temp Oil	Texaco Incorporated
		Aviation Instrument Oil	Standard Oil Company of California
		Royco 363	Royal Lubricants Co.
Rain Repellent	FSCM 50150	Repcon	Unelco Corporation
Safety Walk Pressure Sensitive		Flextred 300	Wooster Products, Incorporated
Sealant	MIL-S-11031B	PRC 5000 PRC 383	Products Research Company
Sealant, Fuel Tank Sealing		RS-36b, Stripper (thin)	CEE BEE Chemical Co.
		RS-24b, Stripper (thick)	
		PR 1422 A-2 Sealant (Brushing Consistency)	Products Research Company
		PR 1422 B-2 Sealant (Trowling Consistency)	
		PR 1431G, Faying Surface Seal, Type 1	
		PR 1321-B 1/2, Access Panel Sealant	
		PR 1560 MK, Primer (Anti-Bacteriological Coating)	Products Research Company

TABLE V (Sheet 7 of 8)
CONSUMABLE MATERIALS

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Sealant, Fuel Tank Sealing (continued)		BJO-0930, Phenolic Balloons	Union Carbide Plastics Division
		ERL-2795, Epoxy Resin	
		22LA-0340 Polyamid Hardener	
	Class A-2	Thiokol MC-236	
Sealant, Fuselage Structure	Class A-1/2, A-2, B-2 B-4, B-6, B-8		H.S. Bancroft Corp.
		EC 1239	Minnesota Mining and Manufacturing Industrial Specialties Division
		EC 612 (Leak Marker or Weatherstripping, etc)	
		G.E.-SS-4004 (Primer) RTV-88 with RTV-9811	General Electric Silicone Products Department
Sealant, Window & Airframe	Piper P/N 279-063	Bostik Chem-Calk 915 (Polyurethane); or,	
	Piper P/N 279-058	Bostik 1100FS (Urethane); or,	Local Supplier
	Piper P/N 179-853	3M Weatherban 606 (Acrylic); or,	Minesota, Mining & Mfg., 3M Center
		3M Weatherban 101 (Polysulfide); or,	
		PR-307 (Polysulfide);	Product Research Company
Sealing Compound, Gasket and Joint		Tite-Seal	Radiator Specialty Co.
Sealer		PR 1321 B-1/2	Products Research Company
Silicone Compound	MIL-S-8660 (MIL-C-21567)	DC-4, DC-6 Compound	Dow Corning
		G-624	General Electric Co. Silicone Products Department

TABLE V (Sheet 8 of 8)
CONSUMABLE MATERIALS

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
Solvents		Methylethyl Ketone	Local Suppliers
		Methylene Chloride	
		Acetone	
		Y2900	Union Carbide; Plastic Division
	Fed. Spec. PD 680 Type I - Stoddard Solvent		Local Supplier
	Type II - High Temperature		Local Supplier
		Peerco #321	Peerless Quality Products
Propeller Slip Ring Cleaning Solvent		CRC-2-26	CRC Industries, Inc.
Tape, Vinyl Foam, Type 2, l/8 in. x 1 in.	Piper P/N 189-721	V510 or V740 Series; or,	Norton Tape Division
		VF-1100 Series; or,	Pres-On Products, Inc. Addison, IL 60101
		V1500 Series	Gaska Tape Inc. Elkhart, IN 46515-1698
Toluol	TT-M-261		Local Supplier
Trichlorethylene	MIL-T-7003	Perm-A-Clor	Dextrex Chemical Industries, Inc.
		Turco 4217	Turco Products, Inc.
Teflon Tape	.003" x .5" wide/-1		Minnesota Mining and Manufacturing Company
			Shamban W.S. and Co.
	.003" x .25" wide/-2		Johnson & Johnson, Inc. Permacel Division
Vinyl Foam	1 in. x 1/8 in.	530 Series, Type I	Norton Tape Division
Vinyl, Black Plastic	2 in. x 9 mil. and/or 1 1/2 in. x 9 mil.		

NOTE: Take precautions when using MIL-G-23827 and engine oil. These lubricants contain chemicals harmful to painted surfaces.

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TABLE VI (Sheet 1 of 2)
VENDOR CONTACT INFORMATION

A

American Gas and
Chemical Co. LTD
220 Pegasus Avenue
Northvale, NJ 07647
201-767-7300

Amoco Oil Co.
200 E. Randolph Drive
Chicago, IL 60601
312-856-5111

Armite Laboratories
1845-49 Randolph Street
Los Angeles, CA 90001
213-587-7744

B

BP Trading Limited
Moore Lane
Brittanic House
London E.C. 2
England

Bray Oil Company
1925 N. Marianna Avenue
Los Angeles, CA 98103
213-268-6171

Burmah - Castrol Inc.
30 Executive Avenue
Edison, NJ 08817
201-287-3140

C

California Texas Oil Corp.,
380 Madison Avenue
New York, NY 10017

Caltex Oil Products Co.
New York, NY 10020

CEE BEE Chamical Co.
9520 E. CEE BEE Drive
Box 400
Downey, CA 92041

Chemi-cap
Chemical Packaging Corp.
1100 N.W. 70th Street
Ft. Lauderdale, FL 33309
305-665-9059

CRC Industries
885 Louis Drive
Warminster, PA 18974-0586
800-272-8963
www.crcindustries.com/

D

Dextrex Chemical
P. O. Box 501
Detroit, MI 48232

Dow Corning Corporation
Alpha Molykote Plant
64 Harvard Avenue
Stanford, CT 06902

Dukes Astronautics Co.
7866 Deering Avenue
Canoga Park, CA 91304

DuPont Company
Finishes Div.
DuPont Building
Wilmington, DE 19898
302-774-1000

E

Exxon Oil Company
1251 Avenue of the Americas
New York, NY 10020
212-398-3093

F

Fel-Pro Incorporated
7450 N. McCormick Blvd.
Box C1103
Skokie, IL 60076
312-761-4500

Fiske Brothers
Refining Company
120 Lockwood Street
Newark, NJ 07105
201-589-9510

G

General Electric Co.
Silicone Products Dept.
Waterford, NY 12188
518-237-3330

Goodrich Corporation
(See listing in Introduction,
Supplementary Publications,
Vendor Publications.)

H

H. S. Bancroft Corp.
One Rockhill
Industrial Park
Cherry Hill, NJ 08003
609-854-8000

Holt Lloyd Corp.
4647 Hugh Howell Rd.
Tucker, GA 30084
404-934-7800

J

Johnson & Johnson, Inc.
Permacel Division
501 George Street
New Brunswick, NJ 08901
201-524-0400

K

Kevlar Special Products
E.I. DuPont de
Nemours & Co., (Inc.)
Textile Fibers
Department
Centre Road Building
Wilmington, DE 19898
302-999-3156

L

Lehigh - Tenneco Chemicals
Co., Inc.
Chestertown, MD 21620
301-778-1991

Loctite Corporation
777 N. Mountain Road
Newington, CT 06111
800-243-8160
In CT 800-842-0225

TABLE VI (Sheet 2 of 2)
VENDOR CONTACT INFORMATION

M

Miller-Stephenson
George Washington Hwy
Danbury, CT 06810
203-743-4447

Minnesota Mining and MFG
3M Center
St. Paul, MN 55144
612-733-1110

Mirror Bright Polish Co., Inc.
Irvine Industrial Complex
P.O. Box 17177 Irvin, CA 92713
714-557-9200

Mobil Oil Corporation
150 E. 42nd Street
New York, NY 10017
212-883-4242

N

Norton Tape Division
Department 6610
Troy, NY 12181
518-273-0100

P

Parker Seal Company
17325 Euclid Avenue
Cleveland, OH 44112
216-531-3000

Peerless Quality Products, Inc.
12416 Cloverdale
Detroit, Michigan 48204
866-933-7525
www.peerlesschem.com

Permatex Co., Inc.
P.O. Box 11915
Newington, CT 06111
203-527-5211

Products Research Co.
2919 Empire Avenue
Burbank, CA 91504
213-849-3992

R

Radiator Specialty Co.
P.O. Box 34689
Charlotte, NC 28234
704-377-6555

Ram Chemicals
201 E. Alondra Blvd.
Gardena, CA 90248
213-321-0710

Rockwell International
600 Grant Street
Pittsburgh, PA 15219
412-565-2000

Royal Lubricants Company
River Road
E. Hanover, NJ 07936
201-887-3100

S

Shamban W.S. and Co.
1857 Centinela Avenue
Santa Monica, CA 90404
213-397-2195

Shall Oil Company
One Shell Plaza
Houston, TX 77003
713-220-6697

Sinclair Refining Co.
600 Fifth Avenue
New York, NY 10020

Socony Mobil Oil Co.
Washington 5, DC 20005

Solar Compounds Corp.
1201 W. Blancke Street
Linden, NJ 07036
201-862-2813

Standard Oil of California
225 Bush Street
San Francisco, CA 94104
415-894-7700

Sun Oil Company of Penna
5 Penn Center Plaza
Philadelphia, PA 19103
215-972-2000

T

Taxacone Company
P.O. Box 10823 TR
Dallas, TX 75208

Texaco, Inc.
2000 Westchester Avenue
White Plains, NY 10650
914-253-4000

Turco Products Inc.
24600 S. Main Street
Box 6200
Carson, CA 90749
213-835-8211

U

U.S. Gulf Corp.
P.O. Box 233
Stoney Brook, NY 11790
212-683-9221

Unelko Corporation
727 E. 110th Street
Chicago, IL 60628

Union Carbide; Plastic Div.
270 Park Avenue
New York, NY 10017
212-551-3763

V

Virginia Chemical
3340 W. Norfolk Rd.
Portsmouth, VA 23703
703-484-5000

W

Wooster Products, Inc.
1000 Spruce Street
Wooster, OH 44691
800-321-4936
In OH 216-264-2844

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TABLE VII
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

TABLE VIII
TEMPERATURE CONVERSION

CENTIGRADE - FAHRENHEIT

Example: To convert 20°C, to Fahrenheit, find 20 in the center column headed (°F - °C); then read 68.0°F, in the column (°F) to the right. To convert 20°F, to Centigrade; find 20 in the center column and read -6.67°C, in the (°C) column to the left.

°C	°F - °C	°F	°C	°F - °C	°F
-56.7	-70	-94.0	104.44	220	428.0
-51.1	-60	-76.0	110.00	230	446.0
- 45.6	-50	-58.0	115.56	240	464.0
- 40.0	-40	-40.0	121.11	250	482.0
- 34.0	-30	-22.0	126.67	260	500.0
- 38.9	-20	-4.0	132.22	270	518.0
- 23.3	-10	14.0	137.78	280	536.0
- 17.8	0	32.0	143.33	290	554.0
-12.22	10	50.0	148.89	300	572.0
-6.67	20	68.0	154.44	310	590.0
-1.11	30	86.0	160.00	320	608.0
4.44	40	104.0	165.56	330	626.0
10.00	50	122.0	171.11	340	644.0
15.56	60	140.0	176.67	350	662.0
21.11	70	158.0	182.22	360	680.0
26.67	80	176.0	187.78	370	698.0
32.22	90	194.0	193.33	380	716.0
27.78	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

TABLE IX
WEIGHTS AND MEASURES CONVERSION

MULTIPLY	BY	TO OBTAIN
CENTIMETERS	0.3937	IN.
	0.03281	FT.
CU. CENTIMETERS	0.001	LITERS
	0.06102	CU. IN.
	0.0002642	U.S. GAL.
CU. FT.	28.320	CU. CM.
	1.728	CU. IN.
	7.481	U.S. GAL.
	28.32	LITERS
CU. IN.	16.39	CU. CM.
	0.01639	LITERS
	0.004329	U.S. GAL.
	0.01732	QUARTS
CU. METERS	1000000	CU. CM.
	35.314	CU. FT.
	61.023	CU. IN.
	264.17	GAL.
	999.97	LITERS
FEET	0.3048	METERS
	12.000	MILS
	304.8	MM.
	0.3333	YARDS
FT.-LB.	0.1383	M-KG
	0.001285	BTU
	0.000000376	KW-HR
FLUID OZ.	8	DRAM
	29.6	CU. CM.
GAL., IMPERIAL	277.4	CU. IN.
	1.201	U.S. GAL.
	4.546	LITERS
GAL., U.S. DRY	268.8	CU. IN.
	0.1556	CU. FT.
	1.164	U.S. GAL., LIQ.
	4.405	LITERS
GAL., U.S. LIQ.	231.0	CU. IN.
	0.1337	CU. FT.
	3.785	LITERS
	0.8327	IMPERIAL GAL.
	128	FLUID OZ.
IN.	2.540	CM.
	.08333	FT.
JOULES	0.000948	BTU
	0.7376	FT.-LB.
KILOGRAMS	2.205	LB.
	35.27	OZ.
	1000	GRAMS
LITERS	1000	CU. CM.
	61.03	CU. IN.
	0.03532	CU. FT.
	0.2642	U.S. GAL.
	0.22	IMPERIAL GAL.
	1.057	QUARTS
METERS	39.37	IN.
	3.281	FT.
	1000	MM.
METER-KILOGRAM	7.233	FT.-LB.
	9.807	JOULES
OUNCES, AVDP	0.0625	LB., AVDP
	28.35	GRAMS
	437.5	GRAINS
OUNCES, FLUID	29.57	CU. CM.
	1.805	CU. IN.
LB., AVDP	453.6	GRAMS
	7000	GRAINS
	16.0	OUNCES
SQUARE INCH	6.4516	SQ. CM.
POUND PER SQUARE INCH (PSI)	0.0703	KG.-CM SQUARED
STATUTE MILE	1.609	KILOMETER
	0.8684	NAUTICAL MILE
NAUTICAL MILE	1.151	STATUTE MILE
QUART	.9463	LITER
MILLIMETER	1000	MICRON
MICRON	0.001	MILLIMETER
	0.000039	INCH
INCH POUNDS	11.521	METER GRAMS
INCH OUNCES	0.72	METER GRAMS
POUNDS	0.453	KILOGRAMS

TABLE X
METRIC CONVERSION

Example: Convert 1.5 inches to millimeters.

(1) Read down inches column to 1. inches.
(2) Read across top inch column to 0.5.
(3) Read down and across to find millimeters (1.5 inches is 38.10 millimeters).

INCHES TO MILLIMETER

INCHES	0.0000	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009
	MILLIMETER									
0.000		0.0025	0.0050	0.0076	0.0101	0.0127	0.0152	0.0177	0.0203	0.0228
0.001	0.0254	0.0279	0.0304	0.0330	0.0355	0.0381	0.0406	0.0431	0.0457	0.0482
0.002	0.0508	0.0533	0.0558	0.0584	0.0609	0.0635	0.0660	0.0685	0.0711	0.0736
0.003	0.0762	0.0812	0.0838	0.0863	0.0889	0.0914	0.0939	0.0965	0.0965	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.		2.54	5.08	7.62	10.16	12.70	15.24	17.78	20.32	22.86
1.	25.40	27.94	30.48	33.02	35.56	38.10	40.64	43.18	45.72	48.26
2.	50.80	53.34	55.88	58.42	60.96	63.50	66.04	68.58	71.12	73.66
3.	76.20	78.74	81.28	83.82	86.36	88.90	91.44	93.98	96.52	99.06
4.	101.60	104.14	106.68	109.22	111.76	114.30	116.84	119.38	121.92	124.46
5.	127.00	129.54	132.08	134.62	137.16	139.70	142.24	144.78	147.32	149.86
6.	152.40	154.94	157.48	160.02	162.56	165.10	167.64	170.18	172.72	175.26
7.	177.80	180.34	182.88	185.42	187.96	190.50	193.04	195.58	198.12	200.66
8.	203.20	205.74	208.28	210.82	213.36	215.90	218.44	220.98	223.52	226.06
9.	228.60	231.14	233.68	236.22	238.76	241.30	243.84	246.38	248.92	251.46

TABLE XI
DRILL SIZES

Decimal/Millimeter Equivalents of Drill Sizes From 1/2" to No. 80

Size	Decimal Equiv.	Millimeter Equiv.	Size	Decimal Equiv.	Millimeter Equiv.	Size	Decimal Equiv.	Millimeter Equiv.	Size	Decimal Equiv.	Millimeter Equiv.
1/2	0.500	12.7000	G	0.261	6.6294	5/32	0.1562	3.9687	51	0.067	1.7018
31/64	0.4843	12.3031	F	0.257	6.5278	23	0.154	3.9116	52	0.0635	1.6129
15/32	0.4687	11.9062	E-1/4	0.250	6.3500	24	0.152	3.8608	1/16	0.0625	1.5875
29/64	0.4531	11.5094	D	0.246	6.2484	25	0.1495	3.7973	53	0.0595	1.5113
7/16	0.4375	11.1125	C	0.242	6.1468	26	0.147	3.7338	54	0.055	1.397
27/64	0.4218	10.7156	B	0.238	6.0452	27	0.144	3.6576	55	0.052	1.3208
Z	0.413	10.4902	15/64	0.2343	5.9531	9/64	0.1406	3.5719	3/64	0.0468	1.1906
13/32	0.4062	10.3187	A	0.234	5.9436	28	0.1405	3.5687	56	0.0465	1.1811
Y	0.404	10.2616	1	0.228	5.7912	29	0.136	3.4544	57	0.043	1.0922
X	0.397	10.0838	2	0.221	5.6134	30	0.01285	3.2639	58	0.042	1.0668
25/64	0.3906	9.9212	7/32	0.2187	5.5562	1/8	0.125	3.1750	59	0.041	1.0414
W	0.386	9.8044	3	0.213	5.4102	31	0.120	3.048	60	0.040	1.016
V	0.377	9.5758	4	0.209	5.3086	32	0.116	2.9464	61	0.039	0.9906
3/8	0.375	9.5250	5	0.2055	5.2197	33	0.113	2.8702	62	0.038	0.9652
U	0.368	9.3472	6	0.204	5.1816	34	0.111	2.8194	63	0.037	0.9398
23/64	0.3593	9.1262	13/64	0.2031	5.1594	35	0.110	2.794	64	0.036	0.9144
T	0.358	9.1281	7	0.201	5.1054	7/64	0.1093	2.7781	65	0.035	0.899
S	0.346	8.7884	8	0.199	5.0546	36	0.1065	2.7051	66	0.033	0.8382
11/32	0.3437	8.7300	9	0.196	4.9784	37	0.104	2.6416	1/32	0.0312	0.7937
R	0.339	8.6106	10	0.1935	4.9149	38	0.1015	2.5781	67	0.032	0.8128
Q	0.332	8.4328	11	0.191	4.8514	39	0.0995	2.5273	68	0.031	0.7874
21/64	0.3281	8.3337	12	0.189	4.8006	40	0.098	2.4892	69	0.029	0.7366
P	0.323	8.2042	3/16	0.1875	4.7625	41	0.096	2.4384	70	0.028	0.7112
O	0.316	8.0264	13	0.185	4.699	3/32	0.0937	2.3812	71	0.026	0.6604
5/16	0.3125	7.9375	14	0.182	4.6228	42	0.0935	2.3749	72	0.025	0.635
N	0.302	7.6708	15	0.180	4.572	43	0.089	2.2606	73	0.024	0.0696
19/64	0.2968	7.5387	16	0.177	4.4958	44	0.086	2.1844	74	0.0229	0.58166
M	0.295	7.4930	17	0.173	4.3942	45	0.082	2.0828	75	0.021	0.5334
L	0.290	7.3660	11/64	0.1718	4.3656	46	0.081	2.0574	76	0.020	0.508
9/32	0.2812	7.1425	18	0.1695	4.3053	47	0.0785	1.9939	77	0.018	0.4572
K	0.281	7.1374	19	0.166	4.2164	5/64	0.0781	1.9844	1/64	0.0156	0.3969
J	0.277	7.0358	20	0.161	4.0894	48	0.076	1.9304	78	0.016	0.4064
I	0.272	6.9088	21	0.159	4.0386	49	0.073	1.8542	79	0.0145	0.3683
H	0.266	6.7564	22	0.157	3.9878	50	0.070	1.778	80	0.0135	0.3429
17/64	0.2656	6.7462									

DRILL SIZES AVAILABLE

Drill may be obtained in regular sizes to a 4 inch diameter, and increase in 64ths of an inch. The regular metric drills vary from 2 to 76mm and increase in 0.5mm variations.

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SECTION

III

INSPECTION

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SECTION III

LIST OF EFFECTIVE PAGES

SECTION	PAGE	DATE	SECTION	PAGE	DATE
III-List of	1	Oct 30/03	IiI (cont.)	36	Oct 30/03
Effective Pages	2	Oct 30/03		37	Oct 30/03
				38	Oct 30/03
III-Table of Contents	1	Oct 30/03		39	Oct 30/03
	2	Oct 30/03		40	Oct 30/03
				41	Oct 30/03
III	1	Oct 30/03		42	Oct 30/03
	2	Oct 30/03		43	Oct 30/03
	3	Oct 30/03		44	Oct 30/03
	4	Oct 30/03			
	5	Oct 30/03			
	6	Oct 30/03			
	7	Oct 30/03			
	8	Oct 30/03			
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	30	Oct 30/03			
	31	Oct 30/03			
	32	Oct 30/03			
	33	Oct 30/03			
	34	Oct 30/03			
	35	Oct 30/03			

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SECTION III - INSPECTION

TABLE OF CONTENTS

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

   A. The recurring maintenance schedule for the PA-34-200 is provided in paragraph 6.

   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 "www1.faa.gov". Additionally, Avantext offers a free email notification service for new AD's as well as the last six weeks worth of AD's at "www.avantext.com".

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

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

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2. TIME LIMITS.

   A. Refer to Section I 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.

   B. Refer to paragraph 8 for Piper's recommended Inspection Programs. They include the frequency and extent of the inspections required for the continued airworthiness of these airplanes.

   C. 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 paragraph 9.

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

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

4. DESCRIPTION.

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

The recurring maintenance schedule for the PA-34-200 is provided herein as an Annual / 100 Hour Inspection. A Progressive Inspection Program is available from Piper Dealers in a separate manual form.

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

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

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

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

5. DEFINITIONS.

A. Inspections - Must be performed only by Certified Mechanics who are qualified on these aircraft, using acceptable methods, techniques and practices to determine physical condition and detect defects.

(1) Routine Inspection - Consists of a visual examination or check of the aircraft and its components and systems without disassembly.

(2) Detailed Inspection - Consists of a thorough examination of the aircraft, appliance, component, or system; with disassembly as necessary to determine condition.

(3) Special Inspection - Involves those components, systems or structure which by their application or intended use require an inspection peculiar to, more extensive in scope or at a time period other than that which is normally accomplished during an event or annual inspection.

B. Checks - Can be performed by pilots and/or mechanics who are qualified on this aircraft and consists of examinations in the form of comparisons with stated standards for the purpose of verifying condition, accuracy and tolerances.

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. Inspection Time Limitations - For owners/operators conducting flight instruction for hire, carrying any person for hire, or with an established Part 91 Progressive Inspection Program (see 91.409(d)) or Part 135 Approved Aircraft Inspection Program (see 135.419), late compliance with the inspection interval of 100 hours may be extended by not more than ten (10) hours while enroute to a maintenance facility. The time used to reach the next inspection facility must be deducted from the next inspection time.

E. Tests - Operation of aircraft components, appliances or systems to evaluate functional performance.

(1) Operation Test - This test is used to ascertain that a system component is in operable condition and can be performed with the equipment installed in the aircraft. In addition, each operational test must be performed by an FAA Certified Repair Station appropriately rated 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.

(2) Functional Test - This test is used to ascertain that system or component is functioning properly and is in conformance with minimum acceptable design specifications. This test may require the use of supplemental bench test equipment. In addition, each functional test 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.

F. Bench Check - Means removal of component from the aircraft to inspect for cleanliness, impending failure, need for lubrication, repair or replacement of parts and calibration to at least the manufacturers specifications using the manufacturers recommended test equipment or standards or the equivalent.

Each bench test will be performed by a Piper Service Center, FAA Certified Repair Station with appropriate rating or by a certified mechanic. This test will be performed at the scheduled interval regardless of any bench test performed on a particular component while being repaired/overhauled before scheduled interval bench test. After the component is installed into the aircraft, an operational test of the component and its related system should be performed to ensure proper function. Serviceable parts that were issued to the component will be filed in the aircraft permanent records. The person performing the check must make appropriate entries in the aircraft's permanent maintenance record.

G. Maintenance - The word maintenance as defined by FAR Part 1, means "inspection, overhaul, repair, preservation and the replacement of parts, but excludes preventive maintenance."

H. On Condition - Maintenance concept whereby some components of the engine remain in service as long as they appear airworthy at each inspection. The replace-on-condition concept, as opposed to replace after a specified life-limited time interval, is a decision made by authorized individual performing the test.

I. Time - as used in this manual.

(1) Time-in-service for aircraft components is a cumulative total determined by:

(a) the date the aircraft was licensed, if new, or;

(b) the date entered in the logbook for replacement / overhaul of the specific component.

NOTE: Do not use the date stamped on the individual component, as these dates are typically applied to determine shelf life - i.e. the maximum time allowed from manufacture/assembly/cure until actually installed in an aircraft.

(2) Aircraft time, flight hours, or aircraft hours are the "Hobbs Time" shown on, or calculated from, the installed "Hour Meter."

6. 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 paragraphs 7 and 8.)

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. The 500 and 1000 hour inspection cycles are extensions of the 100 hour inspection which require a more detailed examination of the airplane, and overhaul or replacement of some major components. 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 as P/N 761-499, 50 Hour Progressive Inspection Manual.

Refer to Piper's Customer Service Information Aerofiche P/N 1761-755 for a checklist to ensure obtaining latest issue.

NOTE: The 50 Hour Progressive Inspection Manual (P/N 761-499) referenced above is not a stand-alone document. It consitutes a snapshot of the Airworthiness Limitations and Inspection sections of the Instructions for Continued Airworthiness (ICA) and is 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 paragraph 8 and applicable vendor publications.

7. ANNUAL / 100 HOUR INSPECTION PROCEDURE.

A. Scheduled Maintenance (i.e. - paragraph 8.)

(1) The required periodic inspection procedures are listed in paragraph 8. These inspection procedures are broken down into major groups which include Propeller, Engine, Cabin and Cockpit, Fuselage and Empennage, Wing, Landing Gear, Operational Inspection and General. The first column in each group lists the inspection or procedure to be performed. The second column is divided into four sub-columns indicating the required inspection intervals of 50 hours, 100 hours, 500 hours, and 1000 hours. Each inspection or operation is required at each of the inspection intervals indicated by a circle (O). When vendor publications specify times other than those designated in the the various columns, it will be indicated as:

As required by "applicable vendor publication"	or	See Note "X"

(2) Refer to the applicable section of this manual for instructions on how to gain access to remove any item that must be removed and is not completely accessible. To help in the performance of periodic inspections, Inspection Report forms are available through Piper Dealers as P/N 230-208.

NOTE: Service centers conducting Part 91 Annual / 100 Hour Inspections can use the Inspection Report Form (P/N 230-208), as a working check-off list, provided they verify its currency against an up-to-date copy of the ICA (i.e. - this Service Manual, this section).

(3) In addition to inspection intervals required in scheduled maintenance (i.e. - paragraph 8), preflight inspection must also be performed.

(4) References to service manual applicable areas are per the "section" assignment of subject material system, see paragraph 14, Introduction.

B. Special Inspections (see paragraph 9.)

C. Unscheduled Maintenance (see paragraph 10.)

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8. SCHEDULED MAINTENANCE - PA-34-200

NATURE OF INSPECTION	Inspection Time (Hrs) 50	100	500	1000
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.				
NOTE: Each inspection item applies to both left and right propellers.				
1. Inspect spinner and back plate for cracks, dents, missing screws, and security	O	O	O	O
2. Inspect blades for nick and cracks	O	O	O	O
3. Inspect for grease and oil leaks	O	O	O	O
4. Lubricate propeller per Lubrication Chart, Section II. (See Six (6) Month and One (1) Year special inspections, paragraph 9.)		O	O	O
5. Inspect spinner mounting brackets for cracks and security	O	O	O	O
6. Inspect propeller mounting bolts for security and safety. Recheck torque if safety is broken		O	O	O
7. Inspect hub parts for cracks and corrosion		O	O	O
8. Rotate blades and check for tightness in hub pilot tube		O	O	O
9. Remove propeller; remove sludge from propeller and crankshaft			O	O
10. Inspect complete propeller and spinner assembly for security, chafing, cracks, deterioration, wear and correct installation		O	O	O
11. If installed, inspect condition of propeller deicer slip ring and brush block assembly. Replace as required		O	O	O
12. If installed, inspect propeller deice boots for security of attachment and condition.		O	O	O
13. If installed, inspect propeller deice wiring and junction blocks for security, cracks, chafing and damage.		O	O	O
14. If installed, check condition and operation of propeller deice system. (See Section XIV, Propeller Deicing System - Inspection - 50 Hour and 100 Hour.)	O	O	O	O
15. Inspect propeller air pressure (* at least every 30 days)	*	O	O	O
16. Overhaul or replace propeller governor. (See 2000 Hour special inspection, paragraph 9.)	As required by Hartzell Service Letter No. 61			
17. If installed, overhaul propeller damper assembly. (See Six (6) Year and 2400 Hour special inspections, paragraph 9.)	As required by Hartzell Service Letter No. 61			
18. Overhaul propeller. (See Five (5) and Six (6) Year and 2000 and 2400 Hour special inspections, paragraph 9.)	As required by Hartzell Service Letter No. 61			

8. SCHEDULED MAINTENANCE - PA-34-200 (continued)

NATURE OF INSPECTION	Inspection Time (Hrs) 50	100	500	1000
B. ENGINE GROUP				
WARNING: IF MAGNETOS ARE NOT GROUNDED, TURNING PROPELLER MAY START ENGINE. USE EXTREME CAUTION WHEN ROTATING PROPELLER BY HAND; PROPELLER MAY KICK BACK. PRIOR TO ROTATING PROPELLER ENSURE BOTH MAGNETO SWITCHES ARE OFF (GROUNDED).				
NOTE: Read Note 5 prior to completing this group.				
NOTE: Each inspection item applies to both left and right engines.				
1. Remove engine cowling	O	O	O	O
2. Clean and inspect cowling for damage, cracks, distortion, and loose or missing fasteners	O	O	O	O
3. Drain oil sump	O	O	O	O
4. Clean suction oil strainer at oil change; inspect strainer for foreign particles	O	O	O	O
5. Change full flow, cartridge type, oil filter element; or, if installed, clean pressure oil strainer: in either case, inspect element/strainer for foreign particles. (See Note 7.)	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, & cracks. (See Eight (8) Year and 1000 Hour special inspection, paragraph 9.)	O	O	O	O
8. Clean and inspect oil radiator cooling fins	O	O	O	O
9. Remove and flush oil radiator			O	O
10. Fill engine with oil per information on cowl or in Lubrication Chart, Section II	O	O	O	O
CAUTION: USE CAUTION NOT TO CONTAMINATE VACUUM PUMP WITH CLEANING FLUID. (REFER TO LATEST REVISION TEXTRON LYCOMING SERVICE INSTRUCTION NO. 1221.)				
11. Clean engine with approved solvents	O	O	O	O
12. Inspect condition of spark plugs. Clean and adjust gap as required; adjust per latest revision Textron Lycoming Service Instruction No. 1042		O	O	O
NOTE: If fouling of spark plugs is apparent, rotate bottom plugs to upper plugs.				
13. Inspect spark plug cable leads	O	O	O	O
14. Check cylinder compression. (Refer to AC 43.13-1, latest revision.)		O	O	O
15. Inspect cylinders for cracked or broken fins. (See Note 8.)		O	O	O
16. Inspect rocker box covers for evidence of oil leaks. If found, replace gasket; torque cover screws 50 inch-pounds. (See 400 Hour special inspection, paragraph 9.)	O	O	O	O
17. Inspect ignition harness and insulators for high tension leakage and continuity		O	O	O

8. SCHEDULED MAINTENANCE - PA-34-200 (continued)

NATURE OF INSPECTION	Inspection Time (Hrs) 50	100	500	1000
B. ENGINE GROUP (CONT.)				
18. Check magneto points for proper clearance		O	O	O
19. Inspect magneto for oil seal leakage		O	O	O
20. Inspect breaker felts for proper lubrication. (Bendix magnetos only.)		O	O	O
21. Inspect distributor block for cracks, burned areas or corrosion, and, (in Bendix magnetos only) height of contact springs			O	O
22. Check magnetos to engine timing		O	O	O
23. Overhaul or replace magnetos. (See Note 6.)				
24. Remove air filters and clean per Induction Air Filter, Section II. (Replace as required.) (See Note 9.)	O	O	O	O
25. Inspect condition of alternate air doors and boxes. (See Note 10.)	O	O	O	O
26. Inspect intake seals for leaks and clamps for tightness		O	O	O
27. Inspect all air inlet duct hoses. (Replace as required.)		O	O	O
28. Inspect fuel injector inlet line strainer. (Clean injector nozzles as required. Clean with acetone only.)	O	O	O	O
29. Inspect fuel injector attachments for loose hardware. (See Note 11.)		O	O	O
30. Inspect condition of flexible fuel lines. (See Eight (8) Year and 1000 Hour special inspection, paragraph 9.)		O	O	O
31. Inspect fuel system for leaks. (See Note 62.)		O	O	O
32. Inspect engine driven and electric fuel pumps for operation. (See Note 32.)		O	O	O
33. Overhaul or replace engine driven and electirc fuel pumps. (See Five (5) Year special inspection, paragraph 9.)	Engine Overhaul or Five (5) Years			
34. Inspect vacuum pumps and lines. (See Note 50 and 500 Hour special inspection, paragraph 9.)		O	O	O

CAUTION: THE ONLY DRY AIR PUMP MOUNTING GASKET AUTHORIZED AND APPROVED FOR USE WITH THE ORIGINAL EQUIPMENT AIRBORNE DRY AIR PUMP IS THE AIRBORNE GASKET B3-1-2, PIPER P/N 751-859. USE OF ANY OTHER GASKET MAY RESULT IN OIL SEEPAGE OR LEAKAGE AT THE MOUNTING SURFACE.

NATURE OF INSPECTION	50	100	500	1000
35. Overhaul or replace vacuum pumps. (See Note 6.)	Engine Overhaul			
36. Inspect throttle, alternate air, mixture and propeller governor controls for security, travel and operating condition. (See Notes 12 and 43.)		O	O	O
37. Inspect exhaust stacks, connections and gaskets. (Replace as required.) (* See 25 Hour special inspection, paragraph 9.)	*	O	O	O
38. Inspect muffler, heat exchanger, baffles and "augmenter" tube. (Replace as required.) (* See 100 Hour special inspection, paragraph 9.)		O*	O	O
39. Inspect breather tubes for obstructions and security		O	O	O
40. Inspect crankcase for cracks, leaks and security of seam bolts		O	O	O
41. Inspect engine mounts for cracks and loose mountings		O	O	O
42. Inspect engine baffles for cracks and loose mountings		O	O	O

8. SCHEDULED MAINTENANCE - PA-34-200 (continued)

NATURE OF INSPECTION	Inspection Time (Hrs) 50	100	500	1000
B. ENGINE GROUP (CONT.)				
43. Inspect rubber engine mount bushings for deterioration. (Replace as required.)		O	O	O
44. Inspect fire wall seals		O	O	O
45. Inspect condition and tension of alternator drive belt		O	O	O
46. Inspect condition of alternator and starter. (See Note 47.)		O	O	O
47. Inspect all lines, air ducts, electrical leads and engine attachments for security, proper routing, chafing, cracks, deterioration and correct installation. (See Notes 30, 38, 39, and 47.)	O	O	O	O
48. Lubricate all controls per Lubrication Chart, Section II	O	O	O	O
49. Complete overhaul of engine or replace with factory rebuilt.	As required by Lycoming Service Instruction No. 1009			
50. Install engine cowling	O	O	O	O
C. CABIN AND COCKPIT GROUP				
1. Inspect cockpit and cabin doors; cargo and baggage doors; and locks, latches and hinges for damage, operation, and security		O	O	O
2. Inspect windows for condition and security		O	O	O
3. Check window and door seals for deterioration, cracks, and voids		O	O	O
4. Inspect upholstery for tears. (See 2000 Hour and Seven (7) Year special inspections, paragraph 9.)		O	O	O
5. Inspect seats, seat belts, shoulder harnesses, security brackets and bolts. (See Note 14 and 61.)		O	O	O
6. Inspect trim operation		O	O	O
7. Inspect operation and condition of rudder bar and pedals		O	O	O
8. Inspect parking brake valve, handle, and toe brakes for operation and cylinder leaks		O	O	O
9. Inspect control wheels, column, pulleys, cables, turnbuckles, and fittings. (See Note 15.)		O	O	O
10. Inspect flap lever to control cable attachment bolt and flap control cable for condition and security. (See Notes 15 and 16.)		O	O	O
11. Check landing, navigation, strobe, cabin and instrument lights. (See Note 17.)	O	O	O	O
12. Inspect instruments, lines and attachments. (See Two (2) Year special inspection, paragraph 9.) (See Notes 29, 31, 44, and 60.)		O	O	O
13. Inspect gyro operated instruments and electric turn and bank (Overhaul or replace as required.)		O	O	O
14. Replace filters on gyro horizon and directional gyro or replace central air filter.		O	O	O
15. Clean or replace vacuum regulator filter		O	O	O
16. Inspect altimeter and transponder for installation/certification per latest revision of AC43.13-1 and tested/inspected per FAR's 91.411 and 91.413, respectively. (See Two (2) Year special inspection, paragraph 9.)		O	O	O

8. SCHEDULED MAINTENANCE - PA-34-200 (continued)

NATURE OF INSPECTION	Inspection Time (Hrs) 50	100	500	1000
C. CABIN AND COCKPIT GROUP (CONT.)				
17. Inspect and test ELT per FAR 91.207. (See Testing, ELT, Section XII.)		O	O	O
18. Inspect operation of fuel selector valves		O	O	O
19. Inspect operation of fuel drains. (See Draining Moisture from Fuel System, 100 Hour Inspection, Section II.)		O	O	O
20. Inspect condition and operation of heater controls and ducts. (See Note 55; Fuel Regulator and Shutoff Valve 100 Hour Inspection, Section XIII; and Two (2) Year special inspection, paragraph 9.)		O	O	O
21. Inspect condition and operation of air vents		O	O	O
22. If installed, overhaul combustion heater. (See 500 Hour special inspection, paragraph 9.)	After each heating season or 500 hours.			
D. FUSELAGE AND EMPENNAGE GROUP				
1. Remove inspection plates and panels.		O	O	O
2. Inspect aft wing attach bolts and fittings for corrosion. (See Note 18.)		O	O	O
3. Inspect forward baggage door, lock, latch and hinge for damage, operation, and security. (* See Note 13.)	*	O	O	O
4. Inspect battery, box and cables. (* at least every 30 days.) Flush box as required and fill battery per instructions on box. (See Note 47.)	O*	O	O	O
5. Check fluid in brake reservoir. Fill as required	O	O	O	O
6. Inspect electronic installations		O	O	O
7. Inspect skins, bulkheads, and stringers for damage. (See Note 42.)		O	O	O
8. Inspect antenna mounts and electrical wiring. (See Note 34.)		O	O	O
9. Inspect hydraulic pump motor brushes. (See Note 19.)		O	O	O
10. Check hydraulic pump fluid level. (Fill as required.)	O	O	O	O
11. Inspect hydraulic lines for damage and leaks		O	O	O
12. If installed, inspect pneumatic deice system deicers, valves, and lines for condition and security		O	O	O
13. Inspect fuel lines, valves and gauges for damage and operation (See Ten (10) and Twenty (20) Year special inspections, paragraph 9.)		O	O	O
14. Inspect security of all lines		O	O	O
15. Inspect vertical fin, rudder, and tab 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. (See Note 63.)		O	O	O
16. Inspect rudder sector and attachments for damage, security, and operation. (See Note 46.)		O	O	O
17. Inspect rudder control stops to insure stops have not loosened and locknuts are tight		O	O	O
18. Inspect vertical fin attachments		O	O	O
19. Inspect rudder and rudder tab hinge bolts for excess wear. (Replace as required.)		O	O	O

8. SCHEDULED MAINTENANCE - PA-34-200 (continued)

NATURE OF INSPECTION	Inspection Time (Hrs) 50	100	500	1000
D. FUSELAGE AND EMPENNAGE GROUP (CONT.)				
20. Inspect rudder trim mechanism. (See Note 21.)		O	O	O
21. Inspect stabilator 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. (See Notes 28, 33, 45, 56, and 57.)		O	O	O
22. Inspect stabilator tab hinges, horn and attachments for damage, security, and operation		O	O	O
23. Inspect stabilator control stops to insure stops have not loosened and locknuts are tight		O	O	O
24. Inspect stabilator attachments and attach brackets for corrosion and security. Repair as required. (See Note 20.)		O	O	O
25. Inspect stabilator and tab hinge bolts and bearings for excess wear. (Replace as required)		O	O	O
26. Inspect stabilator trim mechanism. (See Note 51.)	O	O	O	O
27. Clean and lubricate stabilator trim drum screw			O	O
28. Clean and lubricate all exterior needle bearings				O
29. Inspect aileron, rudder, rudder trim, stabilator, and stabilator trim cables, turnbuckles, fittings, guides and pulleys for safety, damage and operation. (See Note 15.)		O	O	O
30. Inspect all cable tensions (use tensiometer). (See Note 22.)		O	O	O
31. Inspect all control cables, air ducts, electrical leads and attaching parts for security, routing, chafing, deterioration, wear and correct installation. (See Note 15.)		O	O	O
32. Lubricate per Lubrication Chart, Section II	O	O	O	O
33. Inspect rotating beacon for security and operation		O	O	O
34. Inspect security of Autopilot bridle cable clamps. (See Note 15.)		O	O	O
35. Inspect ELT battery for condition/date per FAR 91.207		O	O	O
36. Inspect ELT installation and antenna for condition and security. Replace antenna if bent or damgaged		O	O	O
37. Reinstall inspection plates and panels		O	O	O
E. WING GROUP				
CAUTION: SEVERE BURNS CAN RESULT FROM COMING IN CONTACT WITH A HEATED PITOT TUBE.				
1. Remove inspection plates and fairings		O	O	O
2. Inspect wing surfaces and tips for damage, loose rivets, and condition of walkway. (See Notes 25 and 35.)		O	O	O
3. If installed, inspect condition of pneumatic deicers (boots). (See Section XIV, Pneumatic Deice System - Inspections - 100 Hour.)		O	O	O

8. SCHEDULED MAINTENANCE - PA-34-200 (continued)

NATURE OF INSPECTION	Inspection Time (Hrs) 50	100	500	1000
E. WING GROUP (CONT.)				
4. 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	O	O
5. Inspect aileron hinges and attachments		O	O	O
6. Inspect aileron control stops to insure stop has not loosened and locknut is tight		O	O	O
7. Inspect aileron cables, turnbuckles, fittings, guides, pulleys and bellcranks for safety, damage and operation. (See Note 15.)		O	O	O
8. Inspect pitot tube for damage and condition		O	O	O
CAUTION: SEVERE BURNS CAN RESULT FROM COMING IN CONTACT WITH A HEATED PITOT TUBE.				
9. Check pitot heat		O	O	O
10. 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	O	O
11. Inspect condition of bolts used with hinges. (Replace as required.)				O
12. Lubricate per Lubrication Chart, Section II	O	O	O	O
13. Inspect wing attachment bolts and brackets		O	O	O
14. Inspect fuel tanks and lines for leaks and water. (See Note 23 and 1000 Hour and Seven (7), Ten (10), and Twenty (20) Year special inspections, paragraph 9.)		O	O	O
15. Remove, drain and clean fuel gascolator bowls. (* Drain and clean at least every 90 days.)	*	O	O	O
16. Inspect fuel tanks marked for minimum octane rating and capacity. (See Notes 40 and 41.)		O	O	O
17. Check fuel tank vents are free and clear of obstructions. (See Note 24.)		O	O	O
18. Inspect all control cables, turnbuckles, and fittings; air ducts; electrical leads; lines and attaching parts for security, routing, chafing, deterioration, wear and correct installation. (See Note 15.)		O	O	O
19. Reinstall inspection plates and fairings		O	O	O

8. SCHEDULED MAINTENANCE - PA-34-200 (continued)

NATURE OF INSPECTION	Inspection Time (Hrs) 50	100	500	1000
F. LANDING GEAR GROUP				
NOTE: Verify compliance with all later revisions of Piper Service Bulletin No. 1123. This 10/30/03 revision of this manual incorporates and supercedes the original 5/7/03 issue of Piper Service Bulletin No. 1123. See also AD 93-24-14.				
1. Inspect oleo struts for proper extension. (Check for proper fluid level as required.)	O	O	O	O
2. Inspect nose gear steering control and travel. (See Alignment of Nose Gear, Section VII, and Note 48.)		O	O	O
3. Inspect wheel alignment		O	O	O
4. Put airplane on jacks		O	O	O
5. Inspect tires for cuts, uneven or excessive wear and slippage		O	O	O
6. Remove wheels, clean, inspect and repack bearings		O	O	O
7. Inspect wheels for cracks, corrosion and broken bolts. (See Note 54.)		O	O	O
8. Check tire pressure (N-31 psi/M-50 psi)	O	O	O	O
9. Inspect brake lining and disc for wear		O	O	O
10. Inspect brake backing plates for cracks		O	O	O
11. Inspect brake and hydraulic lines for condition and security		O	O	O
12. Inspect condition of centering spring		O	O	O
13. Inspect gear forks for damage		O	O	O
14. Inspect oleo struts for fluid leaks and scoring. (See Note 36.)		O	O	O
15. Inspect nose and main gear struts, attachments, torque links, retraction links and bolts for condition and security. (See Cleaning, Inspection, and Repair, Nose Landing Gear and Cleaning, Inspection, and Repair, Main Landing Gear; Section VII.) (See also 100 Hour special inspections, paragraph 9.)		O	O	O
16. Inspect main gear trunnion for cracks. (* See Ten (10) and 100 Hour special inspections, paragraph 9, and Main Gear Trunnion Inspection, Section VII.)	*	O*	O	O
17. Inspect nose gear trunnion (P/N 95723-00 or -05) for cracks. (* See 1000 Hour special inspection, paragraph 9.)				O*
18. Inspect nose gear drag link upper attach bolt for condition and security. (See Airworthiness Limitations, Section I; Nose Landing Gear - 100 Hour Nose Gear Drag Link Upper Attach Bolt Inspection, Section VII; and Nose Landing Gear - Modified Components, Section VII.)		O	O	O
19. Inspect the nose gear retraction link retention spring (P/N 96178-0) for damage, distortion, or corrosion. (See Item# 44, Figure 2, Section VII.)		O	O	O

8. SCHEDULED MAINTENANCE - PA-34-200 (continued)

NATURE OF INSPECTION	Inspection Time (Hrs) 50	100	500	1000
F. LANDING GEAR GROUP (CONT.)				
20. Remove triangular shaped, nose gear strut servicing access panel located in the forward baggage compartment floor:				
a. Inspect nose tiller roller, steering arm channel and tiller track for condition		O	O	O
b. Inspect the tiller, tiller roller, steering arm channel, and turnstop bosses for damage caused by exceeding nose wheel turn limits when towing with power equipment		O	O	O
c. Inspect the AN4-10A bolts attaching the P/N 95393-0 arm to the steering channel for proper torque (50-70 in. lbs). If found loose, replace bolts and re-torque		O	O	O
21. Inspect the nose gear drag link center pivot and attachment bolts for condition and security. (Replace as required.)		O	O	O
22. Inspect the nose gear down lock link assembly (Item# 40, Figure 2, Section VII) for binding, worn spring retention pin, and any noticeable elongation of the hole associated with the spring retention pin. Inspect the down lock link spring for damage, distortion, or corrosion. Clean and lubricate using MIL-PRF-7870C oil		O	O	O
23. Inspect the actuator mounting bracket (Item# 47, Figure 2, Section VII) for wear, cracks, loose rivets, and elongation of the .250 dia. holes where the retraction link assembly attaches. (* See 50 Hour special inspection, paragraph 9.)	*	O	O	O
24. Inspect the bolt and bushing associated with the attachment of the P/N 95712-00 or –04 retraction link assembly (Item# 53, Figure 2, Section VII) to the actuator mounting bracket. Replace if "wear grooves" are noted in either the bolt or bushing		O	O	O
25. Inspect the AN23-25 stop bolt (Item# 54, Figure 2, Section VII) (in the actuator mounting bracket) for condition and security		O	O	O
26. Inspect downlocks for operation and adjustment		O	O	O
27. Inspect torque link bolts and bushings. (Rebush as required.)		O	O	O
28. Inspect upper and lower drag link assembly over center dimension		O	O	O
29. Inspect main gear side brace link attaching and pivot bolts. (Replace as required.)			O	O
30. Inspect gear doors and attachments		O	O	O
31. Check gear warning horn and light for operation		O	O	O
32. Retract gear - check operation. (See Notes 49 and 52.)		O	O	O
33. Retract gear - inspect doors for clearance and operation		O	O	O
34. With the gear retracted - pull emergency gear release knob and check operation of freefall valve		O	O	O
35. Check operation of squat switch		O	O	O
36. Inspect downlock switches, up switches, electrical leads and and attaching parts for security, routing, chafing, deterioration, wear, and correct installation		O	O	O
37. Lubricate per Lubrication Chart, Section II	O	O	O	O
38. Verify proper adjustment of nose gear down lock link by rigging per Installation and Rigging of Nose Landing Gear, Section VII		O	O	O
39. Remove airplane from jacks		O	O	O

8. SCHEDULED MAINTENANCE - PA-34-200 (continued)

NATURE OF INSPECTION	Inspection Time (Hrs) 50	100	500	1000
G. SPECIAL INSPECTIONS				
See paragraph 9	O	O	O	O
H. OPERATIONAL INSPECTION				
Note: Refer to Note 26 prior to starting engine or taxiing airplane.				
1. Check fuel pump and fuel tank selector and crossfeed operation	O	O	O	O
2. Check fuel quantity and pressure or flow gauges	O	O	O	O
3. Check oil pressure and temperatures	O	O	O	O
4. Check alternator output	O	O	O	O
5. Check manifold pressure	O	O	O	O
6. Check alternate air	O	O	O	O
7. Check parking brake and toe brakes	O	O	O	O
8. Check vacuum gauge	O	O	O	O
9. Check gyros for noise and roughness	O	O	O	O
10. Check cabin heater operation	O	O	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	O	O	O	O
18. Check operation of controls	O	O	O	O
19. Check operation of flaps	O	O	O	O
20. Check operation of Autopilot including automatic pitch trim and manual electric trim. (See Note 27.)	O	O	O	O
I. GENERAL				
1. Aircraft conforms to FAA Specification	O	O	O	O
2. Latest revisions of all Airworthiness Directives complied with	O	O	O	O
3. Latest revisions of all Manufacturers' Service Bulletins and Letters complied with	O	O	O	O
4. Check for proper Airplane Flight Manual (AFM)	O	O	O	O
5. Aircraft papers in proper order	O	O	O	O

8. SCHEDULED MAINTENANCE - PA-34-200 (continued)

J. 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 (i.e. - “See Section II.”) are to the corresponding 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. All inspections or operations are required at each of the inspection intervals as indicated by a (O). Both the annual and 100 hour inspections are complete inspections of the airplane, identical in scope, while the 500 and 1000 hour inspections are extensions of the annual or 100 hour inspection, which require a detailed examination of the airplane, and overhaul or replacement of some major components. Inspections must be accomplished by persons authorized by the FAA.

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

3. Piper Service Bulletins are of special importance and Piper considers compliance mandatory. In all cases, see Service Bulletin/Service Letter Index P/N 762-332 or Service Bulletin/ Service Letter Aerofiche Set P/N 1762-331 to verify latest revision.
4. Piper Service Letters are product improvements and service hints pertaining to servicing the airplane and should be given careful attention.
5. Inspections given for the power plant are based on the engine manufacturer’s operator’s manual (Textron Lycoming Part No. 60297-12) for this airplane. Any changes issued to the engine manufacturer’s operator’s manual shall supersede or supplement the inspections outlined in this report.
6. Overhaul as required and at engine overhaul. If installed, in no case may Slick 4300 series magneto's time-in-service exceed engine TBO.
7. Refer to latest revision of Textron Lycoming Service Bulletin No. 480.
8. Check cylinders for evidence of excessive heat indicated by burned paint on the cylinders. This condition is indicative of internal damage to the cylinder and, if found, its cause must be determined and corrected before the airplane is returned to service. Heavy discoloration and appearance of seepage at the cylinder head and barrel attachment area is usually due to emission of thread lubricant used during assembly of the barrel at the factory, or by slight gas leakage which stops after the cylinder has been in service for a while. This condition is neither harmful nor detrimental to engine performance and operation. If it can be proven that leakage exceeds these conditions, the cylinder must be replaced.
9. Verify compliance with Piper Service Bulletin No. 1041 (i.e. - Airborne (Parker Hannifin) Service Letter No. 56.

8. SCHEDULED MAINTENANCE - PA-34-200 (continued)

J. NOTES (CONT.)

10. In serial numbers 34-7250001 thru 34-7350074 only, verify installation of Kit No. 760-722v per Piper Service Bulletin No. 374. If not installed, remove original equipment air box P/N's 96780-0 and 96780-1 and inspect per Alternate Air Door 100 Hour Inspection, Section VIII. See also AD 72-17-1.
11. Torque all attachment nuts to 135-150 inch-pounds; seat "Pal" nuts fingertight against plain nuts, and then tighten an additional 1/3 to 1/2 turn.
12. Inspect throttle and mixture control attachments per Throttle and Mixture Control Attachments 100 Hour Inspection, Section VIII.
13. Verify installation of Placard P/N 69669-81 and Kit No. 760-792v per Piper Service Bulletin (PSB) No. 447; Doubler P/N 36521-02 and Push Rod P/N 96937-03 per PSB No. 633B; and Kit No. 765-350 per PSB No. 872. See also, Baggage Door Pre/Post-Flight Inspection, Section IV, and AD 88-4-5
14. Verify compliance with Piper Service Bulletin No. 896. See also, Seat Belt and Shoulder Harness Inspection, Section XIV.
15. Examine cables for broken strands by wiping them with a cloth for their entire length. Visually inspect the cable thoroughly for damage not detected by the cloth. Replace any damaged or frayed cables.
    (a) See Section V, Control Cable Inspection, or the latest edition of FAA AC 43.13-1.
    (b) At fifteen (15) years time-in-service, begin Cable Fittings 100 Hour Special Inspection (see Section V).
16. Verify compliance with Piper Service Bulletin No. 965. See also AD 96-10-3.
17. Verify compliance with Piper Service Bulletin No. 475.
18. Verify compliance with Piper Service Bulletin No. 977. (See also Section IV: Figure 2 and 100 Hour Aft Wing Attach Fitting Corrosion Inspection.
19. For Prestolite pumps only: Inspect brushes every 100 hours if aircraft is used for training or every 500 hours if aircraft is used for normal service. (See Section VI.)
20. See Stabilator, Attach Fittings Corrosion Control Inspection, Section IV.
21. In serial numbers 34-7250001 thru 34-7450084 only, verify installation of Kit No. 760-800v per Piper Service Letter No. 714. If not installed, see Section V, 100 Hour Rudder Tab Freeplay Inspection. See also AD 73-13-1.
22. Maintain cable tensions specified in Section V.
23. Sloshing of fuel tanks not approved.
24. See Fuel Tank Vent Obstruction Test, Section IX.
25. In serial numbers 34-7250001 thru 34-7450082 only, verify compliance with Piper Service Bulletin No. 437A.
26. Refer to Section 4 of the Pilot's Operating Handbook for preflight and flight check list. See also, Baggage Door Pre/Post-Flight Inspection, Section IV.
27. Refer to Pilot's Operating Handbook Supplement for preflight and flight check and for intended function in all modes.
28. In serial numbers 34-7250001 thru 34-7250160 only, verify compliance with Piper Service Bulletin No. 350.

8. SCHEDULED MAINTENANCE - PA-34-200 (continued)

J. NOTES (CONT.)

29. In serial numbers 34-7250001 thru 34-7250149, 34-7250151 thru 34-7250164, 34-7250166, 34-7250169, 34-7250170, 34-7250171, 34-7250173 thru 34-7250176, 34-7250178 thru 34-7250181, 34-7250184, 34-7250187, 34-7250192, 34-7250193, and 34-7250195 only, verify installation of Kit(s) No. 760-614v and, for those airplanes equipped with co-pilot's instruments, 760-615v per Piper Service Bulletin No. 352.
30. In serial numbers 34-7250001 thru 34-7250119 only, verify compliance with Piper Service Bulletin No. 357A.
31. In serial numbers 34-7250150, 34-7250165, 34-7250167, 34-7250168, 34-7250172, 34-7250177, 34-7250182, 34-7250183, 34-7250185, 34-7250186, 34-7250188 thru 34-7250191, 34-7250194, and 34-7250196 thru 34-7250360 only, verify installation of Kit(s) No. 760-679v and, for those airplanes equipped with co-pilot's instruments, 760-680v per Piper Service Bulletin No. 359.
32. In serial numbers 34-7250001 thru 34-7250202, 34-7250204, 34-7250207, 34-7250208, 34-7250210 thru 34-7250213, 34-7250215 thru 34-7250223, 34-7250225 thru 34-7250229, 34-7250231, 34-7250232, 34-7250234, 34-7250235, 34-7250237, 34-7250238, 34-7250240 thru 34-7250242, 34-7250244, 34-7250246, 34-7250249, 34-7250250, 34-7250252, 34-7250253, 34-7250255 thru 34-7250259, 34-7250261, 34-7250265, 34-7250267 thru 34-7250272, 34-7250280, 34-7250284, 34-7250285, 34-7250287, 34-7250288, 34-7250291, 34-7250292, and 34-7250294 thru 347250297 only, verify installation of two (2) ten amp circuit breakers (P/N 454-707), for the left and right electric fuel pumps, per Piper Service Bulletin No. 364A.
33. In serial numbers 34-7250001 thru 34-7250335 only, verify compliance with Piper Service Bulletin No. 367. See also AD 72-18-6.
34. In serial numbers 34-7250038 thru 34-7250318 only, for airplanes with factory installed IDF Starlight or Narco AT-50 transponders, verify installation of Kit No. 760-697v per Piper Service Bulletin No. 368.
35. In serial numbers 34-7250001 thru 34-7250022, 34-7250024 thru 34-7250089, 34-7250091 thru 34-7250202, 34-7250204 thru 347250261, 34-7250263 thru 34-7250274, 34-7250276 thru 34-7250281, 34-7250283 thru 34-7250289, 34-7250291 thru 34-7250295, 34-7250297 thru 34-7250315, 34-7250318, 34-7250320, 34-7250321, 34-7250323, 34-7250324, 34-7250327, 34-7250329 thru 34-7250332, and 34-7250335 only, verify installation of Kit No. 760-696v per Piper Service Bulletin No. 369. See also AD 73-11-2.
36. In serial numbers 34-7250001 thru 34-7450039 only, verify compliance with Piper Service Bulletin No. 406. See also AD 73-11-2.
37. In serial numbers 34-7250001 thru 34-7450084 only, verify installation of two (2) restrictor plugs (P/N 581-025 or 690-817) in lower forward corner openings in glove compartment box per Piper Service Bulletin No. 412.
38. In serial numbers 34-7250001 thru 34-7450205 only, verify installation of Kits No. 760-877v and 760-886v per Piper Service Bulletin No. 429. See also AD 74-17-8.
39. In serial numbers 34-7450206 thru 34-7450209 only, verify installation of Kit No. 760-886v per Piper Service Bulletin No. 429. See also AD 74-17-8.
40. In serial numbers 34-7250001 thru 34-7350353 only, verify installation of Kit No. 760-980v per Piper Service Bulletin No. 438. See also AD 75-20-3.

8. SCHEDULED MAINTENANCE - PA-34-200 (continued)

J. NOTES (CONT.)

41. In serial numbers 34-7450001 thru 34-7450220 only, verify installation of Kit No. 760-982v per Piper Service Bulletin No. 438. See also AD 75-20-3.
42. Verify compliance with Piper Service Bulletin No. 545.
43. Verify compliance with Piper Service Bulletin No. 548. See also AD 77-23-3.
44. Verify installation of Kit No. 761-133v or compliance with Piper Service Bulletin No. 553.
45. Verify compliance with Piper Service Bulletin No. 579. See also AD 80-9-4.
46. Verify compliance with Piper Service Bulletin No. 899. See also AD 92-8-4.
47. Verify compliance with Piper Service Bulletin No. 836A. For airplanes which have no record of compliance, see Section XI, Aluminum Wiring.
48. Verify compliance with Piper Service Bulletin No. 893; see Figure 1, Section VII. See also AD 92-13-5.
49. Verify compliance with Piper Service Bulletin No. 1023 (i.e. - Cleveland (Parker Hannifin) Service Bulletin No. SB7063).
50. For those airplanes equipped with Airborne vacuum pumps: verify compliance with Piper Service Bulletin No. 1026 (i.e. - Airborne (Parker Hannifin) Service Letter No. 48).
51. Verify compliance with Piper Service Bulletin No.1100A.
52. Verify compliance with Piper Vendor Service Publication No. 155 (i.e. - Cleveland (Parker Hannifin) Service Bulletin No. SB7076).
53. In aircraft which have replaced Eye Bolt, P/N 95830-0, or Nose Gear Down Lock Link Assembly, P/N 95829-0, since November 2, 2000: verify compliance with Piper Service Bulletin No. 1113.
54. In aircraft which have either Cleveland (Parker Hannifin) Main Wheel Assembly Model No. 40-90 or 40-90B installed: verify compliance with Piper Vendor Service Publication No. 134 (i.e. - Cleveland (Parker Hannifin) Service Bulletin No. SB7071) and reinspect per SB7071 each 100 hours and each tire change.
55. In aircraft equipped with the optional Janitrol (Kelly Aerospace) Combustion Heater: verify compliance with Piper Vendor Service Publication No. 149 (i.e. - Kelly Aerospace Service Bulletin No. A-107A).
56. In serial numbers 34-7250001 thru 34-7250242 only, verify compliance with Piper Service Letter No. 614. See also AD 72-14-7 and Section IV, Figure 3, Sketch I.
57. In serial numbers 34-7250001 thru 34-7250235 only, verify compliance with Piper Service Letter No. 615.
58. In serial numbers 34-7250001 thru 34-7350119 only, verify compliance with Piper Service Letter No. 617A or 617B. See also AD 73-7-2.
59. In serial numbers 34-7250001 thru 34-7250202, 34-7250204 thru 34-7250235, 34-7250237, 34-7250238, 34-7250240 thru 34-7250261, 34-7250263 thru 34-7250274, 34-7250276 thru 34-7250281, 34-7250283 thru 34-7250289, 34-7250291 thru 34-7250295, 34-7250297, 34-7250298, 34-7250301 thru 34-7250308, 34-7250310, 34-7250311, 34-7250314, 34-7250315, and 34-7250318 only, verify installation of Kit No. 754-827v per Piper Service Letter 618. See also AD 72-15-2 and Prestolite Service Bulletin No. ASM-8.

8. SCHEDULED MAINTENANCE - PA-34-200 (continued)

J. NOTES (CONT.)

60. In serial numbers 34-7450001 thru 34-7450220 only; for aircraft with King radio installations , dual glideslope indicators (but not King KI-211, 212, 213, or 214 indicators), and only one (1) glidescope receiver: verify installation of placard P/N 69669-112 or 582-606 per Piper Service Letter No. 756.
61. See Rear Seat Quick-Disconnect Mechanism Inspection, Section IV. See also AD 75-24-2.
62. For airplanes with any fuel injector servo manufactured, overhauled, rebuilt, or repaired by Precision Airmotive between January 30, 2003, and April 24, 2003; this includes fuel injector servos installed on new, rebuilt, overhauled, or repaired engines shipped from Lycoming between January 30, 2003 and May 5, 2003: verify compliance with Piper Service Bulletin No. 1134, Lycoming Service Bulletin No. 557, or Precision Airmotive Service Bulletin No. PRS-105.
63. Verify compliance with Piper Service Bulletin No. 1130 or the installation of Kit No. 767-369.

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9. 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 scheduled maintenance. 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.

A. Per Flight Hour.

Each 10 Hours

☐ For those airplanes which have not installed main landing gear trunnions P/N 67926-030 or 67926-031 (both of which can be identified by the embossed forging number 025599-2) per Piper Service Bulletin No. 787C and where the installed trunnions time-in-service is 2000 hour or more, but less than 2500 hours: each 10 hours inspect per Main Gear Trunnion Inspection, Section VII. See also AD 94-13-11.

Each 25 Hours

☐ In serial numbers 34-7250001 thru 34-7350342 only, for those airplanes which have not installed Kit No. 760-764v per Piper Service Letter No. 673: each 25 hours inspect per Exhaust System 25 Hour Inspection, Section VIII. See also AD 73-14-2.

Each 50 Hours

☐ For those airplanes which have not installed either Kit No. 767-357 or 767-358 per Piper Service Bulletin No. 1123: inspect Actuator Mounting Bracket for wear, cracks, loose rivets, and elongation of the .250 dia. holes where the retraction link assembly attaches.

Each 100 Hours

☐ In serial numbers 34-7350343 through 34-7450220, and in serial numbers 34-7250001 thru 34-7350342 with Kit No. 760-764v installed per Piper Service Letter No. 673; beginning at 1000 hours and each 100 hours thereafter, inspect the interior of each heat exchanger per Heat Exchanger 100 Hour Inspection, Section VIII. See also AD 83-14-5.

☐ For those airplanes which have not installed main landing gear trunnions P/N 67926-030 or 67926-031 (both of which can be identified by the embossed forging number 025599-2) per Piper Service Bulletin No. 787C and where the installed trunnions time-in-service is 500 hours or more, but less than 2000 hours: each 100 hours inspect per Main Gear Trunnion Inspection, Section VII. See also AD 94-13-11.

☐ For those airplanes which have not installed main landing gear trunnion attach fittings P/N 67040-014, 67040-015, and two (2) P/N's 67042-013 per Piper Service Bulletin No. 956: each 100 hours inspect per Main Gear Trunnion Attach Fittings Inspection, Section VII.

Each 400 Hours

- ☐ At every 400 hours of engine operation, remove the rocker box covers and check for freedom of valve rockers when valves are closed. Look for evidence of abnormal wear or broken parts in the area of the valve tips, valve keepers, springs, and spring seats. If any indications are found, the cylinder and all of its components must be removed (including the piston and connecting rod assembly) and inspected for further damage. Replace any parts that do not conform with limits shown in the latest revision for Textron Lycoming Service Table of Limits SSP1776.

Each 500 Hours

- ☐ Each 500 hours, or after each heating season, whichever comes first, remove heater for disassembly and inspection. Repair or replace as required.
- ☐ For airplanes equipped with service replacement Tempest (Aero Accessories) Dry Air Pumps: beginning at 500 hours time-in-service, and each 100 hours thereafter, inspect vacuum pump vane wear per Vacuum Pump, Inspection, in Section X.

Each 1000 Hours

- ☐ Beginning at 2000 hours and each 1000 hours thereafter, inspect the nose gear trunnion (P/N 95723-00 or -05) for cracks per 1000 Hour Nose Gear Trunnion Inspection, Section VII.
- ☐ Replace flexible fuel hose (which includes, if installed: fuel supply flexible hose and hose couplings; fuel tank flexible hose interconnect couplings; and fuel tank vent line flexible hose and hose couplings) as required; but not to exceed seven (7) years, 1000 hours time-in-service, or fuel tank removal, whichever comes first.
- ☐ 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 2000 Hours

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

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.)
- ☐ If installed, overhaul or replace Hartzell propeller damper assemblies each six (6) years or each 2400 hours, whichever comes first. (Refer to latest revision of Hartzell Service Letter No. 61.)

B. Per Calendar Year

Each Six (6) Months

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

Each One (1) Year

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

Each Two (2) Years

- ☐ Inspect combustion heater fuel regulator and shutoff valve for leaks, per Fuel Regulator and Shutoff Valve100 Hour Inspection, Section 13, each two (2) years or 100 hours, whichever comes first.
- ☐ 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.)

Each Five (5) Years

- ☐ Replace engine-driven or electric fuel pumps at engine overhaul or five (5) years, whichever comes first.
- ☐ Overhaul or replace Hartzell propellers each five (5) or six (6) years or each 2000 or 2400 hours. (Refer to latest revision of Hartzell Service Letter No. 61 to determine specific requirements for individual airplanes.)

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.)
- ☐ If installed, overhaul or replace Hartzell propeller damper assemblies each six (6) years or each 2400 hours, whichever comes first. (Refer to latest revision of Hartzell Service Letter No. 61.)

Each Seven (7) Years

- ☐ Replace flexible fuel hose (which includes, if installed: fuel supply flexible hose and hose couplings; fuel tank flexible hose interconnect couplings; and fuel tank vent line flexible hose and hose couplings) as required; but not to exceed seven (7) years, 1000 hours time-in-service, or fuel tank removal, whichever comes first.
- ☐ 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.

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

- ☐ Hydrostatically test the portable fire extinguisher each twelve (12) years.

Each Twenty (20) Years

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

C. Per Specific Operation / Operating Environment.

(1) **Operation in High Dust or Industrial Pollution Environment**

CAUTION: DISCONNECT LINES FROM PITOT/STATIC SYSTEM 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 Up and Down Lock Assemblies	Clean, Inspect, and Lubricate.	100 Hours.
☐ Landing Gear Actuators and 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.

(2) **Operation in High Salt or High Humidity Environment**

	Item	Inspection	Inspection Interval
☐	Fuselage, Empennage and Wings.	Remove floor panels and exterior access plates; inspect for corrosion.	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.

	Item	Inspection	Inspection Interval
☐	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.

(3) **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.

(4) **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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10. 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.

A. **Lightning Strike.**

	Item	Inspection	Inspection Interval
☐	Propeller.	Refer to latest Hartzell Service Letter. Overhaul prior to return to service.	Each occurrence, before further flight.
☐	Engine.	See latest revisions of appropriate Textron-Lycoming 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).	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, vacuum, pitot/static, and fuel systems, for damage and correct operation.	Each occurrence, before further flight.
☐	Static Wicks.	Replace.	Each occurrence, before further flight.
☐	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.

B. **Engine Overspeed, Overtemp, Loss of Oil, or Sudden Stoppage.**

Item	Inspection	Inspection Interval
☐ Engine.	See latest revisions of appropriate Textron-Lycoming Service Bulletins and Overhaul Manual.	Each occurrence, before further flight.
☐ Propeller.	Propeller overspeed of more than 10%. Refer to latest Hartzell Service Letter. Remove and overhaul before return to service.	Each occurrence, before further flight.
☐ Engine Mount and Attachments.	Inspect for distortion and damage. Replace or repair as required.	Each occurrence, before further flight.

C. **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 Textron-Lycoming Maintenance Manual procedures. If there are any questions regarding repairs or procedures, contact your Piper Dealer's Service Advisor (DSA).

D. Inspect the following items closely to determine the extent of damage:

Item	Inspection	Inspection Interval
☐ Landing Gear Struts. (Not required for severe turbulence.)	Cracks, signs of overstress deformation, loose or damaged strut housings. Axles for cracks, bending or flat spots. Damaged oleos and seals, hydraulic leaks and landing gear alignment.	Each occurrence, before further flight.
☐ 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. Dye check or magnaflux wheels and bolts.	Each occurrence, before further flight.
☐ Wheel Wells and Landing Gear attach points. (Not required for severe turbulence.)	Buckling, cracks, overstress, wing skin buckling, and side brace for damage and condition. Magnaflux landing gear attachment bolts.	Each occurrence, before further flight.

C. **Severe Turbulence, Hard or Overweight Landing.** (continued)

	Item	Inspection	Inspection Interval
☐	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.

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

	Item	Inspection	Inspection Interval
☐	Flap torque tube/pushrod.	Inspect for distortion. Replace as required. (See Flap Torque Tube/Pushrod Distortion Inspection, Section V.)	Each occurrence, before further flight.
☐	Flaps.	Inspect for damage to the skin and attach points. Replace as required.	Each occurrence, before further flight.

E. **Flood Damage, Immersion in Water.**

(1) 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.

(2) Follow Piper and Textron-Lycoming Maintenance Manual procedures. If there are any questions regarding repairs or procedures, contact your Piper Dealer's Service Advisor (DSA).

(3) Determine the water level on the aircraft. Determine which operating and/or electrical components have been exposed to the water.

(4) 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, Locks, Torque Links, Shimmey Dampeners, etc.	Check all limit switches, replace non-sealed type. Jack airplane and cycle landinggear 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.
☐	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.

E. **Flood Damage, Immersion in Water.** (continued)

	Item	Inspection	Inspection Interval
☐	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. All reused parts must conform with Lycoming Table of Limits No. SSP-1776 for fits and clearances. See latest revision of Lycoming Service Bulletin No. 357.	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.
☐	Hydraulic System.	Replace hydraulic powerpak.	If immersed, each event, before further flight.

E. **Flood Damage, Immersion in Water.** (continued)

	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 check per appropriate maintenance manual. If installed, replace deicer timers. Clean and check prop deicer brush holders. Clean and check voltage regulators and overvoltage relays. Replace as necessary Clean and check all strobe light power supplies. Refer to appropriate service 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 check in accordance with appropriate maintenance manual. Pay particular attention to clutch settings.	If immersed, each event, before further flight.

E. **Flood Damage, Immersion in Water.** (continued)

	Item	Inspection	Inspection Interval
☐	Vacuum and Pitot-Static Systems.	Replace gyros. 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.	If immersed, each event, before further flight.
☐	Induction System.	Clean and inspect for silt and corrosion. Check all ducts and gaskets. Replace as necessary. Clean and inspect all heat shrouds and ducting.	If immersed, each event, before further flight.
☐	Fuel System.	Remove and clean fuel tanks and associated wing/spar area. Clean all associated lines and pumps. Clean and inspect all fuel tank vents, cap vents and vent lines.	If immersed, each event, before further flight.
☐	Instruments.	Clean and inspect instruments. Bench check per appropriate maintenance manual.	If immersed, each event, before further flight.
☐	Heating and Ventilating Systems.	Replace blower. 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 heater and associated components.	If immersed, each event, before further flight.

E. **Flood Damage, Immersion in Water.** (continued)

	Item	Inspection	Inspection Interval
☐	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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SECTION

IV

STRUCTURES

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SECTION IV

LIST OF EFFECTIVE PAGES

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SECTION IV - STRUCTURES

TABLE OF CONTENTS

SECTION IV - STRUCTURES

TABLE OF CONTENTS (cont.)

SECTION IV - STRUCTURES

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STRUCTURES

1. INTRODUCTION. This section explains the removal and installation procedures for the structural surfaces of the airplane. For the removal, installation, and rigging and adjustment procedures of the flight control components of the various structural surfaces, refer to Section V.

   NOTE: When torquing structural assembly fasteners, standard torque values are to be used as found in Section II, or the latest revision of FAA Advisory Circular 43.13-1, unless otherwise stated in this section.

2. DESCRIPTION. The PA-34-200 Seneca is a six place (seventh seat optional), twin engine, low-wing monoplane of all metal construction. The all metal semi-monocoque structure has an overall length of 28 feet 7.5 inches. The fuselage is constructed of bulkheads, stringers and stiffeners, to which all of the outer skin is riveted, and consists of three basic units: nose section, cabin section, and tail cone. Windows include a single pane windshield and six side windows; all windows are single pane. The 1974 models have two additional side windows; one on each side of the fuselage. A storm window is located in the forward lower section of the left cockpit window and can be opened inward when the latch is released. The cockpit door is located on the right side of the fuselage, above the wing, and is equipped with a safety latch on the top of the door, which can be operated from the inside or outside. A cabin door provided for entrance to the passenger compartment is located just aft of the left wing.

   The laminar flow wing is an all-metal, full cantilever semi-monocoque type construction, low-wing design with removable fiberglass tips. 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. Attached to each wing is a cable and pushrod controlled, statically balanced, aileron; a manually operated 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 is a full cantilever design consisting of a vertical stabilizer (fin), rudder and stabilator, all with removable fiberglass tips. The rudder and stabilator have trim tabs 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.

3. WING GROUP.

   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 supporting cradle is required.

4. WING TIP.

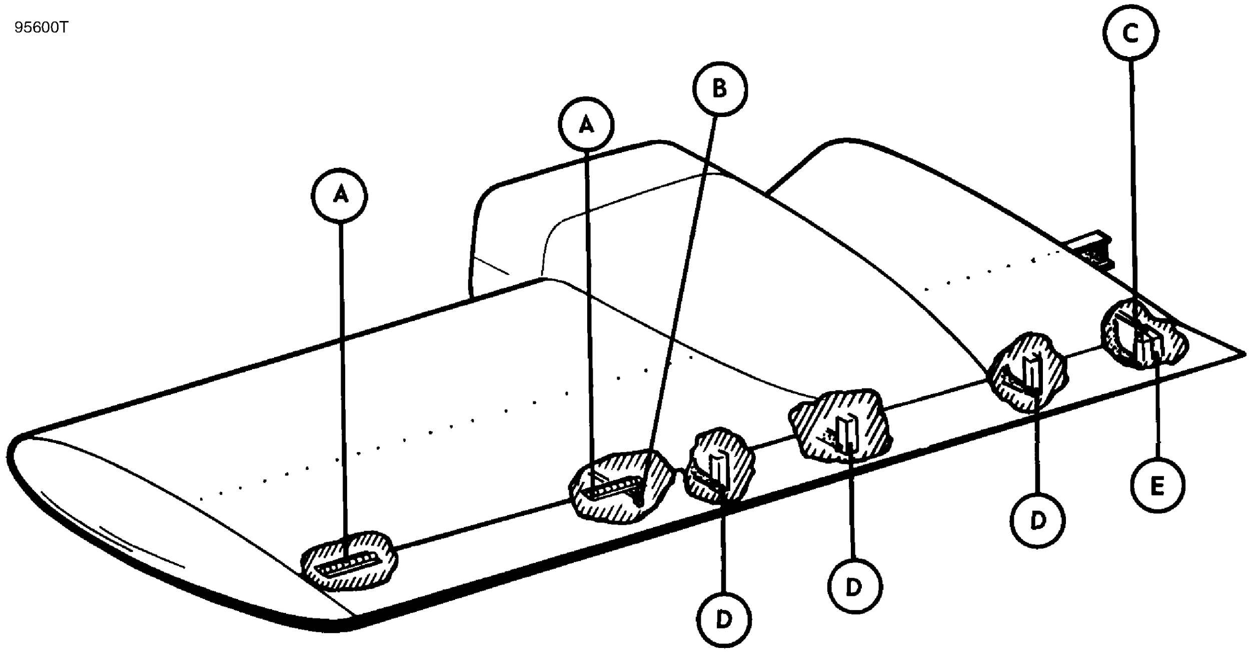
5. REMOVAL.

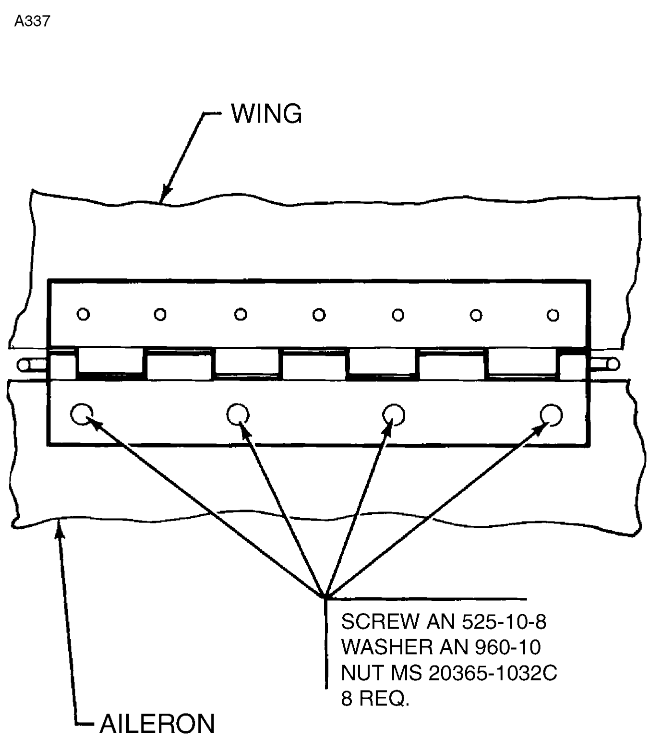
   a. Remove the screws holding the wing tip to the wing, being careful not to damage the wing or fiberglass wing tip.

   b. Pull off the wing tip far enough to disconnect the navigation 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.

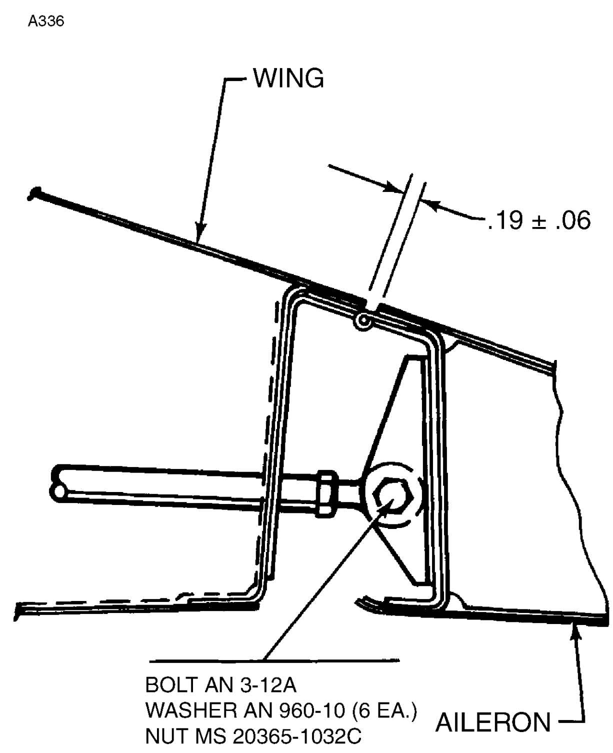
   c. Inspect the fiberglass wing tip to ascertain that it is free of cracks, severe nicks, and minor damage.

6. REPAIR. The wing tip may be repaired in accordance with fiberglass repair procedures in the structural repairs portion of this section.



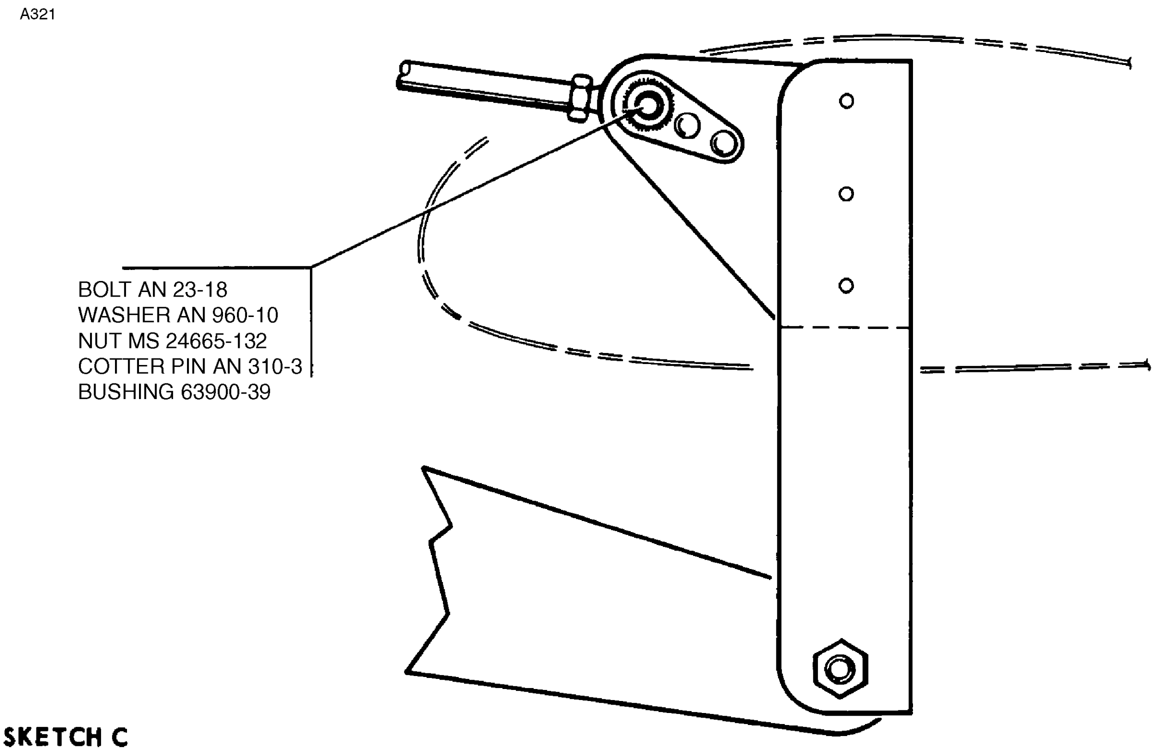


SKETCH A



SKETCH B

Aileron and Flap Installation
Figure 1 (Sheet 1 of 2)



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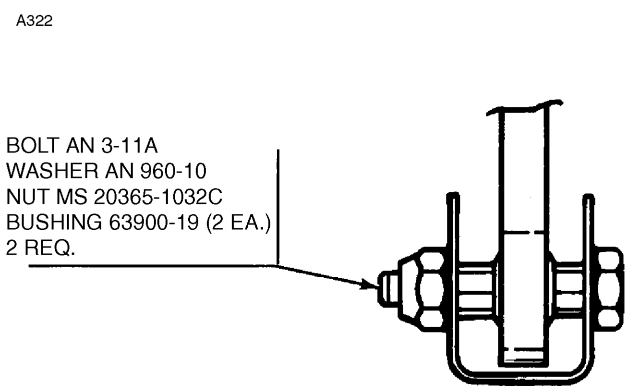

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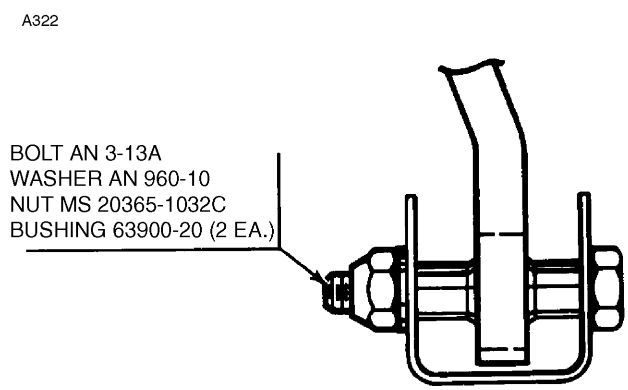


SKETCH E

Aileron and Flap Installation
Figure 1 (Sheet 2 of 2)

7. INSTALLATION.

   a. Place the wing tip in a position that the navigation 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 navigation 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 insure a good connection.

   b. Insert the wing tip into position and install the screws around the tip. Use caution to refrain from damaging the fiberglass wing tip or wing. Check operation of the navigation light.

8. AILERON.

   CAUTION: CONTROL SURFACE SKINS MUST BE REPLACED IF THEY SUSTAIN DAMAGE OR EXHIBIT CRACKS.

9. REMOVAL. (Refer to Figure 1.)

   a. Disconnect the aileron control rod at the inboard end of the aileron by removing the nut, washers and bolt from the rod end bearing. To simplify installation note location of the washers.

   b. Remove the attaching screws, with nuts, from the hinge at the leading edge of the aileron, and remove the aileron by lowering the inboard end and swinging it forward to allow the balance arm to clear the opening in the outboard rib.

10. INSTALLATION. (Refer to Figure 1.)

   WARNING: ALL CONTROL SURFACES THAT HAVE BEEN REPLACED OR REPAINTED MUST BE BALANCED BEFORE INSTALLATION PER INSTRUCTIONS IN BALANCING, BELOW.

   Install the balance arm into the opening in the outboard rib by moving the inboard end of the aileron forward to allow the arm to be inserted through the opening. Move the aileron into place, and install attaching screws and nuts.

11. WING FLAP.

   CAUTION: CONTROL SURFACE SKINS MUST BE REPLACED IF THEY SUSTAIN DAMAGE OR EXHIBIT CRACKS.

12. REMOVAL. (Refer to Figure 1.)

   a. Extend the flaps to their fullest degree and remove the bolt and bushing from the rod end bearing by use of an angle or offset screwdriver.

   b. Remove the nuts, washers, bushing and hinge bolts that hold the flap to the wing assembly.

   c. Pull the flap straight back off the wing.

13. INSTALLATION. (Refer to Figure 1.)

   WARNING: ALL CONTROL SURFACES THAT HAVE BEEN REPLACED OR REPAINTED MUST BE BALANCED BEFORE INSTALLATION PER INSTRUCTIONS IN BALANCING, BELOW.

   a. Replace the wing flap by placing the flap into its proper position and inserting the hinge bolts, bushings, washers, and nuts.

   b. 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.

   c. Operate the flap several times to be certain it operates freely.

14. WING.

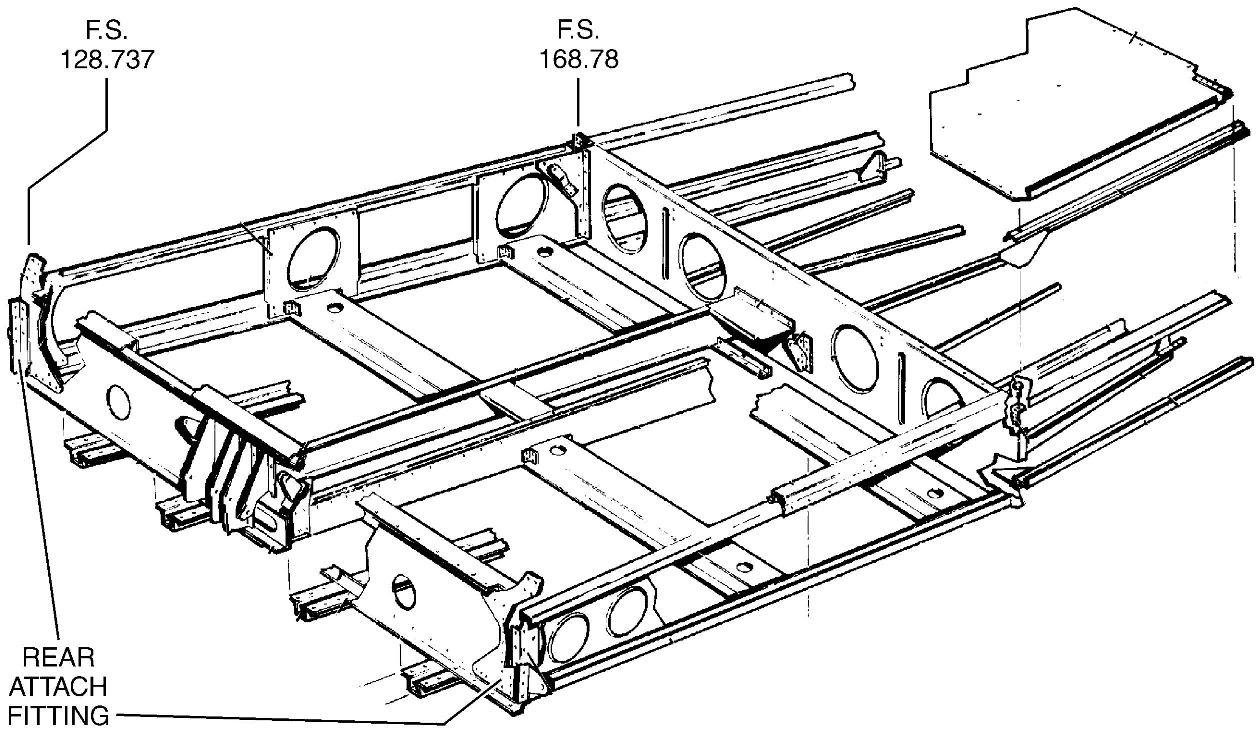
14a. 100 HOUR AFT WING ATTACH FITTING CORROSION INSPECTION. (See Figure 2.)

Gain access to the left and right wing rear attach fittings. Remove center seats and the center floorboard. Remove interior mouldings and carpet as necessary.

a. Inspect thoroughly the left and right rear wing attach fittings for evidence of flaking paint and/or corrosion. (Flaking paint may be a symptom of hidden corrosion.) If no corrosion exists, continue with these instructions. If corrosion is superficial and there is no metal flaking and/or pitting, clean and paint fittings (use good quality aircraft primer). If corrosion is found, consult the Parts Catalog, P/N 753-816, for replacement part numbers and obtain and install new parts (see Aft Wing Attach Fitting Removal and Installation, below) before continued operation.

b. Upon completion of the inspection and after replacement or refurbishment of fittings, treat attach fitting area using Dinitrol AV 8 corrosion inhibiting compound, P/N 89500-800. The treatment may be brushed or sprayed.

c. Inspect insulation in and around the rear fittings. If insulation is wet or matted down where it has been wet, it will be necessary to replace this insulation and it will be necessary to inspect all windows, doors and exterior panels leading to the cabin. Check door seals for deterioration, cracks and voids in adhesive. Check window seals for voids, cracks, and deterioration. Perform a leak check with water to determine where the water is entering. Cure all leak paths before continuing these instructions. Consult the Parts Catalog, P/N 753-816, for replacement part numbers and obtain and install new parts before continued operation. If sealing windows, use P/N 279-058 Sealant (Bostik 1100 FS) or equivalent. If using insulation other than Piper original material, be sure that the insulation is flame resistant and conforms to FAR Part 23.853.



Aft Wing Attach Fitting Corrosion Inspection
Figure 2

d. If the insulation material has not been wet, or if new material is being installed, it is necessary to ensure a 6-inch cut-out exists in the insulation in all directions around each attach fitting.

e. Ensure the .191 inch drain holes in the bottom fuselage skin beneath each attach fitting are clean and clear.

f. Re-install floorboards, seats, interior panels, and other articles removed, above. Perform a functional test of any system or component that may have been interrupted or removed.

14b. AFT WING ATTACH FITTING REMOVAL AND INSTALLATION.

NOTE: The following procedure is general in nature. More extensive disassembly may be required to remove the rear attach fitting. Assess the job before beginning to determine if additional steps or additional parts may be necessary. Consult the parts catalog for additional parts as required. Technical support is available through the nearest Piper Dealer's Service Advisor (DSA).

a. Remove electrical power from aircraft by disconnecting the battery.

b. Place jacks under wings and tail - tie down to stabilize aircraft. Provide support for fuselage in effected area.

c. Remove seats, interior panels and center floorboard to gain access to rear wing attach fittings.

d. Remove or relocate systems components to gain access to the attach fittings.

e. Remove bolt that attaches fuselage to wing spar.

f. Carefully remove rivets, screws, inner panels, channels and brackets necessary to remove attach fitting.

NOTE: In order to remove some channels, it may be necessary to remove the wings.

g. Clean and inspect the areas that were under bracket for any signs of corrosion.

h. If corrosion is found, repair or replace parts as necessary. Coat the area with primer and allow to dry.

i. If no corrosion is found, coat the area with primer. Allow time to dry.

j. Install new wing attach fitting and align rivet holes. It may be necessary to ream open the bolt hole to proper size. The hole is close tolerance and should be .3115 / .3135 (5/16). Replace attach fitting bolt should there be any sign of wear or corrosion.

k. Re-rivet wing attach fitting into place with appropriate fasteners.

NOTE: For hard to reach areas, replace existing MS20470AD-5 rivets with Hi Lok fasteners, if desired. Use HL30-5 with HL-94 Hi Lok collars. Torque to 15 to 25 inch lbs. Observe standard practices for use of Hi Lok fasteners.

l. Install wing spar and fuselage attach fitting bolt per Installation of Wing, below, and Figure 3.

m. Seal the edges of the attach fittings with PRC PR1422 (or equivalent) before installing interior.

n. Complete the same process to the opposite side.

o. Reinstall center floorboard, interior panels, and seats. Connect battery and check for operation.

15. REMOVAL OF WING. (Refer to Figure 3.)

a. Close the fuel valve and drain the fuel from the wing to be removed. (Refer to Draining Fuel System, Section II.)

b. Drain the brake lines and reservoir. (Refer to Draining Brake System, Section II.)

c. Remove the engine from the wing to be removed. (Refer to Engine, Removal, Section VIII.)

d. Drain the hydraulic lines of the landing gear of the wing to be removed by separating the lines and elbows at the actuating cylinder.

e. Remove the access plate at the wing butt rib and wing inspection panels. (Refer to Access Plates and Panels, Section II.)

f. Remove the front and back seats from the airplane.

g. Expose the spar box and remove the side trim cockpit panel assembly that corresponds with the wing being removed.

h. Place the airplane on jacks. (Refer to Jacking, Section II.)

NOTE: To help facilitate reinstallation of control cables, and fuel and hydraulic lines, mark cable and line ends in some identifying manner and attach a line where applicable to cables before drawing them through the fuselage or wing.

i. Disconnect the aileron balance and control cables at the turnbuckles that are located within the fuselage aft of the spar.

j. 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.

k. Disconnect the flap from the torque tube by extending the flap to its fullest degree, and removing the bolt and bushing from the bearing at the aft end of the control rod.

CAUTION: TO PREVENT DAMAGE OR CONTAMINATION OF FUEL, HYDRAULIC AND MISCELLANEOUS LINES, PLACE A PROTECTIVE COVER OVER THE LINE FITTINGS AND ENDS.

l. 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.

m. 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.

n. 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.

o. Disconnect the landing gear hydraulic lines at the fittings aft of the spar and within the fuselage.

p. 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.

q. Arrange a suitable fuselage cradle and supports for both wings.

r. Remove the wing jacks.

s. Remove the front and rear spar nuts, washers and bolts.

t. Remove the eighteen main spar bolts.

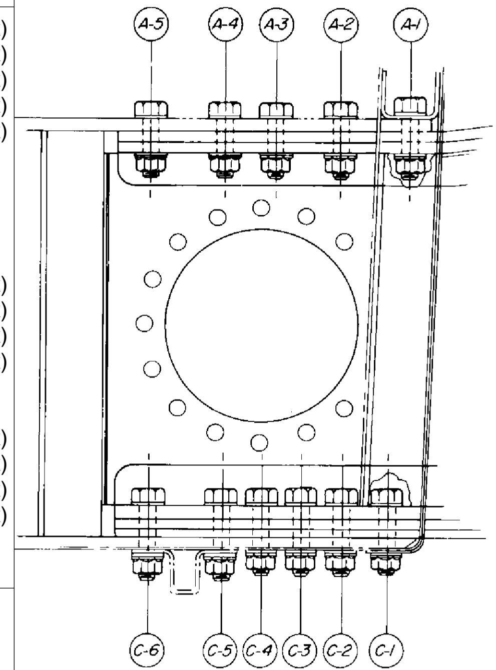
u. Slowly remove the wing being certain that all electrical leads, cables and lines are disconnected.

	BOLT LEGEND [1]		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 [2]	NAS464P6LA15	H19300-6	AN960-616L	K19301-6 [3]
B2 [2]	NAS464P6LA14	H19300-6	AN960-616	K19301-6 [3]
B3 [2]	NAS464P6LA14	H19300-6	AN960-616	K19301-6 [3]
B4 [2]	NAS464P6LA14	H19300-6	AN960-616	K19301-6 [3]
B5 [2]	NAS464P6LA14	H19300-6	AN960-616	K19301-6 [3]
C1	NAS464P5LA20	MS21042-5	AN960-516L	AN960-516 (2 Max)
C2	NAS464P6LA20	MS21042-6	AN960-616L	AN960-616 (2 Max)
C3	NAS464P6LA20	MS21042-6	AN960-616L	AN960-616 (2 Max)
C4	NAS464P6LA20	MS21042-6	AN960-616L	AN960-616 (2 Max)
C5	NAS464P6LA21	MS21042-6	AN960-616L	96352-3 [3]
C6	NAS464P5LA21	MS21042-5	AN960-516L	96352-2 [3]
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 [3]
D6	NAS464P5LA21	MS21042-5	AN960-516L	96352-2 [3]

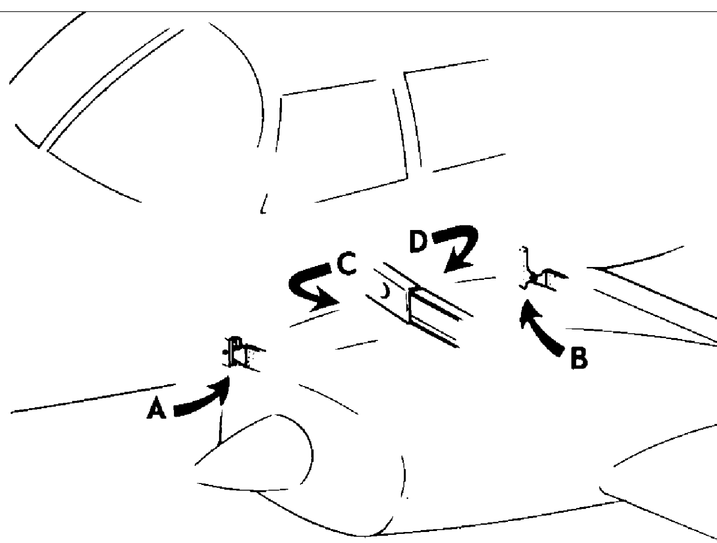
NOTES:

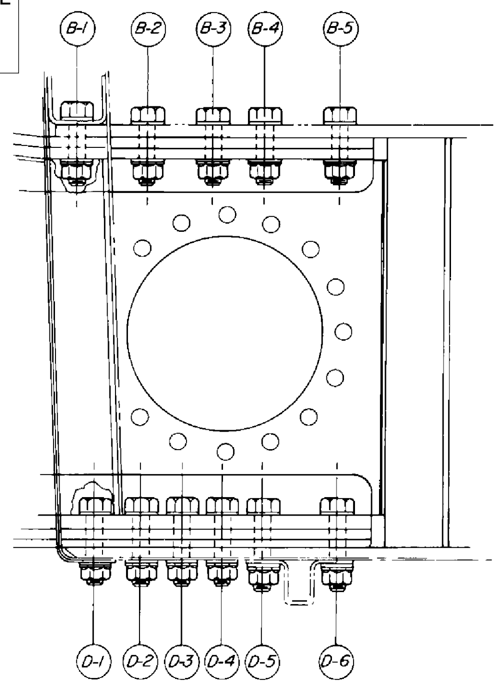
1. TORQUE BOLT HEADS ON UPPER SPAR CAP & NUT ON LOWER SPAR CAP AS FOLLOWS: 5/16 INCH BOLT = 205-225 IN-LBS;
   3/8 INCH BOLT = 360-390 IN-LBS.
2. NUTS H19300-6 (I.E. - B1 THRU B5) TO BE STEEL GRAY IN COLOR.
3. A MAXIMUM OF ONE AN 960-516 WASHER OR AN 960-616 WASHER MAY ALSO BE USED UNDER THE SPECIAL WASHER.
4. IN SKETCH B, IT IS ACCEPTABLE TO HAVE THE FACES OF THE FITTINGS AGAINST EACH OTHER. IN THAT CASE, USE THE AN 960-616L WASHER UNDER THE BOLT HEAD. THE AN 960-616 MAY BE ADDED UNDER THE NUT WHEN NOT USED AS A SHIM.

95004W



SKETCH C





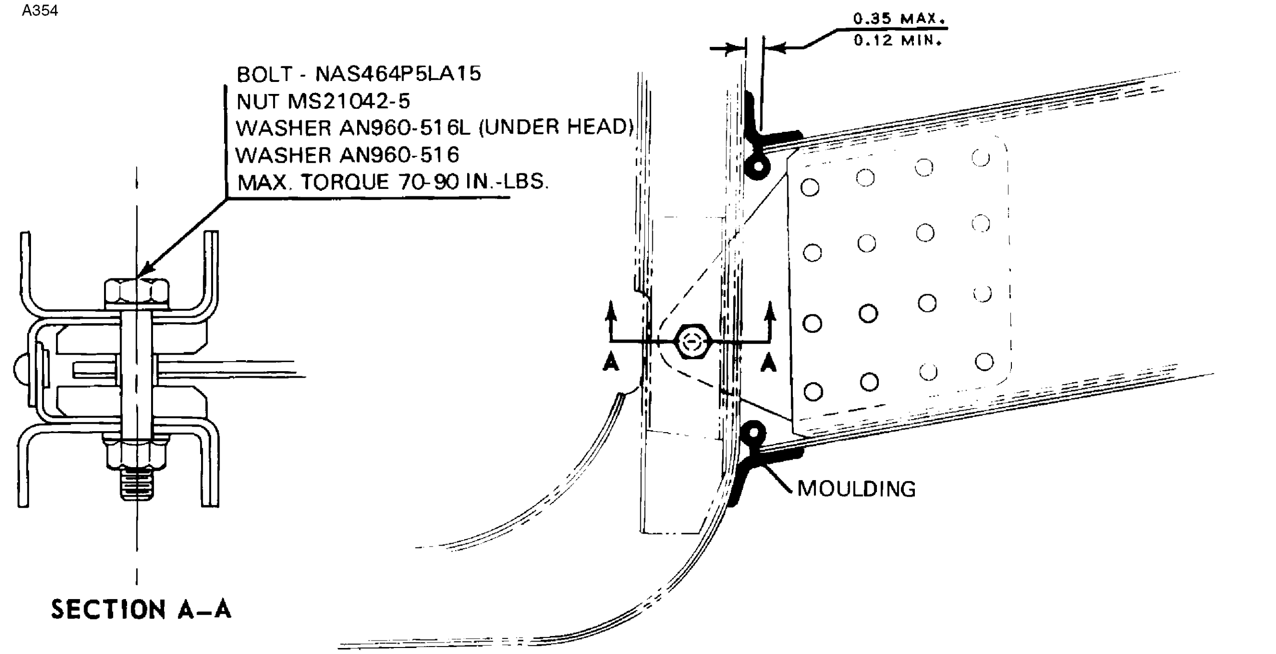
SKETCH D

— WARNING —

DO NOT DRIVE BOLTS IN OR OUT OF THE MAIN SPAR ATTACHING BOLT HOLES (C AND D). TAKE EXTRA CARE IN REMOVING AND REPLACING THESE BOLTS TO PRECLUDE DAMAGING THE BOLT HOLES.

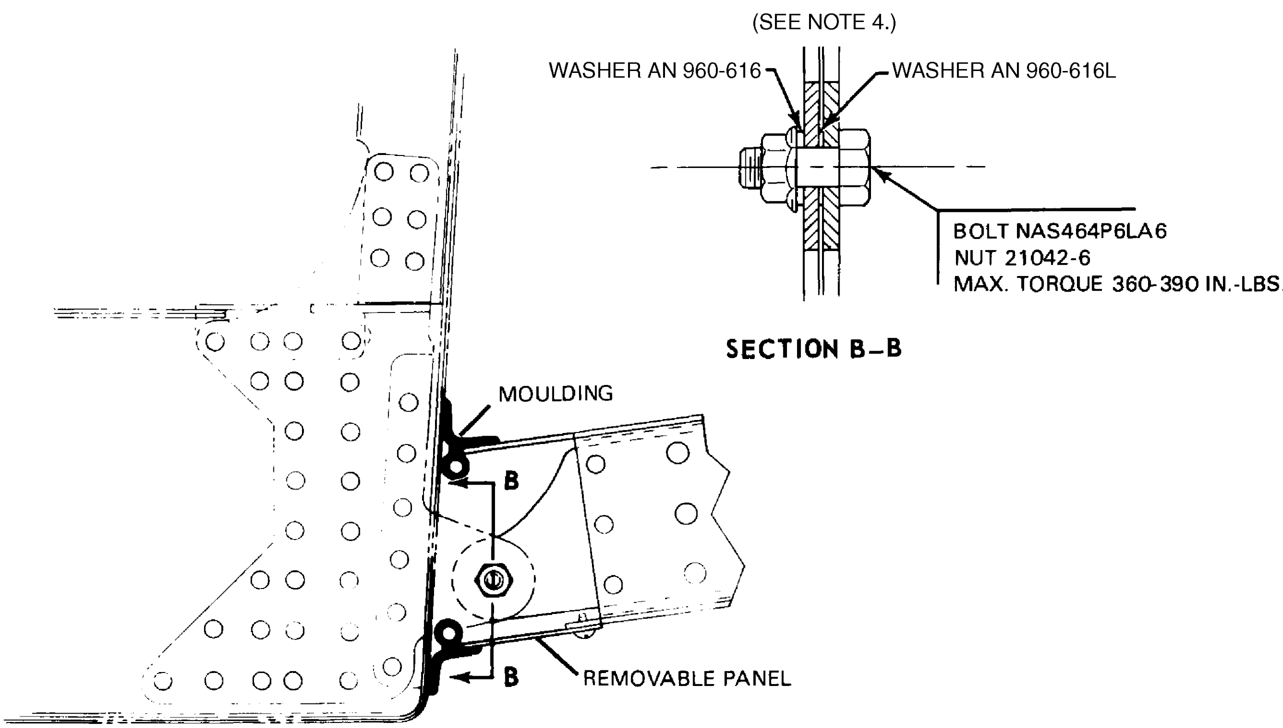
Wing Installation
Figure 3 (Sheet 1 of 2)

A354



SKETCH A

A355



SKETCH B

Wing Installation
Figure 3 (Sheet 2 of 2)

16. INSTALLATION OF WING. (Refer to Figure 3.)

a. Ascertain that the fuselage is positioned solidly on a support cradle.

b. Place the wing in position for installation, with the spar end a few inches from the side of the fuselage and set on trestles.

c. Prepare the various lines, control cables, etc. for inserting into the wing or fuselage when the wing is eased into place.

d. Slide the wing into position on the fuselage.

e. Install the eighteen main spar bolts in accordance with the bolt legend.

f. Install the bolt, washers, and nut that attaches the front spar and fuselage fitting. A minimum of one washer is required under the nut, then add washers as needed to leave a maximum of one and one-half threads visible or a minimum of the bolt chamfer exposed.

g. Insert the number of washers required between the forward face of the wing fitting and aft face of the fuselage fitting. The maximum number of washers allowed is one of AN960C-516L and one AN960C-516. It is also acceptable to have the faces of the fitting against each other. After the required washers are inserted between the plates, install the bolt and check to insure that no threads are bearing on the forward plate prior to installing the nut. Use the shortest bolt which will leave 0.580 of an inch minimum from the fitting to the end of the bolt. Add washers, AN960-516, as required, (minimum of one), to leave a maximum of one and one-half visible threads, or minimum of the bolt chamfer exposed after the nut is torqued.

h. Torque the eighteen main spar bolts to 360 inch pounds. Be certain that the bolts, nuts and washers are installed in accordance with the bolt legend. The forward spar attachment bolt should be torqued 70 to 90 IN.-LBS. Torque the rear spar attachment bolt from 360 to 390 inch pounds.

i. 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.

j. 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. On occasion, one tube may be painted red, denoting the pitot tube. Replace or install clamps where found necessary.

k. Connect the hydraulic brake line onto the fitting located within the cockpit at the leading edge of the wing, and the landing gear hydraulic lines at the fittings within the fuselage aft of the spar.

l. 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 Section XI.) Place the clamps along the electrical harness to secure it in position and install the terminal strip dust cover.

m. Connect the fuel line at the fitting located inside of the wing, by reaching through the access panel on the forward inboard portion of the wheel well.

n. 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.

o. 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.

p. Install engine. (Refer to Engine, Installation, Section VIII.)

q. Check the rigging and control cable tension of the ailerons and flaps. (Refer to Ailerons, Rigging and Adjustment: and Flaps, Rigging and Adjustment, Section V.)

r. Service and refill the brake system with hydraulic fluid in accordance with Servicing Brake System, Section II. Bleed the system as given in Section VII and check for fluid leaks.

s. Check the fluid level of the landing gear hydraulic system and fill in accordance with Servicing Hydraulic Pump/Reservoir, Section II. With the airplane setting 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 Section VI.

t. Service and fill the fuel system in accordance with Servicing Fuel System, Section II. Open the fuel valve and check for leaks and flow.

u. Check the operation of all electrical equipment, pitot and static systems.

v. Remove the airplane from jacks.

w. 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 on the wing involved.

17. EMPENNAGE GROUP.

NOTE: Before entering the aft portion of the fuselage, attach a stand to the tail skid for support; and with the use of a heavy pad, protect the inside of the fuselage. Be certain to distribute weight on top of the bulkheads so as not to damage the fuselage skin.

18. STABILATOR.

CAUTION: CONTROL SURFACE SKINS MUST BE REPLACED IF THEY SUSTAIN DAMAGE OR EXHIBIT CRACKS.

18a. ATTACH FITTING CORROSION CONTROL INSPECTION. (See Figure 4.)

During each annual inspection, use the following method to inspect stabilator attach brackets for rust and corrosion between the steel attach fittings and the adjacent fuselage structure. Take corrective action as required.

a. Remove upper and lower tail cone fairing assembly.

b. Remove the aft fuselage closeout plate assembly on the applicable models.

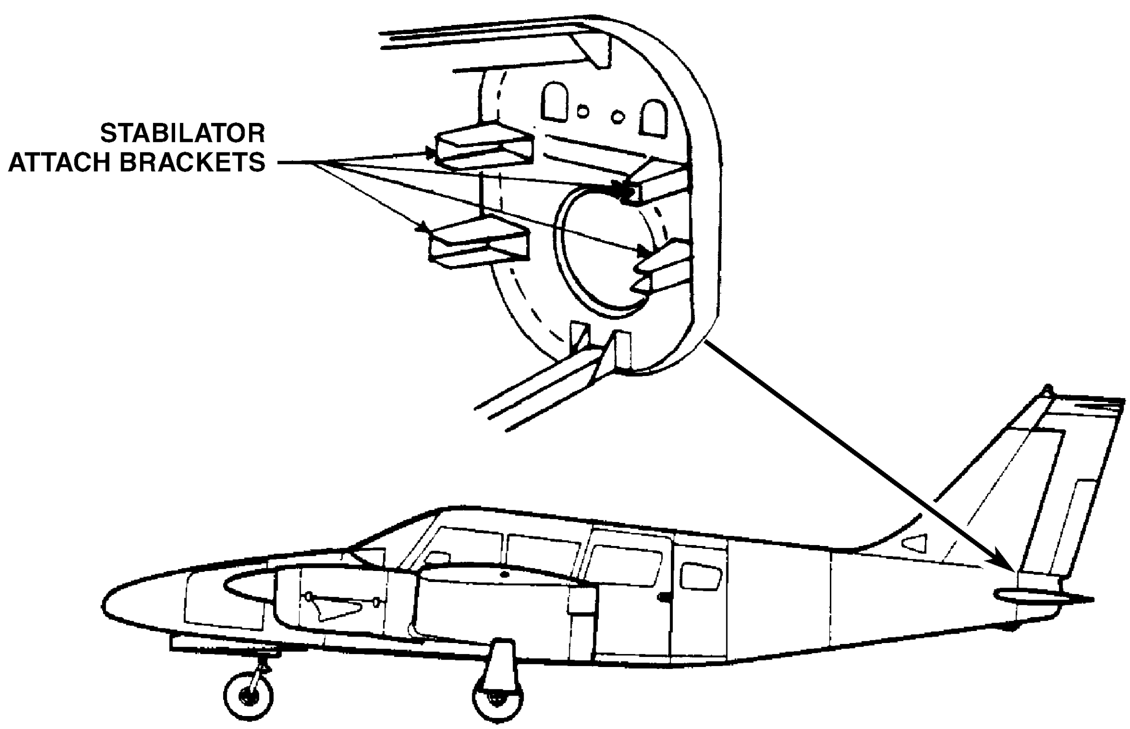
c. Inspect the steel stabilator attach fittings (4 places) and adjacent fuselage structure for the presence of rust and/or corrosion. (Refer to Figure 4.)

NOTE: Refer to F.A.A. Advisory Circular (AC) 43-4A, Corrosion Control for Aircraft.

d. If rust and/or corrosion is present, repair or replace as required. Add corrosion protection per AC43-4A.

e. Install aft fuselage closeout plate assembly. Verify integrity of rubber seals; replace if required

f. Install upper and lower tail cone fairing assembly.



Stabilator Attach Fittings Corrosion Control Inspection
Figure 4

19. REMOVAL. (Refer to Figure 5.)

CAUTION: AT EACH REMOVAL OF THE STABILATOR, CONDUCT ATTACH BRACKETS CORROSION CONTROL INSPECTION, BELOW.

NOTE: Should it be necessary to move the rudder to its extreme left or right for clearance, do so with the use of the rudder pedals or tow bar.

a. Remove the screws from around the upper and lower tail cone fairing assembly and remove the fairing separately.

b. Block the trim cable at the barrel of the trim screw assembly to prevent the cable from unwrapping

c. Remove the access panel to the aft section of the fuselage located at the back wall of the baggage compartment.

d. Install cable blocks, as illustrated in Figure 6, on the stabilator trim control cable at the first set of pulleys forward of the cable turnbuckles to prevent the forward cable from unwrapping.

e. Disconnect the trim cables at the turnbuckles within the aft section of the fuselage.

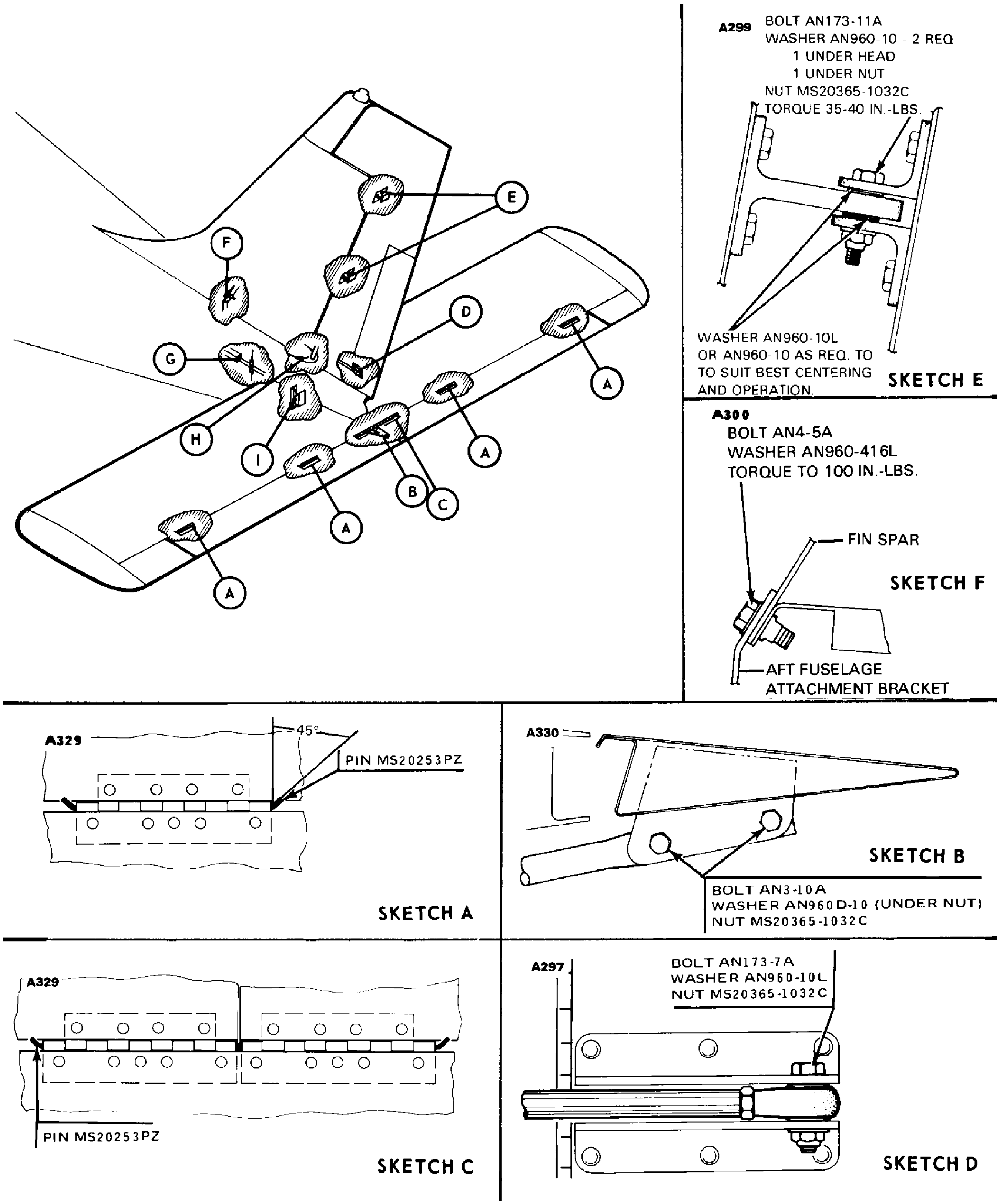
f. Relieve tension from the stabilator control cables by loosening one of the cable turnbuckles in the aft section of the fuselage.

g. Disconnect the stabilator control cables from the stabilator balance arm by removing cotter pins, nuts, washers, bushings and clevis bolts.

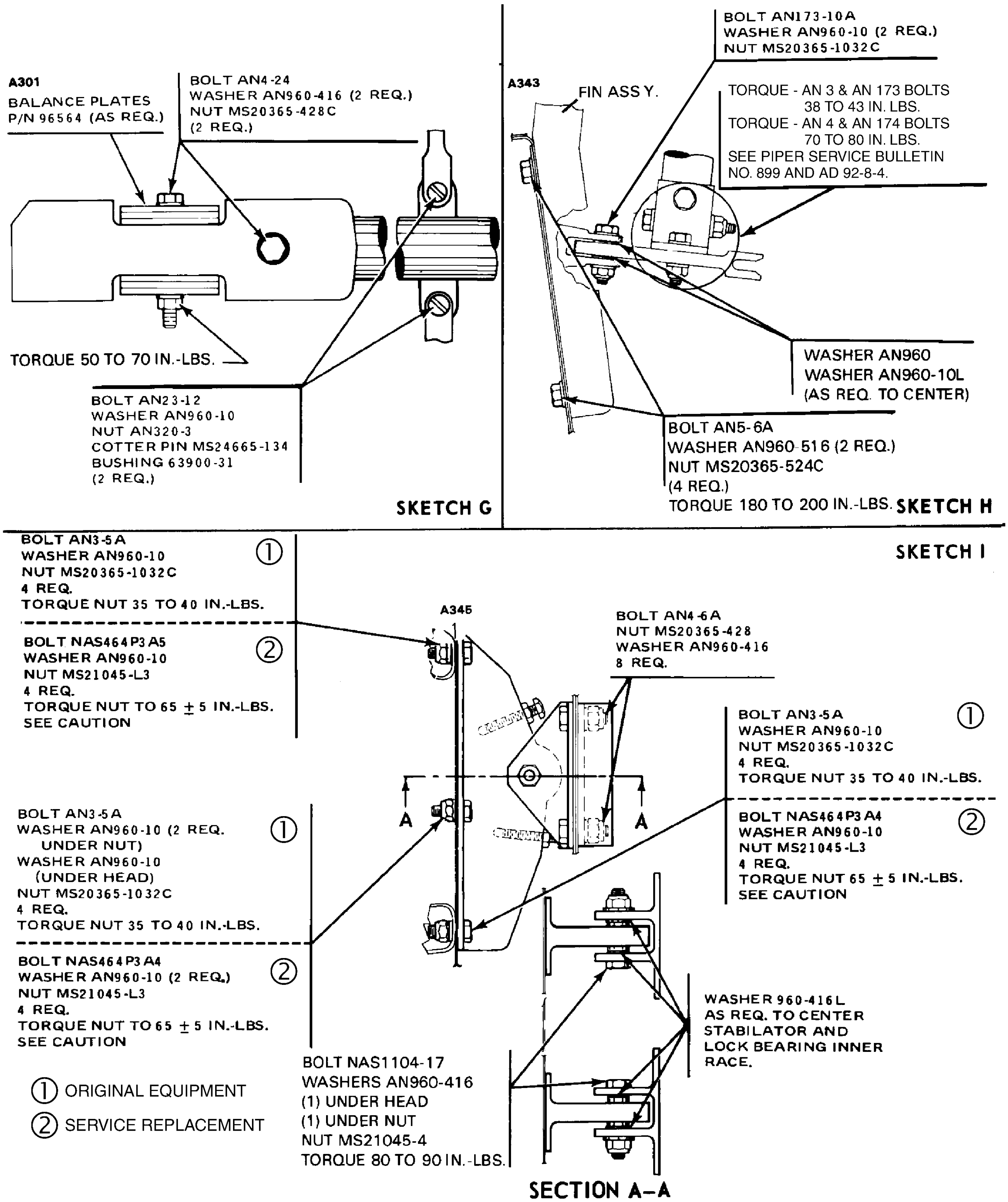
h. Disconnect the trim assembly from the aft bulkhead of the fuselage by removing the attaching nuts, washers and bolts of the horizontal and diagonal support brackets.

i. Move the trim assembly up through the tail cone fairing cutout in the stabilator and remove, with cable, from the airplane.

j. Remove the stabilator by disconnecting the stabilator at its hinge points by removing attaching nuts, washers and bolts.

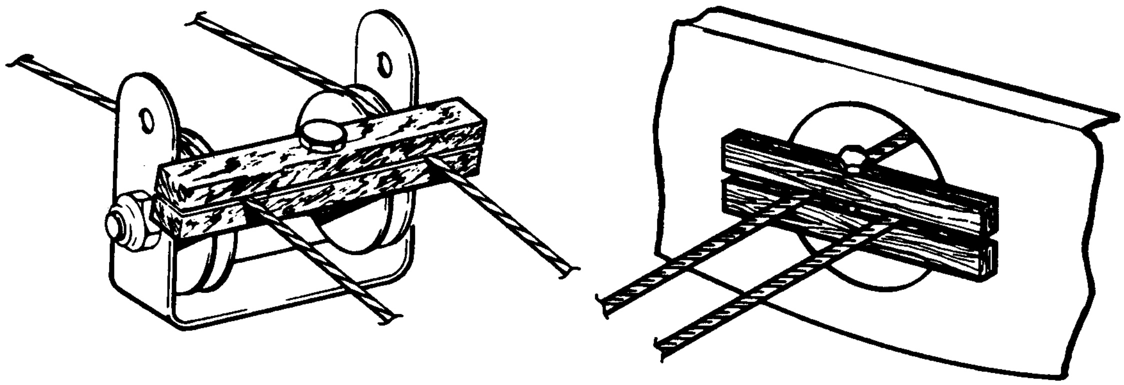


Empenage Installation
Figure 5 (Sheet 1 of 2)



CAUTION: ATTACHING HARDWARE VARIES DEPENDING ON SERVICE KITS INSTALLED. POSITIVELY IDENTIFY HARDWARE BEFORE TORQUING.

Empenage Installation
Figure 5 (Sheet 2 of 2)



Methods of Securing Control Cables
Figure 6

20. INSTALLATION. (Refer to Figure 5.)

WARNING: ALL CONTROL SURFACES THAT HAVE BEEN REPLACED OR REPAINTED MUST BE BALANCED BEFORE INSTALLATION PER INSTRUCTIONS IN BALANCING, BELOW.

NOTE: A clearance of .25 ± .06 of an inch between the stabilator and the side of the fuselage and .18 of an inch 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.

a. Insert the stabilator in position and install attaching hinge bolts, washers and nuts.

b. 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.

c. Attach the stabilator control cables to the stabilator balance arm with clevis bolts, bushings, washers, nuts and cotter pins.

d. Connect the ends of the fore and aft trim cables at the turnbuckles within the aft section of the fuselage.

e. Remove the cable block from the trim control cable within the fuselage.

f. Set stabilator control cable tension and check rigging and adjustment according to Rigging and Adjustment of Stabilator, Section V.

g. Remove the cable blocks from the trim cable at the barrel of the trim screw assembly.

h. Set stabilator trim control cable tension and check rigging and adjustment according to Rigging and Adjustment of Stabilator Trim, Section V.

i. Remove the pad from the aft section of the fuselage and replace the access panel.

j. Install the tail cone fairing and remove tail stand.

21. STABILATOR TRIM TAB.

CAUTION: CONTROL SURFACE SKINS MUST BE REPLACED IF THEY SUSTAIN DAMAGE OR EXHIBIT CRACKS.

22. REMOVAL. (Refer to Figure 5.)

a. Disconnect the stabilator trim control rod by removing the bolts that attach the control rod to the stabilator trim tab.

b. Remove the stabilator trim hinge pins by cutting one end of the wire pins and removing.

c. The stabilator trim tab can now be removed.

23. INSTALLATION. (Refer to Figure 5.)

a. Place the trim tab in position on the aft end of the stabilator.

b. Replace the old hinge pins with new pins. (Refer to Parts Catalog for proper Part No.)

c. Insert the pins and secure by bending the end to a 45 degree angle.

d. Install the control rod and attach with the four bolts and washers.

e. The trim tab free end play must not exceed .175 inches maximum.

24. RUDDER.

CAUTION: CONTROL SURFACE SKINS MUST BE REPLACED IF THEY SUSTAIN DAMAGE OR EXHIBIT CRACKS.

25. REMOVAL. (Refer to Figure 5.)

a. Remove the screws from around the upper tail cone fairing assembly and remove the fairing.

b. 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.

c. Relieve the cable tension from the rudder control system by loosening one of the cable turnbuckles in the aft section of the fuselage.

d. Disconnect the two control cables from the rudder horn by removing the cotter pins, nuts, washers, bushings and bolts.

e. Disconnect the rudder trim tab push rod from the actuating link by removing cotter pin, nut, washer and bolt.

f. Remove the cotter pins, nuts, washers and bolts from the upper and lower rudder hinge pivot points.

g. Pull the rudder up and aft from the vertical fin.

26. INSTALLATION. (Refer to Figure 5.)

WARNING: ALL CONTROL SURFACES THAT HAVE BEEN REPLACED OR REPAINTED MUST BE BALANCED BEFORE INSTALLATION PER INSTRUCTIONS IN BALANCING, BELOW.

a. Place me rudder in position and install me 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.

b. Connect the rudder trim tab push rod to me actuating link with bolt, washer, nut and cotter pin.

c. Connect the tail position light electrical lead at the quick disconnect and cover me connector with an insulating sleeve. Tie both ends of the sleeve with number six electrical lacing twine.

d. Connect me control cables to the rudder horn with bolts, washers, nuts and cotter pins.

e. Check me rudder in accordance with Rigging and Adjustment of Rudder, Section V.

f. Install the upper tail cone fairing and rudder tip and secure with the attachment screws. Secure me access panel to the aft section of fuselage.

27. RUDDER TRIM TAB.

CAUTION: CONTROL SURFACE SKINS MUST BE REPLACED IF THEY SUSTAIN DAMAGE OR EXHIBIT CRACKS.

28. REMOVAL. (Refer to Figure 5.)

a. Remove me bolt assembly which connects the trim tab actuating arm to the tab assembly.

b. Remove the trim tab hinge pin and remove me tab assembly from the rudder.

29. INSTALLATION. (Refer to Figure 5.)

WARNING: ALL CONTROL SURFACES THAT HAVE BEEN REPLACED OR REPAINTED MUST BE BALANCED BEFORE INSTALLATION PER INSTRUCTIONS IN BALANCING, BELOW.

a. Position me trim tab assembly into the rudder aligning me two hinge bolts.

b. Install a new hinge pin. Ascertain that at least .50 of an inch of hinge pin extends out from each end of the hinge.

c. Bend both ends of the hinge pin to a 30° angle to secure it in place.

d. Connect me trim tab actuating arm to the bracket and me tab and secure with bolt assembly.

30. VERTICAL FIN.

31. REMOVAL. (Refer to Figure 5.)

a. 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.

b. Remove the rudder per instructions given in paragraph 25.

c. Disconnect the leads from the antenna terminals (optional) and attach a line to the leads to assist in reinstallation.

d. Disconnect the wire antenna (optional) mat attaches to the leading edge of the fin.

e. 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.

f. Remove the rudder trim assembly and trim cable in accordance with Removal of Rudder Trim Assembly, Section V.

g. Remove the bolt and washer that attaches the leading edge of the fin to the fuselage.

h. Remove the nuts, washers and bolts that secure the fin spar to the aft bulkhead and remove the vertical fin.

32. INSTALLATION. (Refer to Figure 5.)

a. Insert the vertical fin into position and install the bolts, washers and nuts that secure the fin spar to the aft bulkhead.

b. Install the bolt and washer that attaches the leading edge of the fin to the fuselage.

c. Install the rudder trim assembly and trim cable per instructions given in Installation of Rudder Trim Assembly, Section V.

d. Install the rudder per paragraph 26.

e. Pull the electrical and antenna leads through the vertical fin with the line that was attached.

f. Connect the antenna leads to the proper terminals and secure with the washers and nuts.

g. Connect the electrical leads at the disconnects and insulate.

h. Rig and adjust the rudder and trim control cables as given in Section V.

i. Check the operation of the radios and electrical lights.

j. Replace all fairings and access plates, and secure with attaching screws.

33. FUSELAGE ASSEMBLY.

34. WINDSHIELD.

35. REMOVAL. (Refer to Figure 7.)

a. Remove the collar molding from around the bottom of the windshield by removing attaching screws.

b. Remove the trim strip from between the windshield halves by removing attaching screws.

c. Remove the windshield by raising the lower portion of the windshield and pulling forward.

NOTE: A damaged windshield should be saved since it can be used as a pattern for drilling holes in a new windshield.

d. Clean old tape and sealer from the windshield retainer channels and strips.

36. INSTALLATION. (Refer to Figure 7.)

a. Ascertain that the new windshield outside contours are that of the old windshield. It may be necessary to cut or grind the new windshield.

b. Apply black vinyl plastic tape around the outer edge of the entire windshield.

c. Apply a strip of vinyl foam tape (1/8 x 1” wide - type 1 P.V.C. per PMS-K0003) over the plastic tape completely around the top and outboard edges of the windshield.

d. Apply white Bostik 1100FS (Urethane), P/N 279-058; or, 3M Marine Sealant 101, P/N 279-177, sealing compound in the upper and outboard windshield channel.

e. Slide the windshield aft and up into place. Use caution not to dislocate the tape around the edges of the windshield. Allow clearance between the two sections of the windshield, at the divider post, for expansion.

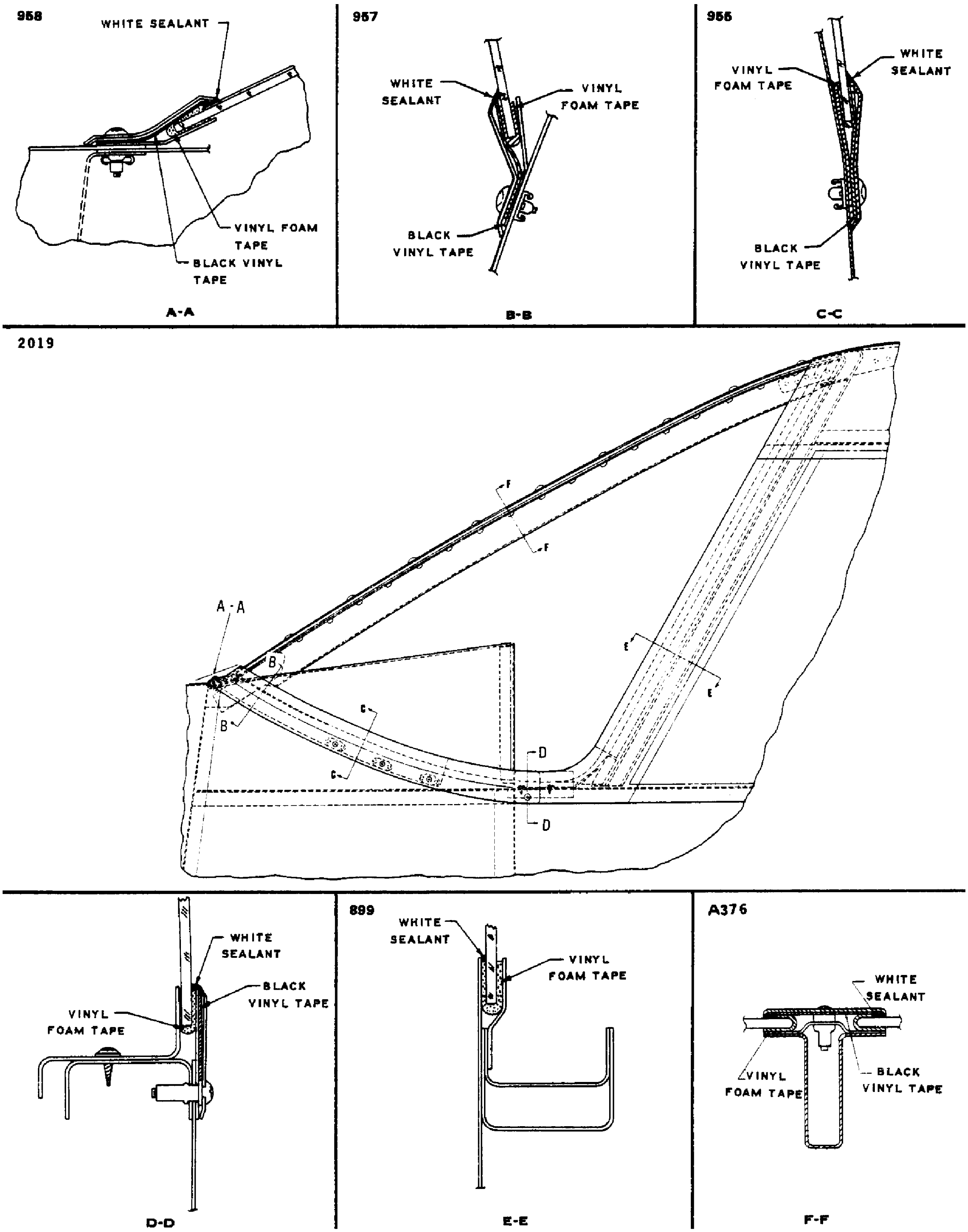
f. Lay sealant at the bottom and center (inboard) of the windshield, in the hollow between the outside edge and channel.

g. Lay a small amount of sealant under the center trim strip, install and secure.

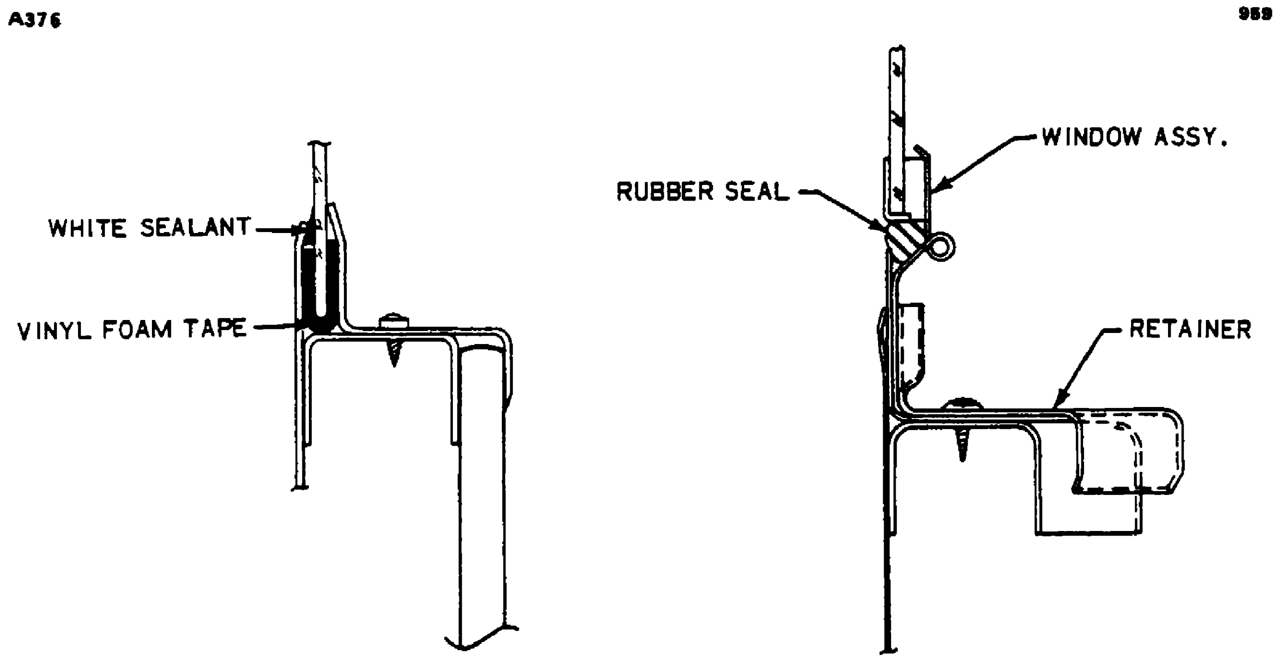
h. Lay black vinyl tape on the underside of the collar molding, install and secure.

i. Apply sealant to any areas around windshield that may allow water to penetrate past windshield.

j. Remove excess exposed sealer or tape.



Windshield Installation
Figure 7



Side Window Installation (Typical)
Figure 8

37. SIDE WINDOWS.

38. REMOVAL. (Refer to Figure 8.)

a. Remove the retainer molding from around the window by removing attachment screws. At the forward end of both the right and left window that is adjacent to the second row of seats, the window retainer is riveted in place and need not be removed.

b. Remove the window from the frame.

c. Remove excess tape and sealer from the window frame.

NOTE: A damaged window should be saved to provide a pattern for shaping the new window.

39. INSTALLATION. (Refer to Figure 8.)

a. Cut or grind the new window to the same dimension as the window removed.

b. Apply a strip of vinyl foam tape (1/8 x 1 inch wide - Type 1 P.V.C. per PMS-K0003) completely around the edge of the window.

c. Apply white Bostik 1100FS (Urethane), P/N 279-058; or, 3M Marine Sealant 101, P/N 279-177, sealing compound completely around the outer surface of the window at all attachment flanges.

d. Install the window in the frame and install retainer moldings. Secure with screws.

e. Remove excess exposed sealer and tape.

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39a. CABIN (AFT) DOOR WINDOW.

40. REMOVAL. (Refer to Figure 9.)

a. Remove the cabin door from the airplane and lay it on a surface that will not scratch the painted surface of the door.

b. Measure in .45 of an inch from the edge of the window frame and scribe a line around the inner side of the door (Line “A”, Figure 9.)

CAUTION: BE CAREFUL NOT TO SET THE REAMER TOO DEEP.

c. Using a reamer in an electric drill as shown in Figure 9 and setting the aluminum guide so that the reamer protrudes not more than 3/16 of an inch, cut along the scribed line in order to remove a section of the inner pan and the old window as shown in Sketch B.

d. Remove the section of the pan and window that is nearest to the edge of the frame with a sharp tool, such as a chisel. Leave a clean smooth surface to receive the new window.

e. Using medium sandpaper, roughen the surface of the inner pan that will receive the retainer, to insure bond.

41. INSTALLATION. (Refer to Figure 9.)

NOTE: Repair Kit, part number 757-023, contains all materials necessary to replace the cabin door window and is available through Piper Aircraft Dealers or Distributors.

a. Temporarily position new retainer. Using a 1/8-inch drill, drill 16 holes around the inner panel assembly using the holes in the retainer as pilot holes. Remove retainer and redrill all 16 holes using a 5/ 16-inch drill.

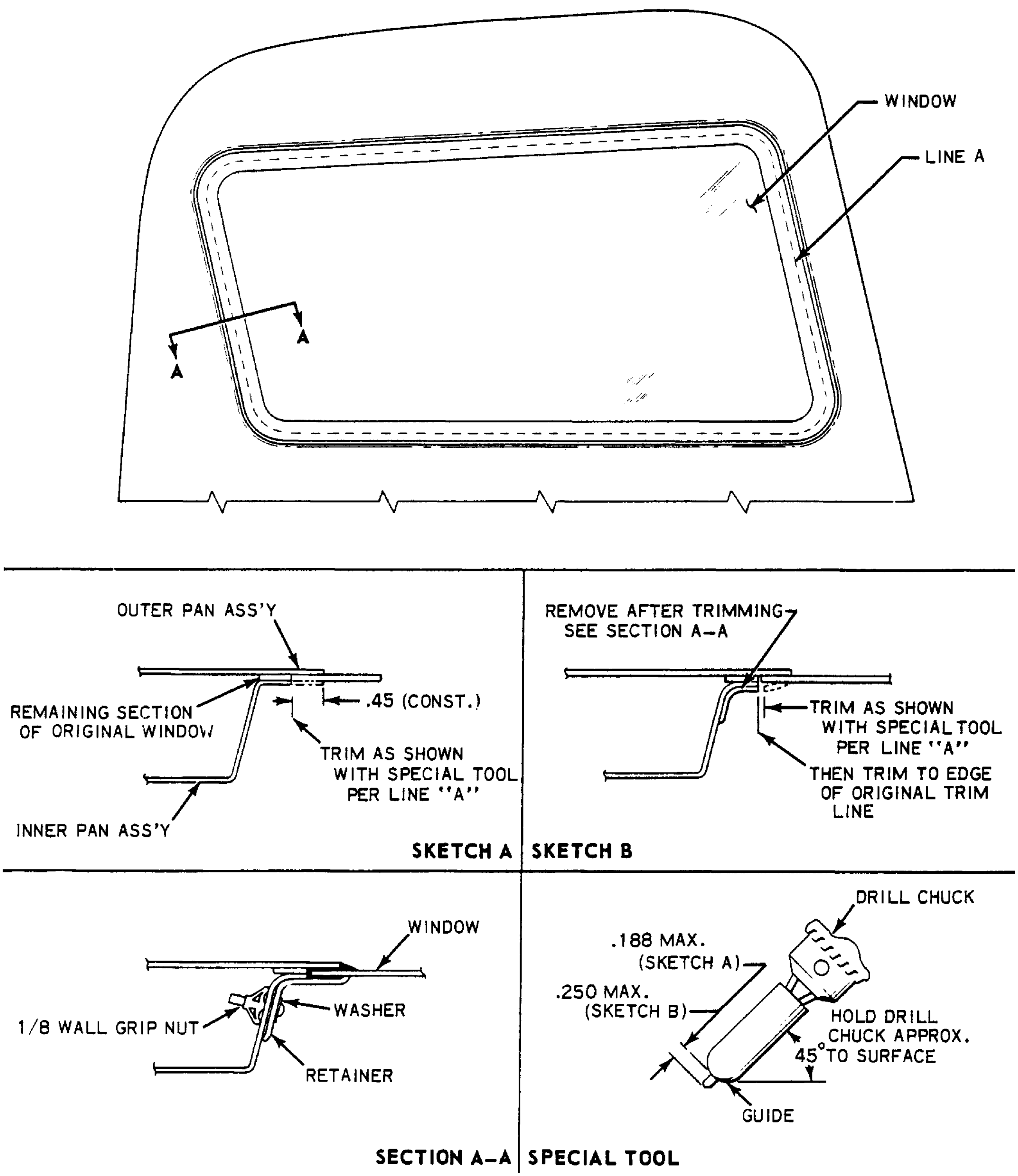
b. Temporarily position new window in its recess to determine that sufficient material has been removed and that it fits properly.

c. Stand the window on edge on a protective surface. Peel the protective masking away from the edge far enough to permit the application of the sealing tape. The tape should be applied in such a manner that the approximate center of the tape will contact the edge of the window.

d. Carefully press tape to connect both sides of the window simultaneously. The tape should be evenly divided on both sides of window. Cut and trim tape as necessary.

e. Position window in its recess in the door. Gently press outer edges of the window so that tape will contact the inner surface of the outer panel assembly.

f. Insert 16 wall grip nuts (with screws installed) through holes previously drilled in the inner panel assembly. Turn screws in clockwise rotation thus activating the locking feature of the nut. Continue in this direction until the nut is drawn up tight. Avoid excess torque to prevent stripping threads. Remove screws.



Cabin (Aft) Door Window Installation
Figure 9

g. Place new retainer into position and secure with 16 screws and washers (AN96-06).

h. Carefully invert the door. Apply a bead of Bostik 1100FS (Urethane), P/N 279-058; or, 3M Marine Sealant 101, P/N 279-177, sealing compound to the outer perimeter of the window. Allow sealant to dry before reinstalling door.

NOTE: Inspect to determine that all original bond lines between outer panel and window, and window and inner panel are tight. Fresh breaks in bond lines can be sealed using one of the following:

1. Eastman 910
2. Aron Alpha Vigor Tool Co., NYC., N.Y.

Older breaks in bond lines should be sealed using one of the following adhesives:

1. Scotchweld 2216 B/A Liquid epoxy, MMM Co., St. Paul, Minn.
2. Chemlock 304 Hughson Chemical Co., Erie, Pa.
3. Reisweld 7006 H.B. Fuller Co., St. Paul, Minn.
4. Locktite 2508t Locktite Corp, Newington, Conn. Packaged in 1-oz cups for ready mix under P/N 53-83.

42. COCKPIT AND CABIN DOORS.

43. REMOVAL.

a. Remove clevis bolt, washer and bushing from door holder assembly.

b. Remove cotter pins, clevis pins and washers from door hinges. Note number and position of washers for reinstallation.

c. Remove door from airplane.

44. INSTALLATION.

a. Insert the door into position and install the washers, clevis bolts and cotter pins in the door hinges.

b. For adjustment of door, see below.

c. Hook up and install the clevis bolt, bushing and washer into the door holder assembly.

45. ADJUSTMENT.

A small amount of vertical adjustment is available by varying the washer combination between the cabin door hinge and fuselage eyebolt.

45a. DOOR LATCH MECHANISM - LOWER.

46. REMOVAL.

a. 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.

b. Disconnect the latch pull rod from the inside door handle.

c. Remove the complete latch mechanism.

47. INSTALLATION.

a. Place the latch assembly into position on the door.

b. Connect the latch pull rod to the inside door handle.

c. Replace the screws that attach the latch plate and mechanism to the door. Install the door trim upholstery and secure with screws.

48. ADJUSTMENT. To adjust the door latch, loosen the screws on the striker plate, make necessary adjustment, and retighten the screws.

48a. DOOR LATCH MECHANISM - UPPER (I.E. - AUXILIARY/SAFETY).

49. REMOVAL.

  a. Remove screw and handle from top outer surface of door.

  b. Remove screws holding latch assembly to the inner panel of the door and remove the latch.

50. INSTALLATION.

  a. Insert hook through rectangular slot in top of door. Align holes in latch assembly with those in the door inner panel and secure with screws.

  b. Install outer handle and screw.

51. ADJUSTMENT.

  a. To adjust the door safety latch remove the two screws from latch plate found at the top of the door opening.

  b. Remove the plate and turn the loop assembly in or out to make necessary adjustments.

  c. Replace the latch plate and secure with the two attachment screws.

51a. DOOR LOCK ASSEMBLY.

52. REMOVAL.

  a. Remove the door trim upholstery by removing the attachment screws.

  b. Loosen the nut on the lock assembly and remove the lock by turning it sideways.

53. INSTALLATION.

  a. Install the lock in the door by turning it sideways and placing it through the opening provided.

  b. Replace the nut on the back of the lock assembly and tighten.

  c. Replace the door trim upholstery and secure with the attachment screws.

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54. BAGGAGE DOORS.

54a. FORWARD BAGGAGE DOOR LATCH.

54b. PRE/POST-FLIGHT INSPECTION. (See Figure 10.) Prior to each flight, during the preflight inspection, and after each flight:

NOTE: The postflight inspection is required in order to determine the integrity of the door latch and locking mechanism after flight since the possibility exists that any discrepancy could go undetected during routine removal of any baggage by ground personnel.

a. With the Door Open. (See Sketch 1, Figure 10.)

(1) Rotate door latch to the full closed position.

(2) Insert key in lock, turn to the full locked position, remove the key.

(3) Grasp the door latch handle and attempt to unlatch the mechanism.

NOTE: There will be some normal backlash in the mechanism, this is indicated by a minor free rotation of the latch handle. There will also be a slight withdrawal of the draw bolts. A safe locked mechanism is indicated by a definite hard stop “feel”.

(4) Grasp the fork ends of the push rods and push inward towards the latch housing. There should be no perceptable movement possible.

(5) If the mechanism is “secure” proceed with normal latching and locking of the door in accordance with Door Latching and Locking Procedure, below.

(6) If there is any doubt as to the security of the door latch and locking mechanism, inspect the installation in accordance with Door Lock Inspection and Rigging, below.

b. Door Latching and Locking Procedure.

(1) Insure all baggage is secure and is stowed so that it does not interfere with normal closure of the door. The door must not be forced closed, compressing baggage in the compartment.

(2) Close the door, rotate the latch to the full closed position (i.e. - handle horizontal).

(3) Hold the latch in the closed position; insert the key in the lock; rotate to the locked position and withdraw the key.

NOTE: The key should turn through a ninety degree arch between fully locked and fully unlocked. If the key can be removed from the lock at any point other than fully locked, the lock and key must be replaced.

c. Security Check.

(1) Grasp the door latch and attempt to turn counter-clockwise (to the left) to unlatch .

(2) Check contour matching of the door edge with the surrounding edge. There should be no excessive out of contour protrusion of the door.

(3) Grasp the door latch handle and attempt to pull the door open without turning the handle. There shall be no perceptable “pull out” of the door especially at the forward and aft lower corners.

54c. DOOR LATCH INSPECTION AND RIGGING. Upon condition as determined by pre/post-flight inspection, above:

NOTE: The following procedures assume compliance with Piper Service Bulletins 447, 633B, and 872.

a. Examine the inside and outside of the forward baggage door along the hinge and along all inner stiffening sections for evidence of cracks or delamination of the figerglass.

b. If damage or cracks are found, replace or repair affected parts. Any repair must be accomplished per latest revision of AC 43.13-1.

c. Detailed inspection with the Door Open. (See Sketch 1, Figure 10.)

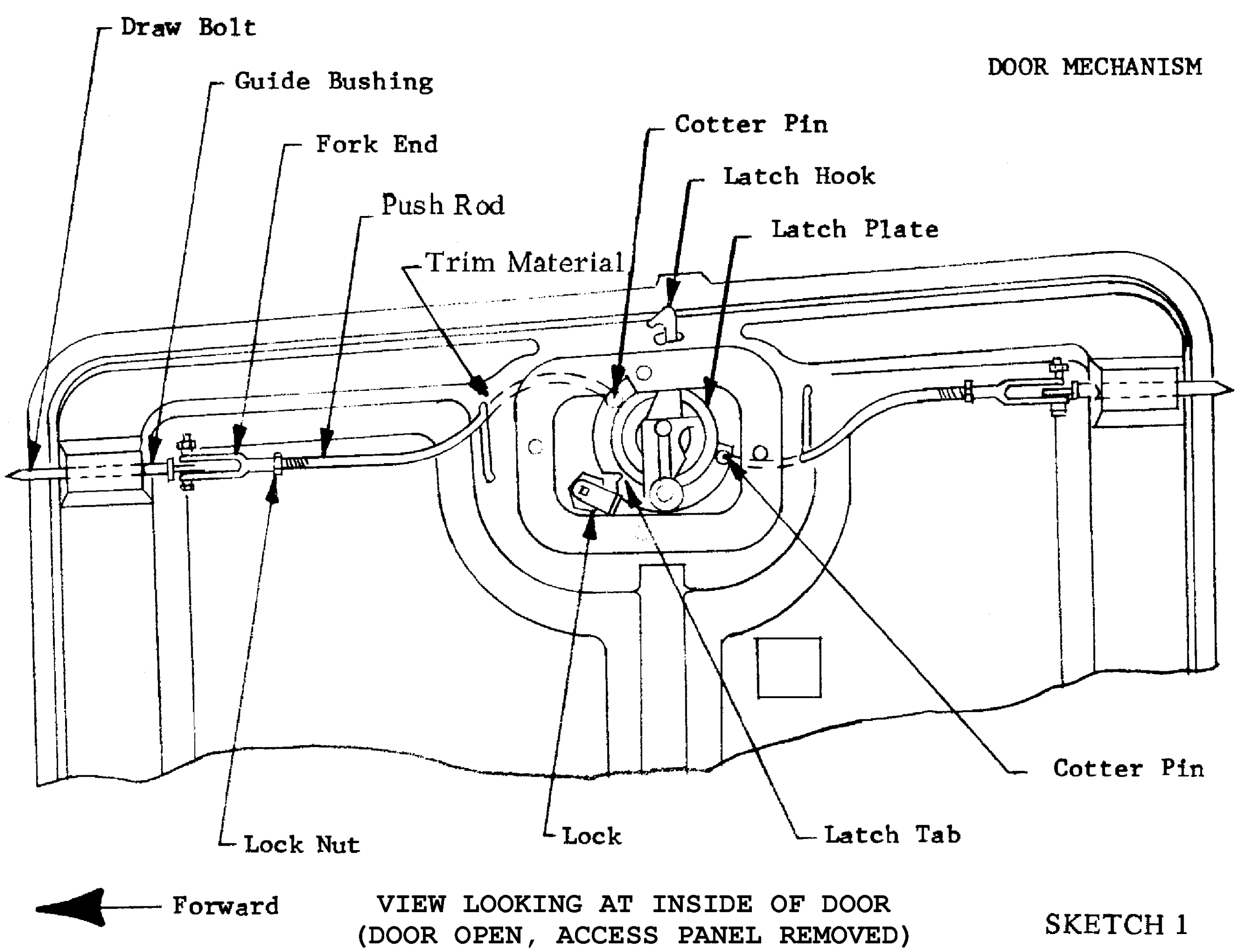
(1) Remove the latch mechanism inner access panel.

(2) Inspect the latch hook for excessive wear, deformation, or breakage.

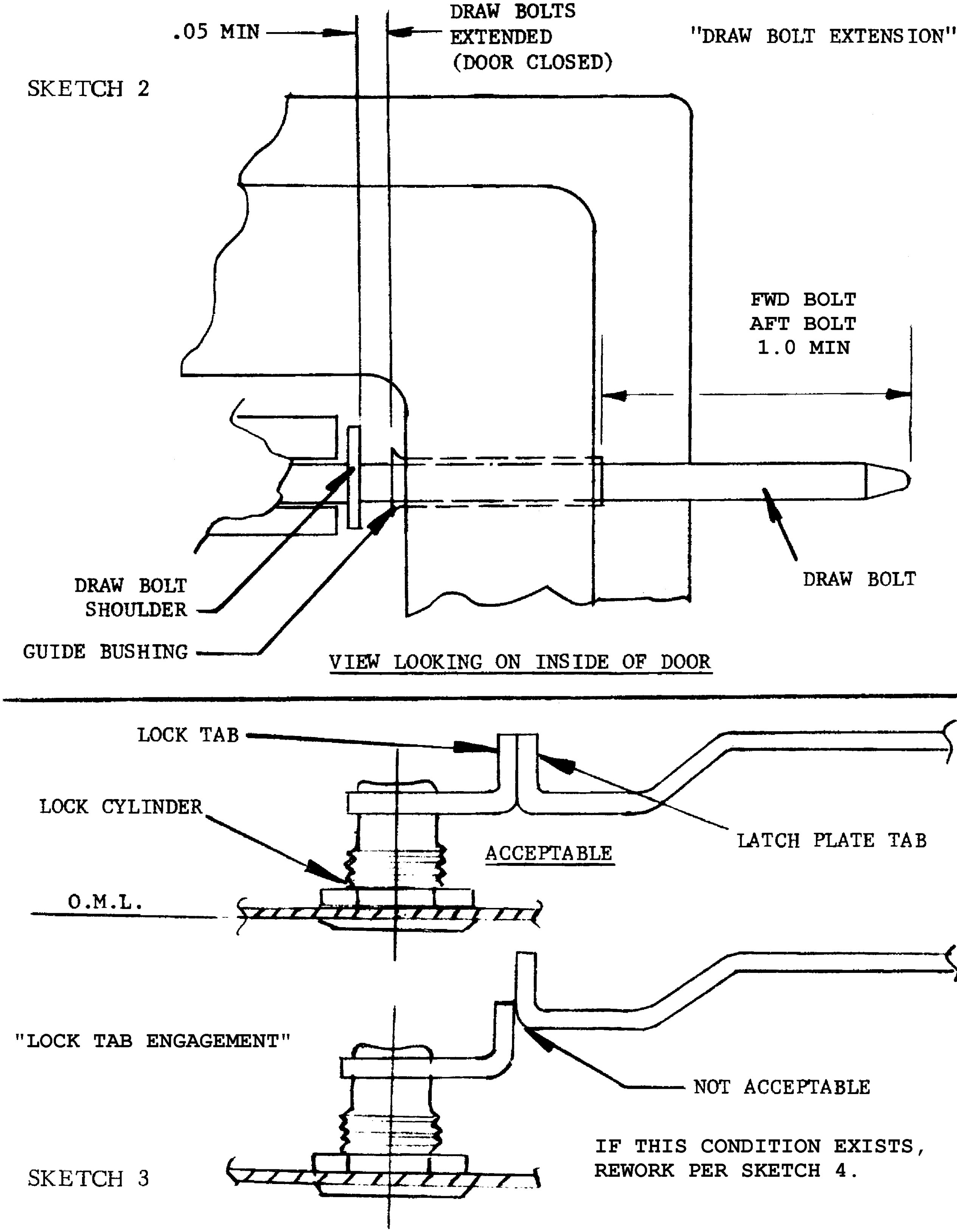
(3) Inspect the ends of the draw bolts for wear, deformation, burrs or breakage.

(4) Inspect the latch plate lock tab for wear, deformation, or breakage.

(5) Inspect the lock tab for looseness, wear or breakage.



Forward Baggage Door Latch Inspection
Figure 10 (Sheet 1 of 3)



Forward Baggage Door Latch Inspection
Figure 10 (Sheet 2 of 3)

(6) Inspect the push rods, fork ends, and lock nuts for security.

(7) Inspect and check all connections of the push rods to the latch plate for security.

(8) Inspect and check the lock body for rotation in the door panel. Tighten the lock nut if necessary.

(9) Inspect and check the latch mechanism attachment to the door panel. If there is any perceptible looseness of the attachment rivets, they must be replaced.

(10) Inspect and check the door structure and the hinge attachment for any visible signs of delamination of the stiffener structure to the skin panel.

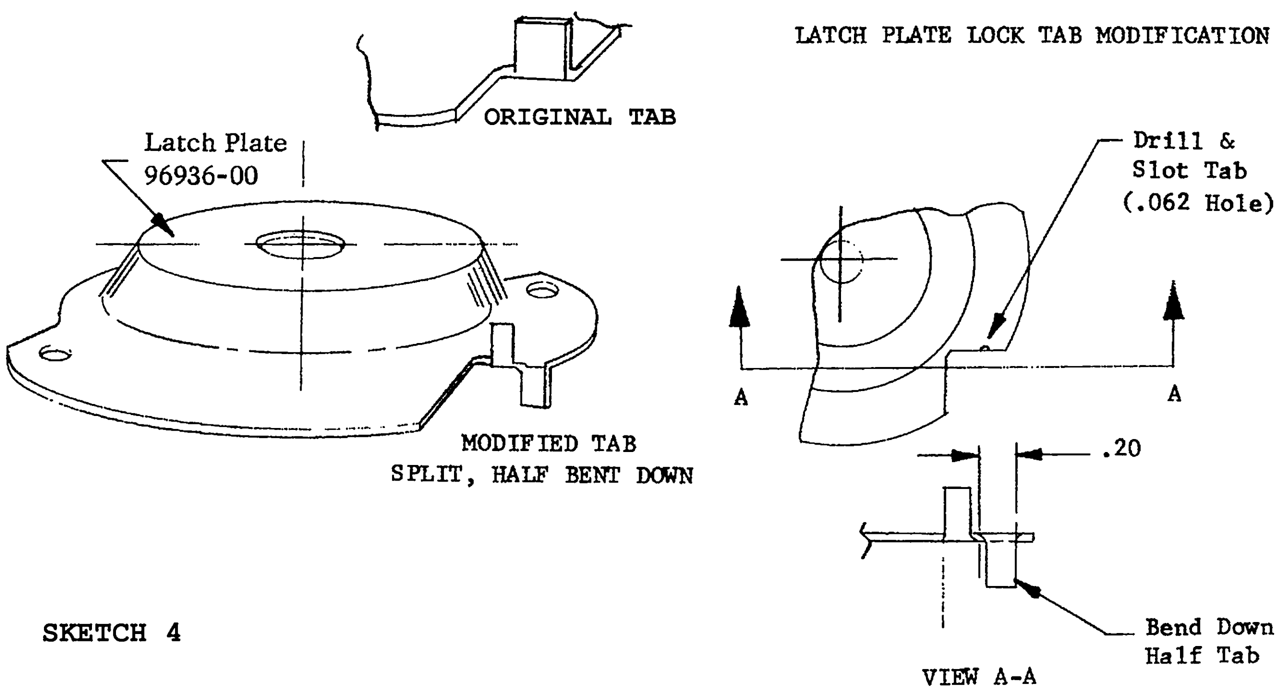
(11) Operate the latch mechanism and check the push rod clearance with the inner door structure in the closed position in the area of the latch housing cut-outs.

d. Rigging Inspection. (Drawbolt Engagement/Travel.)

NOTE: The one (1) inch minimum drawbolt extension dimension given herein supercedes the 1.5 inch dimension previously given in Piper Service Bulletin No. 633B.

(a) With the door open, the latch mechanism turned to the full closed position and locked, turn the latch counter-clockwise to take up the "back lash" in the mechanism. (Refer to Sketch 2, Figure 10.) Check the minimum protrusion of the drawbolt, as measured from the face of the guide bushing. The forward bolt should be one (1) inch and the aft bolt one (1) inch. If the minimum drawbolt protrusion requires re-rigging proceed to steps (b), (c) and (d), below.

(b) When the drawbolts are withdrawn to the open position, the ends should not protrude. so far as to prevent closure of the door.



Forward Baggage Door Latch Inspection
Figure 10 (Sheet 3 of 3)

(c) When the drawbolts are extended into the closed position, the shoulders of the bolts should not prematurely contact the guide bushing (i.e. - create pre-tensioning/springback in push rods).

(d) Re-rigging the engagement of the drawbolts is facilitated by adjusting the fork end. Minimum thread engagement of the push rod is .40 inches.

e. Latch Plate Tab to Lock Tab Engagement.

(a) With the door open, the mechanism turned to the fully closed position and locked, check that tab faces align correctly. (Refer to Sketch 3, Figure 10.)

(b) Grasp the latch handle and attempt to unlatch and over-ride the lock tabs.

f. Upon completion of the re-rigging and any rework, conduct a Pre/Post-Flight Inspection, above, to confirm security and integrity of the latching and locking mechanism.

55. REMOVAL OF BAGGAGE DOOR. With the door open remove the hinge pin from the hinge and remove the door.

56. 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 freed of bends and wear.

56a. BAGGAGE DOOR LOCK ASSEMBLY.

57. REMOVAL.

a. With door open remove the nut from the back of the lock assembly.

b. Remove the lock assembly through the front of the door.

58. INSTALLATION.

a. Insert the lock through the hole in the front of the door.

b. Insert the nut on the lock assembly and tighten.

58a. BAGGAGE DOOR HINGE.

59. REMOVAL.

a. Remove the door from the airplane as described in Removal of Baggage Door, paragraph 55.

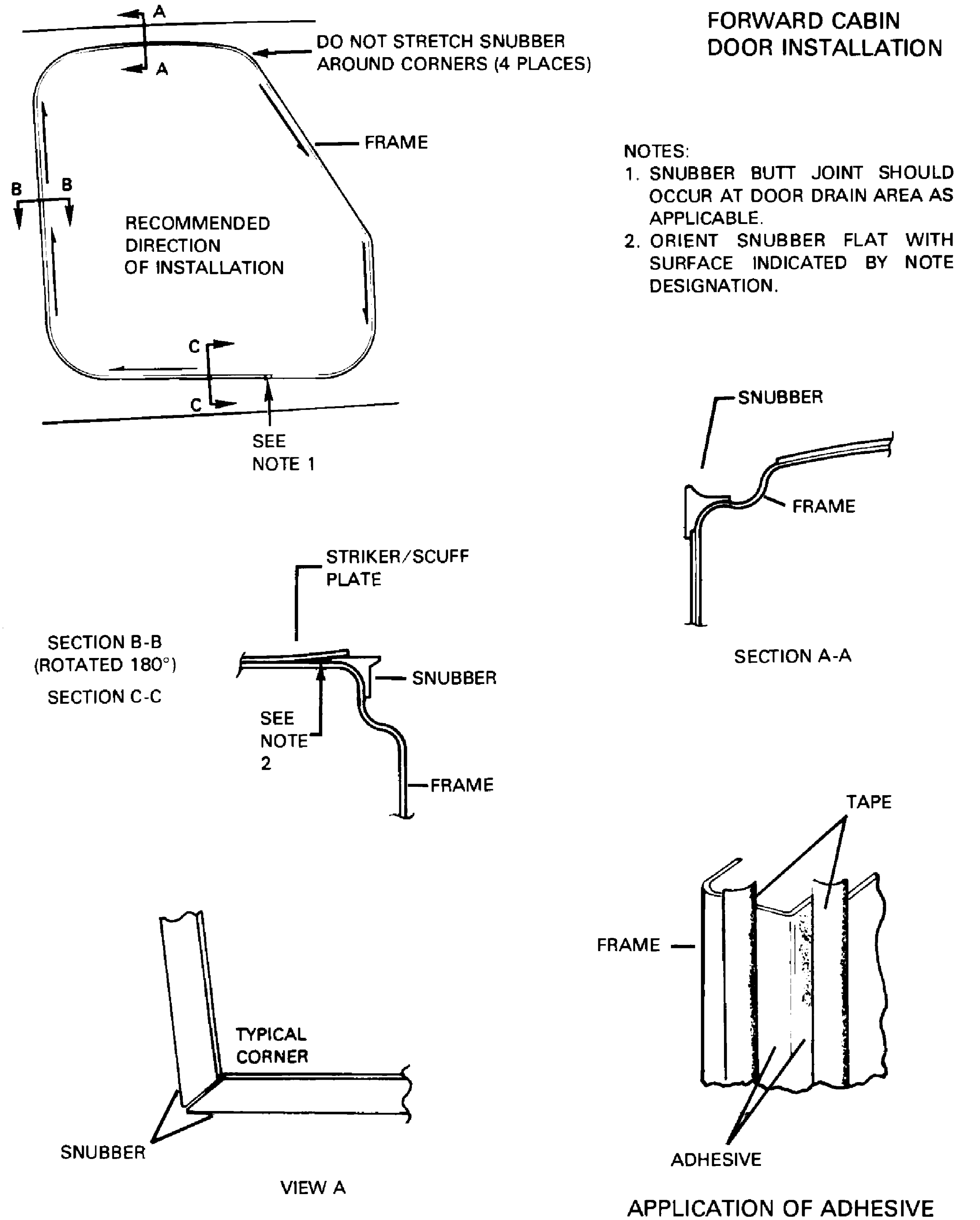
b. Remove the hinge half from the airplane or door by drilling out the rivets and removing the hinge.

60. INSTALLATION.

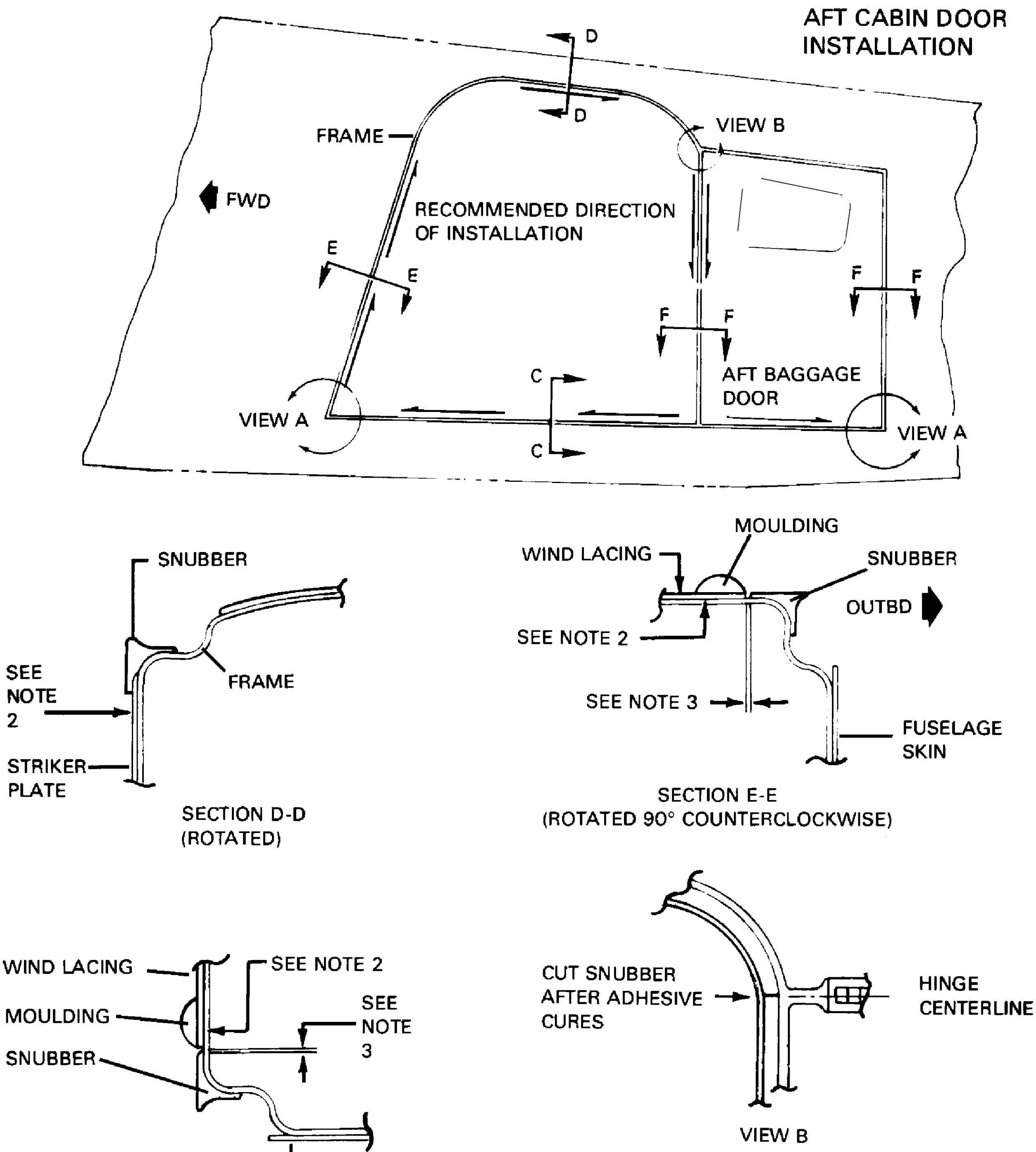
a. Place the hinge halves together and install the hinge pin.

b. Install the door into the closed position and drill the two end rivet holes and install the rivets.

c. Operate the door and check for proper fit and installation. Drill the remaining holes and install the rivets.



Door Snubber Installation
Figure 11 (Sheet 1 of 2)



NOTES:
2. ORIENT SNUBBER FLAT WITH SURFACE INDICATED WITH NOTE DESIGNATION.
3. TRY TO KEEP WIND LACING AT LEAST .03 TO .06 IN. FROM SNUBBER.

Door Snubber Installation
Figure 11 (Sheet 2 of 2)

60a. 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” (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. 3M EC1300L (Preferred).
2. Scotch Grip 2210.
3. Proco #6205-1.

Refer to the List of Consumable Materials for vendor information.

a. Removal:

   1. Back off the windlacing trim screws, tape the windlacing back out of the way, remove all scuff plates, disconnect doorholders and remove all striker plates except that shown in Section D-D, Figure 11.
   2. With mineral spirits, soak the edges of the snubber all around the door jamb.
   3. With a plastic scraper or other appropriate instrument scrape off the snubber while applying mineral spirits as necessary to loosen the strip.
   4. With mineral spirits and a clean cloth, clean off all excess adhesive.

b. Installation.

   Before proceeding with installation instructions make sure the windlacing is rolled back far enoughto prevent adhesive from coming in contact with it.

c. If the door jamb is flaking or excessively scuffed proceed as follows:

   1. Rub down and feather the finish with “wet or dry” emery cloth. Make sure to go over the surface with fine (400 grit) paper.
   2. Go over the surface with “Prep-Sol” or other type of cleaner that will not leave an oily residue.
   3. Prime, sand (400 grit), and paint affected area. Wait for paint to dry before proceeding.

d. Go over the entire door jamb with “Prep-Sol” or other cleaner that will not leave an oily residue.

   NOTE: Normal tack time for 3M EC1300L (which is used as a reference) is 30 to 45 minutes, at 75° F. Adhesive that has “set” may be reactivated by a clean rag moistened with Toluol or M.E.K.

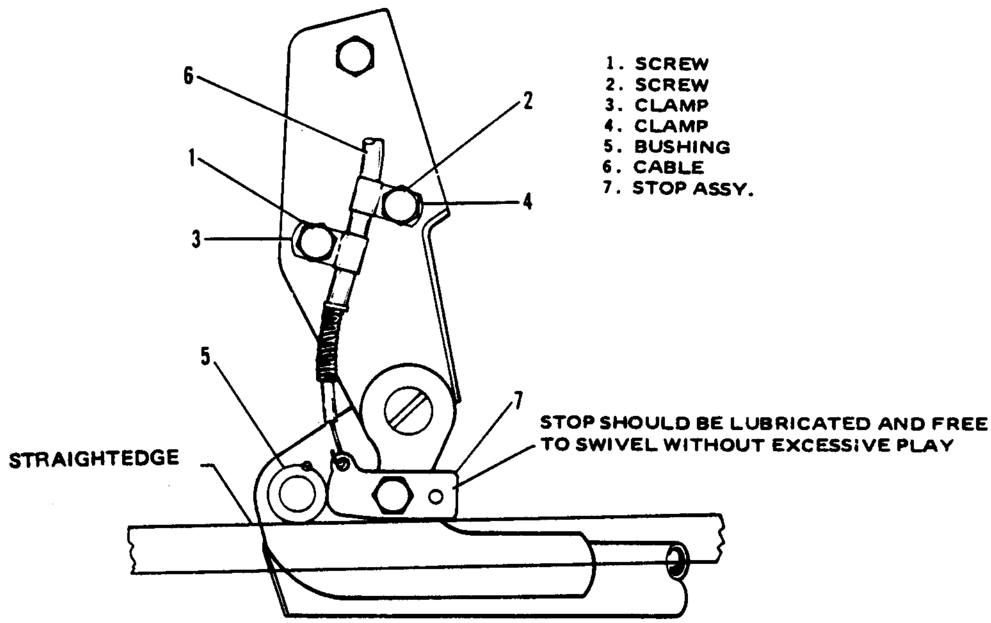
   NOTE: On cockpit door make sure leg of snubber goes under striker plate on side latch and over the striker plate for the upper latch.

   On the 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.

e. 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 11.)

f. Apply adhesive to 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.

g. Position the snubber with the protruding leg facing outboard. Beginning at the lower center of the jamb and applying pressure to insure a proper bond, work progressively around the door jamb. DO NOT prestretch the snubber. Stretching the snubber will cause cracks.



Seat Back Lock
Figure 12

h. Wait at least one day for the bond to cure and 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.

i. To check for proper cure try peeling back a small local area of the snubber leg.

j. With adhesive properly cured, remove the masking tape. Replace scuff plates, windlacing, striker plates and reconnect door holders. If the snubber for the aft cabin door has just been installed, cut snubber as shown in Figure 11.

k. Check that the door closes properly and readjust as necessary to achieve a flush fit. Latching effort must not have increased.

l. With all hardware and plates reinstalled, coat snubbers with silicone.

61. SEATS.

61a. RIGGING - SEAT BACK LOCK AND RELEASE. (Refer to Figure 12.)

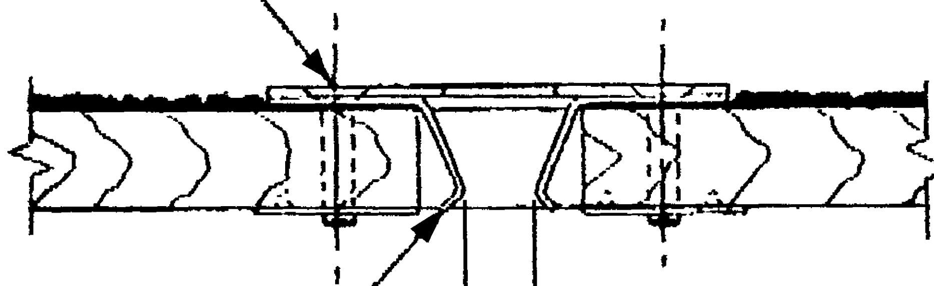
a. Loosen screws (1 and 2) and ascertain that clamps (3 and 4) are in a relaxed condition. (Push-pull cable (6) is able to move within the clamps.)

b. Place a straightedge along the lower surface of bushing (5) of the seat back release

c. Adjust the push-pull cable (6) by raising or lowering it until the lower surface of the stop assembly (7) is parallel to the straightedge.

d. Secure the push-pull cable in this position by tightening screws (1 and 2) on clamps (3 and 4). The stop (7) should be lubricated and free to swivel without excessive play

e. Push on seat back with stop assembly (7) in an engaged position to check engagement. Rotate the seat back release handle and check for disengagement of seat back.



Retention Clip Adjustment
Figure 13

61b. REAR SEAT QUICK-DISCONNECT MECHANISM INSPECTION. (See Figure 13.)

NOTE: This inspection incorporates the requirements of Piper Service Letter No. 763 as referenced in AD 75-24-3.

A. Inspection. Each 100 hours or at each annual inspection, whichever comes first, inspect the quick-disconnect mechanism for each rear seat as follows:

(1) With one hand, grasp the lower rear portion of the seat and lift up.

(2) The rear seat legs should disengage from the retention mechanism with a noticeable “snap,” when a minimum of 10-15 lbs of pull is applied. If so, inspection is complete.

(3) If less effort is required and there is not a noticeable “detent” feel when disengaging the seat legs, the retention mechanism must be adjusted, below, or replaced (see Parts Catalog, P/N 753-816).

B. Adjustment. If the quick-disconnect mechanism fails the above inspection, remove and adjust the retention clips as shown in Figure 13. Reinstall the adjusted clips and reinspect.

(1) If the quick-disconnect mechanism passes inspection after adjustment, no further action is required.

(2) If the quick-disconnect mechanism fails the above inspection after adjustment, replace the retention clips per parts catalog.

C. Parts Availability. If replacement parts are not immediately available, the aircraft may be operated with the seat belts securely fastened across each rear seat when unoccupied. A temporary placard must be installed in full view of the pilot stating: “PRIOR TO TAKE-OFF ALL SEAT BELTS MUST BE SECURELY FASTENED ACROSS EACH UNOCCUPIED AFT SEAT.” The airplane may be operated in this fashion only until replacement parts are delivered, but no longer than the next 100 hour or annual inspection, whichever comes first.

62. STRUCTURAL REPAIRS. Structural repair methods used must be in accordance with the procedures set forth in latest revision of FAA Advisory Circular 43.13-1; ACCEPTABLE METHODS, TECHNIQUES, AND PRACTICES, AIRCRAFT INSPECTION AND REPAIR. To assist in making repairs, Figure 14 identifies the type and thickness of skin structure used. Never make a skin replacement or patch from a material other than the type of the original skin. Original material and thickness is recommended and must result in a surface which is as strong as, or stronger than, the original skin. However, flexibility must be retained so that the surrounding areas will not receive extra stress.

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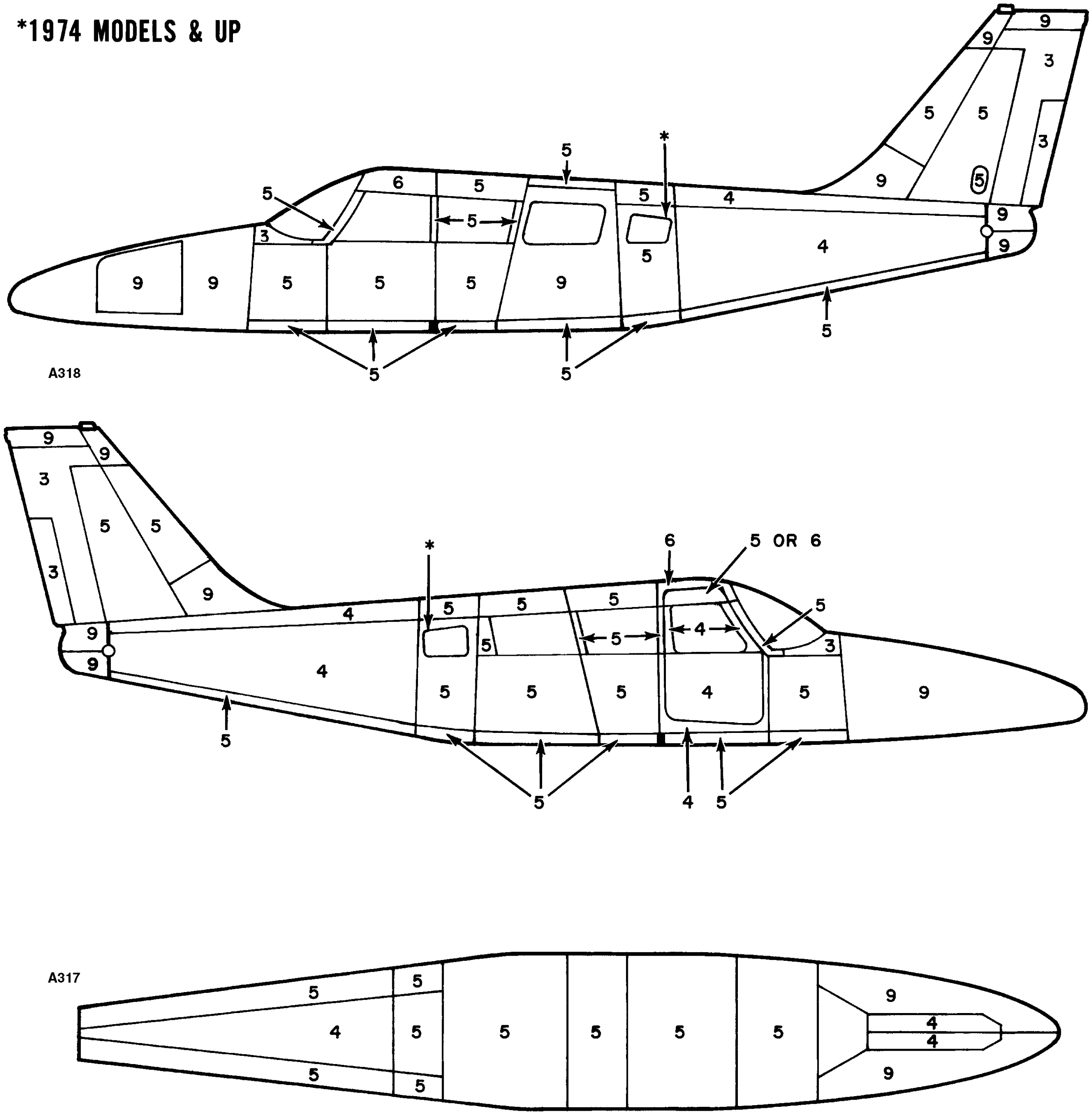
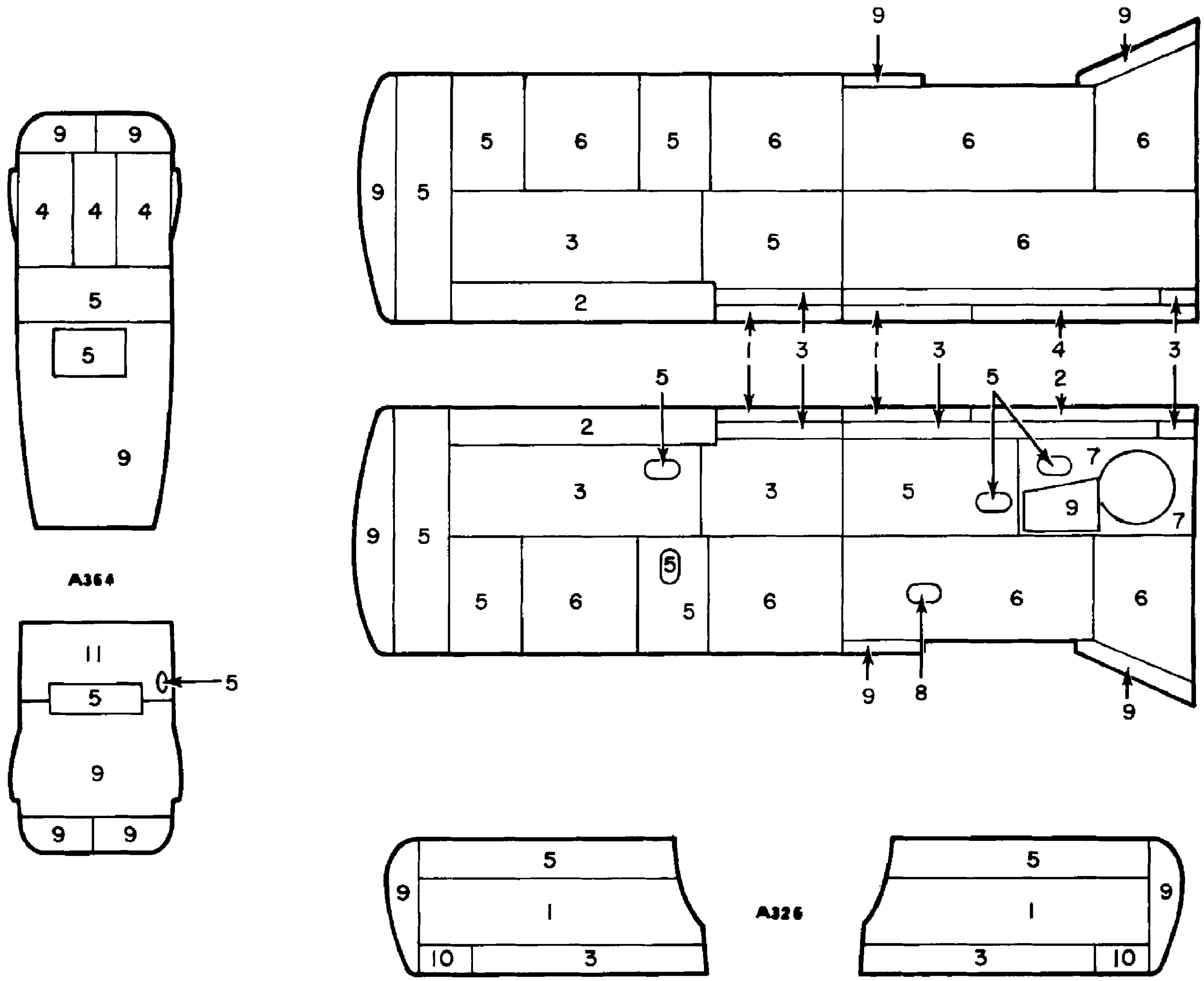


Skin Material and Thickness
Figure 14 (Sheet 1 of 2)



NUMBER	MATERIAL	THICKNESS	NUMBER	MATERIAL	THICKNESS
1	2024-T3	.016	8	304-$\frac{1}{4}$ H SS	.018
2	2024-0*	.020	9	FIBERGLASS	
3	2024-T3	.020	10	2024-T3**	.020
4	2024-T3	.025	11	304-2D COND. A	.018
5	2024-T3	.032			
6	2024-T3	.040			
7	2024-T3	.050			

NOTE: LEFT WING SHOWN, RIGHT WING OPPOSITE.
LEFT NACELLE SHOWN, RIGHT NACELLE OPPOSITE.
* HEAT TREAT TO 2024-T4 AFTER FORMING.
** HEAT TREAT TO 2024-T42 AFTER FORMING.

Skin Material and Thickness
Figure 14 (Sheet 2 of 2)

62a. METAL WIRE STITCHING REPAIR. (See Figure 15.) (Ref. PPS-20024, Rev. A.)

CAUTION: METAL/WIRE STITCHING (AND THE ALTERNATE METHOD OF JOINING DESCRIBED BELOW) SHALL ONLY BE USED FOR NON-STRUCTURAL, NON-LOAD CARRYING APPLICATIONS.

A metal/wire stitching process is used to staple fabric and rubber seal materials to engine baffles and some composite materials. The following alternate method of joining is approved for field use when replacing these fabric and rubber seal materials.

Alternate (Rivet) Method of Joining.

(1) Substitute two rivets in lieu of each staple where stitching was previoiusly used or is specified. Maintain a minimum of .75 inch spacing between rivets.

(2) When materials being joined include Stainless Steel, Galvanized Steel or Steel, use:

(a) MS20615M4 Rivet (Monel) and NAS1149CN432R Washer (See Figure 15.)

(b) Install with manufactured (factory) head against hardest material. Install washer against opposite side of joint and upset rivet (bucktail) against washer.

(3) When materials being joined include only aluminum and nonmetallic materials use:

(a) MS20470A4 Rivet and NAS1149DN432H Washer (See Figure 15.)

(b) Install with manufactured (factory) head against hardest material. Install washer against opposite side of joint and upset rivet (bucktail) against washer.

63. FIBERGLASS REPAIRS. The repair procedure in this manual will describe the methods for the repair of fiberglass reinforced structures. Paragraph 64 describes Touch-up and Surface Repairs such as blisters, open seams, delaminations, cavities, small holes and minor damages that have not harmed the fiberglass cloth material. Paragraph 65 describes Fracture and Patch Repairs such as puncture, breaks and holes that have penetrated through the structure and damaged the fiberglass cloth. A repair kit, part number 756-729, that will furnish the necessary material for such repairs is available through Piper Distributors.

NOTE: Follow resin and catalyst mixing instructions furnished with repair kit very carefully.

64. FIBERGLASS TOUCH-UP AND SURFACE REPAIRS.

a. Remove wax, oil and dirt from around the damaged area with acetone, methylethylketone or equivalent and remove paint to gel coat.

b. 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 f.)

c. 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 syringe may be used to inject gel into small cavities not requiring fiberglass millings mixed with the gel.

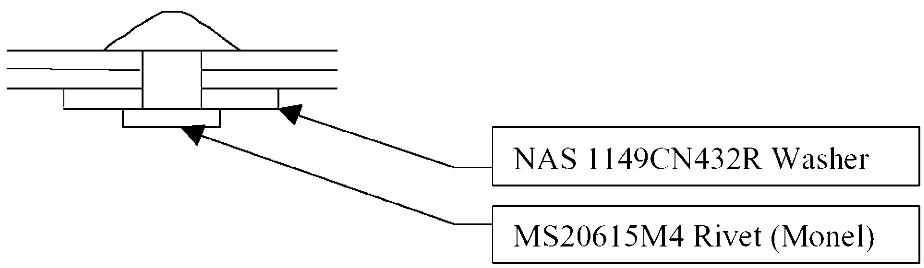
d. Work the mixture of resin, fibers and catalyst into the damaged area, using the sharp point of a putty knife or stick to press it into the bottom of the hole and to puncture any air bubbles which may be present. Fill the scratch or hole above the surrounding undamaged area about 1 / 16 inch.

e. Lay a piece of cellophane or waxed paper over the repair to cut off air and start the cure of gel mixture.

When materials being joined include Stainless Steel, Galvanized Steel or Steel, use:

MS20615M4 Rivet (Monel)
NAS1149CN432R Washer

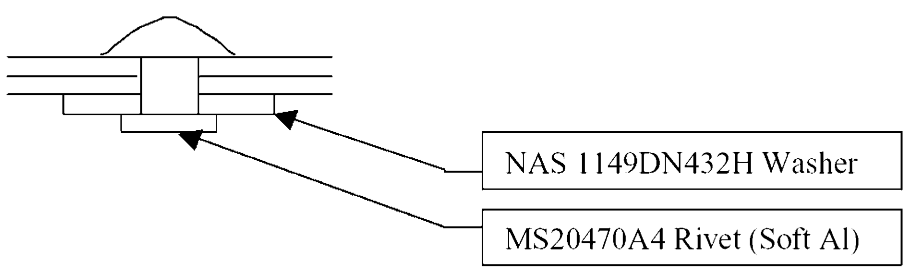
Install with manufactured (factory) head against hardest material. Install washer against opposite side of joint and upset rivet (bucktail) against washer.



When materials being joined include only aluminum and nonmetallic materials use:

MS20470A4 Rivet
NAS1149DN432H Washer

Install with manufactured (factory) head against hardest material. Install washer against opposite side of joint and upset rivet (bucktail) against washer.



Metal Wire Stitching Repair
Figure 15

f. 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.)

g. Rough up the bottom and edges of the hole with an electric burr attachment or rough sand paper. Feather hole into surrounding gel coat, do not undercut.

h. Pour out a small amount of resin, add catalyst and mix thoroughly, using a cutting motion rather than stirring. Use no fibers.

i. Using the tip of a putty knife or finger tips, fill the hole to about 1/16 inch above the surrounding surface with the gel coat mixture.

j. Lay a piece of cellophane over the patch to start the curing process. Repeat step f, trimming patch when partially cured.

k. After trimming the patch, immediately place another small amount of gel coat on one 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.

l. After repair has cured for 24 hours, sand patched area, using a sanding block with fine wet sandpaper. Finish by priming, again sanding and applying color coat.

65. FIBERGLASS FRACTURE AND PATCH REPAIRS.

a. Remove wax, oil and dirt from around the damaged area with acetone, methylethylketone or equivalent.

b. Using a key hole saw, electric saber saw, or sharp knife cut away ragged edges. Cut back to sound material.

c. Remove paint three inches back from around damaged area.

d. 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.

e. 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.

f. Prepare a patch of fiberglass mat and cloth to cover an area two inches larger than the hole.

g. Mix a small amount of resin and catalyst, enough to be used for one step at a time, according to kit instructions.

h. 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.

i. 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.

j. Remove cardboard or aluminum sheet from outside of hole and rough-sand the patch and edge of hole. Feather edge of hole about two inches into undamaged area.

k. 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.

l. 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.

m. 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 on outside edge of feathering. Strip cut edges of structure. Do this before cure is complete, to save extra sanding. Allow patch to cure overnight.

n. 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.

o. Mix catalyzed resin and work into patch with fingers. Smooth carefully and work into any crevices.

p. Cover with cellophane and squeegee smooth. Allow to cure completely before removing cellophane. Let cure and resand.

q. Brush or spray a coat of catalyzed resin to seal patch. Sand patch, finish by priming, again sanding and applying color coat.

NOTE: Brush and hands may be cleaned in solvents such as acetone or methylethylketone. If solvents are not available, a strong solution of detergent and water may be used.

66. 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 (see Table I). Common safety precautions should be observed when handling some of the materials and tools used while making these repairs.

a. Surface Preparation:

1. Surface dirt and paint if applied must be removed from the item being repaired. Household cleaners have proven most effective in removing surface dirt.
2. Preliminary cleaning of the damaged area with perchlorethylene or VM&P Naptha will generally insure a good bond between epoxy compounds and thermoplastic.

b. Surface Scratches, Abrasion or Ground-in-Dirt: (Refer to Figure 16.)

1. Shallow scratches and abraded surfaces are usually repaired by following directions on containers of conventional automotive buffing and rubbing compounds.
2. If large dirt particles are embedded in thermoplastic parts, they can be removed with a hot air gun capable of supplying heat in 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.
3. The thermoplastic will return to its original shape upon cooling.

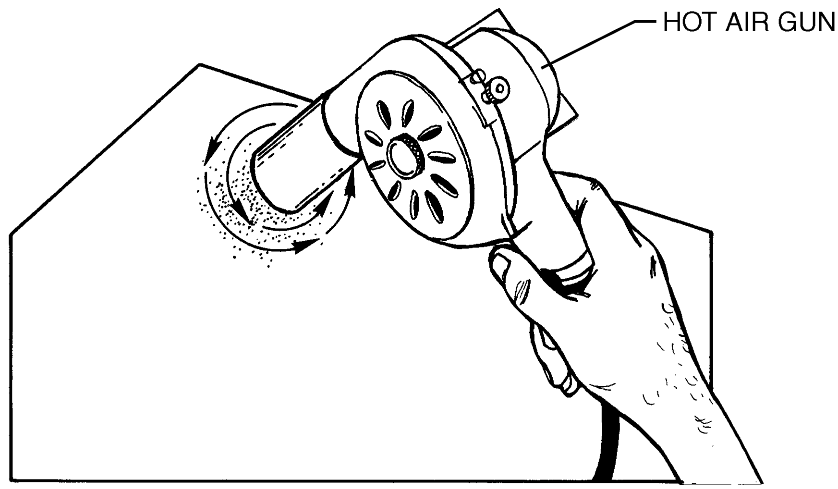
TABLE I
LIST OF MATERIALS - THERMOPLASTIC REPAIR

Buffing and Rubbing Compounds	Automotive Type - DuPont #7	DuPont Company Wilmington, Del. 19898
	Ram Chemical #69 x I	Ram Chemicals Gardena, Cal. 90248
	Mirror Glaze #I	Mirror Bright Polish Co., Inc. Irvin, Cal. 92713
Cleaners	Fantastic Spray Perchlorethylene VM&P Naptha (Lighter Fluid)	Obtain From Local Suppliers
ABS-Solvent Cements	Solarite #11 Series	Solar Compounds Corp. Linden, N.J. 07036
Solvents	Methylethyl Ketone Methykne Chloride Acetone	Obtain From Local Suppliers
Epoxy Patching Compound	Solarite #400	Solar Compounds Corp. Linden, N.J. 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

c. Deep Scratches, Shallow Nicks and Small Holes: (Less than 1 inch in diameter.) (See Figure 17.)

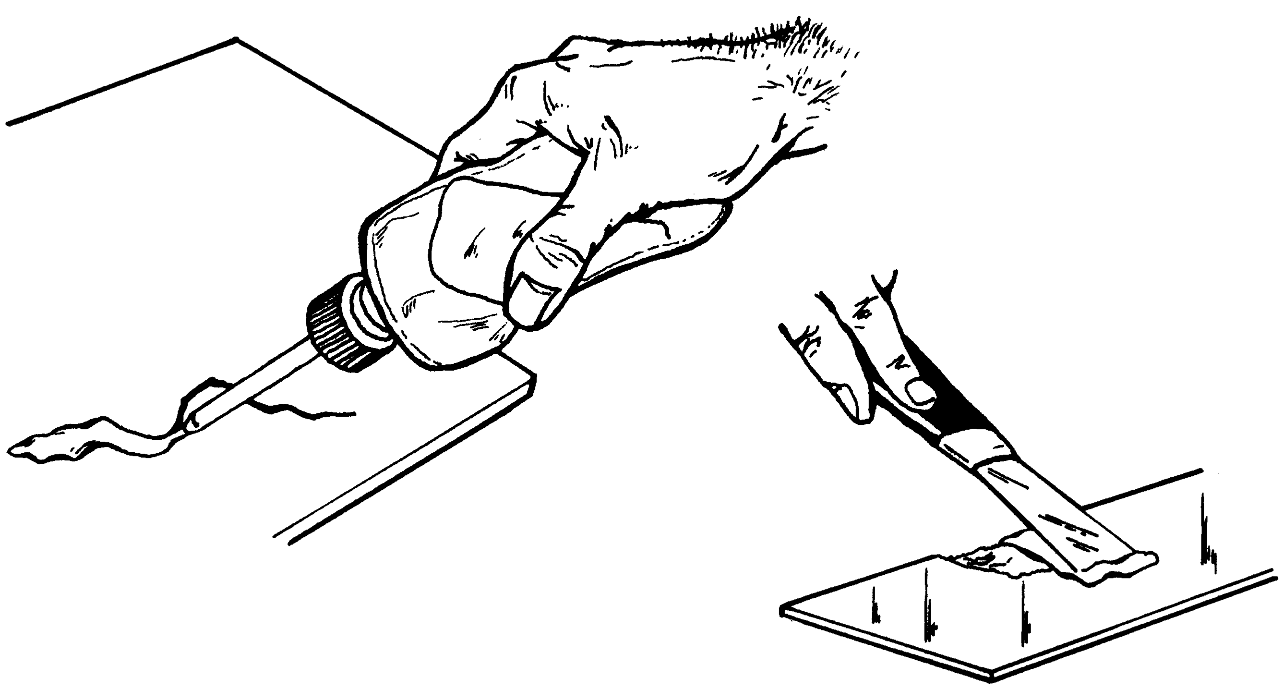
1. Solvent cements will fit virtually any of these applications. If the area to be repaired is very small, it may be quicker to make a satisfactory cement by dissolving thermoplastic material of the same type being repaired in solvent until the desired paste-like consistency is achieved.
2. This mixture 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.
3. Solvent adhesives are not recommended for highly stressed areas, on thin walled parts or for patching holes greater than I /4 inch in diameter.
4. For larger damages an epoxy patching compound is recommended. This type material is a two part, fast curing, easy sanding commercially available compound.
5. Adhesion can be increased by roughing the bonding surface with sandpaper and by utilizing as much area for the bond as possible.
6. 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 18.)
7. A mechanical sander can be used after the compound is cured, providing the sander is kept in constant motion to prevent heat buildup.
8. 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.

871



Surface Scratches, Abrasions or Ground-in-Dirt
Figure 16

871



Deep Scratches, Shallow Nicks, and Small Holes
Figure 17

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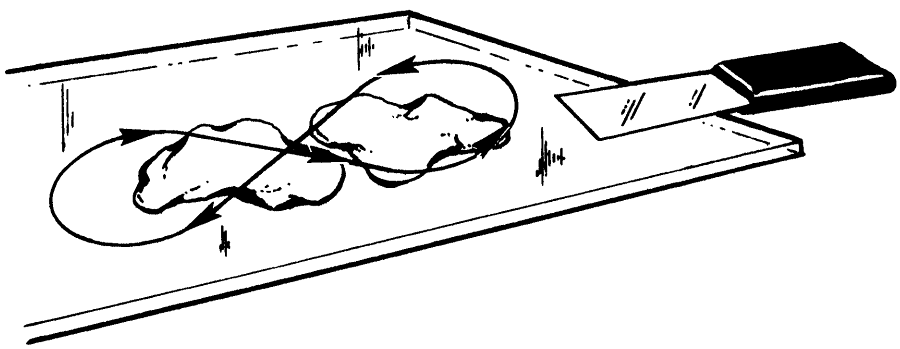
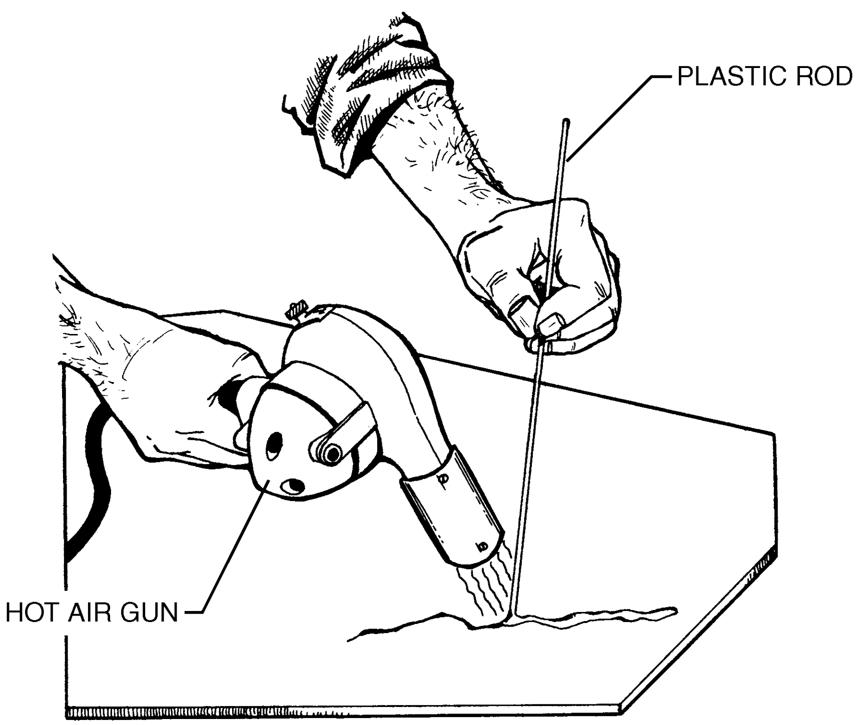
MIX THOROUGHLY USING "FIGURE 8" MOTION

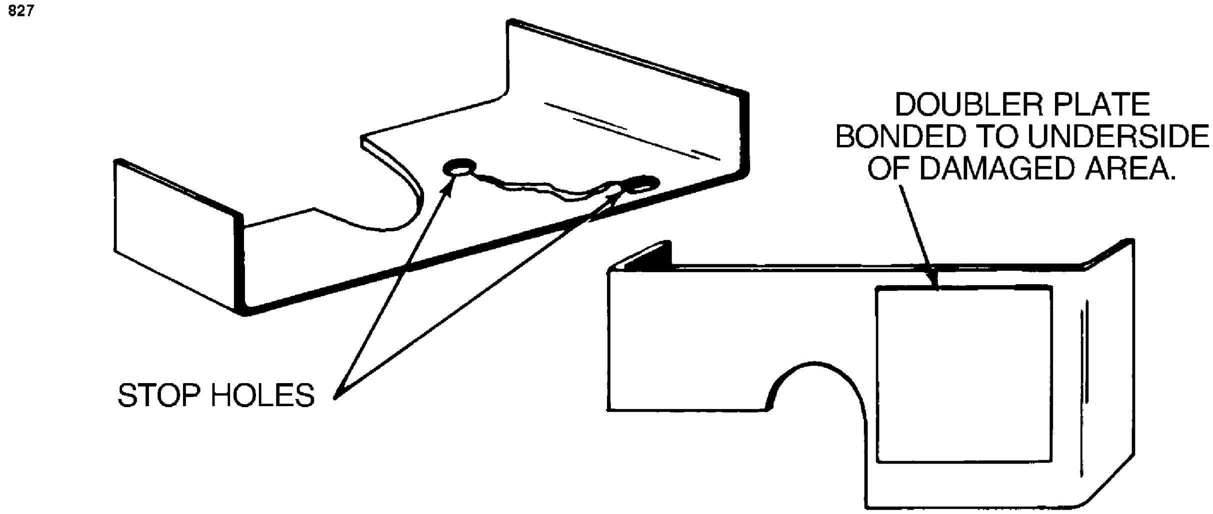


Mixing Epoxy Patching Compound
Figure 18

870



Retention Clip Adjustment
Figure 19



Repairing Cracks
Figure 20

9. For repairs in areas involving small holes, indentations or cracks in the material where high stress is apparent or thin walled sections are used, the welding method is suggested.
10. This welding method requires a hot air gun and ASB 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 insure good adhesion. (Refer to Figure 19.)
11. After the repair is completed, sanding is allowed to obtain a surface finish of acceptable appearance.

d. Cracks: (Refer to Figure 20.)

1. 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.
2. Drill small stop holes at each end of the crack.
3. If possible, a double plate should be bonded to the reverse side of the crack to provide extra strength to the part.
4. 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.
5. After the repair has cured, it may be sanded to match the surrounding surface finish.

e. Repairing Major Damage: (Larger than I inch in diameter.) (Refer to Figure 21.)

1. If possible a patch should be made of the same material and cut slightly larger than the section being repaired.
2. When appearances are important, large holes, cracks, tears, etc. should be repaired by cutting out the damaged area and replacing it with a piece of similar material.
3. 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.
4. Coat the patch with solvent adhesive and firmly attach it over the damaged area.
5. Let the patch dry for approximately one hour before any additional work is performed.
6. 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 a 1/2 inch in thickness at a time, thus allowing the compound to cure and insuring a good solid buildup of successive layers as required.

f. Stress Lines: (Refer to Figure 22.)

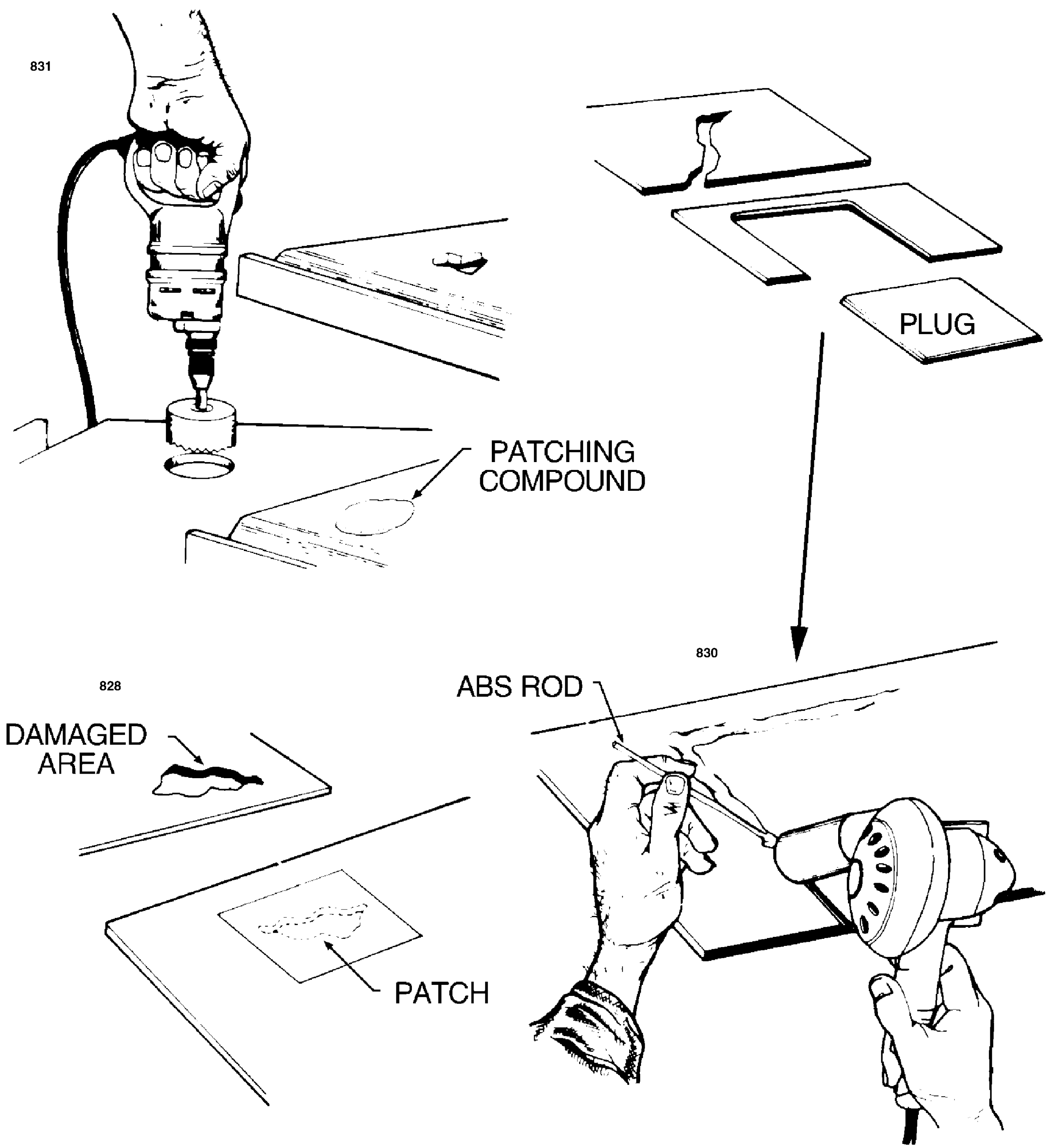
1. Stress lines produce a whitened appearance in a localized area and generally emanate from the severe bending or impacting of the material. (Refer to Figure 23.)
2. To restore the material to its original condition and color, use a hot air gun or similar heating device and carefully apply heat to the affected area. Do not overheat the material.

g. Painting the Repair:

1. An important factor in obtaining a quality paint finish is the proper preparation of the repair and surrounding area before applying any paint.
2. It is recommended that parts be cleaned prior to painting with a commercial cleaner or a solution made from one-fourth cup of detergent mixed with one gallon of water.
3. The paint used for coating thermoplastic can be either lacquers or enamels depending on which is preferred by the repair facility or customer.

   NOTE: It is extremely important that solvent formulations be considered when selecting a paint, because not all lacquers or enamels can be used satisfactorily on thermoplastics. Some solvents used in the paints can significantly affect and degrade the plastic properties.

4. Another important matter to consider is that hard, brittle coatings that are usually best for abrasion resistance should not be used in areas which incur high stress, flexing or impact. Such coatings may crack, thus creating a weak area.



Various Repairs
Figure 21

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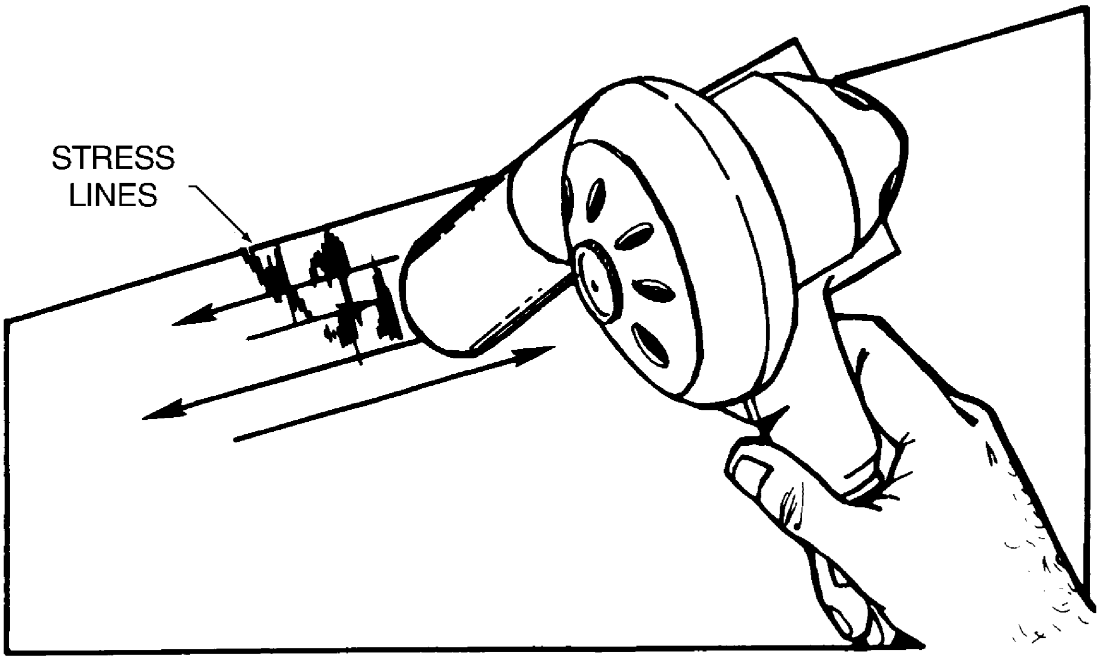

Repair of Stress Lines
Figure 22

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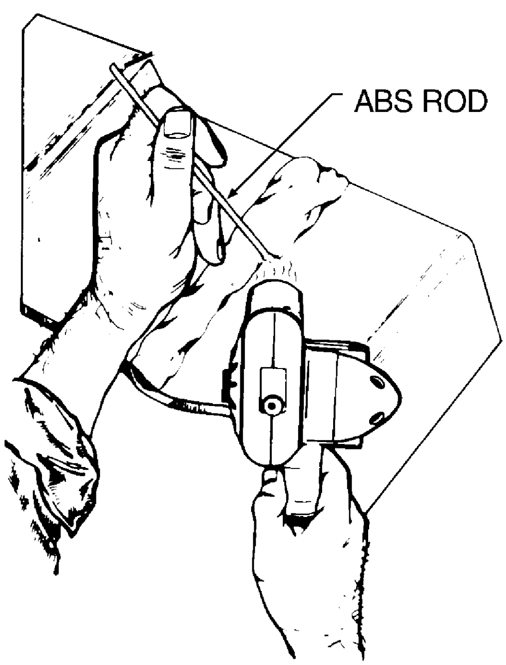


832

Repairing Impact Damage
Figure 23

67. SAFETY WALK REPAIR.

67a. LIQUID SAFETY WALK COMPOUND.

68. SURFACE PREPARATION.

NOTE: When existing shelf stocks are depleted, see Pressure Sensitive Safety Walk, below.

a. Clean all surfaces with a suitable cleaning solvent to remove dirt, grease and oils. Solvents may be applied by dipping, spraying or mopping.

b. Insure that no moisture remains on the surface by wiping with a clean dry cloth.

c. 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.

69. PRODUCT LISTING.

a. Suggested Solvents:

Safety solvent per MIL-S18718
Sherwin Williams Lacquer Thinner R7KC 120
Glidden Thinner No. 207

b. Safety Walk Material:

Walkway Compound and Matting, Nonslip

70. APPLICATION. Liquid safety walk compound shall be applied in an area free of moisture for a period of 24 hours minimum after application. Do not apply when surface to be coated is below 50°F. Apply liquid as follows:

a. Mix and thin the liquid safety walk compound in accordance with the manufacturer’s instructions on the container.

b. 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.

c. Allow the coating to dry for 15 minutes to one hour before recoating or touch-up, if required after application of the initial coating.

d. 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.

70a. PRESSURE SENSITIVE SAFETY WALK.

71. SURFACE PREPARATION. 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 installed the area must be prepared as follows:

a. Area must be masked off to protect painted surfaces.

b. Apply suitable stripper MEK Federal Spec. TT-M-261, U.S. Rubber No. 3339 to wingwalk compound. As compound softens remove by using putty knife or other suitable tool.

c. Area must be clean and dry prior to painting.

d. Prime and paint area.

NOTE: Newly painted surfaces shall be allowed to dry for 2.5 hours minimum prior to the application of the safety walk.

72. APPLICATION. (Order Kit No. 763-849.) Wipe area with a clean dry cloth to insure that no moisture remains on surface. Do not apply when surface temperature is below 50°F. Apply pressure sensitive safety walk as follows:

a. Peel back the full width of the protective liner approximately 2 inches from the leading edge of the safety walk.

b. Apply the safety walk to the wing area, begin at the leading edge, insure proper alignment and position from wing lap.

c. Remove the remaining protective liner as the safety walk is being applied from front to back of wing area.

d. Roll firmly with a long handled cylindrical brush in both lengthwise directions. Make sure all edges adhere to the wing skin.

e. Install leading edge retainer by inserting between wing leading edge fairing and forward wing spar. Hold all parts in position by using existing fairing screws.

73. CONTROL SURFACE BALANCING.

WARNING: ALL CONTROL SURFACES THAT HAVE BEEN REPLACED OR REPAINTED MUST BE BALANCED BEFORE INSTALLATION PER INSTRUCTIONS IN BALANCING, BELOW.

74. CHECKING CONTROL SURFACE BALANCE. The movable control surfaces have been statically balanced at the time of installation at the factory and normally should not require rebalancing. Where possible the control surfaces were set with the balance weight on the heavy side of the limits, to permit limited repair or paint touch-up without adjusting the balance weight. It should be noted however, that spare control surfaces are delivered unpainted and the static balance will not necessarily fall within the limits provided. This is more pronounced on the stabilator and rudders. The completed control surface including paint should be within the limits given in Table II. If the surface is not to be painted, the balance weight will probably require adjustment. All replacement control surfaces or surfaces that have been repainted or repaired should be rebalanced according to the procedures given in paragraphs 76 thru 78. The static balance of the surfaces must be as specified in Table II.

TABLE II
CONTROL SURFACE BALANCE SPECIFICATIONS

	Static Balance Limits (In./Lbs.)		
Surface	**Heavy Side Leading Edge**		**Heavy Side Trailing Edge**
Aileron	0.00	to	-14.00
Stabilator	0.00	to	-13.00
Rudder	-20.00	to	-36.00

75. BALANCING EQUIPMENT. (Refer to Figure 24.)

Balancing must be done using a suitable tool capable of measuring unbalance in inch-pounds from the centerline of the control surface hinge pin. See the tool configuration in Figure 24. Other tool configurations may be used if accuracy is maintained and recalibration capability is provided.

To use the tool shown in Figure 24:

a. Insure that the control surface is in its final Flight configuration, static wicks, trim tabs, trim tab push pull rod and control surface tip (as applicable) should be installed. The surface should be painted and trim/servo tabs should be in the neutral position.

NOTE: Because paint is a considerable balance factor, it is recommended that existing paint be removed prior to repainting a control surface.

b. Place hinge bolts through control surfaces and place control surface on a holding fixture.

c. Calibrate the tool.

(1) Avoiding rivets, place the balancing tool on the control surface with the tool's hinge centerline directly over the hinge line of the control surface.

(2) Adjust the movable trailing edge support to fit the width of the control surface. Tighten the set screw on the trailing edge support.

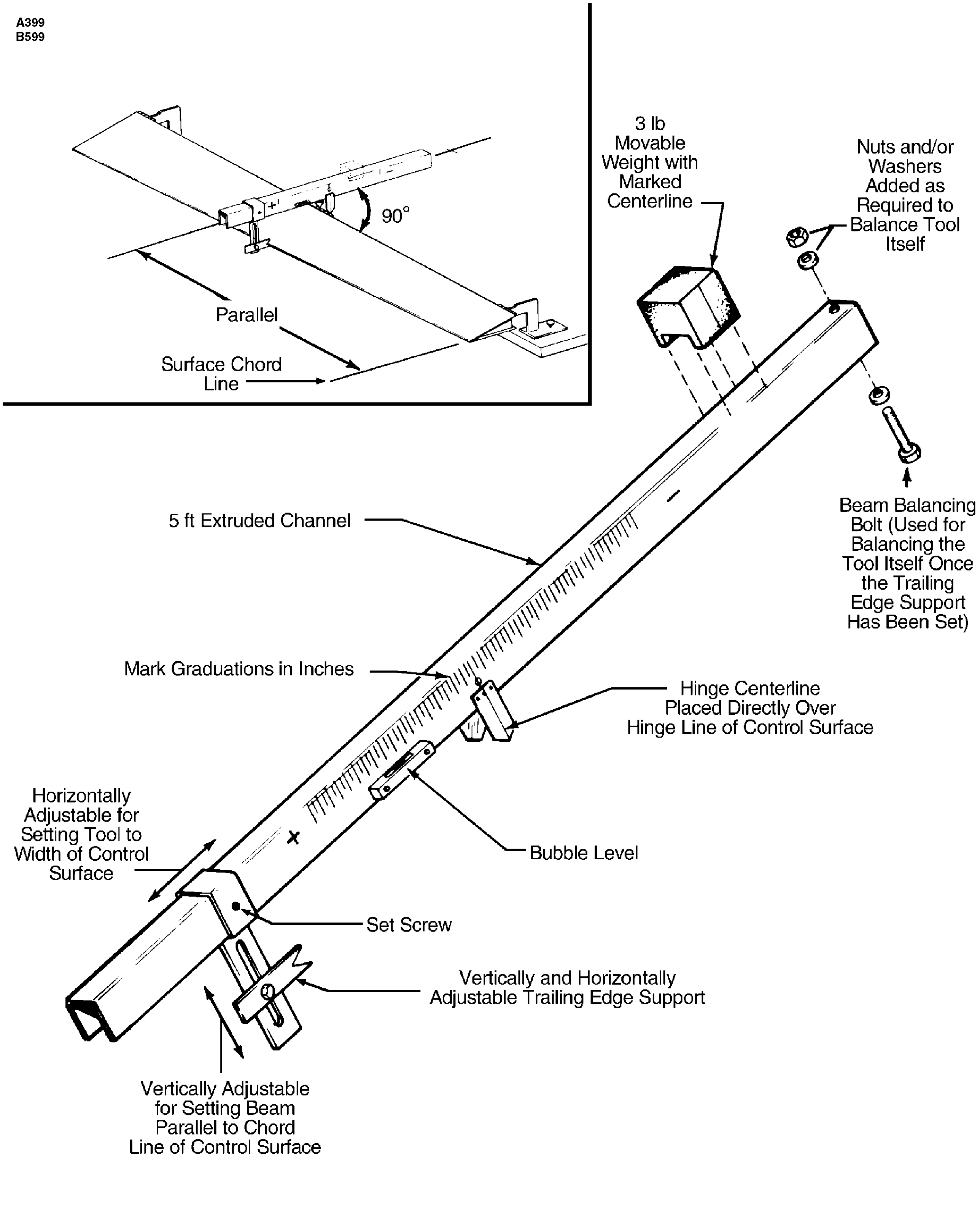
(3) Adjust the trailing edge support vertically until the beam is parallel with the control surface chord line.

(4) Remove the tool from the control surface and balance the tool itself by adding or removing nuts or washers from the beam balancing bolt. When balancing the tool, the movable weight must be at the bar's hinge centerline.

d. After balancing the tool, reattach it to the control surface per Figures 25 and 27. Keep the beam positioned 90° from the control surface hinge line.

e. Determine balance of control surface by sliding movable weight along the balance beam.

f. Read the scale when the bubble level has been centered. Multiply by three to determine inch-lbs. (I.E. - Since the movable weight weighs three pounds, every inch it is moved from the center of the beam equals three inch-lbs of force.)

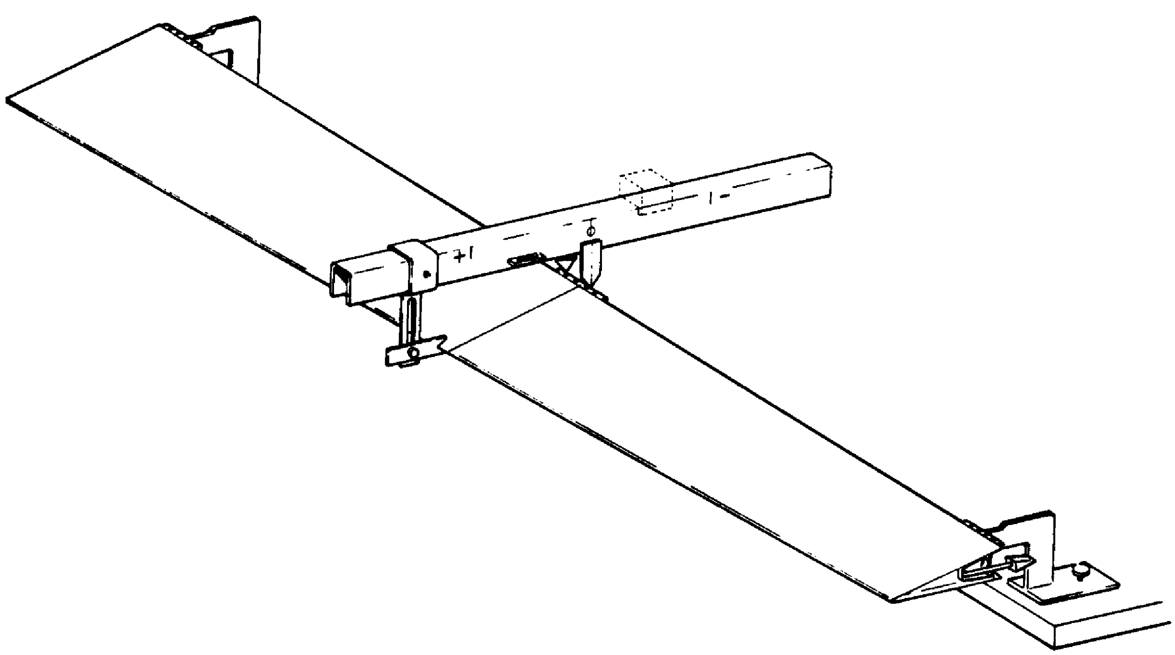


Control Surface Balancing Tool
Figure 24

76. BALANCING AILERONS. (Refer to Figure 25.) Position the aileron on the balancing fixture in a draft free area and in a manner which allows unrestricted movement of the aileron on the hinge bearings. Place the tool on the aileron, avoid rivets and keep the beam perpendicular to the hinge centerline. Calibrate the tool as described in Paragraph 75. 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 Table II, proceed as follows:

   a. Leading Edge Heavy: This condition is improbable; recheck measurements and calculations.

   b. 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, it will be necessary to replace all repaired parts and recheck the balance.

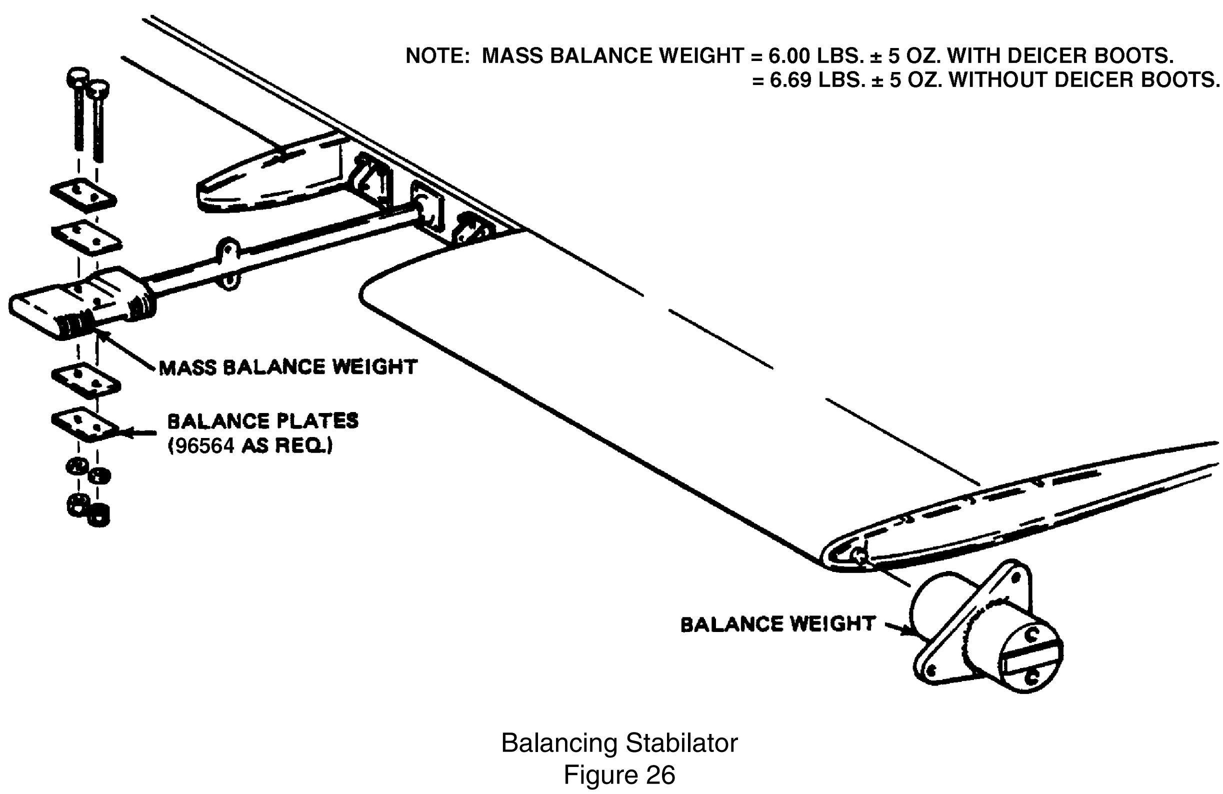


Balancing Aileron
Figure 25

77. BALANCING STABILATOR. (Refer to Figure 26.) 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. Place the complete assembly on the knife edge supports in a draft free area in a manner that allows unrestricted movement. Place the tool on the stabilator with the beam perpendicular to the hinge centerline. Do not place the tool on the trim tab. Calibrate the tool as described in Paragraph 75. Read the scale when the bubble level had been centered by adjustment of the movable weight and determine the static balance limit. If the static balance is not within the limits given in Table II, proceed as follows:

a. 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. Do not attempt to adjust the stabilator tip balance weight.

b. If the stabilator is out of limits on the trailing edge heavy side, add balance plates to the mass balance weight until the static balance is within limits.

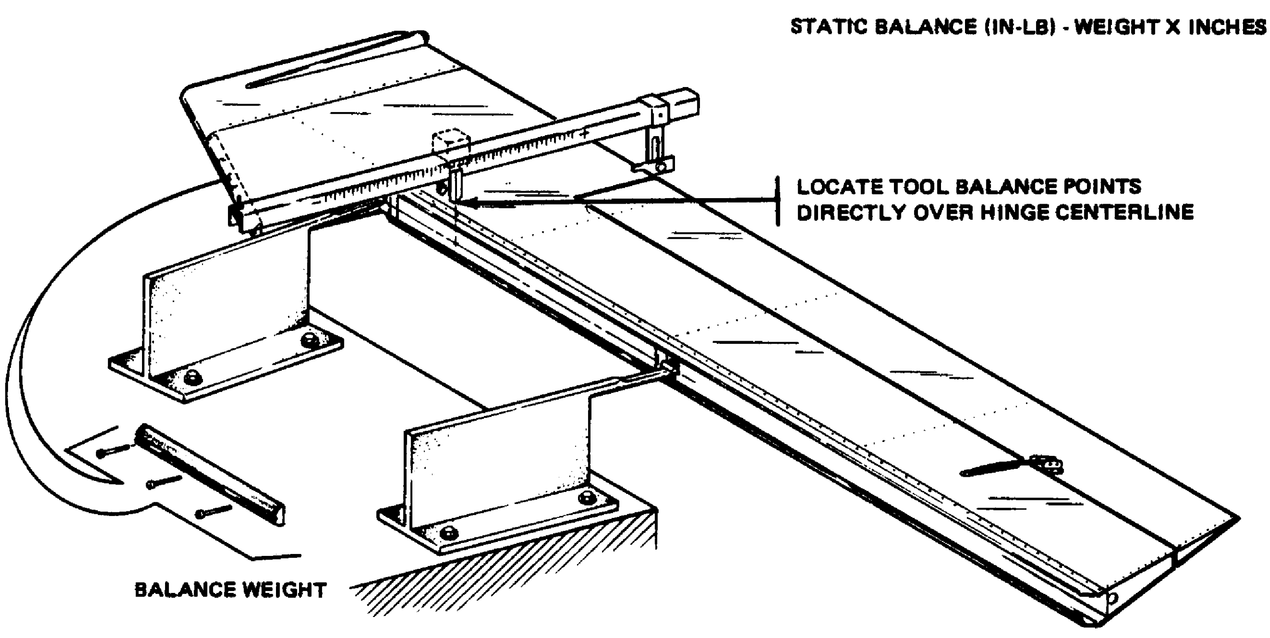


Balancing Stabilator
Figure 26

78. BALANCING RUDDER. (Refer to Figure 27.) To balance the rudder, the assembly must be complete including the tip assembly and all attaching screws, the position light wiring and trim tab and push rod. Tape the trim tab in neutral position with a small piece of tape. 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. Do not place the tool on the trim tab. Calibrate the tool as described in Paragraph 75. 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 in Table II, proceed as follows:

a. Nose Heavy: This condition is highly improbable; recheck calculations and measurements.

b. Nose Light: In this case the mass balance weight is too light or the rudder is too heavy because of painting; it will be necessary to strip the paint and repaint. If the rudder is too heavy as a result of repairs, the repair must be removed and the damaged parts replaced.



Balancing Rudder
Figure 27

79. CHECKING CONTROL SURFACE FREE PLAY. The following checks are recommended before balancing to ascertain the amount of "freeplay" in the stabilator trim tab and aileron:

a. Stabilator: Check the stabilator for any "free play" at its attachment points by grasping each half near the tip and gently trying to move it up and down, fore and aft, and in and out. No play is allowed.

b. Stabilator Trim Tab: Set the stabilator trim tab in neutral position. This neutral position is determined with the airplane properly rigged per instructions given in Section V 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 0.15 of an inch. The use of a dial indicator and fixed stand is recommended.

c. 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. Should free play exceed the limit stated make necessary repairs or replace parts as required to eliminate excessive free play. Grasp the aileron and move it spanwise (inboard/outboard) to insure maximum end play of. 035 inch is not exceeded.

80. SUPPORT CLAMP USE ON FLUID TUBING. Support clamps are used to secure the fluid tubing to the airframe or powerplant assemblies. The maximum allowable distance between supports for rigid tubing is shown in Table III.

TABLE III
MAXIMUM DISTANCE BETWEEN SUPPORTS FOR FLUID TUBING

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

81. HOSE CLAMP TIGHTENING. The following information is for use upon initial hose installation in the absence of a hose clamp torque-limiting wrench Due to variations in hose clamp design and hose structure, the values given in Table IV are approximate. Therefore, use good judgement when tightening hose clamps by this method

NOTE: Since hose connections are subject to “cold flow” or a setting process, a follow-up tightening check should be made for several days after installation.

TABLE IV
HOSE CLAMP TIGHTENING

	Type of Clamp	
Type of Hose	**Worm Screw**	**All Others**
Self-Sealing	Fingertight plus two complete turns.	Fingertight plus 2 1/2 complete turns.
All Other	Fingertight plus 1 1/4 complete turns.	Fingertight plus 2 complete turns.

82. IDENTIFICATION OF FLUID LINES. 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 are 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.

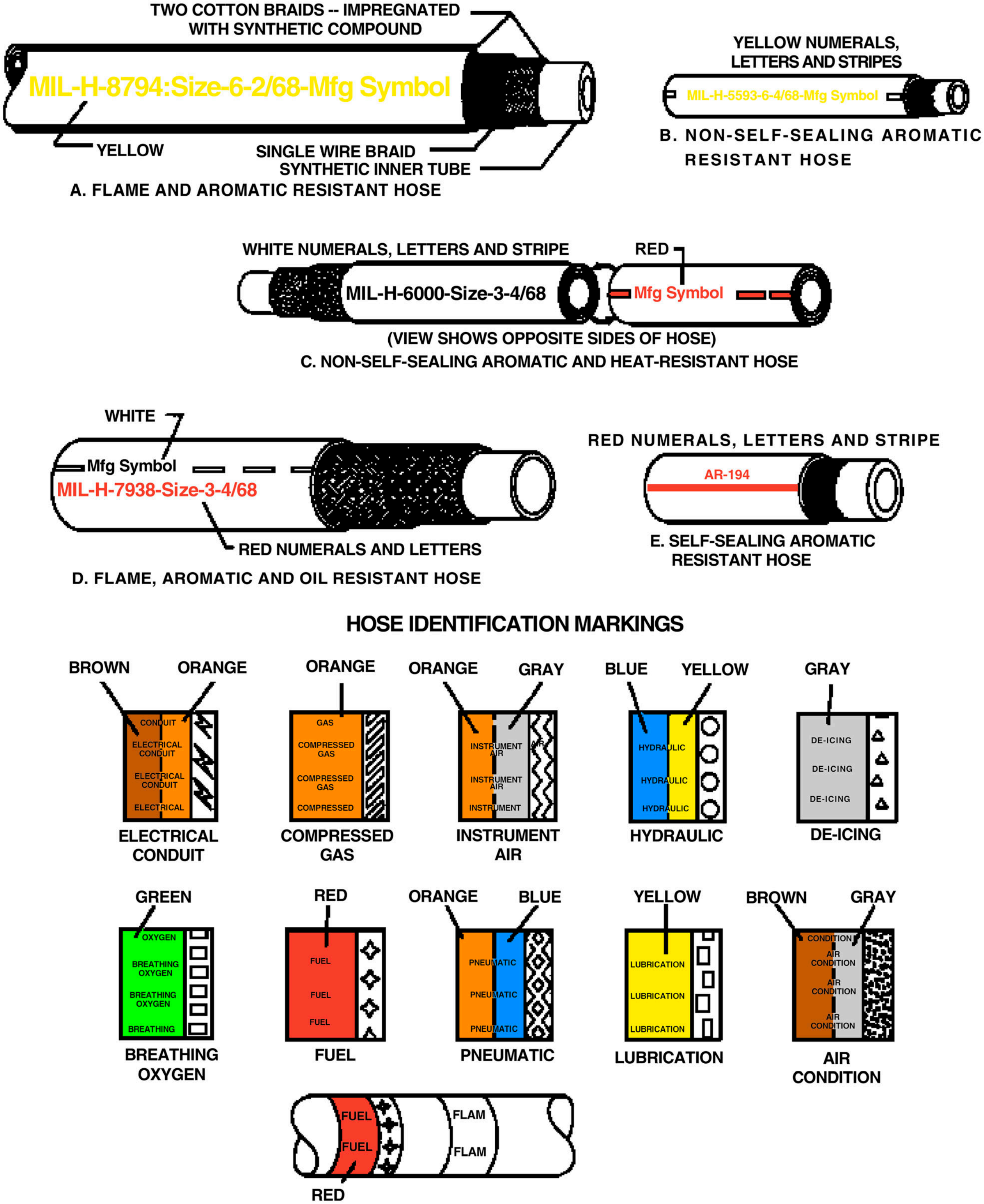
Generally, tapes and decals are placed on both ends of a line and at least once in each compartment through which the line runs. In addition, identification markers are placed immediately adjacent to each valve, regulator, filter or other accessory within a line Where paint or tags are used, location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

83. INSTALLATION OF FLEXIBLE HOSE ASSEMBLIES.

a. Flexible hose must not be twisted on installation. Flexible hose which is installed with a twist may have a reduced service life and may cause a loosening of the fittings to which it is attached.

b. Never exceed the minimum bend radius and avoid tight bends in flexible hose assemblies. (Refer to the latest revision of AC43:13-1, Chapter 10.)

c. Never stretch a hose tight between two fittings as this may result in overstressing and eventual failure. The length of the hose should be sufficiently long to provide 5 to 8 percent slack.



Fluid Line Identification
Figure 28

84. REMOVAL OF CHERRYLOCK RIVETS. (See Figure 29.) Should it be necessary to remove an installed cherrylock rivet, the following procedures are recommended:

a. 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.

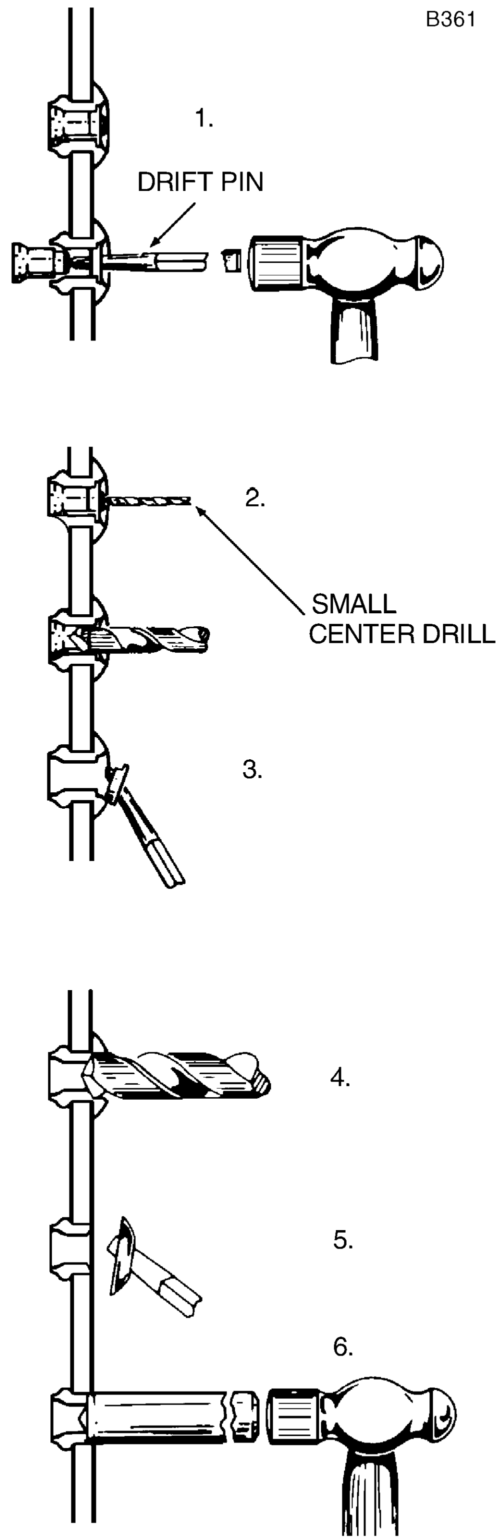
b. If the rivets have been installed in thin sheets, driving out the locked stem may damage the sheets. It is recommended that a small center drill be used to provide a guide for a larger drill on top of the rivet stem, and the tapered portion of the stem be drilled away to destroy the lock (See Views 2 and 3).

c. Pry the remainder of the locking collar out of the rivet head with the drift pin (See View 3).

d. Drill nearly through the head of the rivet, using a drill the same size as the rivet shank (See View 4).

e. Break off rivet head, using a drift pin as a pry (See View 5).

f. Drive out the remaining shank with a pin having a diameter equal to the rivet shank. (See View 6).



Removing Cherrylock Rivets
Figure 29

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GRIDS 1K14 THRU 1L24
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AIRPLANE SERVICE MANUAL

CARD 2 OF 4

PA-34-200

PIPER SENECA

(S/N's 34-7250001 THRU 34-7450220)

PIPER AIRCRAFT CORPORATION

PART NUMBER 753-817 October 30, 2003

Published by
Technical Publications

2926 Piper Drive
Vero Beach, Florida 32960
U.S.A.

GAMA

Member
General Aviation
Manufacturers Association

AEROFICHE REVISION STATUS

Revisions to this Service Manual 753-817 originally issued April 5, 1971 are as follows:

Revision	Publication Date	Aerofiche Card Effectivity
ORG710405	April 5, 1971	N/A
CR720613	June 13, 1972	N/A
CR031030 *	October 30, 2003	1, 2, 3, & 4

*** COMPLETE REISSUE OF SERVICE MANUAL 753-817**

This is a complete reissue of this publication. Accordingly, replace your existing Aerofiche Card Set (i.e. - Cards 1 and 2) with this set (i.e. - Cards 1, 2, 3, and 4) dated 10/30/03.

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

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INTRODUCTION

LIST OF EFFECTIVE PAGES

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TABLE OF CONTENTS

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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-34-200 Seneca Service Manual constitutes the Instructions for Continued Airworthiness. Section I contains the Airworthiness Limitations and the Inspection Program is in Section III.

2. GENERAL.

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

Genuine PIPER parts are produced and inspected under rigorous procedures to insure airworthiness and suitability for use in PIPER airplane applications. Parts purchased from sources other than PIPER, even though identical in appearance, may not have had the required tests and inspections performed, may be different in fabrication techniques and materials, and may be dangerous when installed in an airplane.

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

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

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

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

3. EFFECTIVITY.

This maintenance manual is effective for PA-34-200 Seneca airplane serial numbers 34-7250001 thru 34-7450220.

This encompasses the following model years:

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

Model Year	Serial Numbers
1972	34-7250001 thru 34-7250360
1973	34-7350001 thru 34-7350353
1974	34-7450001 thru 34-7450220

4. SERIAL NUMBER EXPLANATION.

Example: 34 72 50 001

TYPE CERTIFICATE DESIGNATION — 34

MODEL YEAR — 72

MODEL CODE — 50
50 = PA-34-200 SENECA

SEQUENCE NUMBER — 001

5. ASSIGNMENT OF SUBJECT MATERIAL.

This publication is divided into logical subject groupings based on aircraft system or task function. Refer to paragraph 14, Section Index Guide, for a complete breakdown and list. The material is arranged in ascending numerical sequence.

6. PAGINATION.

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

7. AEROFICHE EFFECTIVITY.

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

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

First number is the Aerofiche card number.
Letter is the horizontal row reference per card
Second number is the vertical column reference per card.

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

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

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

8. IDENTIFYING REVISED MATERIAL.

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

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

Example.

9. INDEXING.

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

10. LIST OF EFFECTIVE PAGES.

Each Section has a List of Effective Pages preceding the Table of Contents to identify the effective revision date for each page in that section.

11. WARNINGS, CAUTIONS AND NOTES.

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

12. ACCIDENT/INCIDENT REPORTING.

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

13. SUPPLEMENTARY PUBLICATIONS.

The following publications/sources provide servicing, overhaul and parts information for the PA-34-200 airplanes and their various components. Use them to supplement this manual.

A. PIPER PUBLICATIONS:

(1) Parts Catalog:	P/N 753-816
(2) Periodic Inspection Report:	P/N 230-208
(3) Progressive Inspection Manual (50 Hour):	P/N 230-208
(4) Autopilot Service Manuals	See Section XII

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) ALTERNATOR:

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

(2) AUTOPILOT:

See Section XII, Autoflight.

(3) BATTERY:

Vendor Address: GILL Batteries PH: - (800) 456-0070
(A Division of
Teledyne Continental Motors,
see listing under Magnetos, below)
http://www.gillbatteries.com

(4) BRAKES AND WHEELS:

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

(5) ENGINE:

Vendor Address:	Textron Lycoming 652 Oliver Street Williamsport, PA 17701 http://www.lycoming.textron.com/main.html	PH - (717) 323-6181 FAX - (717) 327-7101
Overhaul Manual:	DIRECT DRIVE MODELS - P/N 60294-7	
Parts Catalog:	IO-540- ..... - K1G5, ... ENGINES - P/N PC-615 TIO-540-AH1A ENGINES - P/N PC-615-12	
Operators Handbook:	O-540, IO-540 SERIES - P/N 60297-10 TIO-540 Series - P/N 60297-23	

NOTE: The above Lycoming publications can be ordered as a set on CD-ROM from Avantext. See www.avantext.com or PH - (800) 998-8857.

(6) FIRE EXTINGUISHER (PORTABLE):

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

(7) FUEL PUMP:

Vendor Address:	Weldon Pumps P.O. Box 46579 640 Golden Oak Parkway Oakwood Village, Ohio 44146 http://www.weldonpumps.com/index.html	PH: - (440) 232-2282 FAX - (440) 232-0606

(8) COMBUSTION HEATER:

Vendor Address:	Electro Systems, Inc. (See listing under Alternator, above.)	PH: - (334)-227-0152

(9) HI-LOK FASTENERS AND TOOLS:

Vendor Address:	Hi-Shear Corporation 2600 Skypark Drive Torrance, California 90509	PH: - (213) 326-8110

(10) LANDING GEAR ACTUATOR, EXTENSION AND RETRACTION:

Vendor Address:	Parker Hannifin Corp Aircraft Wheel and Brake Division 1160 Center Road Avon, Ohio 44011 http://www.parker.com/cleveland/	PH: - (800) 272-5464
Component Maintenance Manual:	(Effective for P/N's 96860-002 and 96860-003 only.) CMSFA232-5 (011-00504)	

(11) LIGHTS - NAVIGATION, STROBE, AND STANDBY/MAP LIGHTS:

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

(12) MAGNETOS:

Vendor Address:	Teledyne Continental Motors P.O. Box 90 Mobile, AL 36601 http://www.tcmlink.com	PH: - (334-438-3411, ext. 8392) FAX - (334-433-2325
Service Support Manual:	S1200 Series Magnetos, P/N X42001-1	
or, if installed:		
Vendor Address:	Slick Aircraft Products Unison Industries Attn: Subscription Dept. 530 Blackhawk Park Ave. Rockford, IL 61104 http://www.unisonindustries.com/index4.html	PH - (815) 965-4700 FAX - (815) 965-2457
Installation, Operation and Maintenance Instructions:	F1100 MASTER SERVICE MANUAL, 4300/6300 SERIES MAGNETO MAINTENANCE AND OVERHAUL MANUAL - L-1363	

(13) PNEUMATIC DEICE SYSTEM:

Vendor Address:	De-Icing and Specialty Systems Goodrich Corporation 1555 Corporate Woods Parkway Uniontown, Ohio 44685-8799	PH - (330) 374-3040 FAX - (330) 374-2290
Technical Assistance:	Email: dssd.support@goodrich.com http://www.deicingsystems.goodrich.com/	PH - (800) 334-2377 (330) 374-3743 FAX - (330) 374-2290
Black Standard Pneumatic De-Icer Installation, Maintenance and Repair Manual:	ATA 30-10-31	

(14) PROPELLER:

Vendor Address:	Hartzell Propeller Inc. One Propellor Place Piqua, OH 45356-2634 http://www.hartzellprop.com/index2.htm	PH - (937) 778-4379 FAX - (937) 778-4321
Standard Practices:	Manual No. 202A	
Overhaul and Maintenance:	Manual No. 117D	
Aluminum Blade Overhaul:	Manual No. 133C	
Propeller Owner's Manual and Logbook:	Manual No. 115N	

(15) PROPELLER DEICE SYSTEM:

Vendor Address:	See Pneumatic Deice System, above.
Installation and Maintenance Manual for Prop De-Icing Systems:	ATA 30-60-02
Removal and Installation Manual, Standard and FASTprop™ Electrothermal Propeller De-Icers:	ATA 30-60-07

(16) PROPELLER GOVERNOR:

Vendor Address:	Hartzell Propeller Inc. One Propellor Place Piqua, OH 45356-2634 http://www.hartzellprop.com/index2.htm	PH - (937) 778-4379 FAX - (937) 778-4321
Governor Maintenance:	Manual No. 130B	

(17) VACUUM PUMPS: (For service replacement, Tempest Dry Air Pumps, only.)

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

(18) VACUUM REGULATORS:

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

(19) VOLTAGE REGULATOR:

Vendor Address: See listing under Alternator, above.

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14 SECTION INDEX GUIDE.

GRIDS 2A18 THRU 2A24
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E (cont.)

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V

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GRIDS 2B6 THRU 2B24
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SECTION

V

SURFACE CONTROLS

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SECTION V

LIST OF EFFECTIVE PAGES

SECTION	PAGE	DATE
V-List of	1	Oct 30/03
Effective Pages	2	Oct 30/03
V-Table of Contents	1	Oct 30/03
	2	Oct 30/03
V	1	Oct 30/03
	2	Oct 30/03
	3	Oct 30/03
	4	Oct 30/03
	5	Oct 30/03
	6	Oct 30/03
	7	Oct 30/03
	8	Oct 30/03
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	68	Oct 30/03
	69	Oct 30/03
	70	Oct 30/03
	71	Oct 30/03
	72	Oct 30/03
	73	Oct 30/03
	74	Oct 30/03

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SECTION V - SURFACE CONTROLS

TABLE OF CONTENTS

SECTION V - SURFACE CONTROLS

TABLE OF CONTENTS (continued)

SURFACE CONTROLS

1. DESCRIPTION AND OPERATION.

The Seneca is controlled in flight by the use of standard three-axis 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 at the balance arm of the stabilator. Cables also connect the rudder pedals with the rudder horn. Provisions for directional and longitudinal trim are provided by adjustable trim mechanisms for the stabilator and rudder. Both the stabilator and rudder trim are controlled by individual wheel and drum assemblies mounted on the floor tunnel between the front seats. Cables routed aft from the drums to the tail cone operate the particular screw assembly which in turn moves the stabilator or rudder trim tab.

The wing flaps are manually operated via a system consisting of an operating handle, a cable routed from the handle to a torque tube and push-pull rods. The flaps can be positioned at 10, 25 and 40 degrees.

2. STANDARD PRACTICES AND PROCEDURES.

The following tips may be helpful in the removal, installation, and rigging of individual control system assemblies.

A. It is recommended, though not always necessary, to level and place the airplane on jacks during rigging and adjustment.

B. Remove turnbuckle barrels from cable ends before withdrawing the cables through the structures.

C. Tie a cord to the cable end before withdrawing the cable through the structures to facilitate installation of cable.

D. Mark cable ends, etc., before disconnecting, use a felt tip marking pen.

E. Assemble and adjust the turnbuckles so that each terminal is screwed an approximately equal distance into the barrel. Do not turn the terminals in such a manner that will put a permanent "twist" into the cables.

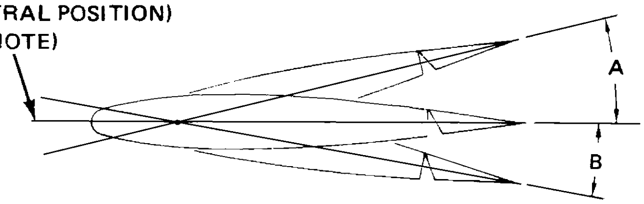
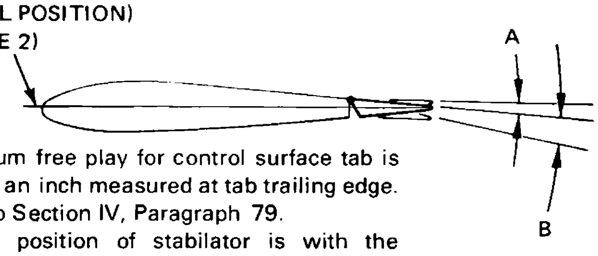
F. Cable tensions should be taken with the appropriate control surface in its neutral position.

NOTE: Cable rigging tensions specified in Table I must be corrected to ambient temperature using Table II. When installing new cables, initially tension them 20 to 30 % over nominal tension, then loosen them to the "High Side" of the tolerance. This "pre-stretching" will aid in maintaining specified tension after flight testing.

G. Check all cable ball ends for proper seating in retainers after setting cable tension.

H. After completion of each adjustment, check the turnbuckles to be sure not more than three terminal threads are visible outside the barrel. Install the locking clips, and check for proper installation by trying to remove the clips using fingers only. Both locking clips may be installed in opposite holes. Locking clips which have been installed and removed must be scrapped and not reused. Turnbuckles may be safetied in accordance with FAA Advisory Circular 43.13-1, latest revision.

TABLE I (Sheet 1 of 2)
CONTROL SURFACE TRAVEL AND CABLE TENSION

Stabilator A - STABILATOR TRAILING EDGE UP TRAVEL FROM NEUTRAL 12° 30' -1° + 0° B - STABILATOR TRAILING EDGE DOWN TRAVEL FROM NEUTRAL 7° 30' ± 1°	STABILATOR CHORD LINE (NEUTRAL POSITION) (SEE NOTE)  Neutral position of stabilator is with the stabilator chord line parallel with the top of the front seat tracks.
Stabilator Trim Tab A - STABILATOR TAB TRAILING EDGE UP TRAVEL FROM NEUTRAL 6° 30' ± 1° B - STABILATOR TAB TRAILING EDGE DOWN TRAVEL FROM NEUTRAL 10° 30' ±1°	STABILATOR CHORD LINE (NEUTRAL POSITION) (SEE NOTE 2)  1. Maximum free play for control surface tab is 0.06 of an inch measured at tab trailing edge. Refer to Section IV, Paragraph 79. 2. Neutral position of stabilator is with the stabilator chord line parallel with the top of the front seat tracks.
Rudder Pedal Neutral Angle	SEE FIGURE 18.
Cable Tensions AILERON FLAP STABILATOR STABILATOR TRIM TAB RUDDER RUDDER TRIM CONTROL	 40 lbs. ± 5 lbs. 10 lbs. ± 1 lb. 40 lbs. ± 5 lbs. **14 lbs. ± 1 lbs.** 40 ± 5 lbs. 10 ± 2 lbs.

NOTE

CABLE TENSIONS GIVEN APPLY ONLY TO AIRPLANES WITHOUT AUTOPILOT BRIDLE CABLES ATTACHED. REFER TO APPROPRIATE AUTOPILOT SERVICE MANUAL FOR PROPER CABLE TENSIONS WHEN ATTACHING BRIDLE CABLES.

CABLE RIGGING TENSIONS SPECIFIED MUST BE CORRECTED TO AMBIENT TEMPERATURE IN THE AREA WHERE THE TENSION IS BEING CHECKED USING TABLE II.

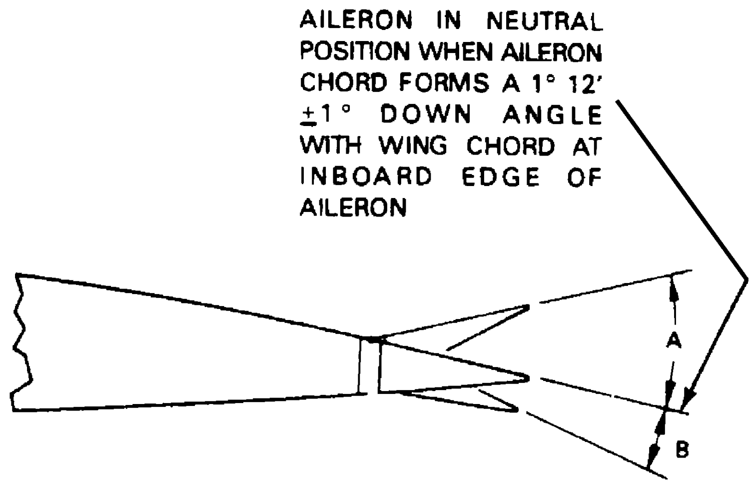
TABLE I (Sheet 2 of 2)
CONTROL SURFACE TRAVEL AND CABLE TENSION

Ref: PPS 50009 & 50009-1

Aileron

A - 31° 12' ± 2° UP

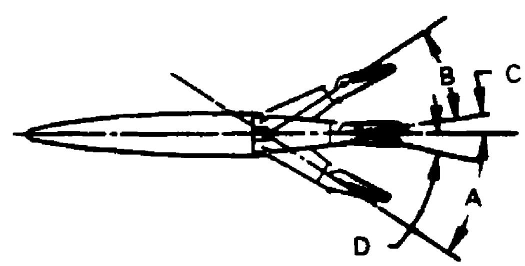
B - 13° 48' ± 2° DOWN



1 Flap Adjustment must be complete before starting aileron adjustment
2 Maximum free play for aileron is 0 24 of an inch, measured at trailing edge Max end play of 0 25 Refer to Section IV, Paragraph 79

Rudder

A - 35° ±1° LEFT
B - 35° ±1° RIGHT
C - 22° ±1° RIGHT
D - 17° ±1° LEFT



Flap

0° NEUTRAL POSITION

A - 10° ± 2° FIRST NOTCH TRAVEL
B - 25° ± 2° SECOND NOTCH TRAVEL
C - 40° ± 2° THIRD NOTCH TRAVEL

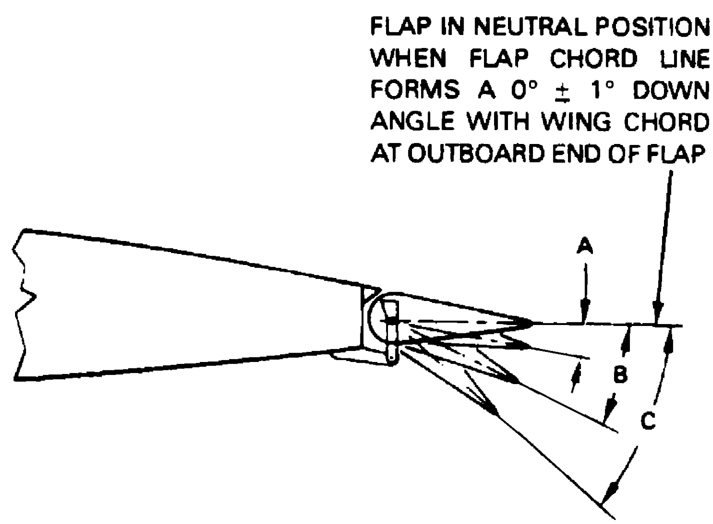
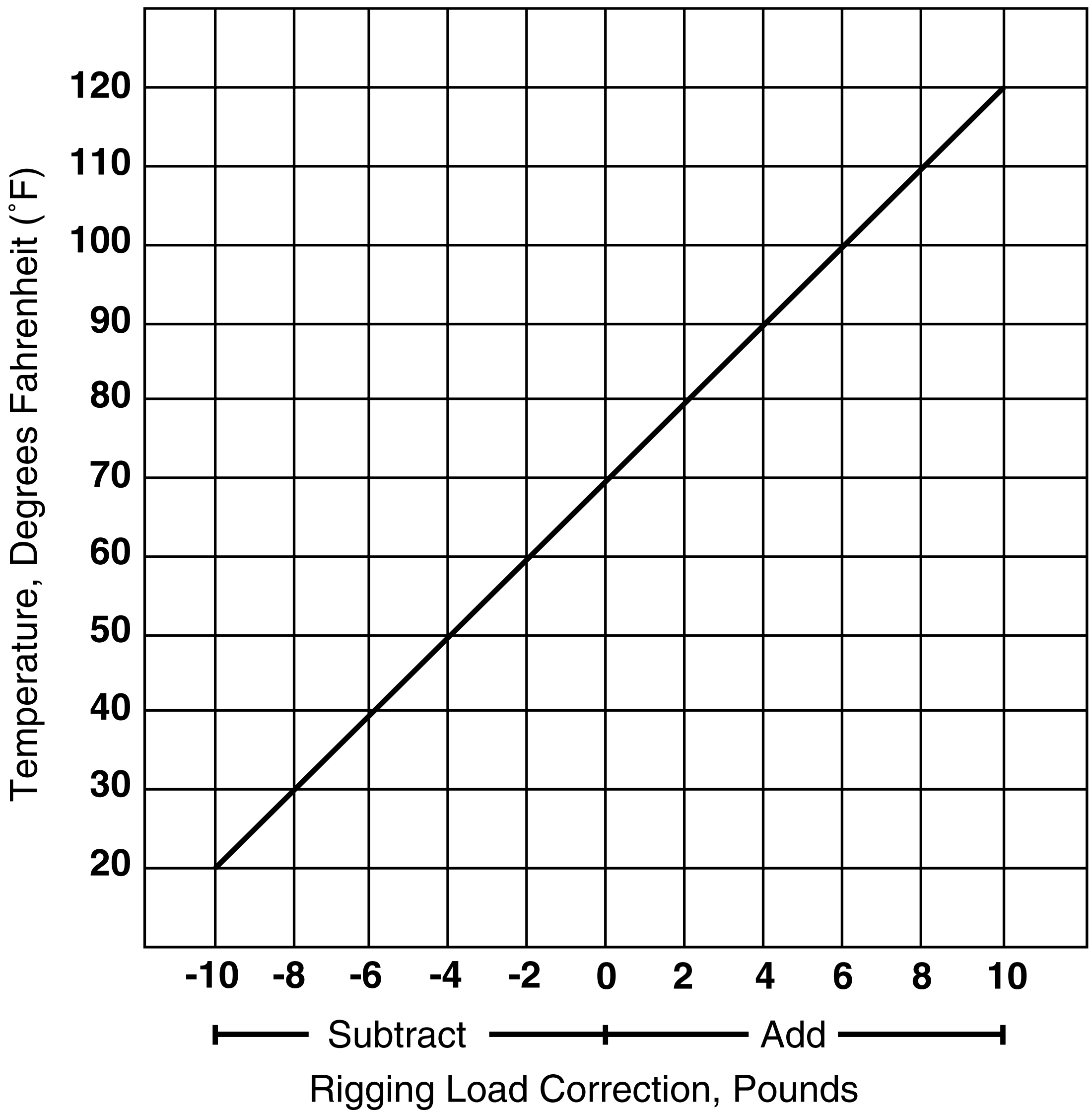


TABLE II
CABLE TENSION VS. AMBIENT TEMPERATURE



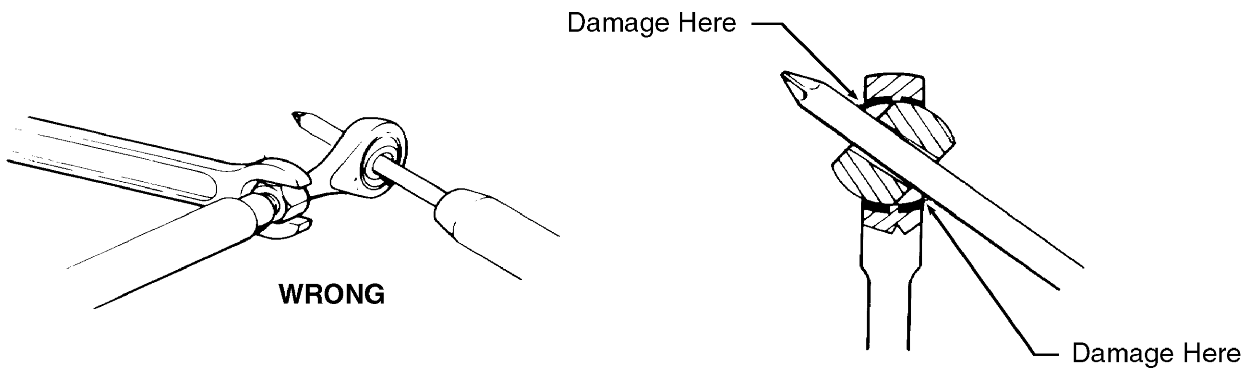
I. When pushrods or rod ends are provided with an inspection hole, the screw must be screwed in far enough to pass the inspection hole. This can be determined visually or by feel, inserting a piece of wire into the inspection hole. If no hole is provided, there must be a minimum of .375 (3/8) of an inch thread engagement.

J. When installing/adjusting rod end jamnuts, refer to Figure 1 for proper method.

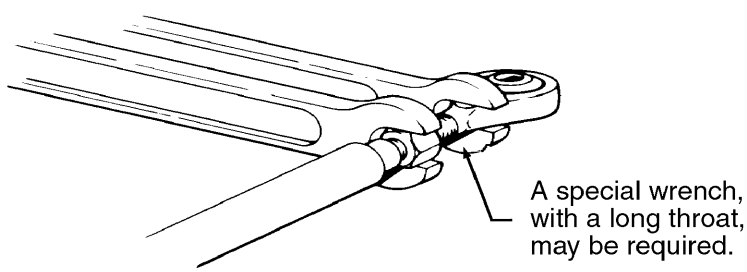
K. After completion of adjustments, each jam nut must be tightened securely.

NOTE: Torque all nuts in the flight control system (including nose wheel steering). Refer to Section II, Table II.

L. Ensure all pulley guard pins are properly installed and secured.



Improper Tool (Resulting in locked ball)



ONLY CORRECT METHOD

Rod End Installation Method
Figure 1

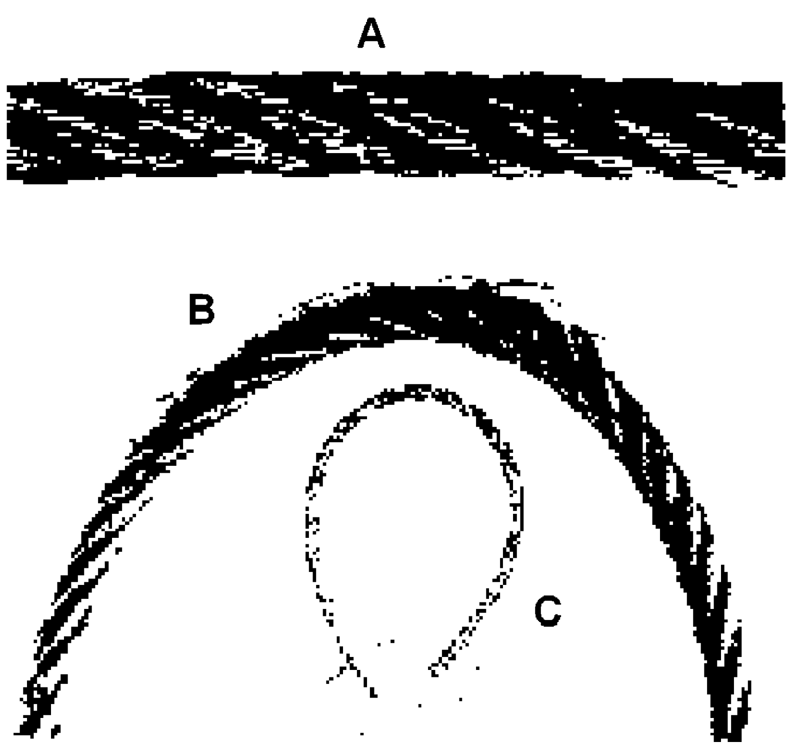
2a. CONTROL CABLE INSPECTION.

Aircraft control cable systems are subject to a variety of environmental conditions and forms of deterioration that, with time, may be easy to recognize as wire/strand breakage or the not-so-readily visible types of wear, corrosion, and/or distortion. The following data may help in detecting the presence of these conditions:

A. Cable Damage.

Critical areas for wire breakage are sections of the cable which pass through fairleads and around pulleys. To inspect each section which passes over a pulley or through a fairlead, remove cable from aircraft to the extent necessary to expose that particular section. Examine cables for broken wires by passing a cloth along length of cable. This will clean the cable for a visual inspection, and detect broken wires, if the cloth snags on cable. When snags are found, closely examine cable to determine full extent of damage.

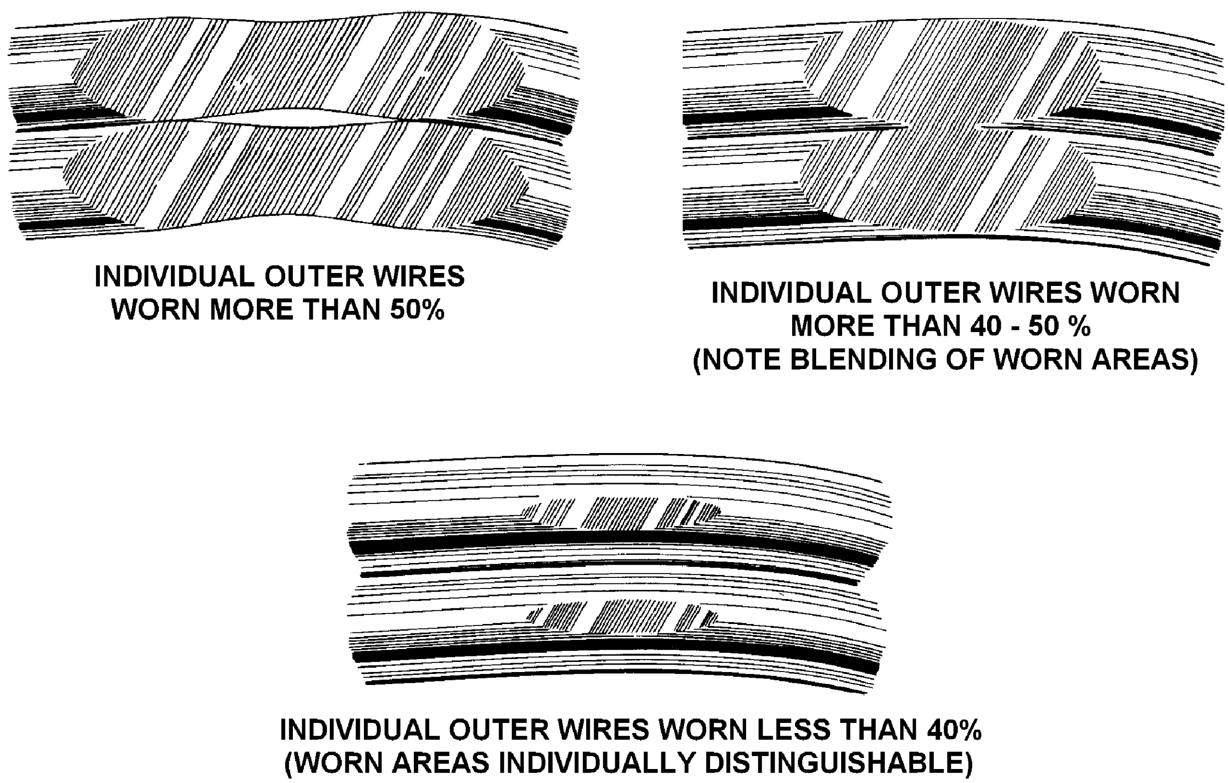
The absence of snags is not positive evidence that broken wires do not exist. Figure 2, View A, shows a cable with broken wires that were not detected by wiping, but were found during a visual inspection. The damage became readily apparent (View B) when the cable was removed and bent using the techniques depicted in View C.



Control Cable Inspection Technique
Figure 2

B. External Wear Patterns.

Wear will normally extend along cable equal to the distance cable moves at that location. Wear may occur on one side of the cable only or on its entire circumference. Replace flexible and non-flexible cables when individual wires in each strand appear to blend together (outer wires worn 40-50 percent) as depicted in Figure 3.



External Cable Wear
Figure 3

C. Internal Cable Wear.

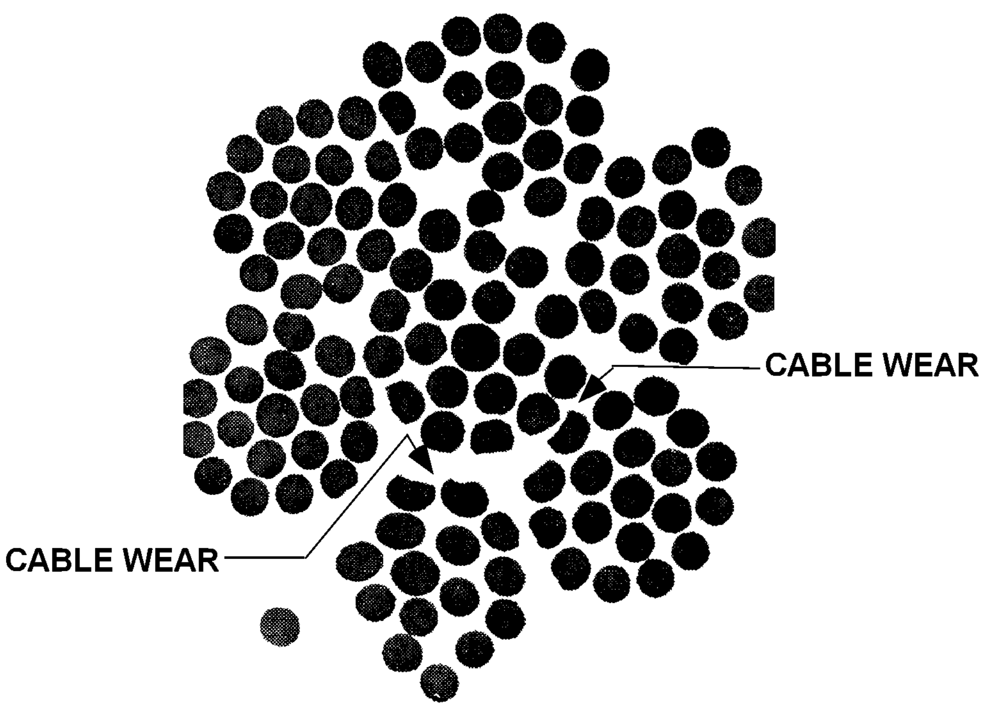
As wear is taking place on the exterior surface of a cable, the same condition is taking place internally, particularly in the sections of the cable which pass over pulleys and quadrants. This condition, shown in Figure 4, is not easily detected unless the strands of the cable are separated. Wear of 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.

D. Corrosion.

Carefully examine any cable for corrosion that has a broken wire in a section not in contact with wear producing airframe components such as pulleys, fairleads, etc. It may be necessary to remove and bend the cable to properly inspect it for internal strand corrosion as this condition is usually not evident on the outer surface of the cable. Replace cable segments if internal strand rust or corrosion is found.

Areas especially conducive to cable corrosion are battery compartments, lavatories, wheel wells, etc., where concentrations of corrosive fumes, vapors, and liquids can accumulate.

NOTE: Check all exposed sections of cable for corrosion after a cleaning and/or metal-brightening operation has been accomplished in that area.



Internal Cable Wear
Figure 4

E. Cable Maintenance.

CAUTION: TO AVOID REMOVAL OF CORROSION-PREVENTATIVE COMPOUNDS AND CABLE INTERNAL LUBRICANT, DO NOT USE VAPOR DEGREASING, STEAM CLEANING, METHYLETHYLKETONE (MEK) OR OTHER SOLVENTS.

CAUTION: DO NOT OIL CONTROL CABLES.

Frequent inspections and preservation measures such as rust prevention treatments for bare cable areas will help to extend cable service life. Where cables pass through fairleads, pressure seals, or over pulleys, remove accumulated heavy coatings of corrosion prevention compound. Provide corrosion protection for these cable sections by lubricating as specified in the Lubrication Chart, 12-20-00.

F. Cable Fittings.

(1) 100 Hour Standard Inspection.

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

Pay particular attention to corrosion and “pitting” on cable terminals, turnbuckles and cable fittings. Any corrosion or pitting found requires replacement of the corroded fitting and/or cable.

(2) 100 Hour Special Inspection.

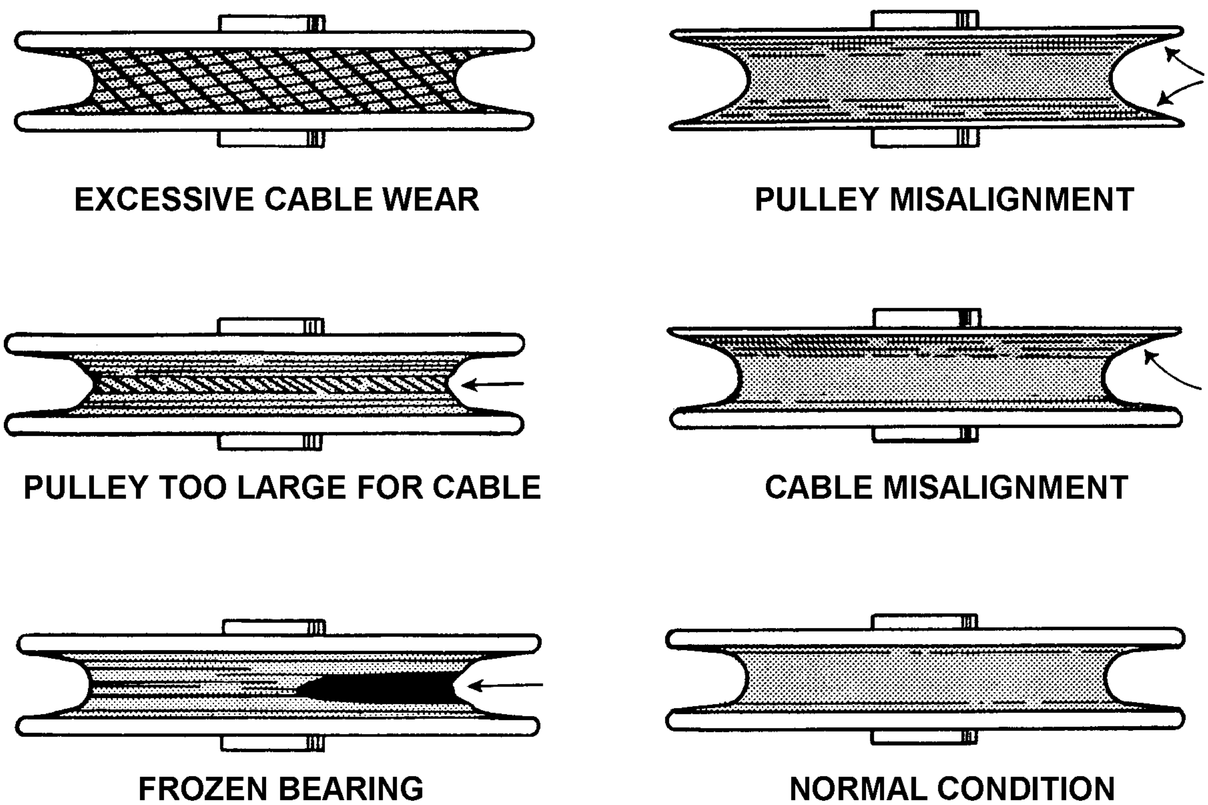
For airplanes 15 years old or older, using a 10X magnifier, visually inspect the entire surface of each cable terminal, turnbuckle, or other cable fitting for corrosion or cracking. Inspect under safety wire or clips wrapped around the cable or fitting. Any evidence of corrosion or cracking, however minute, is cause for replacement. A logbook entry documenting the replacement of a cable terminal, turnbuckle, or other cable fitting relieves the inspection requirement for that fitting only, until such time as that fitting has been in service for 15 years.

G. Pulleys.

Inspect pulleys for roughness, sharp edges, and presence of foreign material embedded in the grooves. Examine pulley bearings to assure proper lubrication, smooth rotation, freedom from flat spots, dirt, and paint spray. Periodically rotate pulleys, which turn through a small arc, to provide a new bearing surface for the cable. Maintain pulley alignment to prevent the cable from riding on flanges and chafing against guards, covers, or adjacent structure. Check all pulley brackets and guards for damage, alignment, and security.

H. 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 5.



Pulley Wear Patterns
Figure 5

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3. CONTROL COLUMN ASSEMBLY.

4. REMOVAL. (Refer to Figure 6.)

   a. To remove either control wheel (5) with tube (4), the following procedure may be used:

      1. Separate the control wheel tube (4) from the flexible joint (2) that is located on either side of the tee bar assembly (7) by removing the nut, washer and bolt (3). Pull the tube from the flexible joint.
      2. If removing the left control tube, slide the stop (12) from the tube.
      3. 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.
      4. Remove the control wheel assembly from the instrument panel.

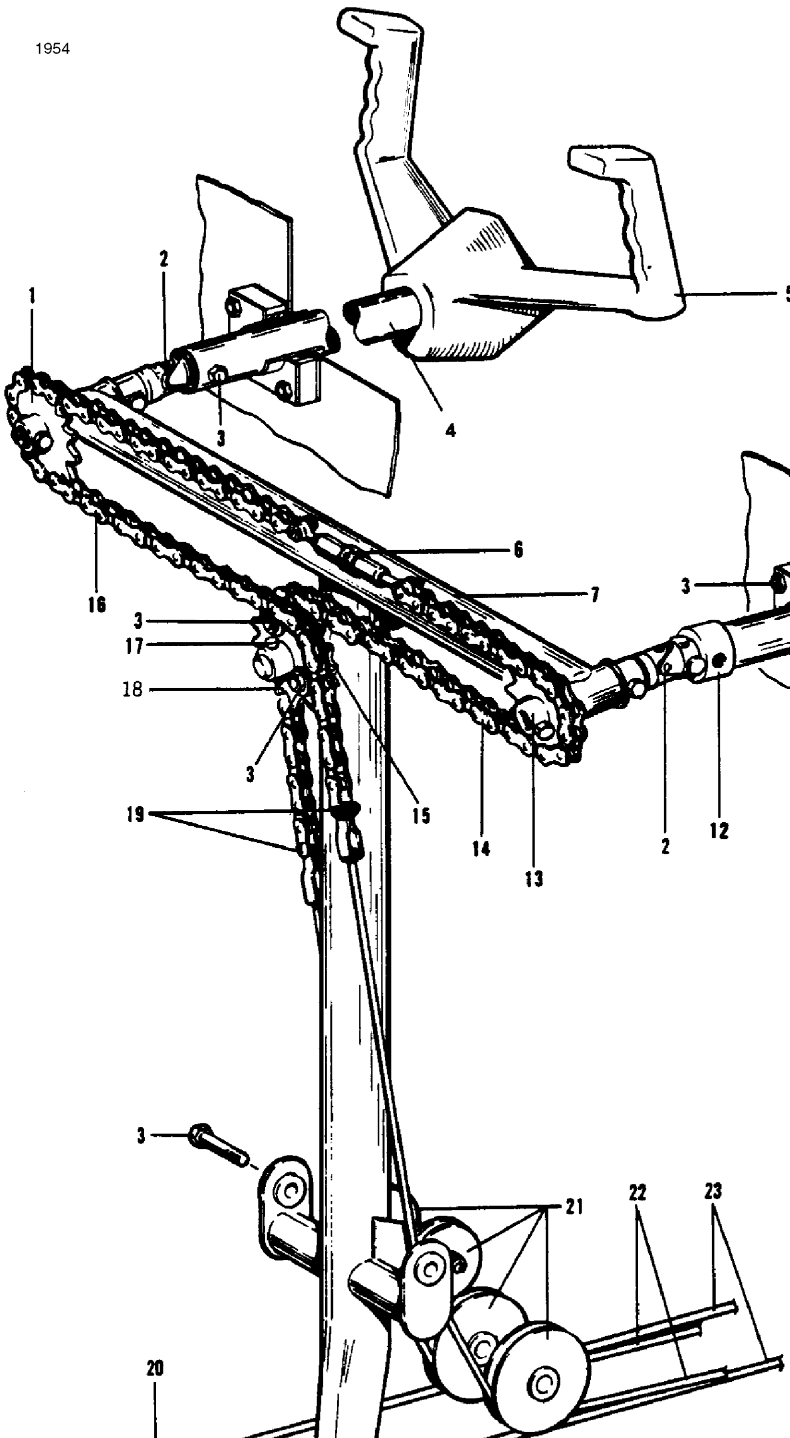
   b. The tee bar (7) with assembled parts may be removed from the airplane by the following procedure:

      1. Remove the access panel to the aft section of the fuselage.
      2. Relieve cable tension from the stabilator control cables (23) at one of the stabilator cable turnbuckles in the aft section of the fuselage.
      3. Relieve tension from the aileron control cables (22) and chains (16 and 14) at the turnbuckle (6) that connects the chains at the top of the tee bar (7).
      4. Disconnect the control chains from the control cables where the chains and cables join by removing the cotter pins, nuts, bolts and bushings.
      5. If the control wheel assemblies have not been previously disconnected from the tee bar assembly, separate the control wheel tubes (4) at the flexible joints (2) by removing the nuts, washers and bolts (3).
      6. Remove the tunnel plate just aft of the tee bar by laying back enough tunnel carpet to remove the plate attachment screws.
      7. Remove the two aileron control cable pulleys (21) attached to the lower section of the tee bar by removing the pulley attachment bolt (8).
      8. Disconnect the stabilator control cables (23) from the lower end of the tee bar assembly.
      9. Disconnect the necessary control cables, such as the propeller pitch control, mixture control, etc., that will allow the tee bar assembly to be removed.
      10. Remove the tee bar assembly by removing the attachment bolts (3) 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.

5. INSTALLATION. (Refer to Figure 6.)

   a. The tee bar assembly may be installed in the airplane by the following procedure:

      1. Swing the tee bar assembly into place from the right side of the cabin and secure with attachment bolts (3), washers and nuts inserted in through each side of the floor tunnel.
      2. Connect the stabilator control cables (23) to the lower end of the tee bar with bolt (3), washer, nut and cotter pin. Allow the cable ends free to rotate.
      3. Place the aileron control cables (22) around the pulleys (21) that attach to the lower section of the tee bar (7), position pulleys and secure with bolt, washers and nut.
      4. Install the control wheel per step b.



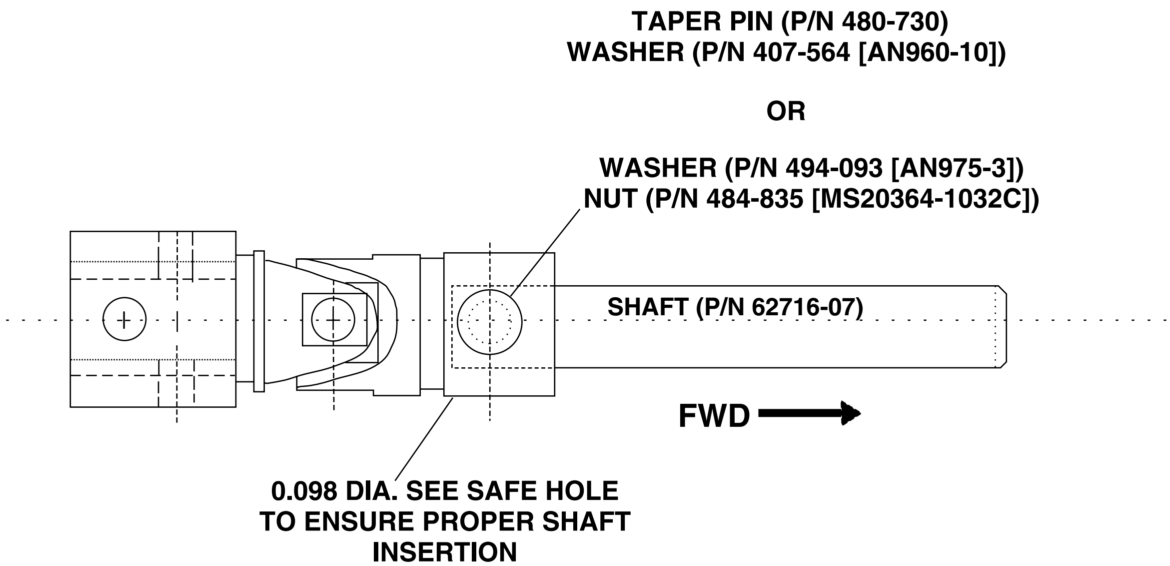
1. SPROCKET, RIGHT CONTROL WHEEL
2. FLEXIBLE JOINT
3. BOLT ASSY. (TORQUE 45 ± 5 IN. LBS.)
4. TUBE, CONTROL WHEEL
5. CONTROL WHEEL
6. TURNBUCKLE
7. TEE BAR ASSY.
8. O-RING
9. WASHER, CONTROL WHEEL
10. PLATE, CONTROL WHEEL
11. WASHER, CONTROL WHEEL
12. SPACER, STOP
13. SPROCKET, LEFT CONTROL WHEEL
14. 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, STABILATOR
21. PULLEYS, AILERON
22. CABLES, AILERON CONTROL
23. CABLES, STABILATOR CONTROL

Control Column Installation
Figure 6

5. Place the control wheels in neutral (centered) position and install the aileron control chains (14 and 16) on the control wheel sprockets (1 and 13) and idler crossover sprockets (15 and 18). The turnbuckle (6) must be centered between the two control wheel sprockets.
6. Loosen the connecting bolts (3) of the idler sprockets (15 and 18) to allow the chain to fit snug around the control wheel sprockets and over the idler sprockets.
7. Connect the aileron control cables (22) to the ends of the chains (14 and 16) with bolts, bushings, nuts and cotter pins (19).
8. Adjust the chain turnbuckle (6) between the two control wheel sprockets to allow the control wheels to be neutral and obtain proper cable tension as given in Table I. 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 paragraph 11. 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. On models with control wheel adjustable stops, maintain. 030 to. 040 clearance between sprocket pin and stop bolts.
9. Set stabilator cable tension with the turnbuckle in the aft section of the fuselage and instruction given in paragraph 15. Check safety of all turnbuckles upon completion of adjustments and install all pulley guard pins.
10. Tighten (see torque in Figure 6) the connecting bolts (3) of the idler sprockets (15 and 18).
11. Install the floor tunnel plate and secure with screws. Fasten the tunnel carpet in place.

b. Either control wheel assembly may be installed by the following procedure:

1. Insert the control wheel tube through the instrument panel.
2. 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.
3. On the left control tube install the stop (12).
4. Connect the control wheel tube (4) to the flexible joint (2) 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 (3) and tighten.



Flex (Universal) Joint Assembly
Figure 7

5a. FLEX JOINT REPLACEMENT. (See Figures 6 and 7.)

Install a replacement control column flex joint as follows:

(1) Carefully lay out location for hole to be drilled in flex joint tube to match hole in control column shaft.

(2) Using a #5 (0.2055) drill bit, drill hole through flex joint tube at location determined above.

(3) 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.

(4) Install pin through tube and shaft.

(a) If pin shoulder does not protruded past tube surface, install a AN960-10 washer.

(b) If pin shoulder does protruded past tube surface, install a MS20364-1032C washer.

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6. AILERON CONTROLS.

6a. TROUBLESHOOTING. See Table III.

TABLE III
TROUBLESHOOTING AILERON CONTROLS

Trouble	Cause	Remedy
Lost motion between control wheel and aileron.	Cable tension too low.	Adjust cable tension. (Refer to Paragraph 11.)
	Linkage loose or worn.	Check linkage and tighten or replace.
	Broken pulley.	Replace pulley.
	Cables not in place on pulleys.	Install cables correctly. Check cable guards.
Resistance to control wheel rotation.	System not lubricated properly.	Lubricate per Lubrication Chart, Section II.
	Cable tension too high.	Adjust cable tension. (Refer to Paragraph 11.)
	Control column horizontal chain improperly adjusted.	Adjust chain tension. (Refer to Paragraph 5.)
	Pulleys binding or rubbing.	Replace binding pulleys and/or provide clearance between pulleys and brackets.
	Cables not in place on pulleys.	Install cables correctly. Check cable guards.
	Bent aileron and/or hinge.	Repair or replace aileron and/or hinge.
	Cables crossed or routed incorrectly.	Check routing of control cables.
Control wheels not synchronized.	Incorrect control column rigging.	Rig in accordance with Paragraph 5.
Control wheels not horizontal when ailerons are neutral.	Incorrect rigging of aileron system.	Rig in accordance with Paragraph 11.
Incorrect aileron travel.	Aileron control rods not adjusted properly.	Adjust in accordance with Paragraph 11.
	Aileron bellcrank stops not adjusted properly.	Adjust in accordance with Paragraph 11.
Correct aileron travel cannot be obtained by adjusting bellcrank stops.	Incorrect rigging of aileron cables, control wheel and control rod.	Rig in accordance with Paragraph 11.
Control wheel stops before ailerons reach full travel.	Incorrect rigging between control wheel and control cables.	Rig in accordance with Paragraph 11.

7. REMOVAL. (Refer to Figure 8.)

   a. 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.

   b. To remove either the right or left primary control cables (8 and 9) that are located in the fuselage, the following procedure may be used:

      1. Remove the tunnel plate just aft of the tee bar by laying back enough tunnel carpet to remove the plate attachment screws.
      2. Separate the primary control cable (8 or 9) at the turnbuckles (6) located in the floor opening aft of the main spar.
      3. Remove the cable pulleys attached to the lower section of the control column tee bar assembly by removing the pulley attachment bolt.
      4. Move the cable guard (see Sketch B) located under the pulley cluster (7) by removing the cotter pin from the exposed end of the guard and sliding it to the left or right as required.
      5. Remove the cotter pins used as cable guards at the pulley (11) in the forward area of the floor opening aft of the main spar.
      6. Disconnect the cable (8 or 9) 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.
      7. Draw the cable back through the floor tunnel.

   c. The primary control cable (5 or 22) in either wing may be removed by the following procedure:

      1. Remove the access plate to the aileron bellcrank (1 or 23) located on the underside of the wing forward of the inboard end of the aileron.
      2. If not previously disconnected, separate the cable at the turnbuckles (6) located in the floor opening aft of the main spar.
      3. Disconnect the cable from the forward end of the aileron bellcrank by removing the cotter pin, nut, washer and bolt.
      4. Draw the cable from the wing.

   d. Either balance cable (3 or 20) may be removed by the following procedure:

      1. Separate the balance cable at the turnbuckle (38) in the right side of the floor opening aft of the main spar.
      2. 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.
      3. Remove the connector clamps (12) securing the interconnecting cable (14 and 17) to the left balance cable (20).
      4. Remove the access plate to the aileron bellcrank (23) located on the underside of the wing forward of the inboard end of the aileron.
      5. Disconnect the cable from the aft end of the aileron bellcrank by removing the cotter pin, nut, washer and bolt.
      6. Draw the cable from the wing.

8. INSTALLATION. (Refer to Figure 8.)

a. The installation of either the right or left primary control cable (8 or 9) that is located in the fuselage may be accomplished as follows:

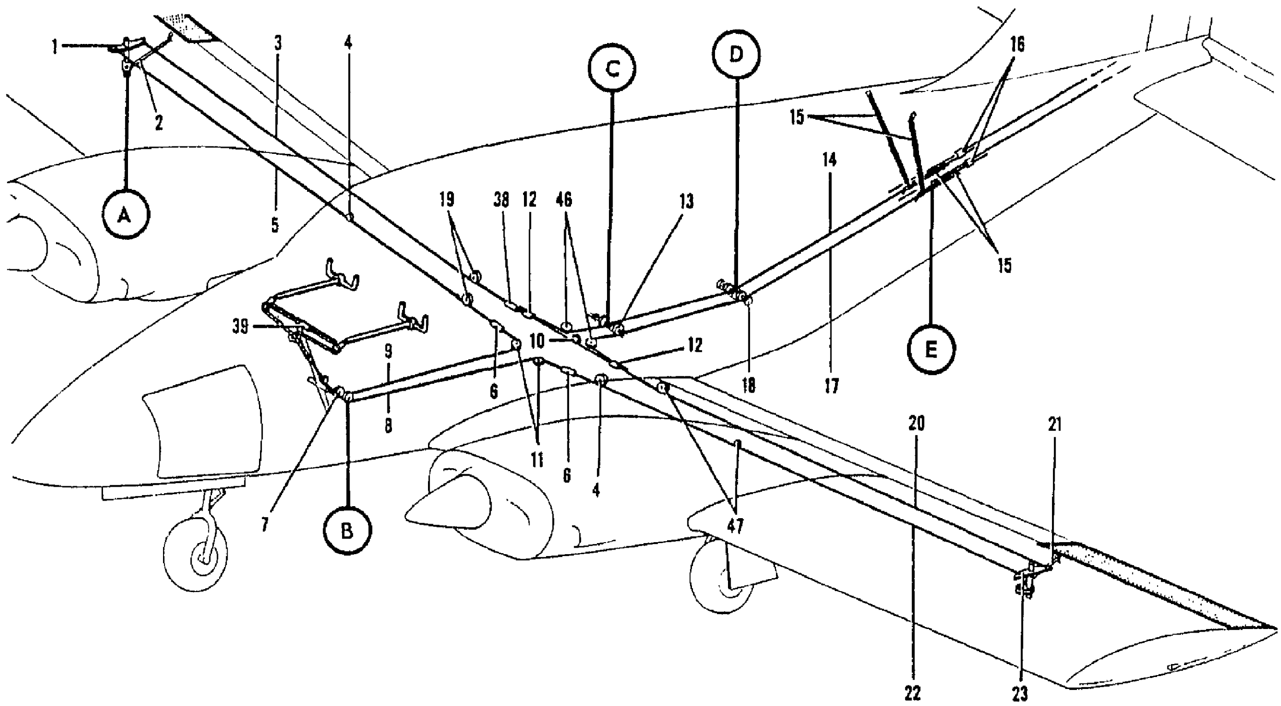
1. Draw the cable through the fuselage floor tunnel.
2. Connect the cable to the end of the control chain and secure using bushing, bolt, nut and cotter pin.
3. Place the cable around the pulley (see Sketch B) that is located in the tunnel.
4. Position cables and install the cable pulleys (21) that attach to the lower section of the tee bar assembly. Secure the bolt, washer and nut. (Refer to Figure 1.)
5. Place the cable around the pulley (11) that is located in the floor opening just aft of the main spar.
6. 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.
7. Check rigging and adjustment per paragraph 11, and install all pulley guards.
8. Position the heat duct and secure with screws.
9. Install the tunnel plate aft of tee bar assembly and secure with screws.
10. Put the floor carpet in place and secure.
11. Place the fuel selector lever on the selector torque tube and secure with pin and cotter pin.
12. Install the lower and upper selector covers and secure with screws.

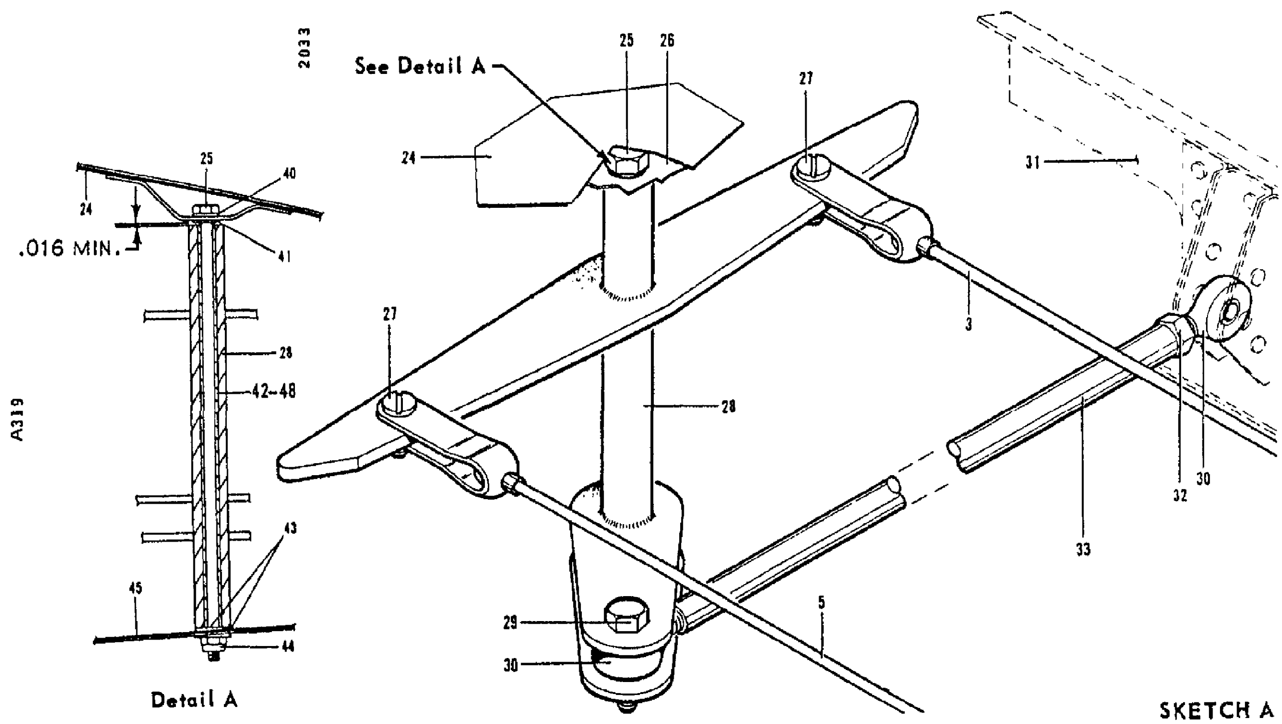
b. The primary control cable (5 or 22) in either wing may be installed by the following procedure:

1. Draw the control cable into the wing.
2. Connect the cable to the forward end of the aileron bellcrank (1 or 23) using a bolt, washer, nut and cotter pin. Allow the cable end to rotate freely on the bellcrank.
3. If the primary control cable in the fuselage is installed, connect the ends at the turnbuckle (6) located in the floor opening aft of the main spar.
4. Check rigging and adjustment per paragraph 11, and install all pulley guards.
5. Install the access plate on the underside of the wing.

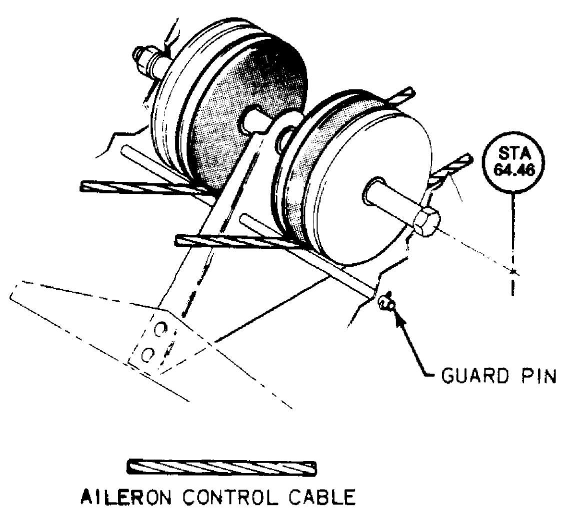
c. Either balance cable (3 or 20) may be installed by the following procedure:

1. Draw the cable into the wing.
2. Connect the cable to the aft end of the aileron bellcrank (1 or 23) using a bolt, washer, nut and cotter pin. Allow the cable end to rotate freely on the bellcrank.
3. Connect the balance cable ends at the turnbuckle (38) in the floor opening aft of the main spar.
4. Check rigging and adjustment per paragraph 11.
5. If the left cable was removed, install the cotter pin cable guard at the pulley (10) located in the center of the floor opening.
6. Reconnect rudder-aileron interconnecting cable (14 or 17) at clamp (12) and set tension of interconnect cable per Table I; see Figure 8, Sketch E.
7. Install the access plate on the underside of the wing.
8. Install the floor panel, seat belt attachments and seats.

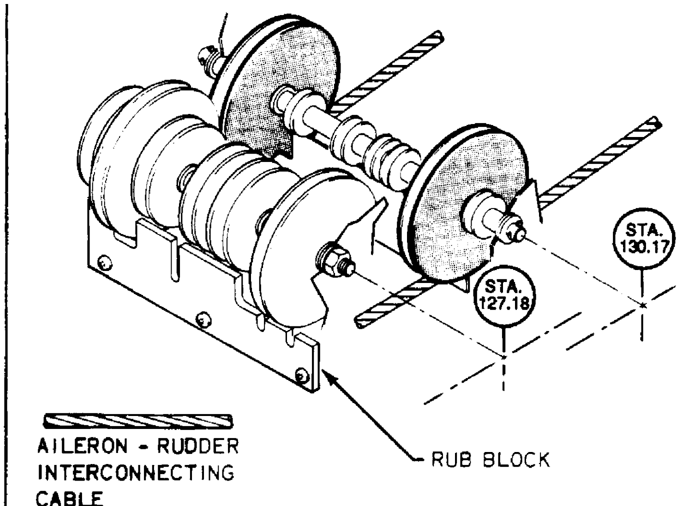




Aileron Controls Installation
Figure 8 (Sheet 1 of 2)



SKETCH B



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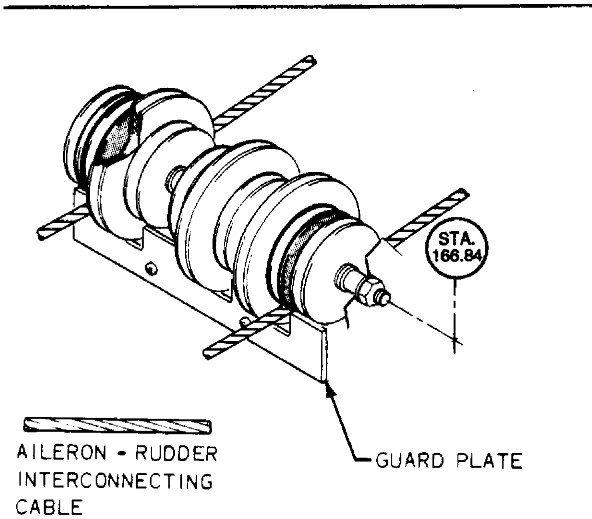
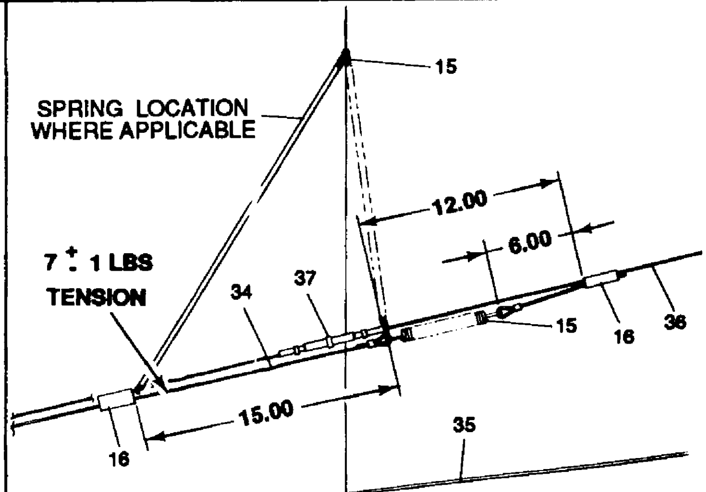


SKETCH D



SKETCH E

1. BELLCRANK, 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. CONNECTOR CLAMPS
13. PULLEY CLUSTER, STA. 130.17
14. INTERCONNECTING CABLE, RIGHT
15. SPRINGS
16. CONNECTOR CLAMPS
17. INTERCONNECTING CABLE, LEFT
18. PULLEY CLUSTER, STA. 166.84
19. PULLEYS
20. CABLE, BALANCE, LEFT
21. CONTROL ROD, LEFT
22. CABLE, CONTROL, LEFT
23. BELLCRANK, LEFT
24. WING SKIN, TOP
25. BOLT ASSY
26. BRACKET
27. BOLT ASSY
28. BELLCRANK ASSY, RIGHT
29. BOLT ASSY
30. ROD END
31. AILERON TRIM TAB
32. JAM NUT
33. CONTROL ROD
34. INTERCONNECTING CABLES
35. FUSELAGE SKIN, BOTTOM
36. CABLE, RUDDER CONTROL
37. TURNBUCKLE, RUDDER, MAIN
38. TURNBUCKLE, AILERON, BALANCE
39. TURNBUCKLE, CONTROL CHAINS
40. WASHER
41. WASHER
42. SPACER
43. WASHER (2 REQ.)
44. NUT
45. WING SKIN, BOTTOM
46. PULLEYS
47. PULLEYS
48. TEFLON TUBE

Aileron Controls Installation
Figure 8 (Sheet 2 of 2)

8a. AILERON BELLCRANK ASSEMBLY.

9. REMOVAL. (Refer to Figure 8.)

a. 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.

b. Remove the access plate to the aileron bellcrank (1 or 23) located on the underside of the wing, forward of the inboard end of the aileron.

c. Relieve tension from the aileron control cables by loosening the balance cable turnbuckle (6) located in the floor opening aft of the main spar.

d. Disconnect the primary (5 or 22) and balance (3 or 20) control cables from the bellcrank assembly by removing cotter pins, nuts, washers and bolts.

e. Disconnect the aileron control rod (33) (Sketch A) at the aft or forward end, as desired.

f. Remove the nut, pivot bolt (25) (Sketch A) and washers that secure the bellcrank. The nut is visible from the underside of the wing.

g. Remove the bellcrank from within the wing.

10. INSTALLATION. (Refer to Figure 8.)

a. Install first the teflon tube (48) then the spacer (42) in the torque tube portion of the bellcrank (28). (See Sketch A.)

b. Place the bellcrank in position in the wing with a washer located between each end of the torque tube and the mounting brackets.

c. Install the bellcrank pivot bolt (25) (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.

d. Install and adjust control rod (33) (Sketch A) and check aileron travel per paragraph 11.

e. Connect the ends of the primary (5 or 22) and balance (3 or 20) control cables to the bellcrank using bolts, washers, nuts and cotter pins. Allow the cable ends to rotate freely on the bellcrank.

f. Tighten the control cables at the balance cable turnbuckle (6) in the floor opening aft of the main spar. Check cable tension per paragraph 11.

g. Install the access plate on the underside of the wing, the floor panel aft of the main spar, seat belt attachments and seats.

11. RIGGING AND ADJUSTMENT OF AILERON CONTROLS.

CAUTION: VERIFY FREE AND CORRECT MOVEMENT OF AILERONS. WHILE IT WOULD SEEM SELF-EVIDENT, FIELD EXPERIENCE HAS SHOWN THAT THIS CHECK IS FREQUENTLY MISINTERPRETED OR NOT PERFORMED AT ALL. ACCORDINGLY, UPON COMPLETION OF AILERON RIGGING AND ADJUSTMENT, VERIFY THAT THE RIGHT AILERON MOVES UP AND THE LEFT AILERON MOVES DOWN WHEN THE CONTROL WHEEL IS TURNED RIGHT; AND THAT THE LEFT AILERON MOVES UP AND THE RIGHT AILERON MOVES DOWN WHEN THE CONTROL WHEEL IS TURNED LEFT.

a. To check and adjust rigging of aileron controls, use the following procedure:

1. Ascertain that the control wheels have been properly rigged. (Refer to Paragraph 5.)

2. Disconnect the rudder-aileron interconnect springs.

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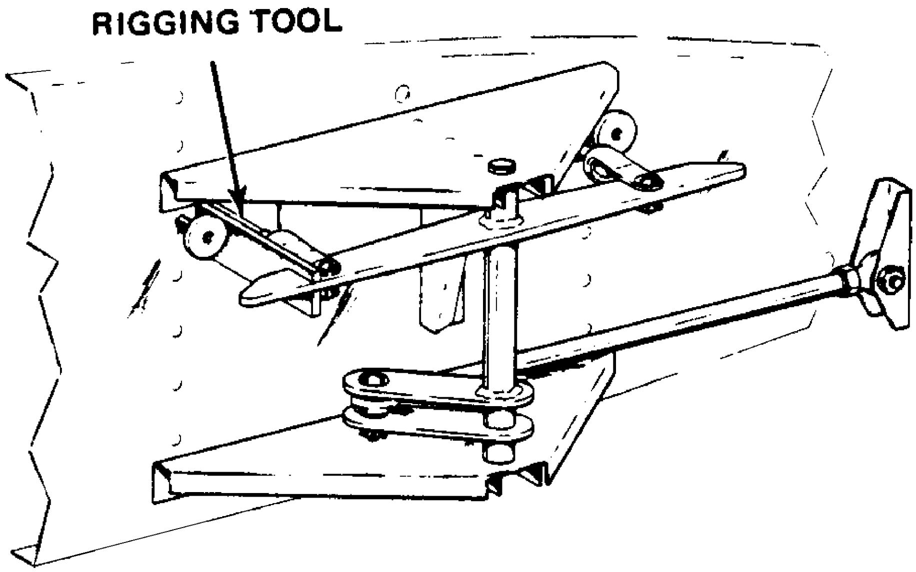


Aileron Bellcrank Rigging Tool
Figure 9

3. Place the control wheel in the centered position and place the tee bar in the full forward position. Maintain the wheel and tee bar in these positions. The tee bar may be kept in this position by placing weights on the stabilator if the stabilator cables have already been tensioned.
4. Remove aileron bellcrank access plates from the underside of the wings, forward of the inboard end of the aileron.
5. Check bellcranks for neutral position. (The neutral position of the bellcrank is the position at which the forward and aft cable connection holes are an equal distance from the adjacent inboard wing rib.) See Figure 24 to fabricate a bellcrank rigging tool.
6. Affix the bellcrank rigging tool as shown in Figure 9 between the forward arm of each bellcrank and the adjacent rib. The slotted end of the tool fits on the arm forward of and adjacent to the primary control cable end. The other end of the tool is positioned so its side contacts the aft side of the bellcrank stop. The bellcrank must be moved to allow a snug fit of the tool between the bellcrank arm and rib. To do so, it may be necessary to loosen a primary control cable or balance cable.

b. Adjust primary and balance cable tension as given in Table I, by the following procedure:
    1. Remove floor panel located directly aft of the main spar by removing the center seats, seat belt attachments and related hardware.
    2. Ascertain that the control wheels are properly rigged (refer to Paragraph 5), and both bellcranks are at neutral position.

3. Adjust the turnbuckles on the primary and balance cables to obtain the proper tension as given in Table I. During adjustment obtain a little more tension on the primary cable to hold the bellcranks in neutral (against the rigging tools), finish with approximately even tension on all cables, and install all pulley guard pins. Primary cable tension may be slightly less than balance cable tension, but it should be within the tension specified.
4. Remove bellcrank rigging tools.

c. Check and adjust the aileron for neutral position by the following procedure:

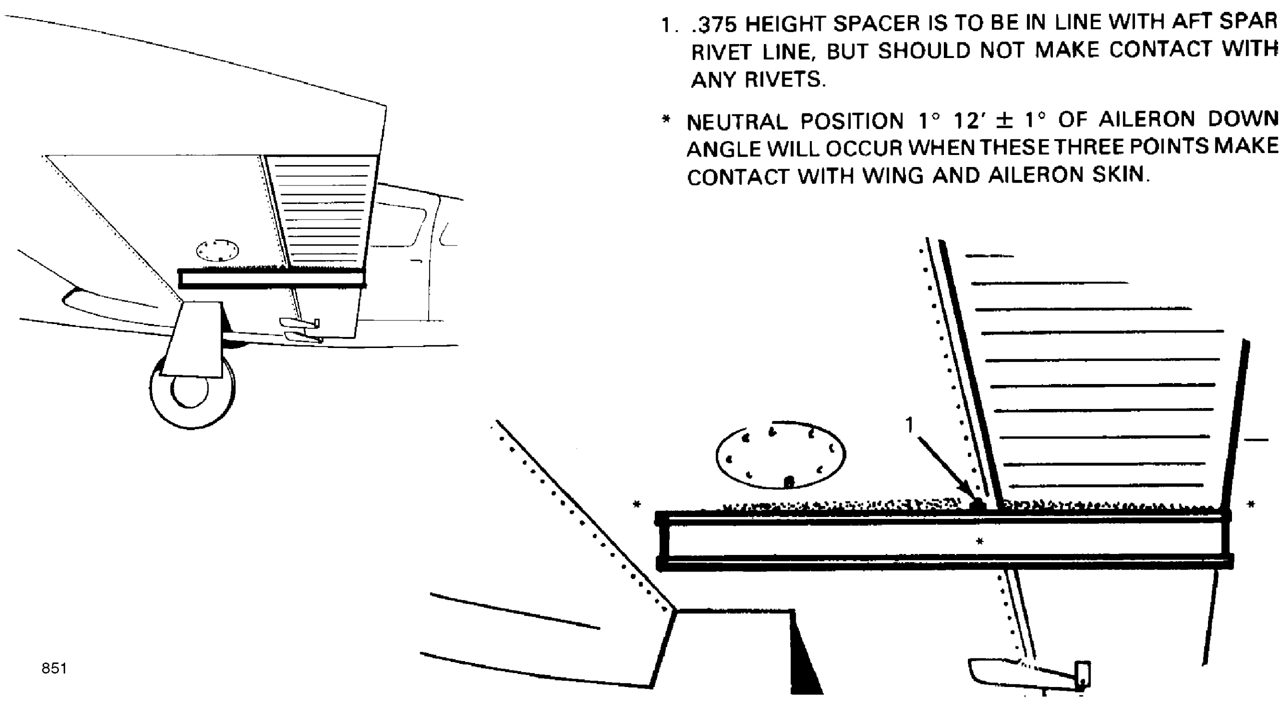
1. Ascertain that the bellcrank rigging tools fit snug between the bellcrank and the rib.
2. Check the aileron for neutral. (The neutral position is the position at which the chord line of the aileron forms a 1° 12’ ± 1° “down” angle with the wing chord at the inboard end of the aileron.) An aileron rigging tool can be fabricated from dimensions given in Figure 25. While measuring the neutral position, a light “up” pressure shall be maintained at the center of the aft edge of the aileron. Use only enough pressure to remove the slack between the bell crank and the aileron.
3. Place the aileron rigging tool as shown in Figure 10 against the underside of the wing and aileron as close as possible to the inboard end of the aileron without contacting any rivets. The tool must be positioned parallel with the wing ribs, and the aft end of the tool even with the trailing edge of the aileron.
4. With the aileron control rod connected between the bellcrank and aileron, check that the surface of the wing contacts the tool at its forward surface and at the spacer, and the trailing edge of the aileron contacts the aft end of the tool. The aileron is neutral at this position. While measuring the neutral position, a light “up” pressure shall be maintained at the center of the aft edge of the aileron, just sufficient to remove the slack between the bellcrank and the aileron.
5. Should the three points not contact, loosen the jam nut at the aft end of the control rod and rotate the rod until the three points contact. After adjustment retighten the jam nut.

d. Check the ailerons for correct travel from neutral per dimensions given in Table I, by the following procedure:

1. Center the bubble of a protractor over the surface of an aileron at neutral position and note the reading.
2. Move the aileron full up and down, and check the degree of travel for each direction. 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. When measuring up travel of the aileron, maintain a light down pressure on the center of the trailing edge of the aileron. When measuring down travel of the aileron, maintain a light up pressure on the center of the trailing edge of the aileron. Use only enough pressure to remove any slack between the bellcrank and aileron.
3. Should the travel not be correct, the travel may be set by rotating the bellcrank stops in or out. Stops are located in the wing attached to the rib that is adjacent to the aileron bellcrank.
4. Repeat this procedure for the other aileron.

e. Check the bellcrank stops to assure that the bellcrank contact is made simultaneously, but still have cushion before contacting the control wheel stops. On models with adjustable control wheel stops, maintain a clearance of .030 to .040 inches between sprocket pin and stop bolts.

f. Check to insure that the aileron stops do not bottom before the control wheel is turned 90 ± 1 degree from its centered position. If the wheel cannot be turned 90°, lengthen the drive cable and shorten the balance cable an equal amount. Recheck cable tension.



Aileron Rigging Tool
Figure 10

g. Reconnect rudder-aileron interconnect springs.

h. Check control operation, and bolts and turnbuckles for safety and connect interconnecting spring. (Refer to Figure 8, Sketch E.)

i. Install access plates and panels.

NOTE: When an out-of-trim condition persists despite all the rigging corrections that can be made, there is a possibility that the trailing edge of the aileron has been used to move the aircraft forward. This can result in a slight bulging of the aileron contour at the trailing edge which will cause an out-of-trim condition that is very difficult to correct.

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12. STABILATOR CONTROLS.

12a. TROUBLESHOOTING. See Table IV.

TABLE IV
TROUBLESHOOTING STABILATOR CONTROLS

Trouble	Cause	Remedy
Lost motion between control wheel and stabilator.	Cable tension too low.	Adjust cable tension per Paragraph 15.
	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 per Paragraph 15.
	Binding control column.	Adjust and lubricate per Paragraph 5.
	Pulleys binding or rubbing.	Replace binding pulleys and/or provide clearance between pulleys and brackets.
	Cables not in place on pulleys.	Install cables correctly.
	Cables crossed or routed incorrectly.	Check routing of control cables.
	Bent stabilator hinge.	Repair or replace stabilator hinge.
	Binding bob weight linkage.	Inspect and adjust or replace.
Incorrect stabilator travel.	Stabilator stops incorrectly adjusted.	Adjust stop screws per Paragraph 15.
Correct stabilator travel cannot be obtained by adjusting stops.	Stabilator cables incorrectly rigged.	Rig cables in accordance with Paragraph 15.
	Bob weight incorrectly rigged.	Rig in accordance with Paragraph 15.

13. REMOVAL. (Refer to Figure 11.)

a. To remove either the forward or aft stabilator cables, first remove the access panel to the aft section of the fuselage.

b. Relieve cable tension from control system by loosening one of the cable turnbuckles in the aft section of the fuselage.

c. Disconnect the stabilator down springs and clamps (18) from the upper stabilator control cable in the aft section of the fuselage.

d. Either forward stabilator cable (20) may be removed by the following procedure:

1. Remove the floor tunnel cover in the aft area of the cabin by removing the trim plate, the carpet over the tunnel and the cover attachment screws.
2. Remove the cable guard plate (see Sketch B) from the underside of the pulley cluster (5) in the aft area of the tunnel opening by removing the guard attachment screws.
3. Remove the floor panel 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.
4. Within the floor opening, remove the cable rub blocks (see Sketch A) that are attached to the spar housing by removing the block attachment screws. Also remove the cotter pin cable guard at the pulley cluster (4) in the aft area of the opening.
5. 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.
6. If the right (upper) stabilator control cable (20) is to be removed, remove the cotter pin cable guards at the pulley (1) located in the forward area of the tunnel.
7. Disconnect the cables (20) from the lower end of the tee bar by removing cotter pin, nut, washer and bolt.
8. Draw the cable aft through the floor tunnel.

e. Either aft stabilator control cable (7) may be removed by the following procedure:

1. Disconnect the cable end at the balance arm (14) of the stabilator by removing the cotter pin, nut, washer and bolt.
2. Remove the cotter pin cable guard at the pulleys (9) or (13) located either above or below the balance arm.
3. Remove the cable from the airplane.

14. INSTALLATION. (Refer to Figure 11.)

a. The forward stabilator cables (20) may be installed by the following procedure:

1. Draw the control cable through the floor tunnel. Ascertain that the right (upper) cable (20) is routed around the pulley (1) that is in the forward area of the forward floor tunnel.
2. Connect the cables (20) to the lower end of the control column tee bar with belt, washer, nut and cotter pin. Allow the cable to be free to rotate.
3. If the aft control cable (7) is not installed, install per step b.
4. Connect the forward control cable to the aft cable at the turnbuckles (17) in the aft section of the fuselage.
5. Set cable tension per Table I and check rigging and adjustment per paragraph 15.

6. For the right control cable (20), install the cotter pin cable guard at the pulley (1) in the forward area of the tunnel.
7. Within the forward area of the floor opening aft of the main spar, install the cable rub blocks (see Sketch A) to the spar housing and secure the screws.
8. In the area of the floor opening, install the cotter pin cable guard at the pulley cluster (4).
9. Install the cable guard plate (see Sketch B) under the pulley cluster (5) located in the aft area of the aft floor tunnel and secure with screws.
10. Connect stabilator down spring and clamps (18) to upper aft stabilator control cable. (See Sketch C.)
11. Install the tunnel plate directly aft of the tee bar assembly and secure with screws.
12. Put the floor carpet in place and secure.
13. Install the floor panel aft of the main spar and secure with screws. Install the seat belt attachments and seats.
14. Install the cover and carpet of the aft floor tunnel.

b. Either aft stabilator control cable (7) may be installed by the following procedure:

1. Route the cable (7) around its pulley (9) or (13) located either over or under the balance arm (14) of the stabilator.
2. Connect the cable to the stabilator balance arm and secure with bolt, washer, nut and cotter pin. (Insure bushing is installed with bolt.)
3. Connect the aft cable to the forward cable at the turnbuckle (17) in the aft section of the fuselage. The upper aft cable (7) connects to the right forward cable (20) and the lower cable (7) to the left cable (20).
4. Connect the stabilator down spring to the upper aft control cable (see Sketch C).
5. Set cable tension per Table I and check rigging and adjustment per paragraph 15.
6. Install the cotter pin cable guard at the pulley (9) or (13) where required.

c. Install the access panel to the aft section of the fuselage.

15. RIGGING AND ADJUSTMENT.

CAUTION: VERIFY FREE AND CORRECT MOVEMENT OF STABILATOR. WHILE IT WOULD SEEM SELF-EVIDENT, FIELD EXPERIENCE HAS SHOWN THAT THIS CHECK IS FREQUENTLY MISINTERPRETED OR NOT PERFORMED AT ALL. ACCORDINGLY, UPON COMPLETION OF STABILATOR RIGGING AND ADJUSTMENT, VERIFY THAT THE REAR EDGE OF THE STABILATOR MOVES UP WHEN THE WHEEL IS PULLED BACK; AND, THAT THE REAR EDGE OF THE STABILATOR MOVES DOWN WHEN THE WHEEL IS PUSHED FORWARD.

a. To check and set the correct degree of stabilator travel, the following procedure may be used:

1. Level the airplane. (Refer to Leveling, Section II.)
2. Place the stabilator in neutral position. (The neutral position of the stabilator is with the stabilator cord line parallel with the top of the front seat track.) A stabilator rigging tool can be fabricated from dimensions given in Figure 26.
3. Check the stabilator travel by placing a rigging tool on the upper surface of the stabilator as shown in Figure 12.

4. Set on a bubble protractor the number of degree up travel as given in Table I and place it on the rigging tool. Raise the trailing edge of the stabilator and determine that when the stabilator contacts its stops, the bubble of the protractor is centered.

   NOTE: The stabilator should contact both of its stops before the control wheel contacts its stop.

5. Set on the protractor the number of degrees down travel as given in Table I and again place it on the rigging tool. Lower the trailing edge of the stabilator and determine that when it contacts its stops, the bubble of the protractor is centered.
6. Should the stabilator travel be incorrect in either the up or down position, remove the tail cone by removing the attachment screws. Turn the stops located at each stabilator hinge in or out (refer to Figure 21) to obtain the correct degree of travel.
7. Check to insure that the stabilator up and down stops are contacted before the tee bar stops are contacted.
8. Ascertain that the locknuts of the stop screws are secure and then reinstall the tail cone.

b. To check and set stabilator control cable tension, the following procedure may be used:

   l. Ascertain that the stabilator travel is correct.
   2. Remove the access panel to the aft section of the fuselage.
   3. Disconnect the down springs.
   4. Position the tee bar at a forward angle of seven degrees (neutral position of tee bar) and secure in this position with suitable tool.
   5. Place the stabilator in neutral (refer to Step a) and maintain in that position.
   6. Check control cables for the correct tension as given in Table I and ascertain that all pulley guard pins are installed.
   7. Should tension be incorrect, loosen the turnbuckles in the aft section of the fuselage and adjust the turnbuckles to obtain correct tension.

      NOTE: Adjust all cables evenly to avoid uneven strain on aircraft components.

   8. Check safety of all turnbuckles and bolts.
   9. With the stabilator in neutral, adjust the stabilator tab pushrod to streamline the tab with the stabilator. This is the neutral position of the tab.
   10. Check the full travel of the control wheel with relation to the full travel of the stabilator to determine that the stabilator contacts its stops before the control wheel contacts its stops.
   11. Reconnect the down springs and reinstall access panels.
   12. Refer to Paragraph 21 for rigging and adjustment of stabilator trim.

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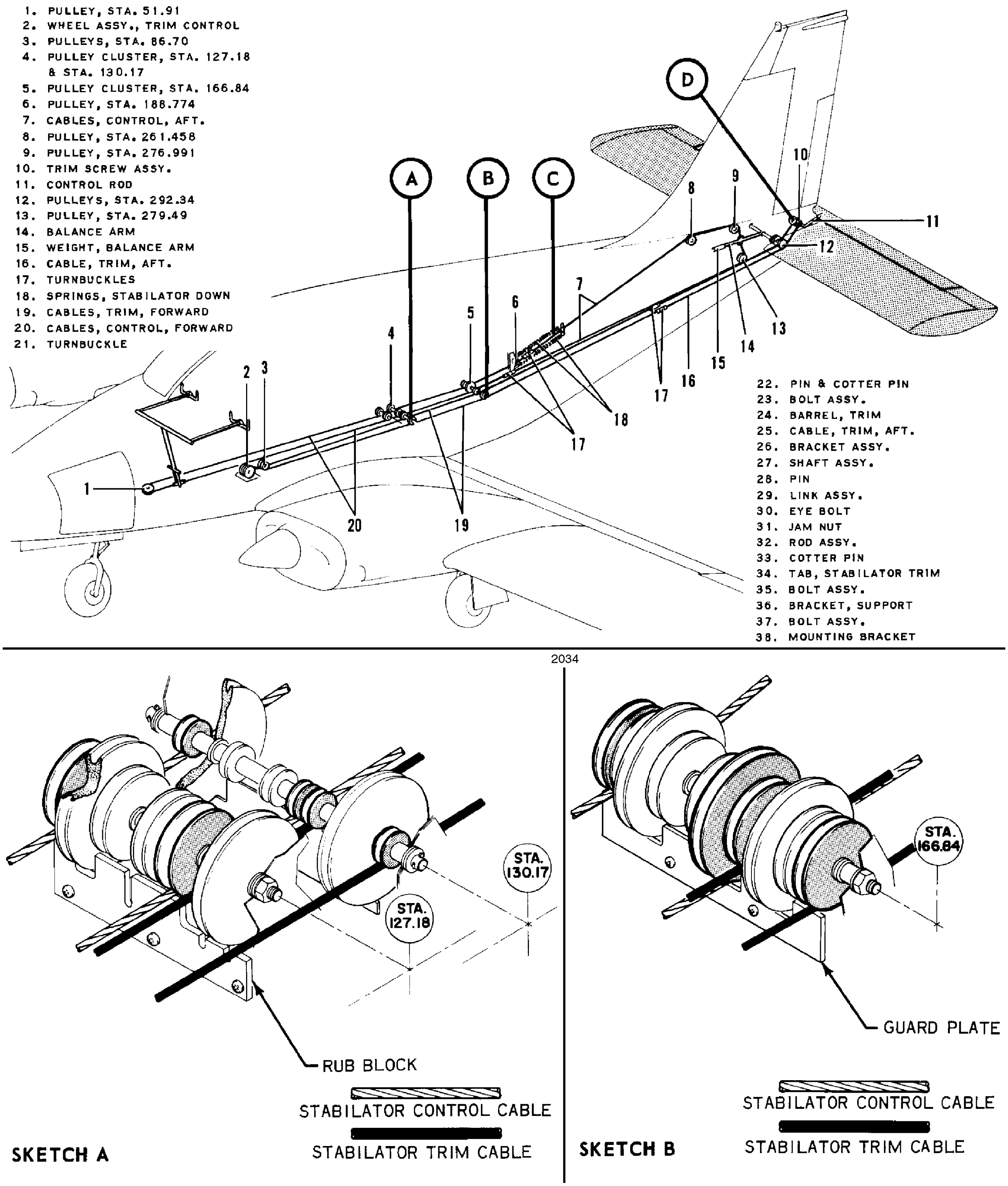

Stabilator and Stabilator Trim Controls Installation
Figure 11 (Sheet 1 of 2)

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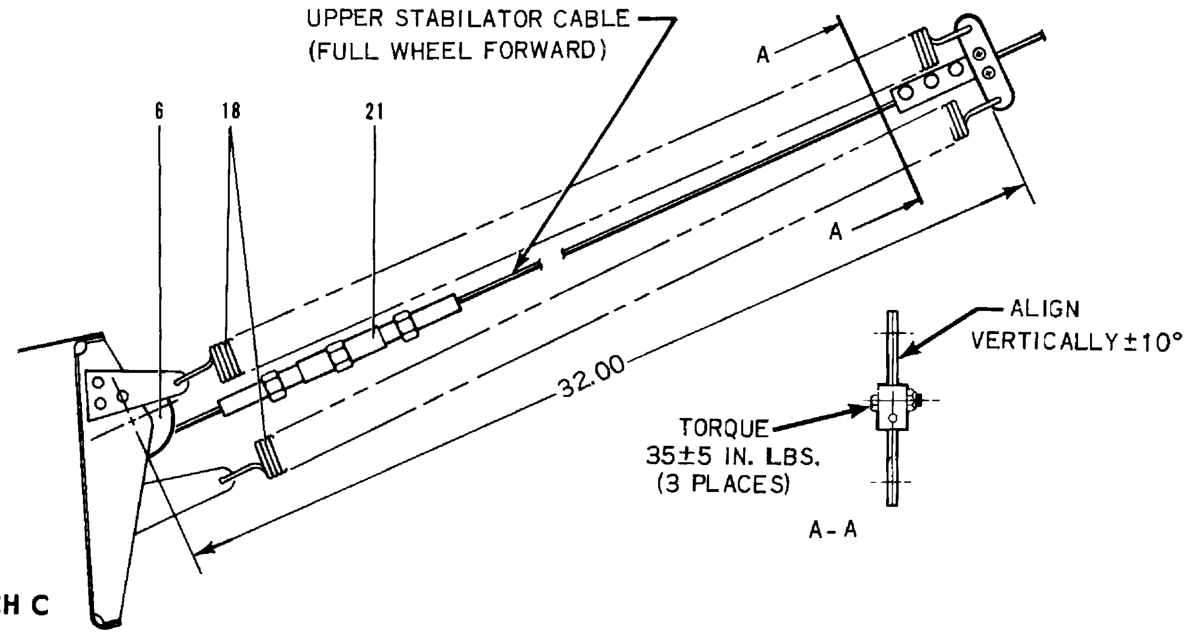

SKETCH C

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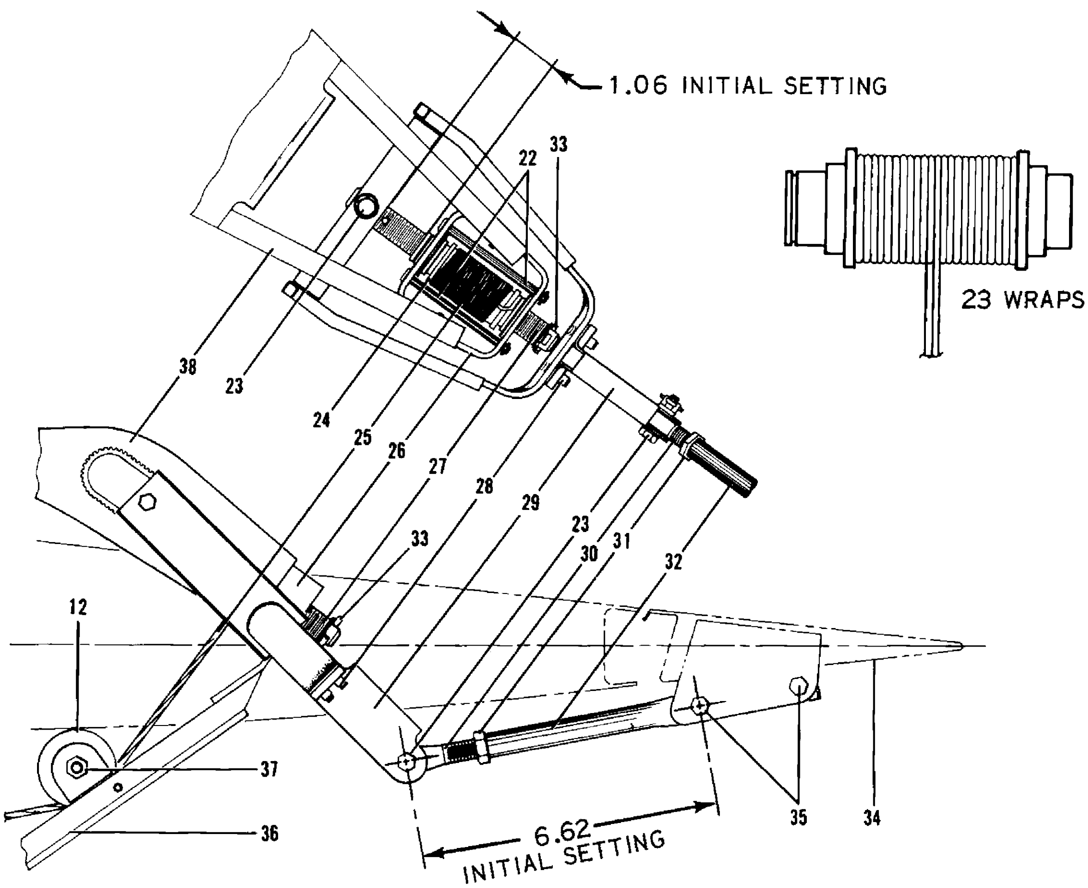

SKETCH D

Stabilator and Stabilator Trim Controls Installation
Figure 11 (Sheet 2 of 2)

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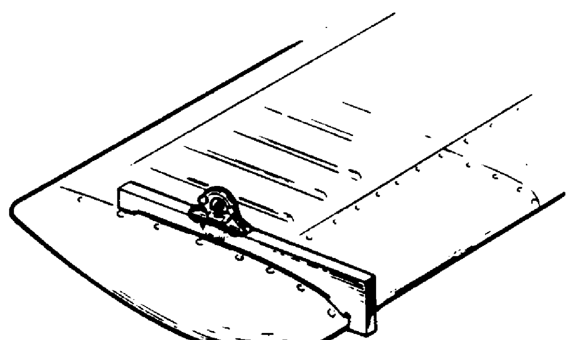

Stabilator Rigging Tool
Figure 12

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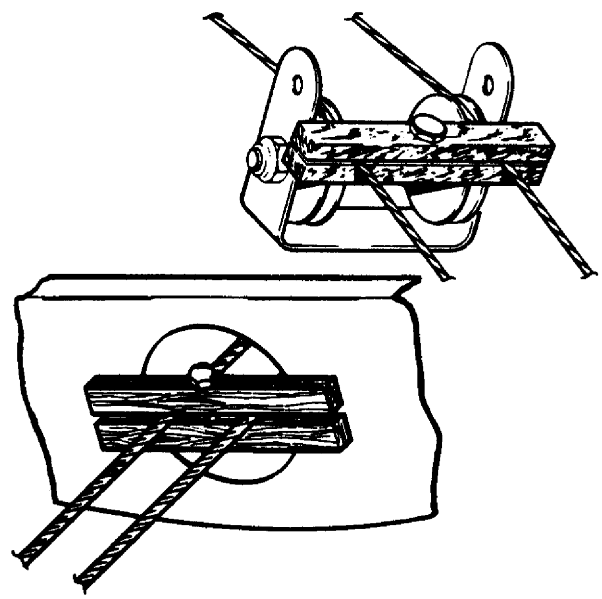


Securing Trim Cables
Figure 13

16. STABILATOR TRIM CONTROLS.

16a. TROUBLESHOOTING. See Table V.

TABLE V
TROUBLESHOOTING STABILATOR TRIM CONTROLS

Trouble	Cause	Remedy
Lost motion between trim control wheel and trim tab.	Cable tension too low.	Adjust in accordance with Paragraph 21.
	Cables not in place on pulleys.	Install cables according to Paragraphs 18 and 20.
	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 per Paragraph 21.
	Pulleys binding or rubbing.	Replace binding pulleys. Provide clearance between pulleys and brackets.
	Cables not in place on pulleys.	Refer to Paragraphs 18 and 20.
	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 per Paragraph 21.
	Trim drum in-correctly wrapped.	Check and/or adjust rigging per Paragraph 21.
Trim indicator fails to indicate correct trim position.	Trim indicator unit not adjusted properly.	Adjust in accordance with Paragraph 21.

16b. STABILATOR TRIM CONTROLS (FORWARD).

17. REMOVAL. (Refer to Figure 11.)

a. To remove the trim control wheel assembly and/or the trim control cables, first remove the panel to the aft section of the airplane.

b. If the aft trim cable (16) is not to be removed, block the cables at the pulleys (12) in the tail cone to prevent them from unwrapping from the trim drum. (Refer to Figure 13.)

c. 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 (17) in the aft section of the fuselage.

d. The control wheel with drum may be removed by the following procedure:

1. Remove the control wheel cover by removing the cover attaching screws.
2. 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 (2).
3. Unwrap the left cable from the drum.
4. 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.
5. Tie the cables forward to prevent them from slipping back into the floor tunnel.

e. The trim control cables (19) may be removed by the following procedure:

1. Remove the center seats, and the pilot and rear seats if desired.
2. Remove the seat belts attached to the forward floor tunnel by removing attachment nuts, washers and bolts.
3. Unfasten the carpet from the aft portion of the forward floor tunnel and lay it forward.
4. Remove the tunnel cover located between the trim control wheel and the spar cover by removing attachment screws.
5. Remove the cable pulleys (3) located in the forward tunnel by removing the cotter pin, washer and clevis pin.
6. 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.
7. Remove the cable rub blocks (39) located in the floor opening on the aft side of the main spar by removing the block attachment screws.
8. Remove the trim plate located on top of the forward end of the aft floor tunnel.
9. Remove the carpet from the aft floor tunnel.
10. Remove the cover plate from the top of the aft floor tunnel by removing attachment screws.
11. Remove the cable guard (see Sketch A) from the underside of the trim cable pulleys (4) located at station 130.167 by removing the cotter pin and withdrawing the roll pin.
12. Remove the cable fairlead (see Sketch B) from the underside of the pulley cluster (5) located at station 166.837 by removing the plate attachment screws.
13. With the cables disconnected from the trim control wheel, draw the cable(s) through the floor tunnel.

18. INSTALLATION. (Refer to Figure 11.)

a. The trim control wheel with drum may be installed by the following procedure:

1. Wrap the right trim cable on the trim drum by inserting the swagged 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.
2. 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.
3. Wrap the left trim cable on the drum by inserting the swagged 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.
4. Lubricate and install the bushing in the control wheel and drum.
5. 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 from the left side and install washer and nut.
6. Install the cover over the control wheel and secure with screws, unless the control cables have yet to be installed.

b. The trim control cables (19) may be installed by the following procedure:

1. Draw the cable(s) through the floor tunnel.
2. Wrap the cable drum and install the trim control wheel as given in step a.
3. Position the cable pulleys (3) on their mounting bracket and install the clevis pin, washer and cotter pin.
4. Connect the cable (19) to the aft cable (16) at the turnbuckle (17) in the aft section of the fuselage. Install aft cable (16) if not installed.
5. Install the cable fairlead (see Sketch B) at the underside of the pulley cluster (5) located at station 166.837 and secure with screws.
6. Remove the blocks that secure the aft trim cable and check that the cables are seated on their pulleys.
7. Set cable tension per Table I and check rigging and adjustment per paragraph 21. Safety all turnbuckles.
8. Install the roll pin type cable guard (see Sketch A) at the underside of the pulleys (4) located in the forward area of the floor tunnel and secure it with a cotter pin.
9. Install the cable rub blocks (39) located on the aft side of the main spar housing and secure with screws.
10. Install the tunnel cover on the forward tunnel and secure with screws.
11. Install the carpet over the floor tunnel.
12. Install the cover over the trim control wheel and secure with screws and special washers.
13. Install the seat belts removed from the top of the floor tunnel and secure with bolt, washer and nut.
14. Install the floor panel and seat belt attachments aft of the main spar, and secure panel with screws.
15. Install the aft floor tunnel and secure with screws.
16. Install the carpet over the aft floor tunnel.
17. Install the trim plate on top of the forward end of the aft floor tunnel.

c. Install the panel to the aft section of the airplane and the seats.

18a. STABILATOR TRIM CONTROLS (AFT).

19. REMOVAL. (Refer to Figure 11.)

a. Remove the access panel to the aft section of the fuselage.

b. Block the trim cables (19) at the first set of pulleys (5) forward of the cable turnbuckles (17) in the aft section of the fuselage by a method shown in Figure 13.

c. Remove the tail cone attachment screws and tail cone from the airplane.

d. Block the cable (16) at the trim barrel (24) to prevent them from unwrapping at the barrel.

e. Disconnect the cables (16) and (19) at the turnbuckles (17).

f. Remove the cable guard pins (22) at the trim screw, and also at the pulleys (12) located below the trim mechanism at station 292.374.

g. Remove the bolt assembly (23) which connects the forward end of the trim screw with the link assembly (29).

h. Unscrew the screw (27) from the trim barrel (24).

i. Remove the four machine screws securing the two parts of the bracket assembly (26) to the mounting bracket (38).

j. Separate the two parts of the bracket assembly (26) and remove the trim barrel and cable. Note the amount and placement of washers at each end of the barrel, to simplify reassembly.

k. Remove the barrel and cables from the airplane.

20. INSTALLATION. (Refer to Figure 11.)

a. Wrap the trim barrel (24) by first laying the center (as measured equally from each end to the center of the cable) of the aft trim cable (16) in the slot of the barrel (24). 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.

b. Block both cables by clamping them between two pieces of wood laid next to the wraps to prevent them from unwrapping.

c. Install the barrel between the two parts of the bracket assembly (26). Be sure to install the washers at both ends of the barrel before installing it in the brackets.

d. Secure the barrel and bracket assembly (26) to the mounting bracket (38) with the four machine screws.

e. Install the screw (27) into the barrel (24) with the drilled bolt hole facing towards the front of the airplane.

f. Position the stabilator and trim tab in a neutral position (refer to paragraph 21) and adjust the trim screw till the bolt hole in the end aligns with the bolt hole in the yoke of the link assembly (29) then install the bolt assembly (23) and secure.

g. Route the cable (16) around the pulleys at station 292.374 and forward to the turnbuckles (17) in the fuselage.

h. Ascertain that the cables are in the pulley grooves.

i. Connect the cables (16) to the turnbuckles (17) and remove the blocking from both the forward and aft cables.

j. Set cable tension in accordance with Table I and check rigging and adjustment per paragraph 21, then install the guard pins (22) at the pulleys (12).

k. Install the tail cone and secure with screws.

l. Install the access panel to the aft section of the fuselage.

21. RIGGING AND ADJUSTMENT OF STABILATOR TRIM CONTROLS. (Refer to Figure 11.)

CAUTION: VERIFY FREE AND CORRECT MOVEMENT OF STABILATOR TAB. WHILE IT WOULD SEEM SELF-EVIDENT, FIELD EXPERIENCE HAS SHOWN THAT THIS CHECK IS FREQUENTLY MISINTERPRETED OR NOT PERFORMED AT ALL. ACCORDINGLY, UPON COMPLETION OF STABILATOR TRIM RIGGING AND ADJUSTMENT, VERIFY THAT THE STABILATOR TAB MOVES UP WHEN THE TRIM WHEEL IS TRIMMED DOWN; AND, THAT THE STABILATOR TAB MOVES DOWN WHEN THE TRIM WHEEL IS TRIMMED UP.

a. Level the airplane. (Refer to Leveling, Section II.)

b. Remove the tail cone fairing from the fuselage by removing the attaching screws.

c. Remove the access panel to the aft section of the fuselage.

d. 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 12. 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.

e. 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 f.

   1. Ascertain that the cable is wrapped 23 times around the barrel as shown in Figure 11.
   2. The trim screw is adjusted to an initial length of 1.06 inches as shown in Figure 11.
   3. The actuating rod is initially adjusted to 6.62 inches in length as shown in Figure 11.
   4. The trim cable tension is correct in accordance with Table I. If the cables were disconnected and replaced, rotate the control wheel several times to allow the cables to seat and then recheck the tension, and install all pulley guard pins.

f. Turn the trim control wheel until the trim tab streamlines with the neutral stabilator.

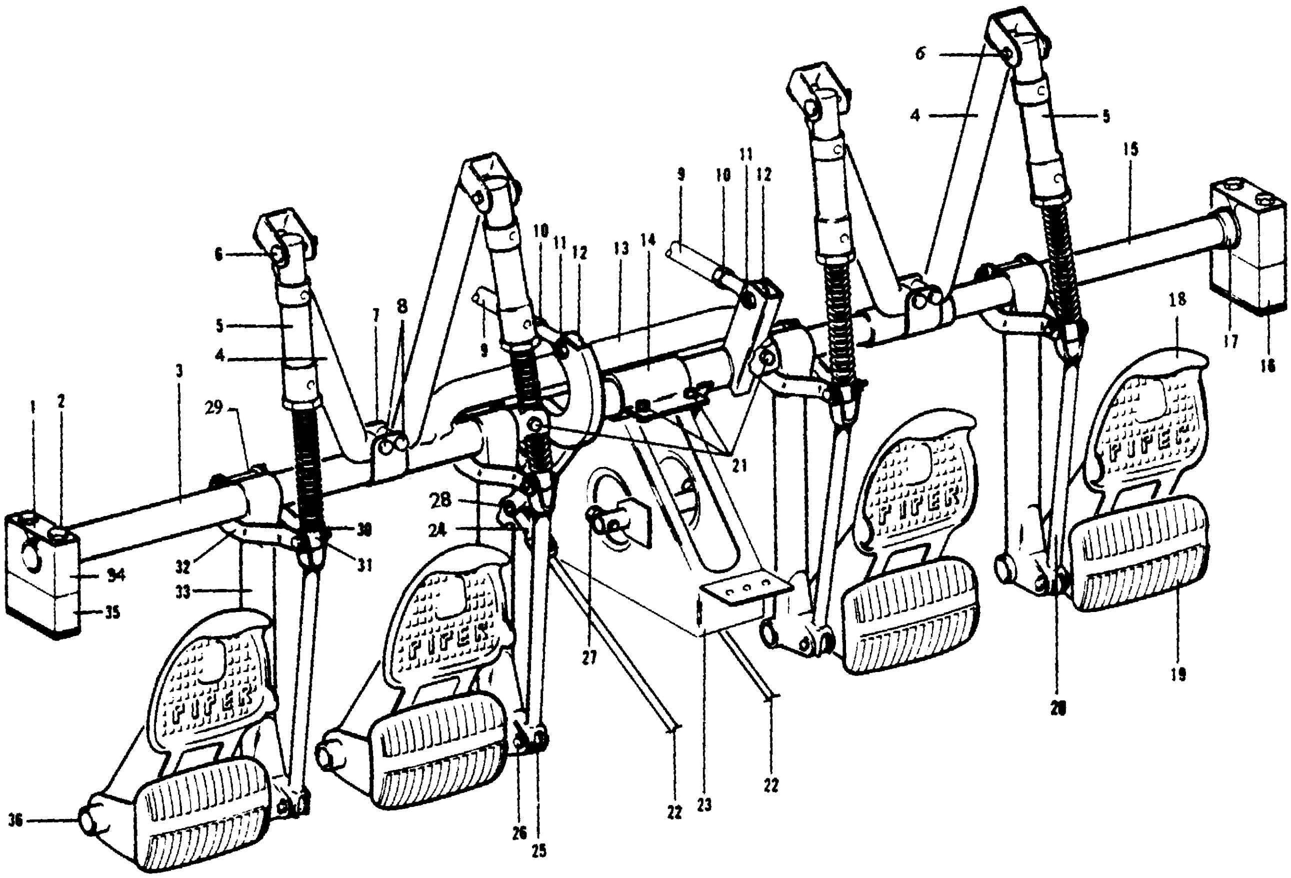
g. Check the bubble of the protractor over the neutral tab and then check the tab travels as given in Table I. The degree of travel on the protractor is determined by taking the difference between the protractor reading at neutral and up, and neutral and down. The bubble must be centered at each reading with the airplane level.

h. To obtain the correct travels, if incorrect, adjust by disconnecting the link (29) at the rod assembly (32) rod end and turning the end in or out as required. Reconnect the rod end to the link.

i. Secure the jam nut (31) on the rod assembly.

j. Turn the trim wheel to full travel and check for turnbuckle clearance and location of tab indicator.

k. Reinstall the tail cone fairing and aft fuselage access panel.



1. PLATE
2. BOLT & NUT
3. TUBE, LEFT, OUTER
4. VEE BRACE
5. BRAKE CYLINDER
6. CLEVIS PIN & COTTER PIN
7. BRACKET
8. BOLT, WASHER & NUT
9. ROD, NOSE WHEEL STEERING
10. JAM NUT
11. BOLT & NUT
12. ROD END, STEERING
13. TUBE, LEFT, CENTER
14. BEARING, SUPPORT
15. TUBE, RIGHT, OUTER
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 SUPPORT
24. CABLE END
25. ROD END
26. CLEVIS PIN & COTTER PIN
27. STOPS, RUDDER PEDAL (UP TO 1974 MODELS)
28. BOLT, WASHER, NUT & COTTER PIN
29. PIN, WASHER, & COTTER PIN
30. CLEVIS PIN & COTTER PIN
31. ROD, BRAKE CYLINDER
32. IDLER ARM
33. TUBE, RUDDER CONTROL
34. SUPPORT BLOCK, UPPER
35. SUPPORT BLOCK, LOWER
36. TUBE, RUDDER CONTROL

Rudder and Brake Pedal Installation
Figure 14

22. RUDDER PEDAL ASSEMBLY.

22a. TROUBLESHOOTING. See Table VI.

TABLE VI
TROUBLESHOOTING RUDDER CONTROLS

Trouble	Cause	Remedy
Lost motion between rudder pedals and rudder.	Cable tension too low.	Adjust cable tension per Paragraph 28.
	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 per Paragraph 28.
	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.	Rig in accordance with Paragraph 28.
Incorrect rudder travel.	Rudder bellcrank stop incorrectly adjusted.	Rig in accordance with Paragraph 28.
	Nose wheel contacts stops before rudder.	Rig in accordance with Paragraph 28.

23. REMOVAL. (Refer to Figure 14.)

a. Remove the access panel to the aft section of the fuselage.

b. Relieve rudder and stabilator cable tension by loosening one of the rudder and stabilator cable turnbuckles in the aft section of the fuselage.

c. Remove the tunnel plate just aft of the tee bar by laying back enough tunnel carpet to remove the plate attachment screws.

d. Disconnect the stabilator control cable from the lower end of the tee bar assembly.

e. 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.

f. Disconnect the control cable (22) ends from the arms on the torque tube by removing the cotter pins, washers, nuts and bolts (28).

g. Disconnect the steering rods (9) at the control arms by removing nuts and bolts (11).

h. Disconnect the brake cylinders (5) at the lower end of each cylinder rod (31) by removing the cotter pins and clevis pins (30).

i. Disconnect the vee brace(s) (4) from the torque tube by removing nuts, washers and bolts (8) that secure the strap bracket (7) to the vee brace.

j. Disconnect the torque tube support bracket (23) where it attaches to the floor tunnel by removing its attachment bolts.

k. Remove the two bolts (21) that extend through the torque tube and are located at the center of the tube assembly over the floor tunnel. Compress the tubes.

l. Disconnect the torque tube support blocks (34 and 35) from their support brackets on each side of the fuselage by removing the attachment nuts, washers and bolts (2).

m. Remove the trim side panels, if desired.

n. Remove the assembly from the airplane. Note the spacer washer (17) on each end and between the support blocks.

24. INSTALLATION. (Refer to Figure 14.)

a. Assemble the torque tube assembly as shown in Figure 14. Do not at this time install the two bolts through the center of the tube assembly.

b. Place the upper support blocks (34) on the ends of the torque tube assembly. Note that a washer (17) is required on each end of the tube.

c. Position the support blocks (34 and 35) 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.

d. Align the bolt holes in the center area of the torque tube assembly, install bolts, washers and nuts (21) and tighten.

e. Position the torque tube support bracket (23) on the floor tunnel and secure with bolts.

f. Position the vee brace(s) (4) on the torque tube, install the strap bracket (7) around the torque tube and brace, and secure with bolts, washers and nuts (8).

g. Check that the rod end (24) on the clevis rod (20) is adjusted to give a dimension of 7.94 inches between hole centers.

h. Connect the ends of the brake cylinder rods (31) and clevis rods (20) to the idler arms (32) and secure with clevis and cotter pins (30).

i. Connect the steering rods (9) to the rudder pedals (19) and secure with bolts and nuts (11). Check steering rod adjustment per Alignment of Nose Gear, Section VI.

j. 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.

k. 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 (28). Allow the ends free to rotate.

l. Swing the tee bar into place and secure with attachment bolts, washers and nuts with the bolts inserted in through each side of the floor tunnel.

m. Connect the stabilator control cables to the lower end of the tee bar with bolt, washer and nut and secure with cotter pin. Allow the cable ends free to rotate.

n. Set rudder cable tension and check rigging and adjustment per paragraph 32.

o. Set stabilator cable tension and check rigging and adjustment per paragraph 15.

p. Check aileron cable tension.

q. Check safety of bolt and turnbuckles.

r. Install the floor tunnel plate and secure with screws. Fasten the tunnel carpet in place.

s. Install the access to the aft section of the fuselage.

24a. RUDDER BAR INSPECTION AND REPAIR. (See Figure 15.)

In serial numbers 34-7250001 thru 34-7350129 only, for those aircraft with original configuration rudder bar assemblies: if inspection reveals cracks in the area noted in Figure 15; the rudder bar may be repaired as shown in Figure 15.

25. RUDDER CONTROLS.

25a. TROUBLESHOOTING. See Table VI.

26. REMOVAL. (Refer to Figure 16.)

a. To remove either the forward (2) or aft (12) rudder cables, first remove the access panel to the aft section of the fuselage, then disconnect interconnecting cables (18) from rudder cables (12).

b. Disconnect the desired cable at the turnbuckles (9) in the aft section of the fuselage.

c. Either forward rudder cable (2) may be removed by the following procedure:

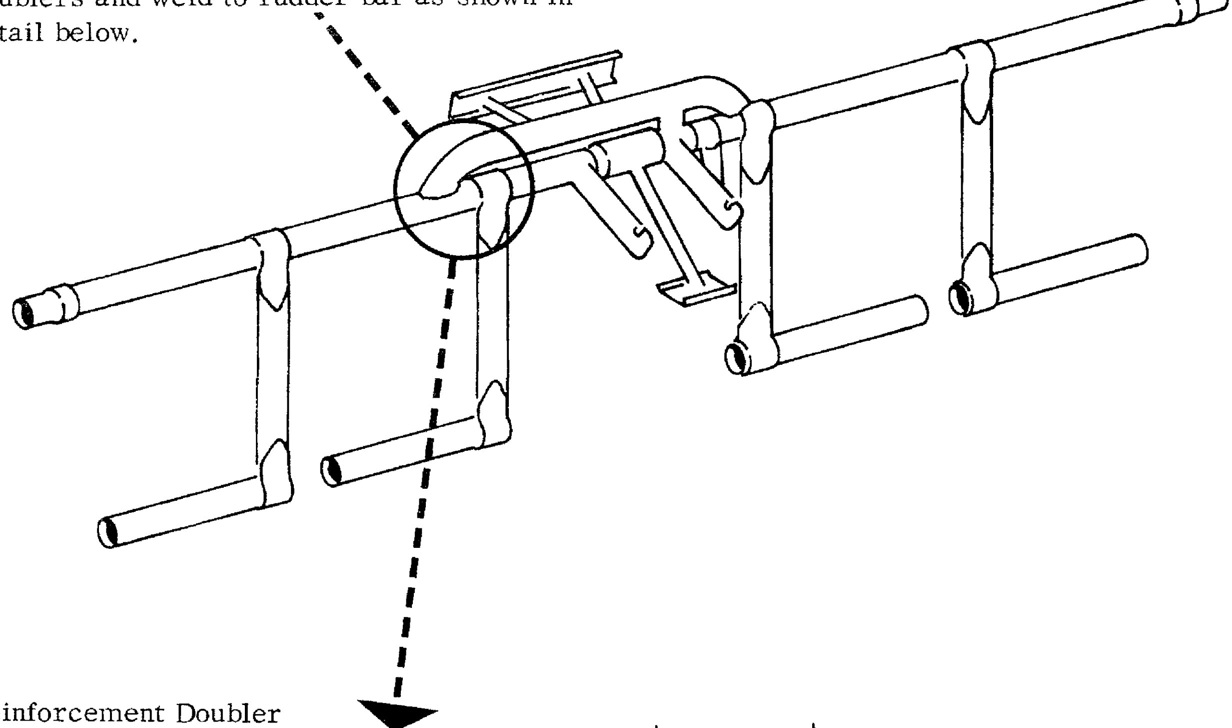
1. Remove the tunnel cover in the aft area of the cabin by removing the carpet over the tunnel and the cover attachment screws.
2. Remove the floor panel located directly aft of the main spar by removing the center seats, seat belt attachments and the screws securing the floor panel. Lift and remove the panel from the airplane.
3. 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.
4. Remove the cable guard plate (see Sketch C) from the underside of the pulley cluster (8) that is located in the aft area of the floor tunnel, by removing the guard attachment screws. Where applicable, remove the inbound pulley of the double pulley at station 187.834 by removing the nut, washer, spacer and bolt.
5. 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.
6. Remove the cable guard pin (see Sketch A) located under the pulley cluster (1) by removing the cotter pin from the exposed end and sliding the pin to the left or right as required.
7. 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 14.)
8. Draw the cable from the floor tunnel.

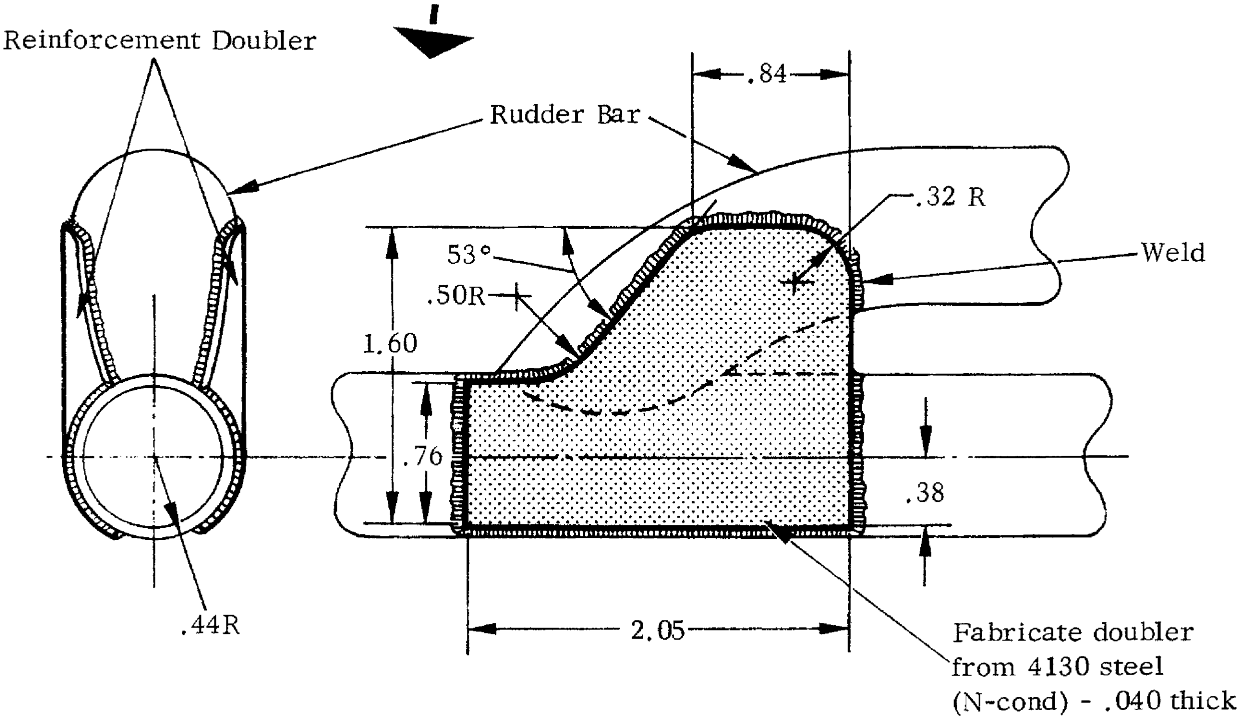
d. The aft rudder control cable (12) may be removed by the following procedure:

1. Remove the tail cone by removing its attachment screws.
2. Disconnect the cable (12) from the rudder sector (15) by removing the two cotter pins at the aft center portion of the sector and moving the swagged ball and cable out of the recessed hole in the sector (15).
3. Remove the cable guard pins from the pulley (13) brackets at station 280.091.
4. Draw the cable from the fuselage.

INSTRUCTIONS

Inspect welded area for evidence of cracks. If cracks are found, or to alleviate repetitive inspection, fabricate two reinforcement doublers and weld to rudder bar as shown in detail below.





REINFORCEMENT DOUBLER DETAIL

Rudder Bar Inspection and Repair
Figure 15

27. INSTALLATION. (Refer to Figure 16.)

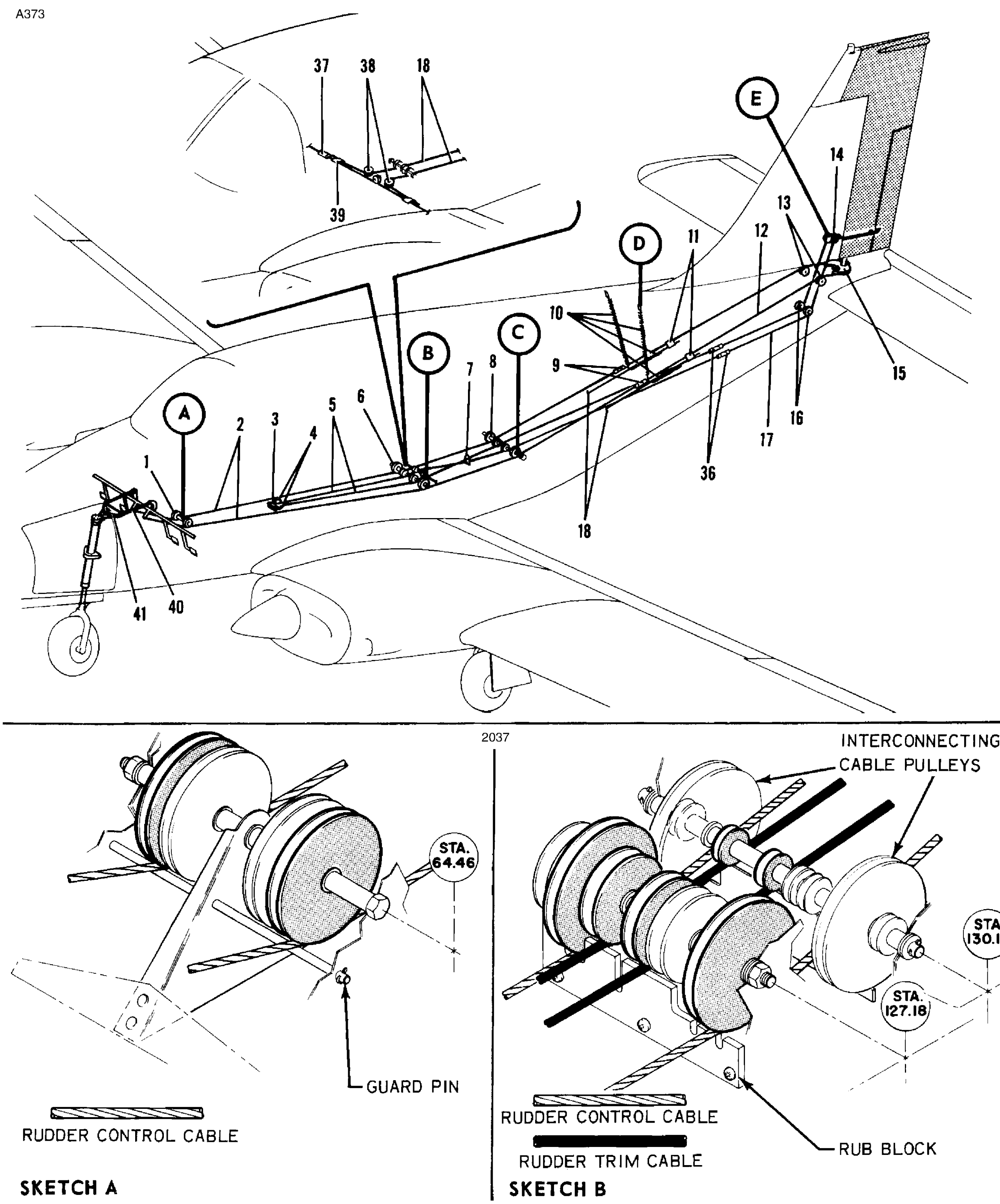
a. The forward rudder control cables (2) may be installed by the following procedure:

1. Draw the control cable through the floor tunnel.
2. Connect the end of the cable to the arm on the rudder pedal torque tube (refer to Figure 14) by installing bolt, washer, nut and cotter pin, allowing the cable end to rotate freely.
3. Connect the forward control cable (2) to the aft control cable (12) at the turnbuckles (9) in the aft section of the fuselage. If the aft control cables are not installed, install then at this time per instructions in step b. Ascertain that each cable is in the proper pulley groove. Where applicable, with the cables in the pulley grooves, install the double pulley in the bracket at station 187.834 with the bolt, spacers, washer and nut. The rudder pulley is positioned inboard.
4. Set cable tension as given in Table I, and check rigging and adjustment per paragraph 28. Safety the turnbuckle.
5. Move the cable guard (see Sketch A) located in the forward tunnel, under the pulley cluster (1) into the position, and secure cotter pin.
6. Within the area of the floor opening aft of the main spar, install the cable guard blocks (see Sketch B) onto the spar housing and secure with screws, at the pulley cluster (6).
7. Install the cable guard plate (see Sketch C) under the pulley cluster (8) located in the aft area of the floor tunnel and secure with screws.
8. Install the forward tunnel plate aft of the tee bar and secure with screws.
9. Put the floor carpet in place and secure.
10. Install the floor panel and seat belt attachment aft of the main spar, securing the panel with screws, and install the seats.
11. Install the cover and carpet of the aft floor tunnel.

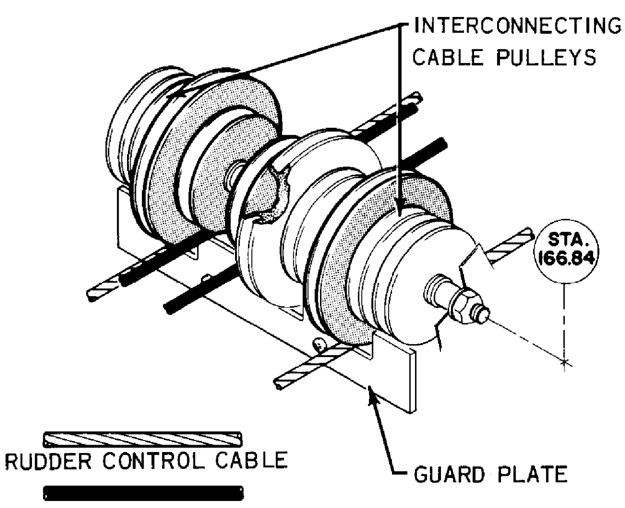
b. The aft rudder control cable (12) may be installed by the following procedure:

1. Position the control cable in the fuselage with the swagged ball next to the rudder sector (15).
2. Route the cable ends over the pulleys (13).
3. Position the swagged ball of the cable in the recessed hole in the sector (15) and secure in place with two MS24665-283 cotter pins.
4. Connect the cable ends to the forward control cables (2) at the turnbuckles (9) in the aft section of the fuselage.
5. Set cable tension as given in Table I and check rigging and adjustment per paragraph 28. Safety the turnbuckle, then reconnect the interconnecting cable (18) and set interconnect cable tension per Table I. Refer to Sketch D. Install the guard pins in the pulley (13) brackets.
6. Install the tail cone and secure with screws.

c. Install the access panel to the aft section of the fuselage.



Rudder and Rudder Trim Controls Installation
Figure 16 (Sheet 1 of 3)



SKETCH C

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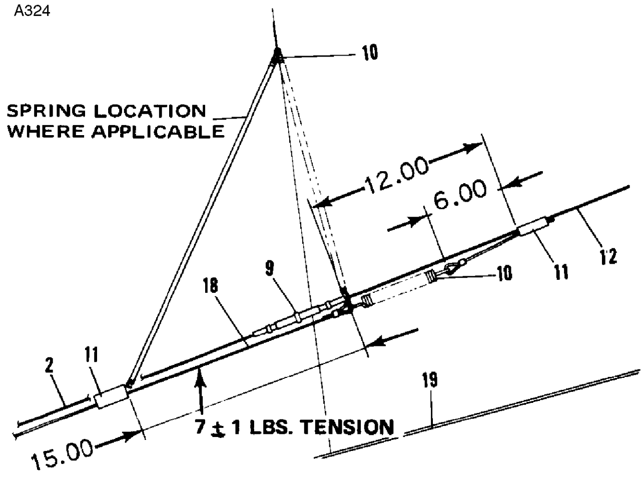

SKETCH D

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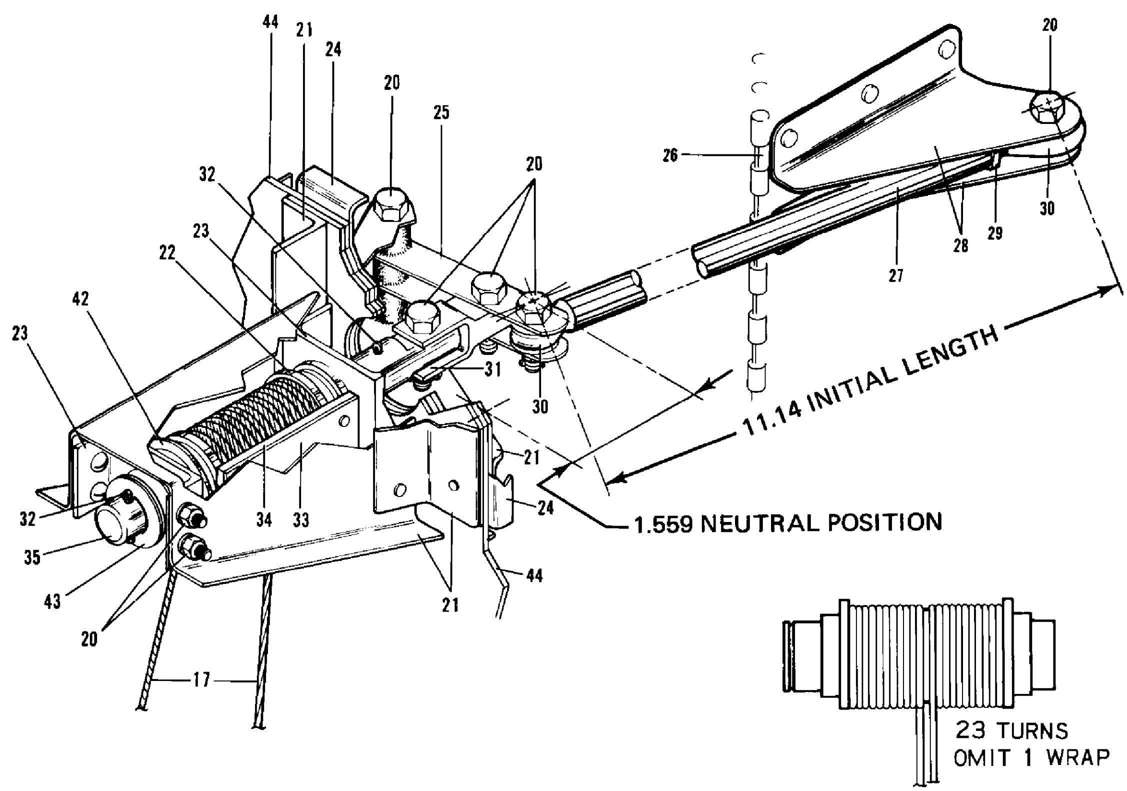


SKETCH E

Rudder and Rudder Trim Controls Installation
Figure 16 (Sheet 2 of 3)

1. PULLEY CLUSTER, STA. 64.46
2. CABLES, CONTROL, FORWARD
3. WHEEL ASSY., TRIM CONTROL
4. PULLEYS, TRIM
5. CABLES, TRIM, FORWARD
6. PULLEY CLUSTER, STA. 127.175 & STA. 130.167
7. FAIRLEAD ASSY.
8. PULLEY CLUSTER, STA. 166.84
9. TURNBUCKLES, MAIN
10. SPRINGS
11. CONNECTOR CLAMPS
12. CABLE, CONTROL, AFT
13. PULLEYS, STA. 280.091
14. SCREW ASSY., TRIM
15. SECTOR ASSY., TORQUE TUBE
16. PULLEYS, STA. 279.032
17. CABLE, TRIM, AFT
18. CABLES, INTERCONNECTING
19. FUSELAGE SKIN, BOTTOM
20. BOLT ASSY.
21. MOUNTING BRACKET
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
30. ROD END
31. LINK ASSY.
32. COTTER PIN
33. SHIM
34. CABLE GUARD
35. SHAFT ASSY., TRIM SCREW
36. TURNBUCKLES, TRIM
37. TURNBUCKLE, AILERON, BALANCE
38. PULLEYS
39. CONNECTOR CLAMPS
40. ROD ASSY., NOSE WHEEL CONTROL
41. ARM ASSY., STEERING
42. SHIM
43. WASHERS
44. SPAR

Rudder and Rudder Trim Controls Installation
Figure 16 (Sheet 3 of 3)

28. RIGGING AND ADJUSTMENT.

CAUTION: VERIFY FREE AND CORRECT MOVEMENT OF RUDDER. WHILE IT WOULD SEEM SELF-EVIDENT, FIELD EXPERIENCE HAS SHOWN THAT THIS CHECK IS FREQUENTLY MISINTERPRETED OR NOT PERFORMED AT ALL. ACCORDINGLY, UPON COMPLETION OF RUDDER RIGGING AND ADJUSTMENT, VERIFY THAT THE RUDDER MOVES RIGHT WHEN THE RIGHT PEDAL IS DEPRESSED; AND, THAT THE RUDDER MOVES LEFT WHEN THE LEFT PEDAL IS DEPRESSED.

a. To check and set the correct degree of rudder travel, the following procedure may be used:

1. Check the rudder travel by swinging the rudder until it contacts its stop. If the control cables are connected, use the rudder pedals to swing the rudder.
2. With the rudder against its stop, place a rigging tool against the side of the rudder and vertical stabilizer as shown in Figure 17. (Ascertain that the tool is not contacting any rivets.) If no gap exists between the rigging tool and the surface of the rudder and vertical stabilizer, the rudder stop for one direction of travel is correct as required in Table I. (This tool may be fabricated from dimensions given in Figure 27.)
3. Swing the rudder in the other direction and check travel as directed in step 2.
4. Should the rudder travel be incorrect showing a gap between the tool and any part of the control surfaces, the tail cone should be removed and the stops reset to obtain correct rudder travel. (Refer to Figure 20.)

b. To set cable tension and alignment of the rudder, the following procedure may be used:

1. Remove the access panel to the aft section of the fuselage and disconnect rudder-aileron interconnect springs.
2. Streamline the rudder and trim tab with the vertical stabilizer and secure in this position.
3. Ascertain that the nose gear steering has been aligned and rudder pedals are secured at neutral. (In neutral position the rudder pedals are tilted aft as shown in Figure 18.)

   NOTE: The nose wheel must be off the ground for remainder of rigging.

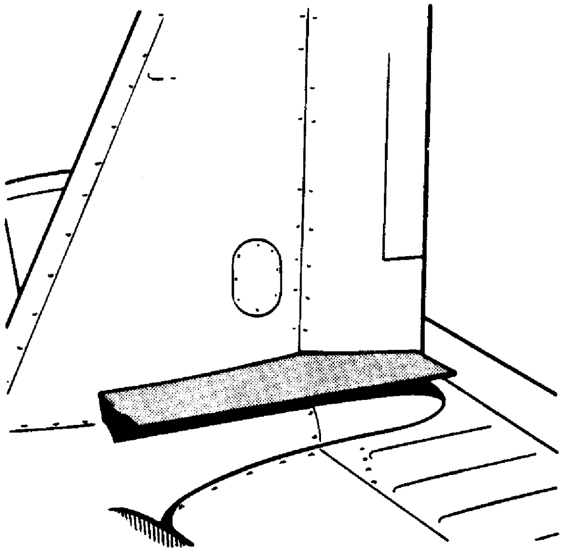
4. Adjust the turnbuckles in the aft section of the fuselage to obtain proper cable tension as given in Table I and to allow the rudder to align at neutral position. Neutral position can be determined by standing behind the airplane and sighting the rudder with the vertical stabilizer or the center of the trim screw. Install all pulley guard pins.
5. Check safety of turnbuckles, reconnect rudder-aileron interconnect springs. (Refer to Sketch D.)

c. With the left rudder pedal depressed and the rudder against the left stop, adjust the rudder pedal stop to provide .25 inch clearance (.060 to .120 inch clearance for 1974 models and up). Repeat this procedure for the right stop.

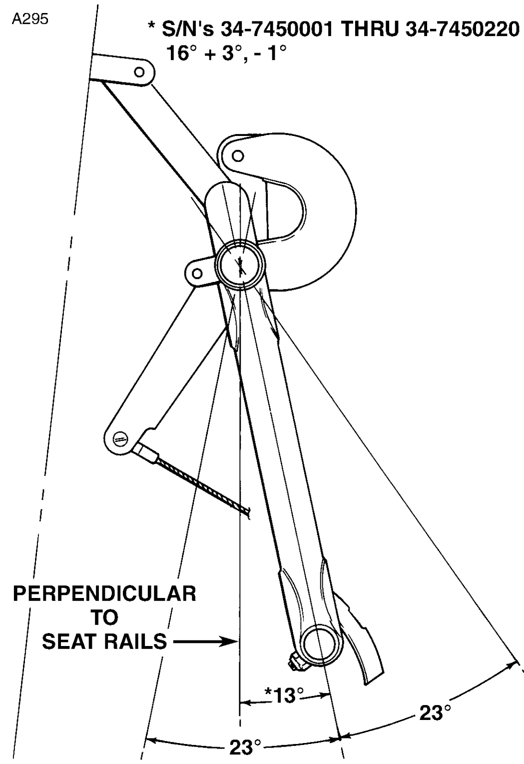
   NOTE: Do not depress the pedals more than is needed for the rudder to contact its stops as the control cables may stretch.

d. Check rigging and adjustment of rudder trim per paragraph 34.

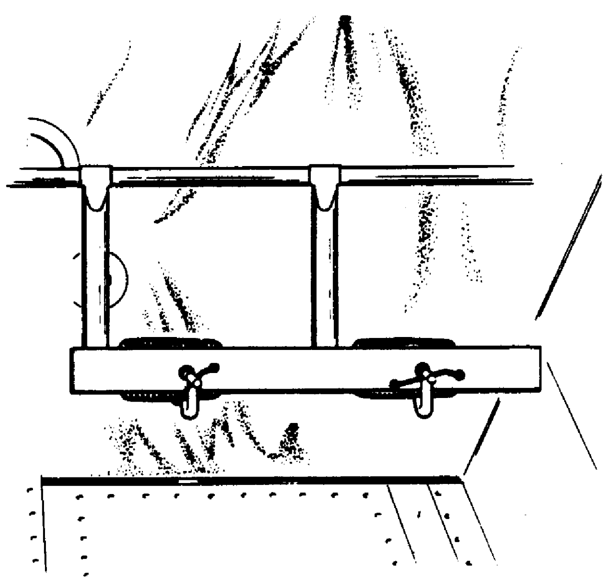
e. Install the tail cone and the access panel to the aft section of the fuselage.



Rudder Rigging Tool
Figure 17



Rudder Pedals Neutral
Figure 18



Clamping Rudder Pedals
Figure 19

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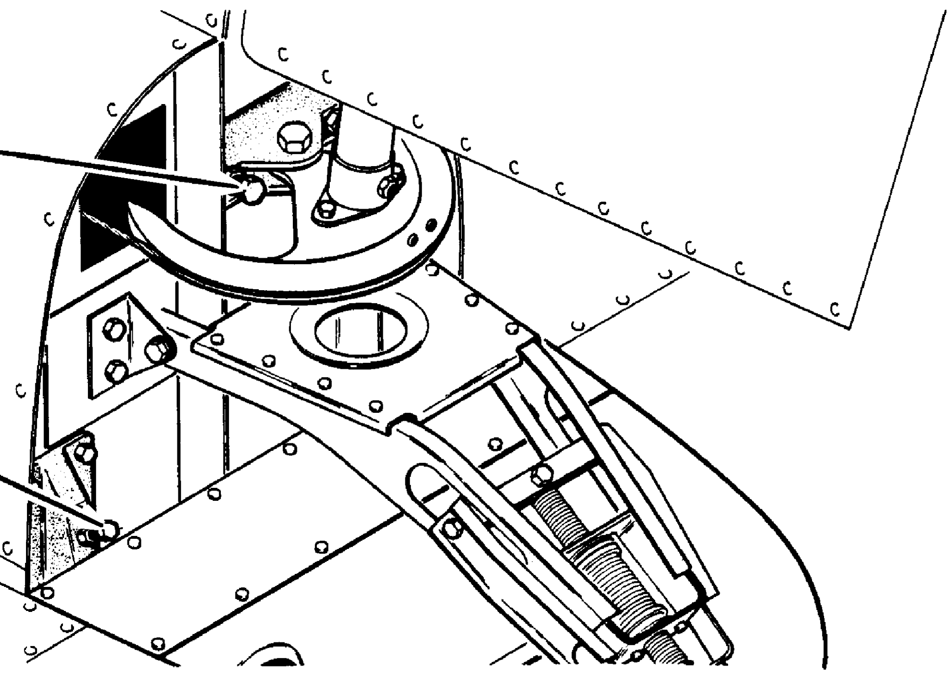


1. RUDDER STOPS
2. STABILATOR STOPS

Rudder and Stabilator Travel Adjustments
Figure 20

29. RUDDER TRIM CONTROLS. (Refer to Figure 16.)

29a. TROUBLESHOOTING. See Table VII.

TABLE VII
TROUBLESHOOTING RUDDER TRIM CONTROLS

Trouble	Cause	Remedy
Lost motion between trim control wheel and trim tab.	Cable tension too low.	Adjust in accordance with Paragraph 34.
	Cables not in place on pulleys.	Install cables according to Paragraphs 31 and 33.
	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.
	Pulleys binding or rubbing.	Replace binding pulleys.
		Provide clearance between pulleys and brackets.
	Cables not in place on pulleys.	Install cables according to Paragraphs 31 and 33.
	Trim tab hinge binding.	Lubricate hinge. Replace if necessary.
	Cables crossed or routed incorrectly.	Check routing of control cables.
Trim tab fails to search full travel.	System incorrectly rigged.	Check and/or adjust rigging per Paragraph 34.
	Either or both trim drums incorrectly wrapped.	Check and/or adjust rigging per Paragraph 34.
Trim indicator fails to indicate correct trim position.	Trim indicator unit not adjusted properly.	Adjust in accordance with Paragraph 34.

29b. 100 HOUR RUDDER TAB FREEPLAY INSPECTION.

In serial numbers 34-7250001 thru 34-7450084 only, for airplanes which have not installed Kit No. 760-800 per Piper Service Letter No. 714, inspect as follows, each 100 hours.

With the rudder in the neutral position and the rudder tab trailing edge at least 3/8 inch off center to one side, determine the rudder tab “free play” as follows:

1. Hold light finger pressure against the rudder tab in one direction to remove "free play" only. Do not push hard enough to structurally deflect the tab or linkage.
2. Measure the horizontal distance from the trailing edge of the tab to the trailing edge of the rudder by placing a scale on the rudder.
3. Reverse the direction of finger pressure and measure the distance again without moving the scale.
4. The difference between the two measurements taken in steps 2 and 3 is the tab "free play," and should not exceed .125 inch. If this tolerance is exceeded, check the following items:
   (a) Inspect the control arm assembly (Figure 16, Item 25) for wear at the center bolt and at the bolt attaching the rudder trim rod assembly (Figure 16, Item 27) to the control arm. Replace the arm assembly and associated hardware if there is any noticeable wear or enlongation of the holes.
   (b) Inspect for end play in the rudder trim barrel (Figure 16, Item 22). If end play exists, shim using shim P/N 62833-18V between the forward barrel mount support assembly (Figure 16, Item 23) and the barrel. Reduce end play to the minimum amount attainable without causing excessive system friction.

   NOTE: Shim P/N 62833-18V is a laminate made of ten pieces of .002 inch brass shim stock, although it appears to be one solid piece. The proper thickness may be obtained by peeling off layers as required. These shims are placed at the forward end of the rudder trim barrel.

   (c) Reduce the rudder tab "free play" to the minimum amount obtainable, which must be below .125 inch.

29c. RUDDER TRIM CONTROLS (FORWARD).

30. REMOVAL. (Refer to Figure 16.)

a. To remove the trim control wheel assembly and/or trim control cables (5), first remove the panel to the aft section of the fuselage.

b. If the aft trim cable (17) is not being removed, block the cables aft to the turnbuckles (36) to prevent them, from unwrapping of the trim barrel (22) in the fin. (Refer to Figure 13.)

c. If the trim control wheel is to be removed, loosen the cables at the turnbuckles (36) and proceed with the following steps:

   1. Remove the trim cover assembly by removing the cover attaching screws.
   2. 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.
   3. Unwrap the lower cable from the drum.
   4. The wheel and drum are joined by three screws. Remove screws and separate these two items and unwrap the upper cable.
   5. Tie the cables forward to prevent them from slipping back into the floor tunnel.

d. If the trim control wheel and forward cables (5) are to be removed, block the aft cables (17) aft of the turnbuckles (36) and proceed with the following steps:

1. Remove the tunnel cover in the aft area of the cabin by removing the carpet over the tunnel and the cover attachment screws.
2. 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.
3. Remove the trim cover assembly to gain access to the trim wheel mounting hardware.
4. Disconnect the turnbuckles (36) and remove the guard plate (see Sketch C) at pulley cluster (8).
5. Remove the rub block (see Sketch B) at pulley cluster (6).
6. 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.

31. INSTALLATION. (Refer to Figure 16.)

a. The trim control wheel with drum may be installed by the following procedure:

1. Wrap the left cable on the trim drum by inserting the swagged 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.
2. 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.
3. Wrap the right cable on the drum by inserting the swagged ball of the cable into the slot provided in the flanged side (lower) of the drum. Looking at this side proceed to wrap three and a half turns of cable in a clockwise direction.
4. 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.
5. Align the trim control cables (5) 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.
6. Install the cover assembly over the trim control wheel and secure with screws, unless the control cables have yet to be installed.

b. The trim control cables (5) may be installed by the following procedure:

1. Draw the cables (5) through the floor tunnel and route them through the pulley clusters at station 127.18 and 166.84. Ascertain that the cables (5) cross at the farlead (7) between the two pulley clusters.
2. Wrap the cable drum and install the trim control wheel as given in step a.
3. Position the cables (5) over their proper pulleys, (as shown in Sketches B and C of Figure 16.)
4. Connect the forward cables (5) to the aft cables (17) at the turnbuckles (36) in the aft section of the fuselage. If the aft cable is not installed, proceed with instruction given in paragraph 33.
5. Remove the blocks securing the aft cables (36) and check that the cables (5) and (36) are seated on the pulleys.
6. Set trim cable tension in accordance with specifications given in Table I and check rigging and adjustment per paragraph 34. Safety both turnbuckles. Install the rub block and guard plate at the appropriate pulley clusters. (Refer to Sketches B and C of Figure 16.)
7. Install the tunnel cover on the forward tunnel and secure with screws.

8. Install the carpet over the floor tunnel.
9. Install the cover over the trim control wheels and flap handle and secure with screws.
10. Install the seat belts removed from the top of the floor tunnel and secure with bolt, washer and nut.
11. Install the aft floor tunnel and secure with screws.
12. Install the carpet over the aft floor plate.
13. Install the trim plate on top of the forward end of the aft floor tunnel.

c. Install the panel to the aft section of the fuselage and the seats.

31a. RUDDER TRIM CONTROLS (AFT).

32. REMOVAL. (Refer to Figure 16.)

a. Remove the access panel from the lower side of the fin, and the tail cone fairing.

b. If the forward trim mechanism is not being removed at this time, block the cables forward of the turnbuckles (9) to prevent them from unwrapping at the forward trim drum. (Refer to Figure 13.)

c. Secure the trim cables (9) at the aft trim drum barrel (22).

d. Disconnect the trim cable turnbuckles (9) in the aft section of the fuselage.

e. Remove the cable cords from the pulley (16) bracket located at station 279.032 in the aft end of the fuselage.

f. Disconnect the trim screw link assembly (31) from the screw (35).

g. Remove the cotter pin (32) from the aft end of the screw (35).

h. Remove the two bolts (20) securing the trim screw assembly (35) to the mounting bracket (21), and remove the assembly from the bracket (21).

NOTE: Remove the washer from the aft end of the screw assembly before pulling the assembly completely from the mounting bracket.

i. Remove the screw and barrel assembly (22) along with the aft cables (17) from the airplane.

33. INSTALLATION. (Refer to Figure 16.)

a. Insert the complete trim screw and barrel assembly (22) into the fin assembly. Route the trim cable ends around the pulleys at station 279.032.

b. Insert the trim screw and barrel assembly (22) into the mounting bracket (21). Ascertain that the shim (42) is in place. (Refer to Sketch E.)

c. Install two bolt assemblies (20) and secure the shaft assembly (35) into the mounting bracket (21).

d. Install the AN-960-916 washer over the aft end of the screw, and insert the cotter pin (32) into the hole in the aft end of the trim screw shaft assembly (35).

e. Adjust the screw assembly to obtain 1.559 of an inch between the center of the bolt assembly holding the rod end (30) and the aft side of the mounting bracket (21), as shown in Sketch E of Figure 17.

f. Connect the link assembly (31) to the trim screw.

g. Connect the aft trim cable (17) to the forward cables (5) with turnbuckles (9). Ascertain that the cables are properly routed around the pulleys.

h. Remove the clamp securing the forward trim cables and proceed to rig the system in accordance with paragraph 34.

i. Install the cable guards at the pulley bracket in the fuselage, at station 279.032.

j. Install the access panel and tail cone fairing.

34. RIGGING AND ADJUSTMENT OF RUDDER TRIM CONTROLS. (Refer to Figure 16.)

CAUTION: VERIFY FREE AND CORRECT MOVEMENT OF RUDDER TAB. WHILE IT WOULD SEEM SELF-EVIDENT, FIELD EXPERIENCE HAS SHOWN THAT THIS CHECK IS FREQUENTLY MISINTERPRETED OR NOT PERFORMED AT ALL. ACCORDINGLY, UPON COMPLETION OF RUDDER TRIM RIGGING AND ADJUSTMENT, VERIFY THAT THE RUDDER TAB MOVES RIGHT WHEN THE RUDDER TRIM WHEEL IS TRIMMED LEFT; AND, THAT THE RUDDER TAB MOVES LEFT WHEN THE RUDDER TRIM WHEEL IS TRIMMED RIGHT.

a. The following items must be accomplished as a preadjustment check before proceeding with the rigging and adjustment of the tab. If these items were accomplished during the installation, proceed with step b.

   1. Remove the access panel on the left side of the vertical fin.
   2. Ascertain that the trim cable is wrapped 23 turns around the barrel (22) with space at the center as shown in Figure 16, Sketch E.
   3. The control rod (27) is adjusted to an initial length of 11.14 inches.
   4. The trim screw (35) is at its neutral position. (Refer to step e of paragraph 33.)
   5. The rudder trim control wheel in the cockpit is centered.
   6. The trim cable tension is set in accordance with Table I and pulley guards installed.
   7. The nose wheel is off the ground before continuing.

b. Check the trim travel only by centering the rudder and rotating the trim control wheel in the cockpit to full right trim. Check the trim tab travel obtained with specifications given in Table I. Repeat above step for left tab travel.

c. To adjust the trim tab travel, adjust the tab actuating rod (27) as required. Recheck the tab travel in accordance with step b.

   NOTE: If proper tab travel cannot be obtained by adjusting the control rod (27), the trim screw (35) must be repositioned in accordance with instructions given in step d and/or e.

d. To adjust the trim travel left, perform the following:

   1. Add shim washers P/N 62833-18V at the forward end of the barrel to reduce travel.
   2. Remove shim washers P/N 62833-18V at the forward end of the barrel to increase travel.

e. To adjust the trim travel right, perform the following:

   1. Add shim washers P/N 62833-18V at the aft end of the barrel to reduce the trim travel.
   2. Remove shim washers P/N 62833-18V at the aft end of the barrel to increase the trim travel.

      NOTE: This shim P/N 62833-18V is a laminate made of ten pieces of .002 inch brass shim stock, although it appears to be one solid piece. The proper thickness may be obtained by peeling off layers as required. These shims are placed at the forward end of the rudder trim barrel.

f. Check the trim and servo travels by positioning the trim control wheel in the cockpit in neutral and apply pressure to the left rudder pedal until the rudder stop is contacted.

NOTE: Do not depress the rudder pedals more than needed to contact the stops, thus avoiding cable stretch.

Check the travel obtained with specifications given in Table I. Repeat the above step with the right rudder pedal.

g. If any adjustment is required, it must be made at the trim barrel screw (35) engagement and in the length of the control rod (27). If either of the above mentioned items is adjusted, the complete check must be accomplished beginning with step b thru f.

h. With the rudder held securely against either stop, determine the tab “free play” as follows:

1. Hold light finger pressure against the rudder tab in one direction to remove “free play” only. Do not push hard enough to structurally deflect the tab or linkage.
2. Measure the horizontal distance from the trailing edge of the tab to the trailing edge of the rudder by placing a scale on the rudder.
3. Reverse the direction of finger pressure and measure the distance again without moving the scale.
4. The difference between the two measurements taken in steps 2 and 3 is the tab “free play,” and should not exceed .125 of an inch. If this tolerance is exceeded, check the following items:
   (a) Inspect the control arm assembly (25) for wear at the center bolt and at the bolt attaching the rudder trim rod assembly (27) to the control arm. Replace the arm assembly and associated hardware if there is any noticeable wear or elongation of the holes.
   (b) Inspect for end play in the rudder trim barrel (22). If end play exists, shim using shim P/N 62833-18V between the forward barrel mount support assembly (23) and the barrel. (See Note in step e about shim.) Reduce end play to the minimum amount attainable without causing excessive system friction.

   NOTE: Reduce the trim tab “free play” to the minimum amount obtainable, which must be below .125 of an inch.

i. Install the access panel on the vertical fin.

35. FLAP CONTROLS.

35a. TROUBLESHOOTING. See Table VIII.

TABLE VIII
TROUBLESHOOTING FLAP CONTROLS

Trouble	Cause	Remedy
Flaps fail to extend or retract.	Control cable broken or disconnected.	Replace or reconnect control cable. Refer to Paragraph 37.
Flaps not synchronized or fail to move evenly when retracted.	Incorrect rigging of system.	Adjust flaps per in structions in Paragraph 38.

35b. TORQUE TUBE/PUSH ROD DISTORTION INSPECTION.

If flaps have been extended at or above V_{FE}, inspect the flap torque tube arms and pushrods for evidence of distortion.

a. If the paint is cracked or peeling anywhere along the torque tube arm or pushrod, torsional movement has occurred.

b. Remove the paint and inspect for cracks:

1. In the welds at the arm on the torque tube end.
2. In the rod ends and pushrod tube.
3. Use a dye penetrant method of inspection.

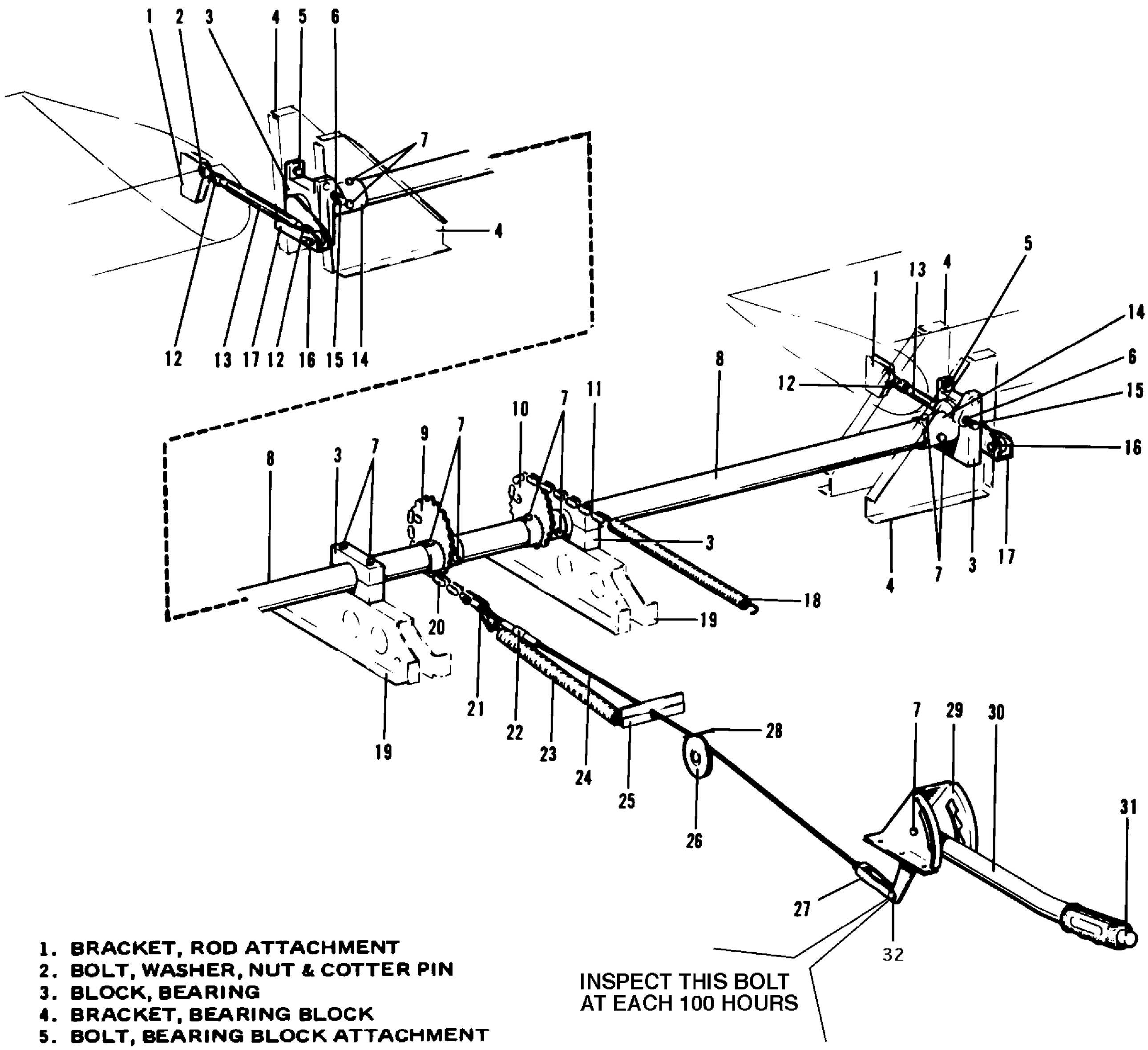
c. If cracks are not found, repaint the part(s) and reinstall.

d. If cracked, replace the affected part(s).

36. REMOVAL OF FLAP CONTROLS. (Refer to Figure 21.)

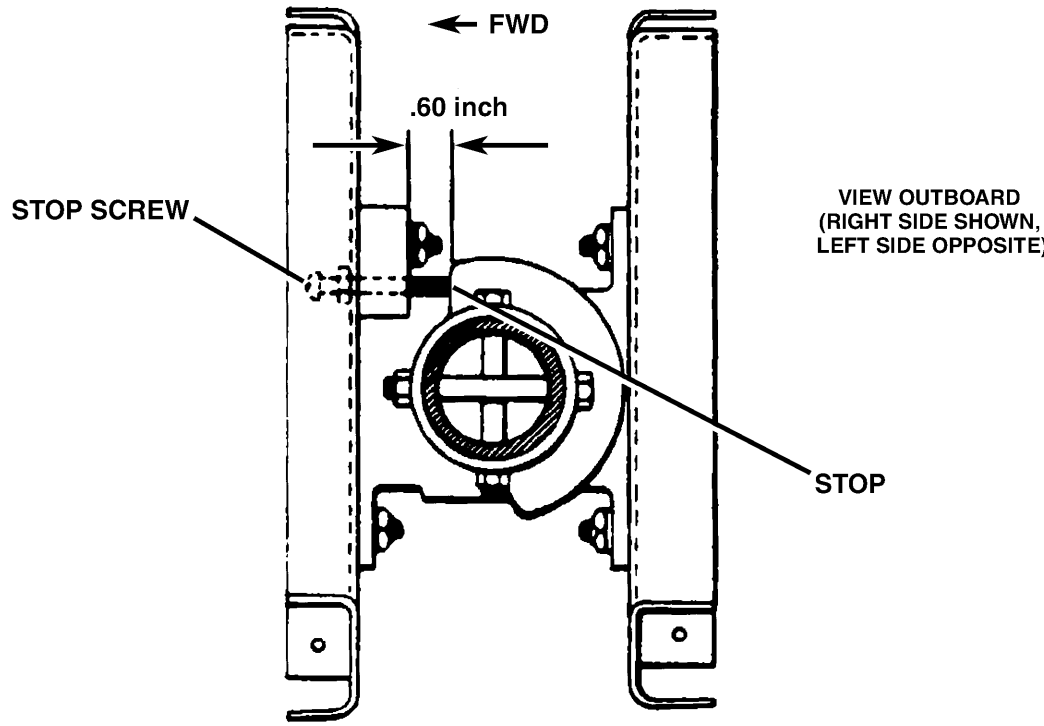
a. The flap torque tube assembly may be removed by the following procedure:

1. Remove the access plate located between the underside of the aft section of each wing and the fuselage by removing attaching screws.
2. Remove the door 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.
3. Disconnect the left and right flap control tubes (rods) (13) at the flaps by removing the nuts, washers and bolts (2) or at the torque tube cranks (arms) (17) by removing the bolts and washers (16) from the inner side of each crank. It will be necessary to remove bolt (16) through a hole in the side skin of the fuselage located over the torque tube with the flap handle moved to its 40 degree position.
4. With the flap handle (30), fully extend the flaps and disconnect the flap tension spring (23) at the spar or the aft end of the control cable (24) as desired.
5. Grasp the flap handle (30), release the plunger (31) and allow the flap to return to the retracted position. Use caution as forward pressure will be on the handle with the tension spring (23) disconnected.



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 ASSY
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
28. SAFETY COTTER PIN
29. BRACKET, FLAP HANDLE
30. HANDLE, FLAP
31. BUTTON, FLAP RELEASE
32. CLEVIS BOLT, BUSHING, WASHER, NUT & COTTER PIN

Flap Controls Installation
Figure 21



Flap Stop Adjustment
Figure 22

6. Disconnect the flap return spring (18) at the spar or return chain (11) as desired.
7. Disconnect the control cable from the chain (20) by removing cotter pin, nut, and clevis bolt (21).
8. Remove the tube support bearing blocks (3) by removing the block attachment bolts (7).
9. Remove the nuts, washers and bolts (7) securing the right and left cranks (17) and stop fittings (14) on the torque tube (8).
10. From between each wing and the fuselage, remove the cranks (17) from the torque tube.
11. Disconnect one bearing block (3) from its mounting brackets (4) by removing nuts, washers and bolts (5).
12. Slide the tube from the bearing block still attached to its brackets, raise the end and lift it from the floor opening.

b. The flap control cable (24) may be removed by the following procedure:

1. If the center seats and floor panel have not been removed, remove the seats and the screws securing the floor panel.
2. Disconnect the flap tension spring (23) from the cable (24) if not previously disconnected, by extending the flaps to relieve spring tension.
3. Retract the flap. Use caution as forward pressure will be on the handle with the spring disconnected.
4. Disconnect the cable from the chain (20) by removing cotter pin, nut, clevis pin and bushing (21).

5. Remove the flap handle bracket (29) and trim control wheel cover.
6. Remove the aft heat deflectors on each forward floor tunnel by sliding far enough to release the spring fasteners.
7. 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.
8. Remove the cotter pin cable guard from the flap cable pulley (26) located inside the floor tunnel just ahead of the spar housing.
9. Remove the cable rub blocks (25) located in the floor opening on the aft side of the spar housing by removing the attachment screws.
10. Disconnect the cable turnbuckle (22) at the end of the cable by removing cotter pin, nut and bolt (21).
11. Disconnect the cable clevis (27) from the flap handle arm by removing cotter pin, nut, washer, bushing, and bolt (32). Check clevis bolt for wear. Replace bolt if any wear is evident.

c. Remove the flap handle (30) and bracket (29) by removing the bolts securing the bracket to the floor tunnel.

37. INSTALLATION OF FLAP CONTROLS. (Refer to Figure 21.)

a. The flap torque tube assembly may be installed by the following procedure:

1. Install the chain sprockets (9 and 10) with chains (20 and 11) on the torque tube (8) and secure with bolts, washers and nuts (7).
2. Slide the tube stop fittings (14) on their respective ends of the torque tube.
3. Ascertain that one bearing block fitting (3) is installed between its attachment brackets (4).
4. Slide the other bearing block over its respective end of the torque tube.
5. 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.
6. Position the remaining bearing block and secure with bolts, washers and nuts (5).
7. Push the torque tube cranks (arms) (17) on each end of the torque tube and slide the stop fitting (14) 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 (3) thus allowing no side play of the assembly. Tighten the bolt assemblies (7) on the stop fittings.
8. Install the tube support blocks (3) on their support brackets (19) and secure with bolts (7).
9. Connect the flap return spring (18) to the rectum chain (11) and/or at the spar housing.
10. Connect the control cable end to the tension chain (20) and secure with bushing, clevis bolt, nut and cotter pin.
11. Pull the flap handle full back and connect the tension spring (23). Release the flap handle to the forward position. (Rig flap cable in accordance with step c.)
12. Connect the flap control tube (13) to the flap and/or torque tube crank (17) and secure. The bolt (16) 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.

b. To install the flap handle (30) with bracket (29) place the assembly on the floor tunnel and secure with bolts.

c. The flap control cable (24) may be installed by the following procedure:

1. Attach the cable (24) and turnbuckle (22) to the chain (20) with clevis bolt assembly (21). 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 c.
2. Route the cable through the tunnel and spar housing.
3. Install cotter pin cable guard over pulley (24) located just ahead of the spar housing in the forward floor tunnel
4. Attach the end of the cable (24) to the flap handle arm and secure with clevis bolt, bushing, washer, nut, and cotter pin (32).
5. Adjust cable tension with handle in the FLAPS UP position. Refer to Table I.
6. Pull the flap handle (30) full back and connect the tension spring (23) to the cable end.
7. Install the cable rub blocks (36) on the aft side of the spar housing and secure with screws.

d. Install the tunnel cover and secure with screws. Also the tunnel carpet and bracket cover.

e. Install the floor panel and seat belt attachments. Secure with screws and install seats.

38. RIGGING AND ADJUSTMENT OF FLAPS.

CAUTION: VERIFY FREE AND CORRECT MOVEMENT OF FLAPS. WHILE IT WOULD SEEM SELF-EVIDENT, FIELD EXPERIENCE HAS SHOWN THAT THIS CHECK IS FREQUENTLY MISINTERPRETED OR NOT PERFORMED AT ALL. ACCORDINGLY, UPON COMPLETION OF FLAP RIGGING AND ADJUSTMENT, VERIFY THAT THE FLAPS MOVE UP WHEN THE FLAP HANDLE IS MOVED FORWARD AND DOWN; AND, THAT THE FLAPS MOVE DOWN WHEN THE FLAP HANDLE IS MOVED AFT AND UP.

a. Place the flap handle in the full forward position.

b. If not previously removed remove the floor panel just aft of the main spar.

c. To adjust the flap up stop and step lock loosen the jam nut of the left torque tube stop screw located in the floor opening along the outer end of the flap torque tube. Turn the right torque tube stop screw to obtain approximately 0.60 of an inch between the stop fitting and the bearing block as measured along the top side of the screw. (Refer to Figure 22).

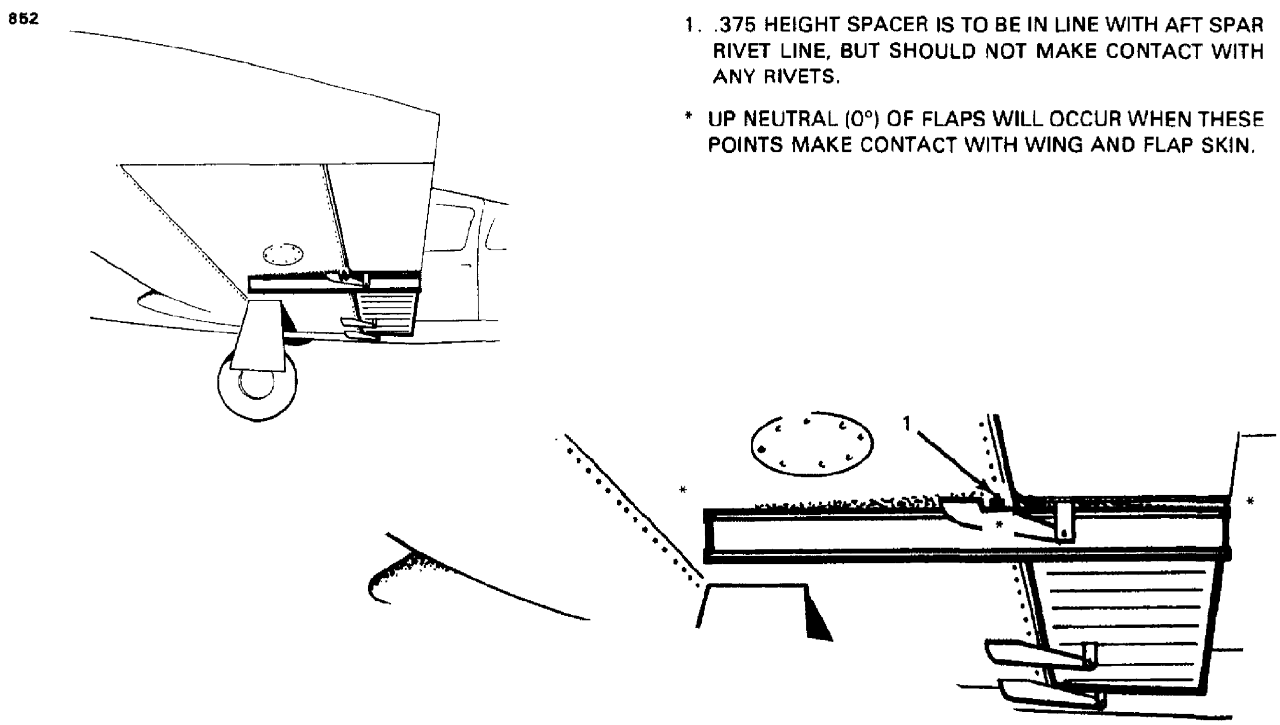
d. Place a 0.125 spacer between the stop fitting and the end of the right hand screw. Determine that when pressure is applied down on the flap, it will remain in the uplock position. If it extends, turn the adjustment screw out a few threads at a time until the flap remains in the uplock position with the spacer inserted Tighten the jam nut and remove the 0.125 spacer.

e. Rotate the left stop adjustment screw until it contacts the stop fitting. Tighten the jam nut.

f. Set the flap control cable tension (handle next to floor 0 degrees) as given in Table I at the turnbuckle that is attached to the lower end of the flap handle in the floor tunnel To do this, remove the flap handle cover and enough tunnel carpet to remove the tunnel cover just aft of the handle. Adjust and refasten the turnbuckle.

NOTE: Do not rotate the torque tube while retensioning the cable or tighten tight enough to allow tube to be pulled away from its stops.

g. To check up-neutral position of the flaps, place a flap rigging tool as shown in Figure 23 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 Figure 25.)



Flap Rigging Tool
Figure 23

h. 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.

i. 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 against the trailing edge of the flap while making this adjustment. After adjustment, retighten the jam nuts.

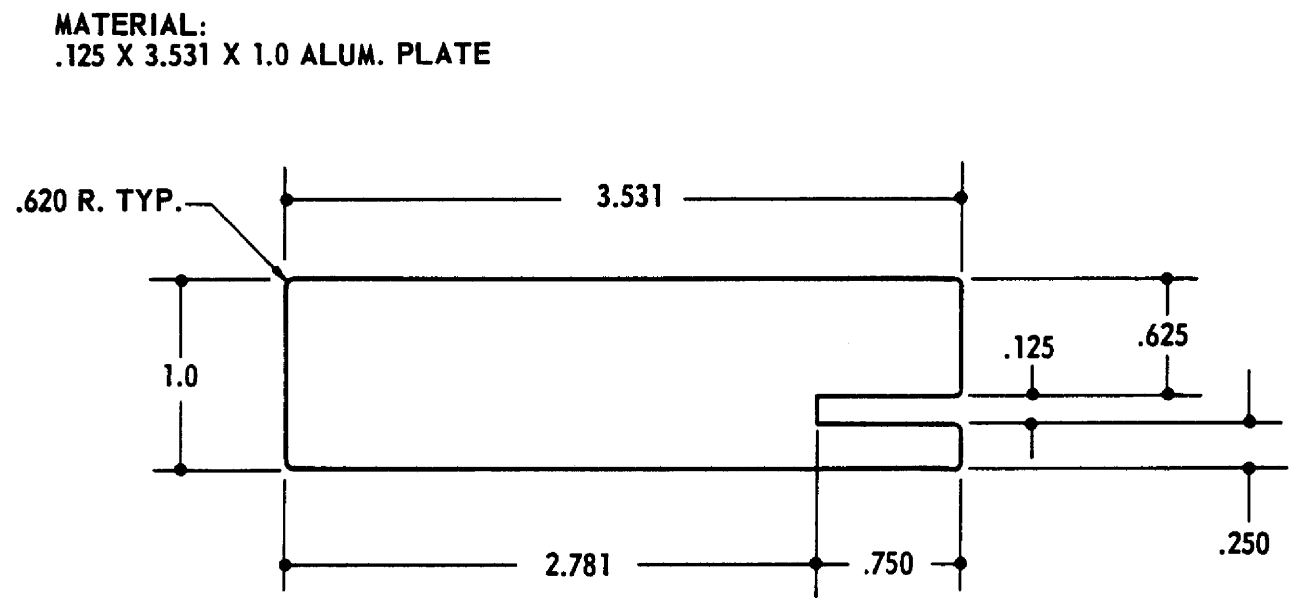
j. Check and adjust the other flap in a like manner.

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 above neutral the flap of the other wing.

k. Check the flap for full down travel to the degrees required in Table I. 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 d thru j.

l. Check operation of the flap and flap handle ratchet mechanism.

m. Install access plates and panels.



Fabricated Aileron Bellcrank Rigging Tool
Figure 24

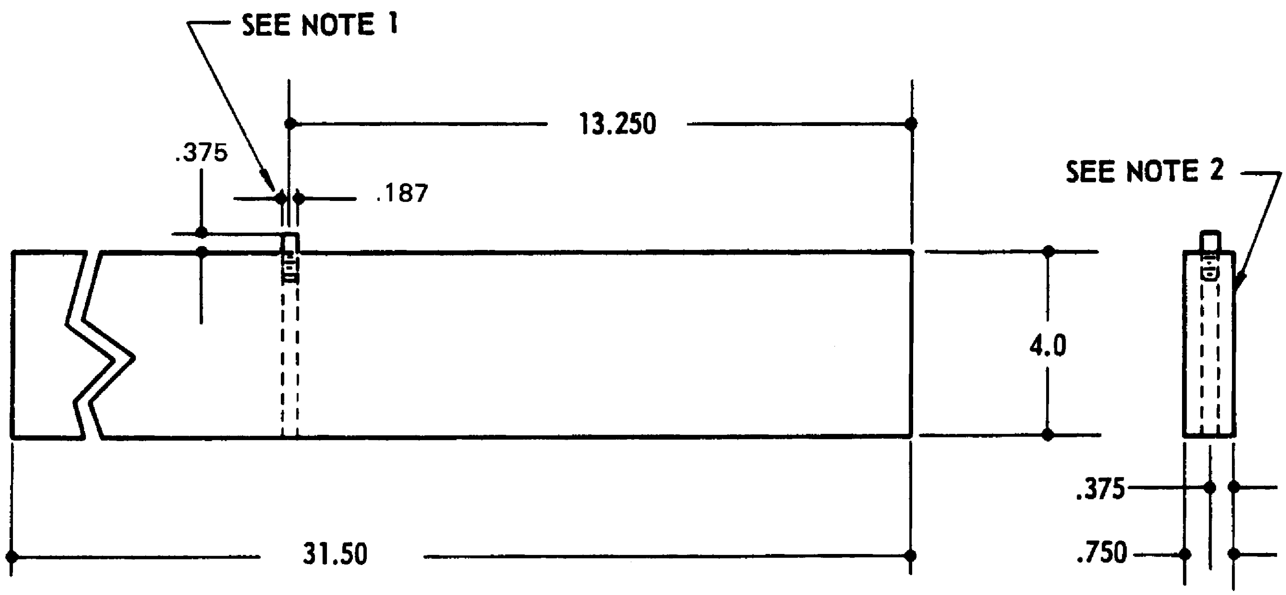
A115

NOTES:

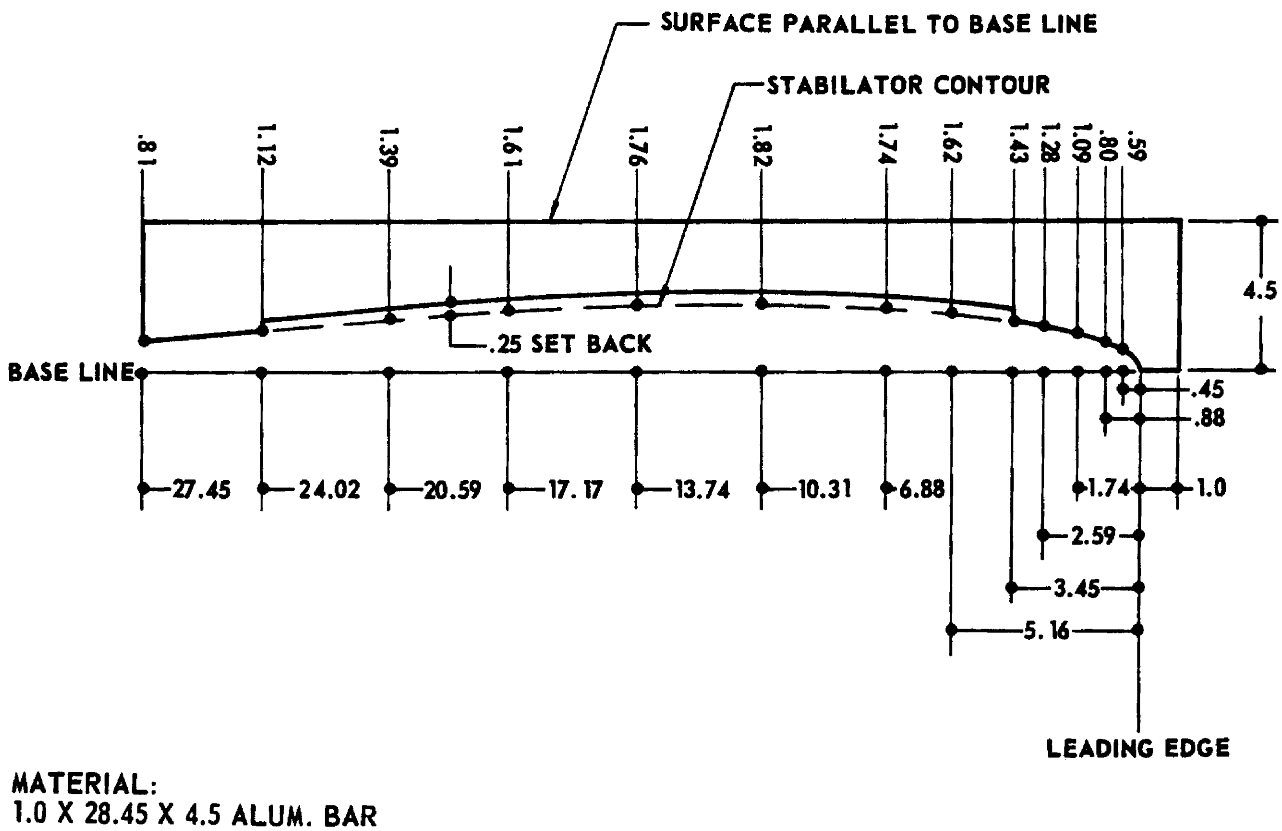
1. DRILL AND TAP TO 10-32 NF. AN-3 BOLT, JAM NUT AND INTERNAL STAR WASHER MAY BE USED FOR SPACER OR AN-3 BOLT WITH HEAD FILED TO REQUIRED LENGTH.
2. SPAR STOCK MAY BE USED IN PLACE OF ALUM. BAR STOCK.

MATERIAL:

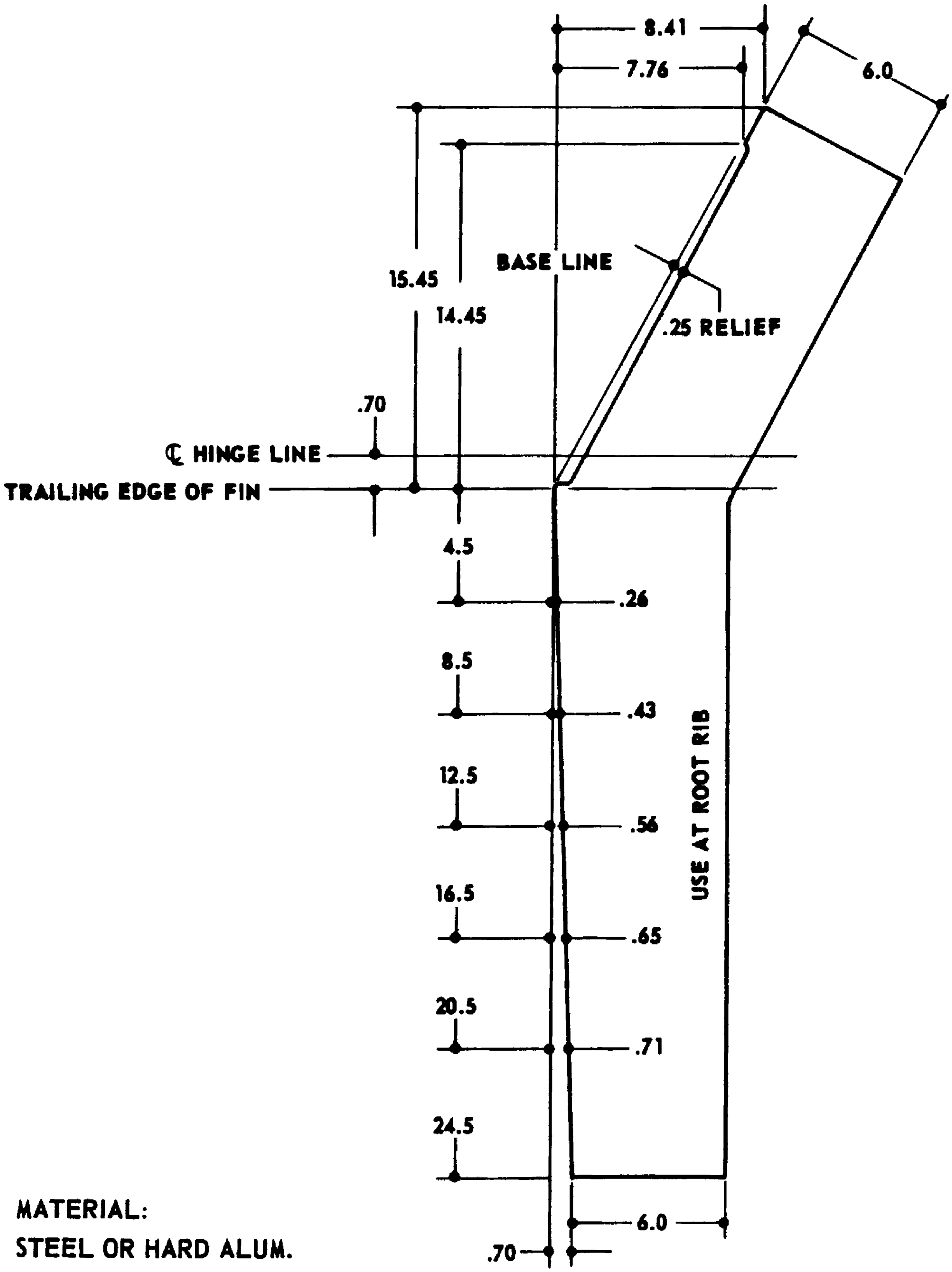
.750 x 31.50 x 4.00 ALUM. BAR OR
.750 x 31.50 x .750 SQ. ALUM. BARSTOCK (MIN.)



Fabricated Aileron and Flap Rigging Tool
Figure 25



Fabricated Stabilator Rigging Tool
Figure 26



Fabricated Rudder Rigging Tool
Figure 27

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SECTION

VI

HYDRAULIC SYSTEM

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SECTION VI

LIST OF EFFECTIVE PAGES

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SECTION VI - HYDRAULIC SYSTEM

TABLE OF CONTENTS

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SECTION VI

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

CAUTION: PRIOR TO STARTING ANY INVESTIGATION OF THE HYDRAULIC SYSTEM, PLACE THE AIRPLANE ON JACKS. (REFER TO JACKING, SECTION II.)

1. INTRODUCTION. The PA-34 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 Section VII.

   This section provides instructions for remedying difficulties which may arise in the operation of the hydraulic system. It includes: a system description; troubleshooting recommendations; and instructions for the removal, repair, and installation of components, as well as adjustments and tests.

2. 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 to approximately 1700 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.

   Two hydraulic pumps may be encountered:

   a. Original Equipment (Prestolite).

      The hydraulic pump is a gear type unit driven by a 12 volt reversible motor designed to operate in a pressure range of 2000 to 2500 psi. To prevent excessive buildup of pressure in the hydraulic system due to expansion, a primary thermal relief valve is incorporated and is located directly above the nose gear actuating cylinder. This relief valve will maintain pressure in the system up to 2350 ± 50 psi. An additional relief valve is incorporated in the pump which will open at 4000 psi and allow fluid to flow into the reservoir. Other valves in the pump, channel fluid to the proper outlet during retraction or extension of 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.

   b. Service Replacement (Oildyne).

      The Oildyne hydraulic pump is a gear type unit driven by a 24 volt reversible motor designed to operate in a pressure range of 2,400 ± 200 psi. To prevent excessive buildup of pressure in the hydraulic system due to expansion, a primary thermal relief valve is incorporated in the pump body which will open at 3,000 +300/-200 psi. Other valves in the pump, channel fluid to the proper outlet during retraction or extension of the gear. A shuttle valve located in the base of the pump allows fluid displaced by the cylinder pistons to return to the reservoir without back pressure. This shuttle valve has a delivery pressure of 400-800 psi during the extension cycle.

A bypass free-fall valve assembly is incorporated in the system to permit extension of the landing gear should a malfunction in the system occur. This valve is manually operated by means of an emergency gear knob located on the instrument panel. This knob must be fully extended to permit emergency extension. Restrictions in the system prevent the gear from extending too fast.

For a description of the landing gear and electrical switches, refer to Section VII, Landing Gear and Brake System.

3. TROUBLESHOOTING. (See Table I.)

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, Section II) and then proceed to determine the extent of the trouble. Generally, hydraulic system troubles fall into two types, troubles involving the hydraulic supplying system and troubles in the landing gear hydraulic system. Table III at the back of this section, lists the troubles which may be encountered and their probable cause, and suggests a remedy for the trouble involved. A hydraulic system operational check may be conducted using Figures 1 or 2. When the trouble has been recognized, the first step in troubleshooting is isolating the cause. Hydraulic system troubles are not always traceable to one cause. It is possible that a malfunction may be the result of more than one difficulty within the system. Starting first with the most obvious and most probable reasons for the trouble, check each possibility and, in turn, by process of elimination, isolate the troubles.

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 DOWNLOCK 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.

NOTE: If the Prestolite hydraulic pump is at fault and requires disassembly, it should be overhauled by an accredited overhaul facility. Pressure checks with adjustments may be accomplished in accordance with instructions given in paragraphs 6 thru 9.

Replacement brushes for the Prestolite pumps are no longer available. Accordingly, when the brushes wear out, the pump must be replaced.

NOTE: Field service of the Oildyne hydraulic pump is limited to motor replacement and removal, cleaning, inspection, and/or replacement of the hydraulic fluid reservoir. Should pump malfunction, replace pump, or return pump to Piper Aircraft via your local Piper distributor for servicing or repairs.

TABLE I (Sheet 1 of 4)
TROUBLESHOOTING HYDRAULIC SYSTEM

Trouble	Cause	Remedy
Landing gear retraction system fails to operate.	Landing gear actuator circuit breaker open.	Reset circuit breaker and determine cause for open circuit breaker.
	Landing gear selector circuit breaker open.	Reset circuit breaker and determine cause for open circuit breaker.
	Landing gear actuator circuit wires broken.	Check wiring.
	Landing gear selector circuit wires broken.	Check wiring.
	Safety (squat) switch out of adjustment.	Readjust switch. (Refer to Adjustment of Safety Switch, Section VII.)
	Squat switch inoperative.	Replace switch.
	Pressure switch in-operative.	Replace switch.
	Pump retraction solenoid inoperative (inboard solenoid).	Replace solenoid.
	Gear selector switch ground incomplete.	Check ground.
	Gear selector switch inoperative.	Replace switch.
	Hydraulic pump ground incomplete.	Check ground.
	Hydraulic pump inoperative.	Replace or overhaul pump.
	Hydraulic fluid in reservoir below operating level.	Fill reservoir with hydraulic fluid.
	Battery low or dead.	Check condition of battery.
Landing gear extension system fails to operate.	Landing gear actuator circuit breaker open.	Reset circuit breaker and determine cause for open circuit breaker.
	Landing gear selector circuit breaker open.	Reset circuit breaker and determine cause for open circuit breaker.
	Landing gear actuator circuit wires broken.	Check wiring.
	Landing gear selector circuit wires broken.	Check wiring.

TABLE I (Sheet 2 of 4)
TROUBLESHOOTING HYDRAULIC SYSTEM

Trouble	Cause	Remedy
Landing gear extension system fails to operate. (cont.)	Pump extension solenoid inoperative (outboard solenoid).	Replace solenoid.
	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 allows pressure to build up and shut off pump before gear has retracted.	Place airplane on jacks and run retraction check. Isolate and determine cause.
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.

TABLE I (Sheet 3 of 4)
TROUBLESHOOTING HYDRAULIC SYSTEM

Trouble	Cause	Remedy
Pump fails to shut off though gear has fully retracted.	Pressure switch inoperative.	Replace switch.
	Pressure switch out of adjustment.	Replace switch.
	Pump retraction solenoid sticking (inboard solenoid).	Replace solenoid.
	Internal leakage of system.	Check gear actuating cylinders and free fall valve for internal leakage.
		Check for internal damage to hydraulic pump.
	External leakage of system.	Check gear actuating cylinders for external leakage.
		Check for broken or damaged hydraulic lines or hoses.
	Pump relief valve out of adjustment.	Replace pump.
Pump fails to shut off though the gear has fully extended.	Pump extension solenoid sticking (outboard solenoid).	Replace solenoid.
	Nose gear down limit switch actuator out of adjustment.	Adjust switch actuator. (Refer to Adjustment of Nose Gear Down Limit Switch, Section VII.)
	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, Section VII.)
	Main gear down limit switch failed.	Replace switch.

TABLE I (Sheet 4 of 4)
TROUBLESHOOTING HYDRAULIC SYSTEM

Trouble	Cause	Remedy
Pump running inter-remittently after gear has retracted.	Leakage of high pressure check valve.	Remove pump and place check valve.
	Internal leakage of system.	Check free fall valve for internal leakage.
		Check gear actuating cylinders for internal leakage.
	External leakage of system.	Check gear actuating cylinders for external leakage.
		Check for broken or damaged hydraulic lines.
Gear stops part way up, but pump continues to run.	Pump high pressure relief valve out of adjustment.	Replace pump.
	Internal leakage of system.	Check gear actuating cylinders and free fall valve for internal leakage.
		Check for broken or damaged hydraulic lines.
	Hydraulic fluid in reservoir below operating level.	Fill reservoir with hydraulic fluid.
All gears fail to free-fall.	Free-fall valve fails to open.	Check valve and replace.

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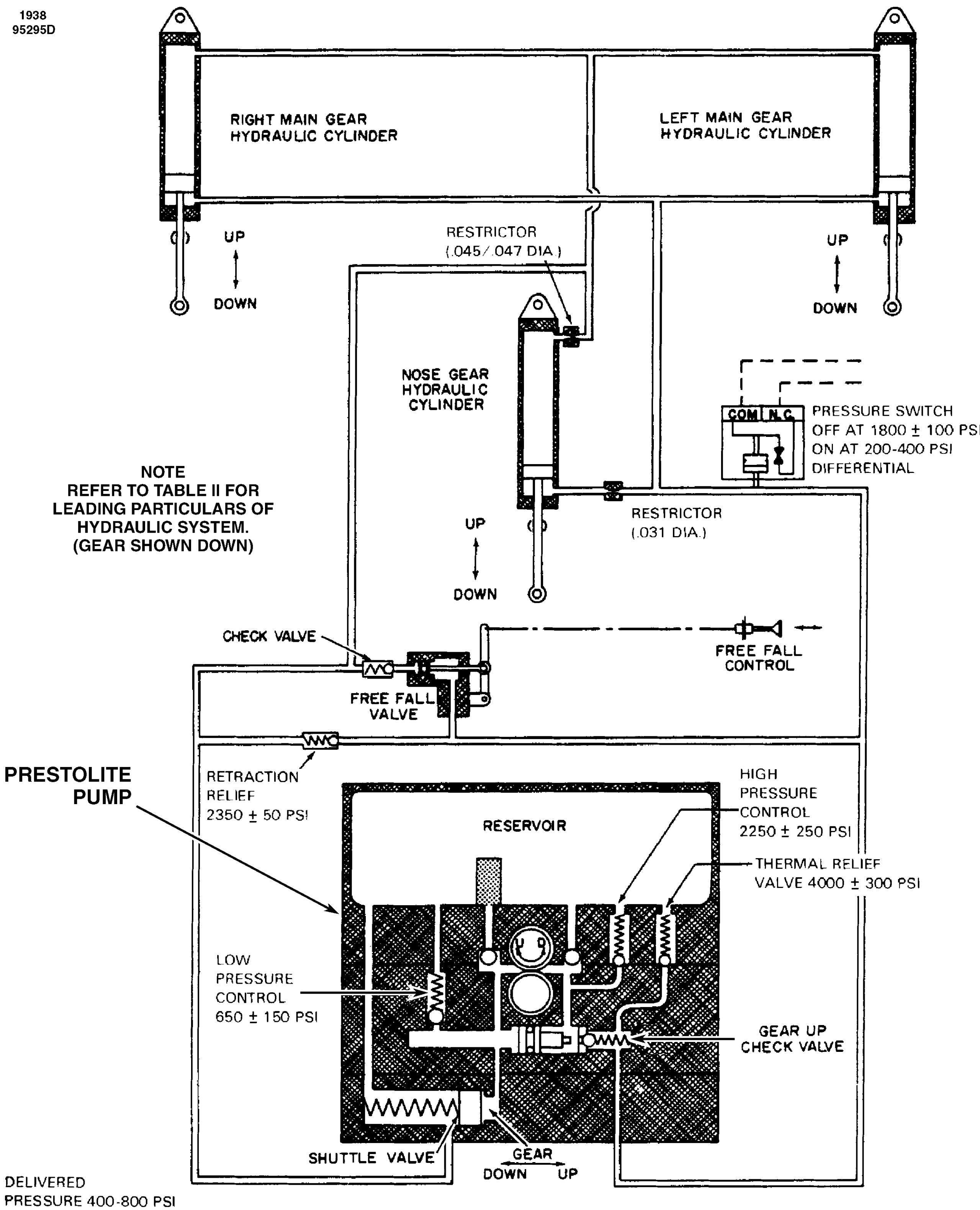
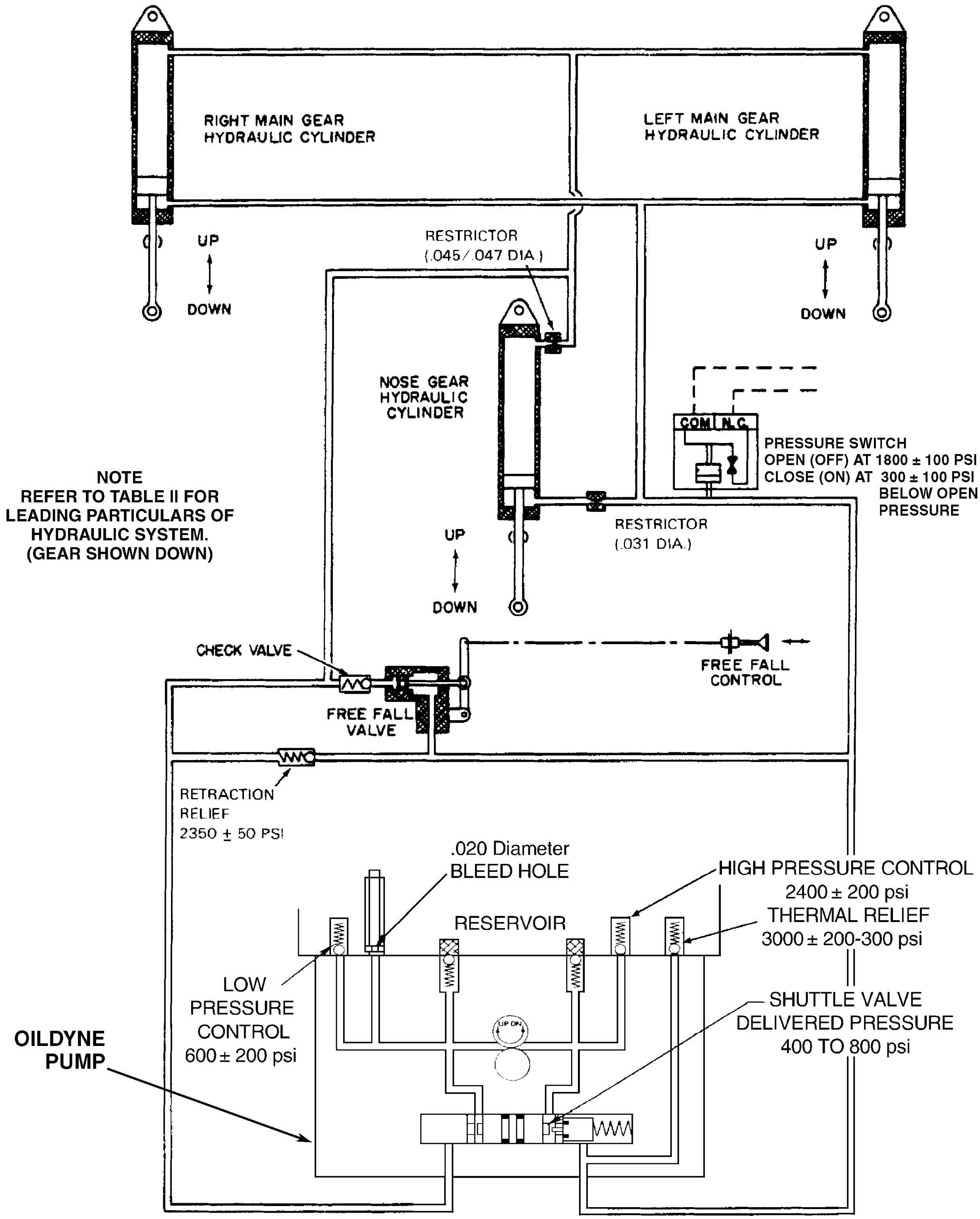
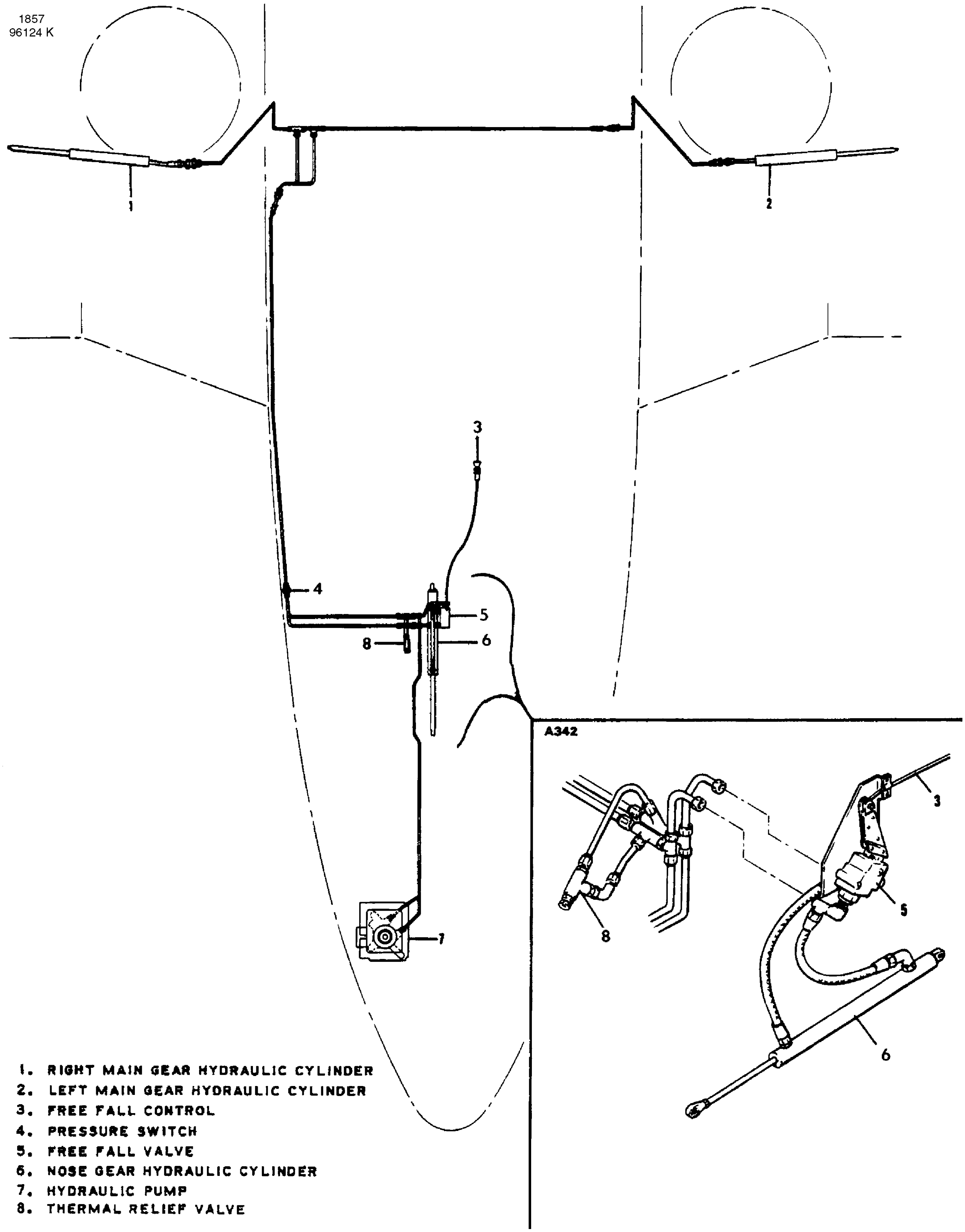


Hydraulic System Schematic
Figure 1 (Sheet 1 of 2)



Hydraulic System Schematic
Figure 1 (Sheet 2 of 2)



Hydraulic System Installation
Figure 2

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4. HYDRAULIC PUMP - ORIGINAL EQUIPMENT - PRESTOLITE. (See Figures 3, 4, and 5.)

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.)

5. REMOVAL. The 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.

   a. Remove the nose gear cover.

   b. Remove anti-splash cover (P/N 96374-0) by removing the four attaching screws.

   c. Disconnect the pump electrical leads from the pump solenoid relays and the ground wire from the battery shelf.

   d. Disconnect the hydraulic lines from the pump. Cap the line ends to prevent contamination.

   e. Remove pump by removing pump attaching bolts.

6. DISASSEMBLY. (Refer to Figure 3.) After the hydraulic pump has been removed from the airplane, cap or plug all ports, and clean exterior of pump using a dry cleaning solvent to remove accumulated dirt and dust. The three major components of the pump assembly are the pump base, pump motor, and valve and gear case. These three major components should be disassembled as follows:

   a. Pump Base: Remove pump base (16) from valve and gear case by:

      1. Cutting safety wire and removing bolts (17) with washers securing pump base to pump and gear case.

      2. 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.

   b. Pump Motor: The pump motor may be removed from the pump and disassembled as follows:

      1. Remove thru bolts (4) from head (1) of motor. Using a knife cut the seal coating between the motor head and case.

      2. Lift the head up from the case approximately .50 of an inch, this will allow inspection of brushes (3) without the brushes unseating from the commutator. (Refer to Paragraph 7 for brush inspection.) The brush leads are secured to the head assembly.

      3. Raise the head assembly (1) off the armature (8) and note the small thrust ball (7) located between the end of the armature (8) and motor head. Do not misplace this bearing.

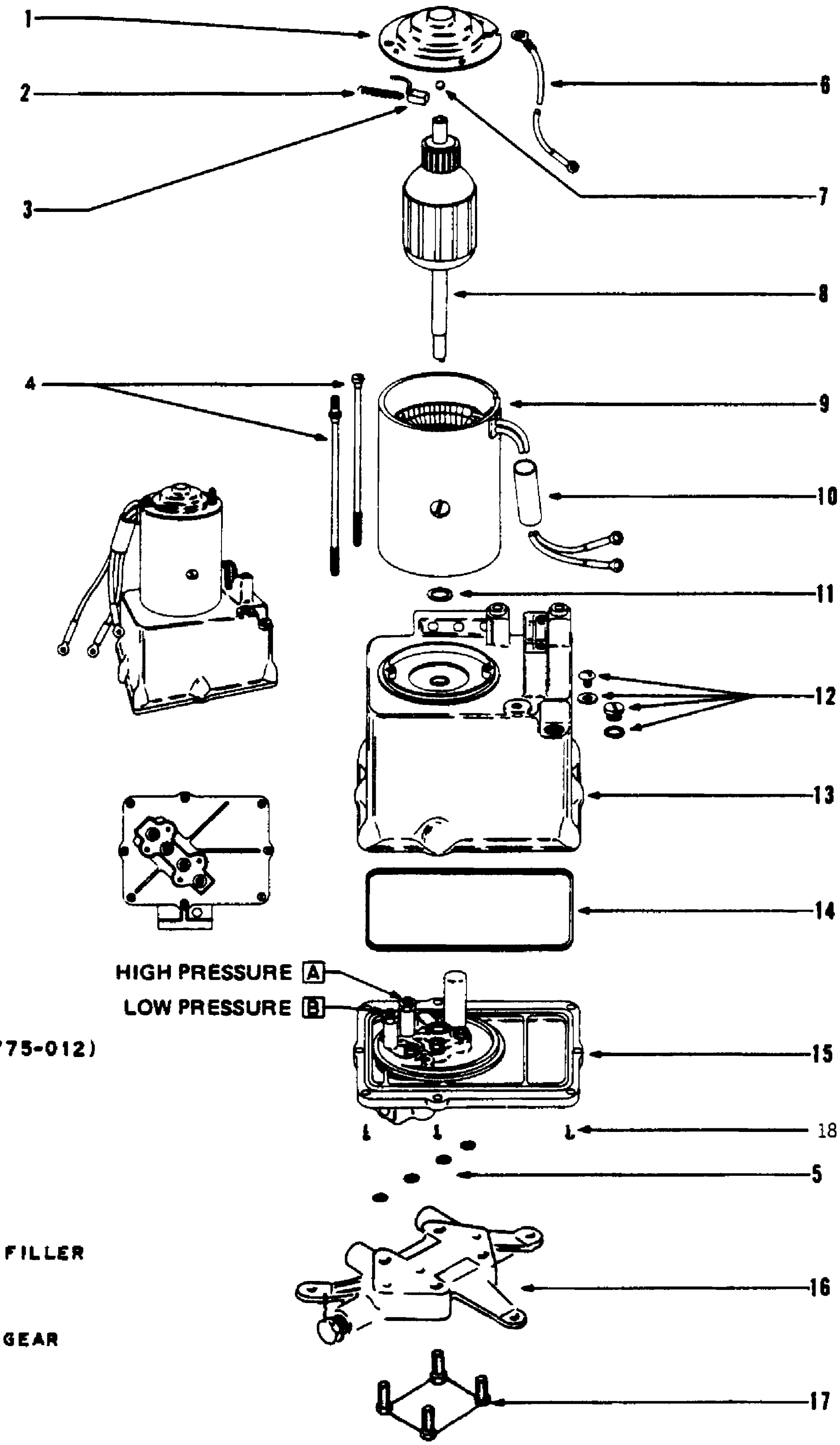
      4. Draw the armature from the motor frame (9). Note the number of thrust washers (11) mounted on the drive end of the armature shaft.

      5. Remove the motor frame from the pump reservoir (13).

   c. Valve and Gear Case: Remove valve and gear case (15) from reservoir (13) as follows:

      1. Remove eight screws from flange of body and separate the two assemblies (18).

      2. 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, THRU
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)

Hydraulic Pump - Prestolite
Figure 3

7. CLEANING, INSPECTION AND REPAIR.

NOTE: Repair facilities must be clean to prevent contamination of pump components. Proper and careful handling should be exercised to prevent damaging pump components.

a. Discard all O-rings.

b. Remove caps or plugs and clean all components with a dry type cleaning solvent and dry thoroughly.

c. Inspect pump components for scratches, scores, chips, cracks and wear.

d. Inspect motor for worn brushes (minimum of .218 of an inch brush remains between the braided wire and commutator end), excess commutator wear and excess bearing wear.

NOTE: Replacement brushes for original equipment Prestolite pumps are no longer available. When brushes wear out, replace entire pump with a new Oildyne pump. See parts catalog, P/N 753-816.

e. Repairs are limited to O-ring replacement.

8. ASSEMBLY. (Refer to Figure 3.)

a. The pump motor may be assembled and installed on the reservoir as follows:

1. Position motor frame (9) on reservoir (13). Note aligning marks on frame and reservoir.
2. Place thrust washers (11), of the same amount removed, on the drive end of the armature (8).
3. Lubricate the entire length of the armature shaft, on the drive end, with light grease to protect O-ring seal from damage. Insert end of shaft in reservoir.
4. Saturate felt oiling pad around commutator end bearing with SAE 20 oil. Allow excess oil to drain off before assembling motor.
5. Insert thrust ball (7) in bearing of motor head (1). To hold ball in position, place a small amount of grease inside the bearing.
6. 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 (4).
7. Check freedom of rotation and end play (thrust) of the armature within the assembly. A minimum of .005 inch end play is permissible. Adjust to this tolerance if necessary by adding or removing thrust washers (11) on drive end of armature shaft.

b. Assemble valve and gear case (15) to the reservoir (13) as follows:

1. If removed, place pump gears in valve and gear case and install cover. Install cover attaching bolts and secure.
2. Lubricate reservoir seal ring (14) with hydraulic fluid (MIL-H-5606) and place in recess provided in case (15).
3. Position reservoir (13) on valve and gear case (15). Care should be taken when aligning the armature shaft with the pump gear. Do not run the motor to accomplish this.
4. Ascertain the seal ring is properly positioned and loosely install screws. With the motor electrically connected to a 12 volt power supply, and an ammeter in the circuit, tighten the screws such that the current drawn does not exceed 12-amperes.

TABLE II
LEADING PARTICULARS, HYDRAULIC SYSTEM

Hydraulic Pump	**Prestolite**	**Oildyne**
High Pressure	2000 to 2500 psi	2400 ± 200 psi
Low Pressure	650 ± 150 psi	600 ± 200 psi
Flow Rate @ 1000 psi	45 cu. in. per min.	60 cu. in. per min.
High Pressure Control	2000 to 2500 psi	2400 ± 200 psi
Hydraulic Fluid	MIL-H-5606	MIL-H-5606
Thermal Relief	4000 ± 300 psi	3000 + 300, - 200 psi
Retraction Relief	2350 ± 50 psi	
Pressure Switch		
Open (OFF) Pressure	1800 ± 100 psi	
Close (ON) Pressure	Pressure decreasing 200 to 400 psi	

TABLE III
CHARACTERISTICS, HYDRAULIC PUMP MOTOR

Electrical Characteristics	**Prestolite**	**Oildyne**
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 Protection	Thermal circuit breaker	
Automatic Reset Time	12 seconds, max.	
Location, Automatic Reset	Commutator end head of motor	
Mechanical Characteristics	**Prestolite**	**Oildyne**
Bearings	Absorbent bronze (Drive end bearing in upper pump and valve assembly casting.)	N/A
	Steel ball (Thrust, between commutator end head and end of armature shaft.)	N/A
End Play, Armature	.005 inch, min. (Adjust by selection of thrust washers on drive end of armature shaft.)	N/A

c. Attach the pump base to the pump as follows:

1. With pump inverted, lubricate O-ring seals and install them in recesses provided in the valve and gear case (15).
2. Install attaching bolts with washers and torque to 70-inch pounds.
3. Safety attaching bolts with MS20995-C32 wire.

d. Conduct motor operational check not to exceed 10 seconds running time.

9. TEST AND ADJUSTMENT. (Refer to Figure 4.)

a. Test Equipment:

1. Hydraulic pump and mounting base.
2. Pressure gauge (10 - 1000 psi).
3. Pressure gauge (0 - 3000 psi).
4. Hoses with fittings to connect base and gauges.
5. Power supply (14 VDC).
6. Ammeter (0 to 100-amps).
7. Fuse or circuit protector (100-amps).

b. Test and Adjustment:

NOTE: Use test gauges or gauges of known accuracy when performing the following tests.

1. Connect the 0 to 1000 psi gauge to the low pressure port of the pump base.
2. Connect the 0 to 3000 psi gauge to the high pressure port of the pump base.
3. Connect black lead of pump motor to the negative terminal of the DC power supply.
4. 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.
5. 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.)
6. 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 3 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 5 thru 8.

7. 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.
8. 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 3, accordingly to obtain desired reading.) Disconnect green lead. Both pressure gauges should indicate zero psi.
9. 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.

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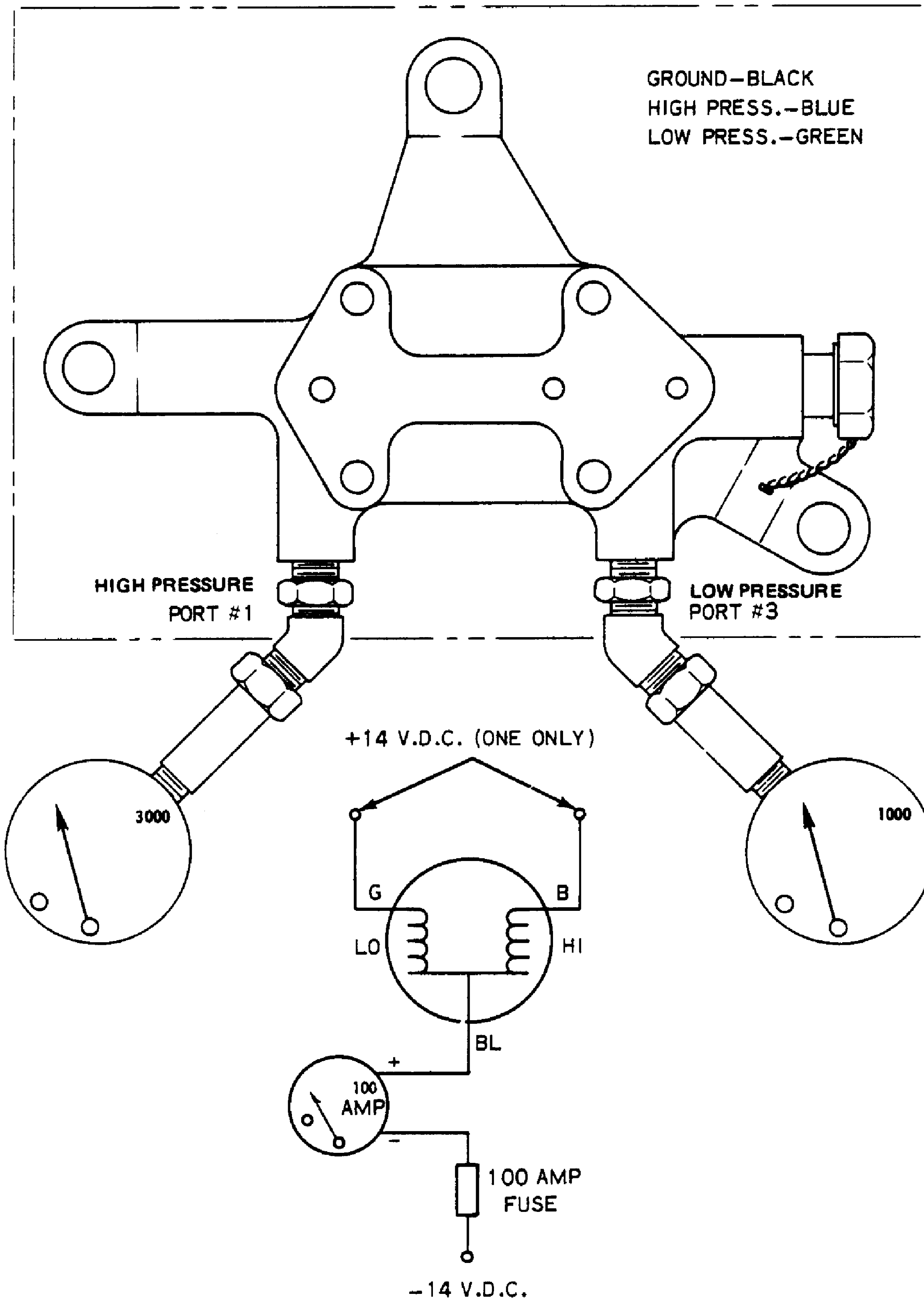

Test/Adjust - Hydraulic Pump - Prestolite
Figure 4

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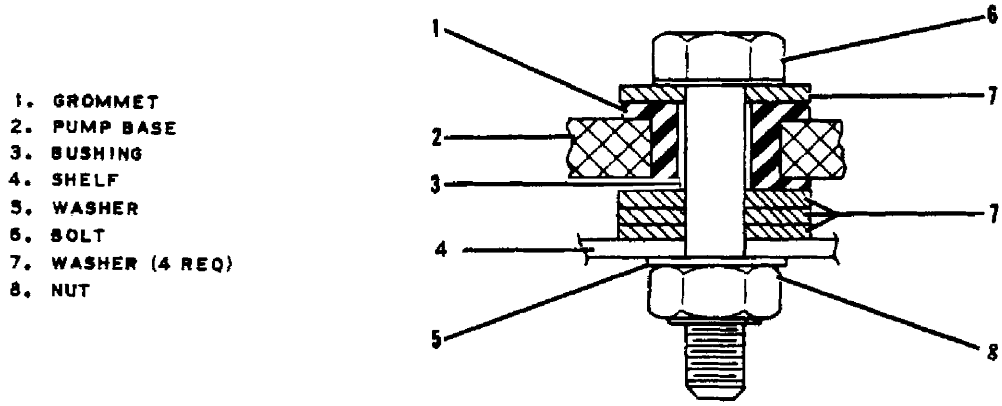


Pump Mounting - Prestolite
Figure 5

10. 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.
11. 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: Replace pump assembly if any of the above tests are not performed satisfactorily.

12. Disconnect the green lead from the power supply and permit the pressure to drop before disconnecting the hydraulic lines.

10. INSTALLATION. (Refer to Figure 5.)

    a. Align three washers (7) over each hole in shelf (4). Insert grommet (1) through mounting holes in pump base (2). Insert bushing (3) through hole in each grommet.
    b. Position pump on washers. Insert bolt (6) with top washer (7) through bushing (3), bottom washers (7) and shelf (4). Mount nut (8) and washer (5) on bolt and tighten.
    c. Connect hydraulic lines to pump.
    d. Connect pump electrical leads. Blue wire to outboard (lower) solenoid, green wire in inboard (upper) solenoid, and black wire to ground on battery shelf.
    e. Check fluid level in pump. Refer to Section II for filling instructions.
    f. With airplane on jacks, operate pump to purge hydraulic system of air, and check for leaks. After operation, recheck fluid level.
    g. Install anti-splash cover (P/N 96374-0) with the four attaching screws.
    h. Install the nose gear cover.

10a. HYDRAULIC PUMP - SERVICE REPLACEMENT - OILDYNE. (See Figure 6.)

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

a. In Aircraft.

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. Removal.

(a) Remove the ABS nose gear cover.

(b) Remove anti-splash cover (P/N 96374-0) by removing the four attaching screws.

(c) Disconnect the three knife connectors that attach the black, blue, and green forward and reverse harness wires.

(d) Disconnect and plug the “up” and “down” pressure hydraulic lines from pump mount. Cap the lines.

(e) Remove the three each mounting bolts and washers securing pump mount to deck.

(f) Lift assembly from airplane.

2. Installation.

(a) Position assembled pump, bracket, and pump mount on pump deck in airplane.

(b) 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 (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.

(c) Install the “up” and “down” pressure hydraulic lines to pump mount.

(d) Connect the three knife connectors that attach the black, blue, and green forward and reverse harness wires.

(e) Install anti-splash cover (P/N 96374-0) by installing the four attaching screws.

(f) Install the ABS nose gear cover.

b. Field Service.

Field service of Oildyne hydraulic pump is limited to motor replacement and removal, inspection, cleaning, and replacement of the hydraulic fluid reservoir. Should the pump/adapter assembly malfunction, either replace pump, or return pump to Piper, via the local Piper distributor, for servicing or repairs.

c. Replacing Entire Pump.

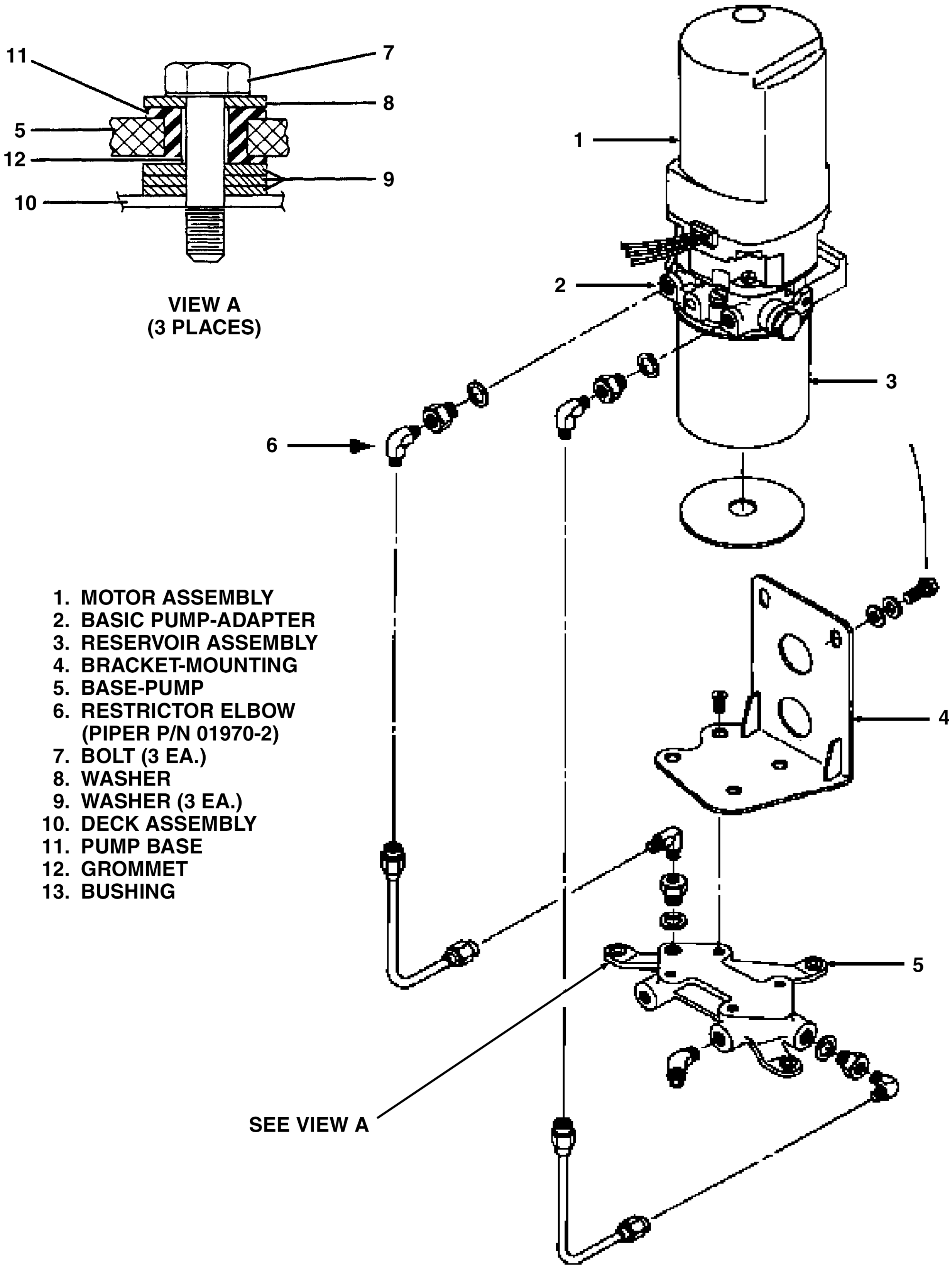
See “In Aircraft,” above, to remove/install pump in aircraft.

1. Disassembly.

(a) Remove safety wire securing two bolts that attach bracket to pump.

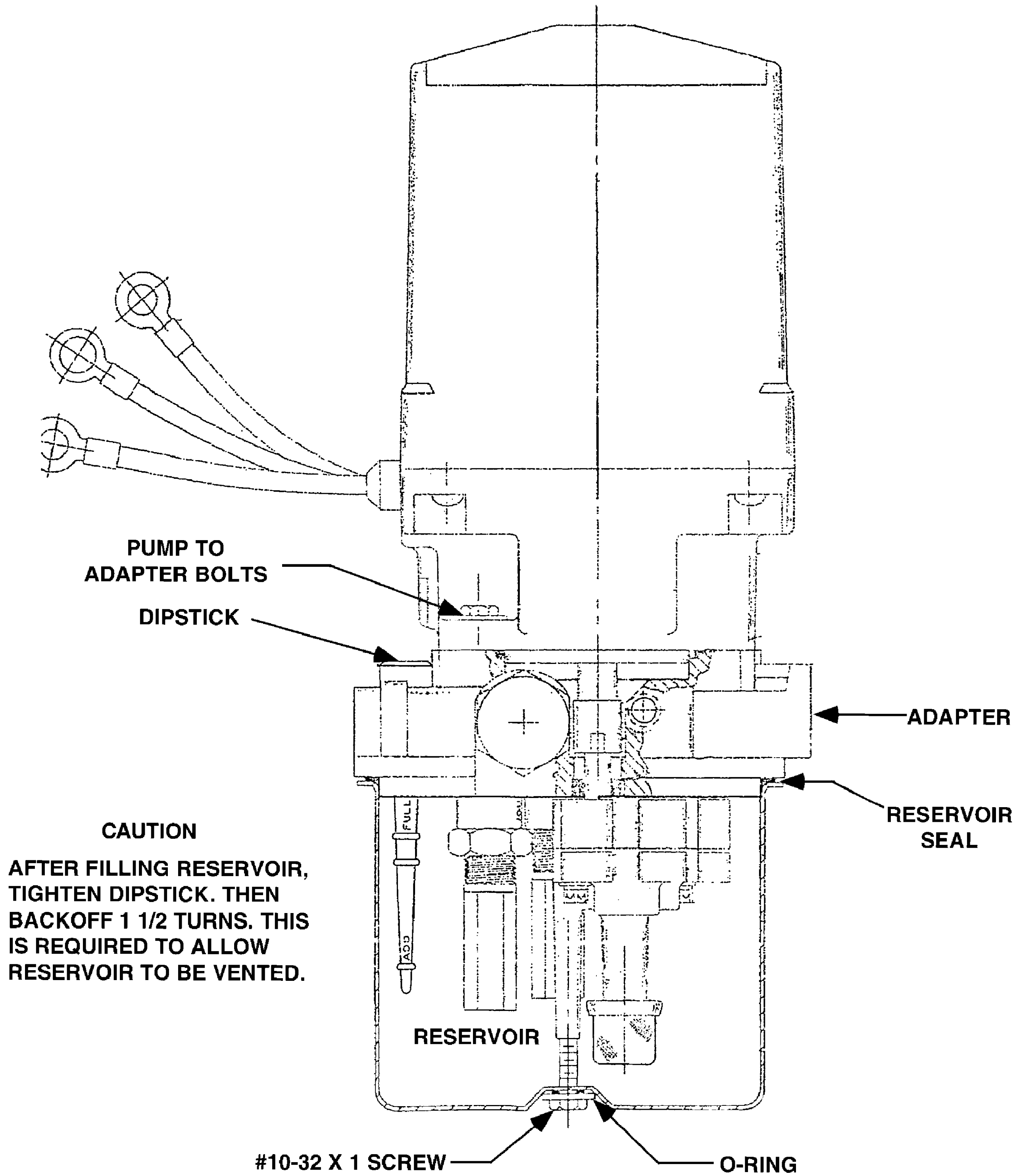
(b) Remove the two bolts and washers.

(c) Separate pump assembly from bracket.



1. MOTOR ASSEMBLY
2. BASIC PUMP-ADAPTER
3. RESERVOIR ASSEMBLY
4. BRACKET-MOUNTING
5. BASE-PUMP
6. RESTRICTOR ELBOW (PIPER P/N 01970-2)
7. BOLT (3 EA.)
8. WASHER
9. WASHER (3 EA.)
10. DECK ASSEMBLY
11. PUMP BASE
12. GROMMET
13. BUSHING

Hydraulic Pump - Oildyne
Figure 6 (Sheet 1 of 2)



Hydraulic Pump - Oildyne
Figure 6 (Sheet 2 of 2)

2. Installation.
   (a) If bracket was removed from pump mount, install bracket to Piper pump mount with four MS24693-S298 screws.
   (b) Position pump assembly on bracket so that tapped holes in oildyne adapter align with bolt holes on bracket.
   (c) Install two AN960-616 washers and two MS20074-06-05 bolts to secure pump assembly to bracket.
   (d) Safety bolts with MS20995-C41 wire.

d. Replacing Hydraulic Pump Motor.

See "In Aircraft," above, to remove/install pump in aircraft.

1. Disassembly.
   (a) Remove two each mounting bolts on flange of motor assembly and separate the motor assembly from the pump.
   (b) Remove coupling and O-ring and discard.

   NOTE: New O-ring and coupling are included in replacement motor assembly.

2. Assembly.
   (a) Locate the replacement O-ring and coupling.
   (b) Place the coupling and O-ring into position between the motor assembly and pump-adapter assembly.
   (c) Apply light coating of Titeseal No. 3 in back of the first two threads of mounting bolts.
   (d) Positioning the two units in place, install two each mounting bolts through the flange of the motor assembly and into the pump-assembly housing.
   (e) Torque bolts to 15 -20 inch pounds.

e. Cleaning, Inspecting, or Replacing Hydraulic Fluid Reservoir.

See "In Aircraft," above, to remove/install pump in aircraft.

1. Disassembly.

   CAUTION: DO NOT DISASSEMBLE PUMP ASSEMBLY FROM ADAPTER ASSEMBLY. DAMAGE TO VALVES AND PRESSURE SETTINGS, WHICH ARE NON-ADJUSTABLE, WILL OCCUR.

   (a) Remove mounting bracket from pump as described in "Replacing Entire Pump," above.
   (b) Remove screw and O-ring securing the reservoir to the adapter assembly.
   (c) Remove reservoir and reservoir seal.
   (d) 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.
2. Assembly.
   (a) Locate the cushion pad and bond it to the bottom surface of the reservoir using Scotch Grip 2210, or Contact Adhesive B-10161 rubber cement.
   (b) Position the reservoir seal between the reservoir and the adapter assembly.
   (c) Locate the O-ring and bolt that secures the reservoir to the pump-adapter assembly and apply a light coating of Titeseal No. 3 in back of first two bolt threads.
   (d) Position the O-ring on the bolt, and install it through the reservoir and into the pump-adapter securing the reservoir.
   (e) Tighten this bolt to a torque value of 40 - 50 inch pounds.
   (f) Install pump on mounting bracket as described in "Replacing Entire Pump," above.

11. LANDING GEAR FREE-FALL VALVE ASSEMBLY. (Refer to Figure 7.)

12. INSPECTION AND REPAIR. This valve is located directly above the nose wheel actuating cylinder. Inspection is limited to determining if any signs of hydraulic fluid leakage are evident around the seam between the end fitting and valve body, and around the periphery of the piston assembly shaft. If leaks appear, the valve assembly should be replaced since it is impractical to repair the valve.

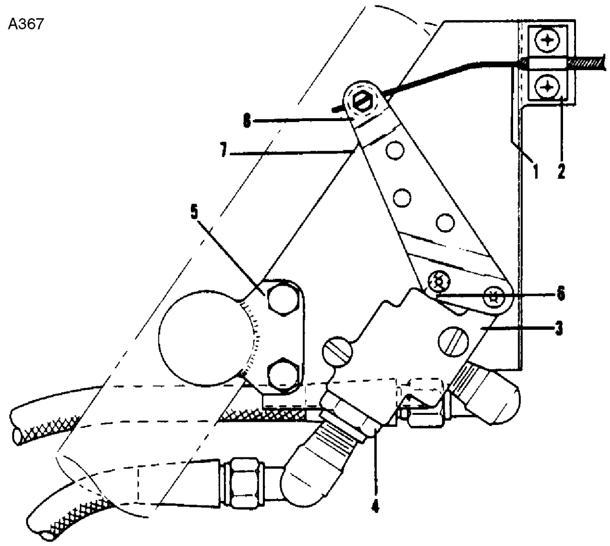
13. REMOVAL.

    a. Loosen three screws and clamp securing cable in position and withdraw cable.

    b. 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.

    c. Remove the hex head bolts securing the valve and bracket to the frame and remove the assembly from the airplane.

    d. 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.



1. CABLE
2. CLAMP
3. VALVE BODY
4. END FITTING
5. FRAME
6. PISTON SHAFT
7. BRACKET
8. ARM ASSY.

Emergency Gear Extension (Free-Fall) Valve
Figure 7

14. INSTALLATION.

    a. Apply Lubon #404, or equivalent, to MALE threads of elbows and tees and insert fittings in valve. Lubon should be applied sparingly to prevent it entering the hydraulic system.

    b. 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.

    c. Position bracket with valve on frame. Apply Lubon #404 to MALE threads of tees and connect hydraulic lines.

    d. Push arm assembly fully forward. Pull cable full forward. Place clamp over reinforced portion of cable and tighten screws. Insert loose end of cable thru the hole in the bushing of the arm assembly. Tighten lock screw on cable.

15. GEAR ACTUATING CYLINDERS.

15a. NOSE GEAR ACTUATING CYLINDER. (Refer to Figure 8.)

16. REMOVAL.

a. Place airplane on jacks. (Refer to Jacking, Section II.)

b. Disconnect hydraulic lines from actuating cylinder and cover open line ends to prevent contamination.

c. Disconnect operating rod end from the bracket on the trunnion assembly by removing attaching bolt and nut.

d. Disconnect cylinder from the link assembly. The downlock spring and downlock 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.

e. Remove the cylinder from the wheel well.

17. INSTALLATION.

a. Refer to paragraph 16.d. Remove bolt (7) far enough to position clevis end of actuating cylinder (3) in the link assembly (1). Reinsert bolt with callouts (1) thru (6) arranged as illustrated in Figure 8.

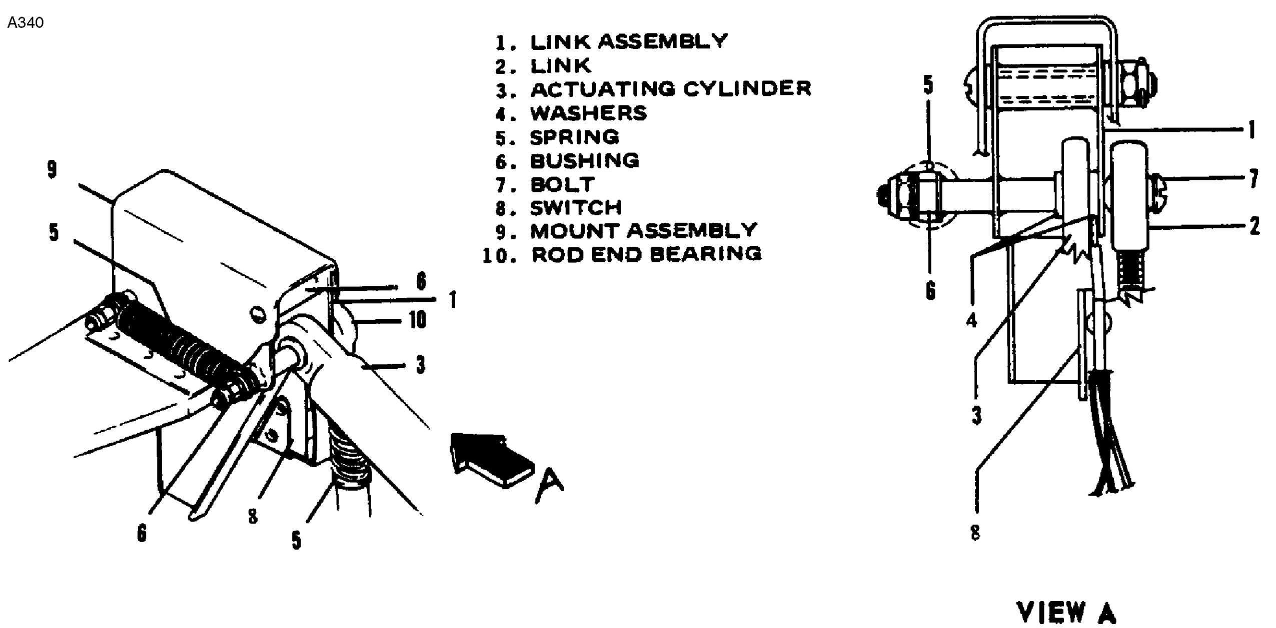
b. Insert the operating rod end into the bracket on the trunnion assembly and secure with bolt, nut and washers.

c. Connect hydraulic lines to their respective fittings on the actuating cylinder.

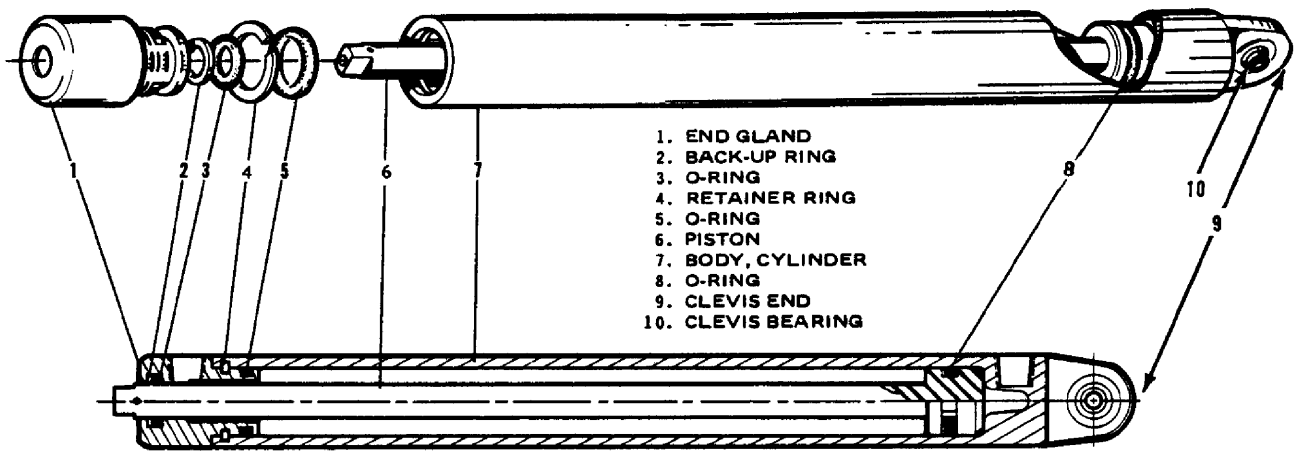
d. Check adjustment of cylinder rod end. (Refer to Adjustment of Nose Landing Gear, Section VII.)

e. Operate pump to purge system of air and check fluid level in reservoir.

f. Remove airplane from jacks.



Nose Gear Actuating Cylinder Installation
Figure 8



Gear Actuating Cylinder
Figure 9

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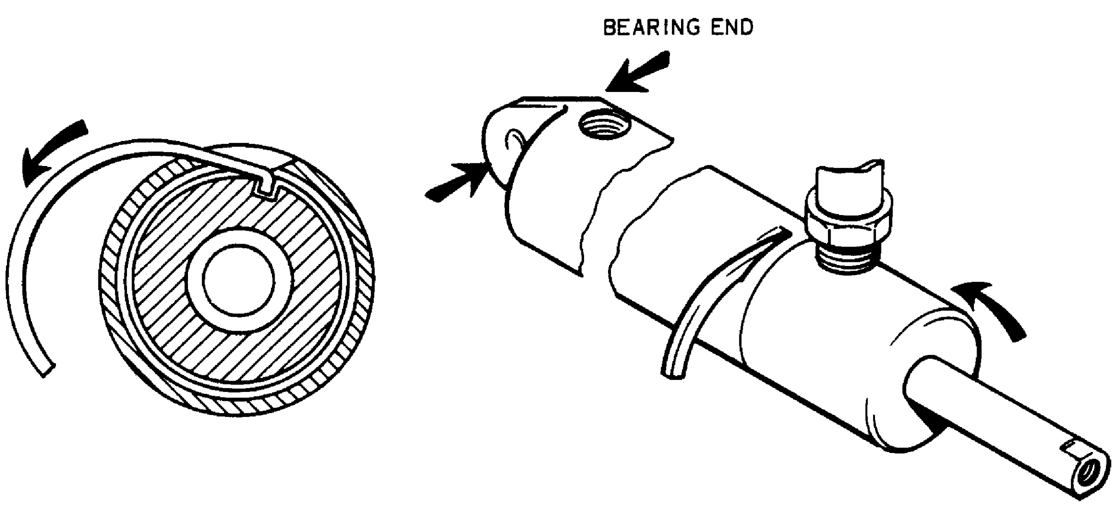

End Gland Locking Device
Figure 10

17a. MAIN GEAR ACTUATING CYLINDER.

18. REMOVAL.

a. Place airplane on jacks. (Refer to Jacking, Section II.)

b. Disconnect hydraulic lines from actuating cylinder and cover open line ends to prevent contamination.

c. Disconnect gear downlock spring from swivel fitting at upper end of spring.

d. Remove downlock spring swivel fitting and disconnect cylinder operating rod end from upper side brace retraction fitting by removing attaching nut, washer and bolt.

e. Disconnect cylinder from its attachment by removing nut and bolt.

f. Remove cylinder from wheel well.

19. INSTALLATION.

a. Attach the cylinder to its attachment fitting in the wheel well using bolt and nut.

b. Attach the operating rod end and downlock spring swivel fitting to the upper side brace retraction fitting using washer and nut. The swivel fitting must be free to rotate.

c. Connect downlock spring to swivel fitting.

d. Check adjustment of cylinder rod end. (Refer to Adjustment of Main Landing Gear, Section VII.)

e. Operate pump and purge system of air. Check fluid level in reservoir.

f. Remove the airplane from jacks.

19a. ACTUATING CYLINDER (NOSE OR MAIN GEAR). (Refer to Figures 9 and 10.)

NOTE: The following instructions apply to actuators P/N 96860-000 (i.e. - SFA232-3 and SFA232-4) only. Disassembly, Assembly, and Cleaning, Inspection and Repair instructions for later model actuators P/N 96860-002 and 96860-003 (i.e. - SFA232-5) are found in Cleveland Wheel and Brakes publication: Component Maintenance Manual - CMSFA232-5 (011-00504) available from the vendor. See Vendor Publications in the Introduction.

20. DISASSEMBLY.

a. Using hand pressure, push piston rod (6) toward clevis end (9) to remove oil from the cylinder.

b. Place clevis in a soft jaw vise and clamp against the clevis bearing (10).

c. 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 10.)

d. Rotate end gland counterclockwise (with use of fitting) until end of retainer ring (4, Figure 9) shows in slot of cylinder body (7). 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.)

e. Remove piston (6) and end gland (1) from cylinder body.

f. Remove O-rings as required.

21. CLEANING, INSPECTION AND REPAIR.

a. Clean cylinder components with a suitable dry type solvent and dry thoroughly.

b. Inspect cylinder assembly for the following:

1. Interior walls of cylinder and exterior surface of the piston for scratches, burrs, corrosion, etc.
2. Stripped or damaged threads.
3. Rod end fitting and swivel fitting of cylinder for wear and corrosion.
4. End fitting retainer slot for excess wear.

c. Repairs to the cylinder are limited to polishing out small scratches, burrs, etc., and replacing components. (Refer to Parts Catalog for replacement part numbers.)

22. ASSEMBLY.

a. Install O-rings (3), (5) and (8) in their respective positions.

b. Lubricate areas around O-rings with hydraulic fluid, park-o-lube or Vaseline. Slide end gland (1) on piston rod (6). Slide piston into cylinder body (7).

c. Insert hook end of new lock ring (4), (P/N 755-997), in slot of cylinder body and slot in end gland. Rotate gland counterclockwise to completely wrap lock ring into assembly.

d. Align port in end gland and cylinder body.

e. Check smoothness of operation of piston and static test unit to check for possible cut O-rings.

f. Clean nose cylinder orifices.

23. HYDRAULIC LINES.

24. REMOVAL AND INSTALLATION. Remove damaged hydraulic lines by disconnecting fittings at both ends and disconnecting where secured by brackets. Refer to Figure 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.

25. 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 in order to conserve the battery. (Refer to External Power Receptacle, Section II.)

CAUTION: TURN MASTER SWITCH OFF BEFORE INSERTING OR REMOVING EXTERNAL POWER SUPPLY PLUG.

a. Place airplane on jacks. (Refer to Jacking, Section II.)

b. With gear down, master switch ON, and circuit breaker closed, place landing gear selector handle in the UP position. The pump should immediately start operating and the gear retract. The red gear unsafe light on the instrument panel should light up until the gear is fully retracted. The hydraulic pump should stop operating after full retraction of the gear.

c. Place gear selector handle in DOWN position. The gear should extend and lock in position. Gear down lights on the instrument panel will light up when all three gears are locked in position. Inspect hydraulic system for leakage of hydraulic fluid.

d. Recycle the landing gear to determine that it functions properly.

e. To check operation of the free-fall valve assembly, retract the landing gear and turn the master switch off. Pull the free-fall valve knob full out. The landing gear should extend and lock in position.

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.

26. SERVICING HYDRAULIC PUMP/RESERVOIR. The fluid level of the reservoir of the combination pump and reservoir should be checked every 50 hours. Access to the pump is through the panel at the right forward side of the nose baggage compartment.

a. PRESTOLITE PUMP - 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 and position 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.

b. OILDYNE PUMP - To check fluid level, remove the filler plug, clean dipstick and check fluid level with dipstick. Add fluid (MIL-H-5606), as required, through the filler hole until full. Reinstall the filler plug.

NOTE: The reservoir is vented through the fill hole. After filling reservior, tighten dipstick. Then backoff 1 1/2 turns to allow venting.

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SECTION

VII

LANDING GEAR AND BRAKES

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SECTION VII

LIST OF EFFECTIVE PAGES

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SECTION VII - LANDING GEAR AND BRAKES

TABLE OF CONTENTS

SECTION VII - LANDING GEAR AND BRAKES

TABLE OF CONTENTS (continued)

SECTION VII

1. INTRODUCTION. This section contains instructions for overhauling, inspecting and adjusting the various components of the PA-34 landing gear and brake system. Also included are adjustments for the electrical limit, safety and warning switches. See Section VI, Hydraulic System, for information on the landing gear extension and retraction system.

2. DESCRIPTION. The PA-34 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.

   Gear positions are indicated by three green lights directly above the selector switch when the gear is down and locked, and a red light at the top of the instrument panel when gear is unsafe. Activation of all three downlock switches will shut the hydraulic pump off. As the instrument lights are turned on, the green lights will dim.

   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 the landing gear is normally extended and retracted by using the gear selector knob; however, in the event of hydraulic or electrical failure, the gear can be extended by pulling the emergency gear extension knob (i.e. - free fall valve) which permits the gear to fall free. The nose and main gear require no assist springs. Once the gear are down and the downlock hooks engage, a spring maintains pressure on each hook in the locked position until released by hydraulic pressure.

   When the airplane is on the ground, and the gear selector knob is moved to the “UP” position, a safety switch (i.e. - squat switch) located on the left main gear will prevent the hydraulic pump from actuating if the master switch is turned on. When the plane leaves the ground and the gear selector knob is “UP”, the safety switch will actuate when the oleo extends in excess of eight (8) inches, the hydraulic pump will activate and the landing gear will come up. In the event the airplane is placed on jacks and raised to the extent the oleo extends in excess of eight (8) inches, the safety switch will actuate the hydraulic pump raising the landing gear if the landing gear selector knob is in the “UP” position and the main switch is turned on.

   The nose gear is steered by the use of the rudder pedals. A gear centering spring mechanism is incorporated in the nose gear steering mechanism. As the gear retracts the steering linkage is disconnected from the nose gear so that rudder control is not impeded in flight.

   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 left (optional on right) set of rudder pedals and a handle connected to a brake cylinder located below and forward of the center of the instrument panel. A parking brake is incorporated with the handle, and is used by pulling back on the handle and pushing forward on the button to the left of the handle. To release the hand brake, pull aft on the handle and allow it to swing forward. The cylinders are supplied hydraulic fluid from a reservoir located on the forward side of the cabin main bulkhead.

3. TROUBLESHOOTING. (See Table I.)

Mechanical and electrical troubles peculiar to the landing gear system are listed in Table I. When troubleshooting, first eliminate potential hydraulic malfunctions as listed in Section VI, Table I. Then proceed to switch malfunctions and last to the mechanical operation of the gear itself, both of which are included in this section.

CAUTION: PLACE THE AIRPLANE ON JACKS BEFORE PERFORMING WORK ON THE LANDING GEAR WHICH INVOLVES DISASSEMBLY OR REQUIRES RAISING OR LOWERING THE GEAR.

CAUTION: WHEN IT BECOMES NECESSARY TO RAISE OR LOWER EITHER THE NOSE GEAR OR THE MAIN GEAR MANUALLY, THE FREE FALL VALVE KNOB SHOULD BE PULLED FULL OUT THUS PREVENTING THE 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 DOWNLOCK MECHANISM ALLOWING THE GEAR TO COLLAPSE WHEN THE WING JACKS ARE REMOVED.

TABLE I (Sheet 1 of 3)
TROUBLESHOOTING LANDING GEAR

Trouble	Cause	Remedy
Green gear down lights dim though 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.
Green gear down lights will go out and not dim when position light switch is turned on though gear is down and locked.	Green light ground dimming resistor open.	Replace resistor.
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.
Green downlock 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.

TABLE I (Sheet 2 of 3)
TROUBLESHOOTING LANDING GEAR

Trouble	Cause	Remedy
Nose landing gear shimmies during fast taxi, take-off, or landing.	Internal wear in centering springs.	Replace shimmy dampener.
	Centering 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 proceedings for correction.
Nose gear fails to steer properly.	Oleo cylinder binding in trunnion.	Lubricate trunnion. (Refer to Lubrication Chart, Section II.)
		Cylinder and/or strut housing bushings damaged.
	One brake dragging.	Determine cause and correct.
	Steering arm roller sheared at top of strut.	Replace defective roller.
	Steering bellcrank loose on attachment plate.	Readjust and tighten.
	Steering bellcrank bearing and/or bolt worn.	Replace bearing and/or bolt.
	Centering springs galling or binding.	Replace.
Nose gear fails to straighten when landing gear extends.	Steering arm roller sheared at top of strut.	Replace defective roller.
	Incorrect rigging of nose gear steering.	Check nose gear steering adjustment.
Nose gear fails to straighten when landing gear retracts.	Centering guide roller sheared.	Replace roller.
	Damaged guide.	Replace guide.

TABLE I (Sheet 3 of 3)
TROUBLESHOOTING LANDING GEAR

Trouble	Cause	Remedy
Main landing gear shimmies during fast taxi, take-off, or landing.	Tire out of balance.	Check balance and re place 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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4. LANDING GEAR SYSTEM.

5. NOSE LANDING GEAR.

5a. 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 components listed below.

a. Nose Gear Drag Link Upper Attach Bolt, P/N 400-274 (AN7-35). (See Item 55, Figure 2.)

The nose gear installation has been revised to change this AN7-35 bolt to a P/N 693-215 (NAS6207-50D) bolt that is 25% stronger. This bolt change is approved for all PA-34 Series aircraft, and is an Alternate Method of Compliance as a substitute for the P/N 400-274 (AN7-35) bolt per AD 93-24-14.

NOTE: Installation of the P/N 693-215 (NAS6207-50D) bolt does not relieve the 500 hour life limit specified for the AN7-35 in Section I. Whichever is installed, the NAS6207-50D (P/N 693-215) or the AN7-35 (P/N 400-274), the bolt must be replaced each 500 hours time-in-service.

b. 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.

c. 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 to steel, and a recent change adding reinforcement to increase the bearing surface for the P/N 95061-089 bushing.

Inspect the aluminum mount bracket for wear, cracks, loose rivets and other damage at 50 hour intervals (see Section III). The following kits are required if the aluminum Actuator Mount Brackets must be replaced:

Serial No.	Kit No.	Mount Assembly
34-7250001 thru 34-7350135	767-357	95724-007 Replaces 95724-000 95061-313 replaces 95061-89
34-7350136 thru 34-7450220	767-358	95724-005 Replaces 95724-002 95061-313 replaces 95061-89

Each kit includes the latest design mount bracket and new hardware required for the attachment of the nose gear retraction Link Assembly P/N 95712-00/-04.

NOTE: Installation of either Kit No. 767-357 or 767-358 relieves the actuator mount bracket 50 hour inspection requirement.

d. Turn-stop boss failure on the strut upper tube assembly P/N 95720.

Install Piper Kit No. 767-368 to add a Turn Limit Indicator.

5b. OLEO. (Refer to Figure 1.)

CAUTION: PLACE THE AIRPLANE ON JACKS BEFORE PERFORMING WORK ON THE LANDING GEAR WHICH INVOLVES DISASSEMBLY OR REQUIRES RAISING OR LOWERING THE GEAR.

6. DISASSEMBLY. The nose gear oleo assembly may be removed and disassembled from the trunnion assembly with gear removed from or installed in the airplane.

   a. With airplane mounted on jacks, place a drip pan under the nose gear to catch spillage.

   b. Remove air and fluid from oleo strut assembly. Depress air valve core pin until strut pressure is released. Remove air valve body (15) and, using a thin hose, siphon as much hydraulic fluid from the strut as possible.

   c. To remove oleo cylinder (26) piston strut (30) and fork (39) from the trunnion assembly (23), cut safety wire (2) and remove four bolts and washers (1) securing the tiller (20) to the top of the oleo cylinder.

   d. Disconnect nose gear centering spring assembly (11) by removing attaching hardware connecting the spring assembly to the strut housing.

   e. Remove oleo cylinder and fork assembly (39) from the trunnion assembly. The upper and lower shoulder bushings (17 and 22) should remain pressed in the trunnion.

   f. To remove the piston strut (30) and fork (39) from the oleo cylinder, first separate upper and lower torque links (33) and remove snap ring (37) from the bottom of the oleo cylinder.

   g. Pull the piston strut with components from the cylinder. Remove two pins (28) and slide components from cylinder.

7. CLEANING, INSPECTION AND REPAIR.

   a. Clean all parts using a suitable dry type cleaning solvent.

   b. Inspect components of the landing gear as follows:

      1. Bearings and bushings for excessive wear, corrosion, scratches and overall condition.
      2. Retaining pins for wear.
      3. Lock rings for cracks, nicks, burrs and overall condition.
      4. Cylinder and piston strut for excessive wear, corrosion, scratches and nicks.
      5. Orifice hole for obstruction.
      6. Fork for misalignment, cracks or other damage.
      7. Air valve for general condition.

   c. Oleo repair is limited to smoothing out minor scratches, nicks and dents, and replacement of parts.

8. ASSEMBLY. (Refer to Figure 1.) After cleaning and inspecting components as explained in paragraph 7, above, reassemble the nose gear oleo as follows:

   a. Insert piston strut (30) into its recess in fork (39) and secure in position with hardware (38).

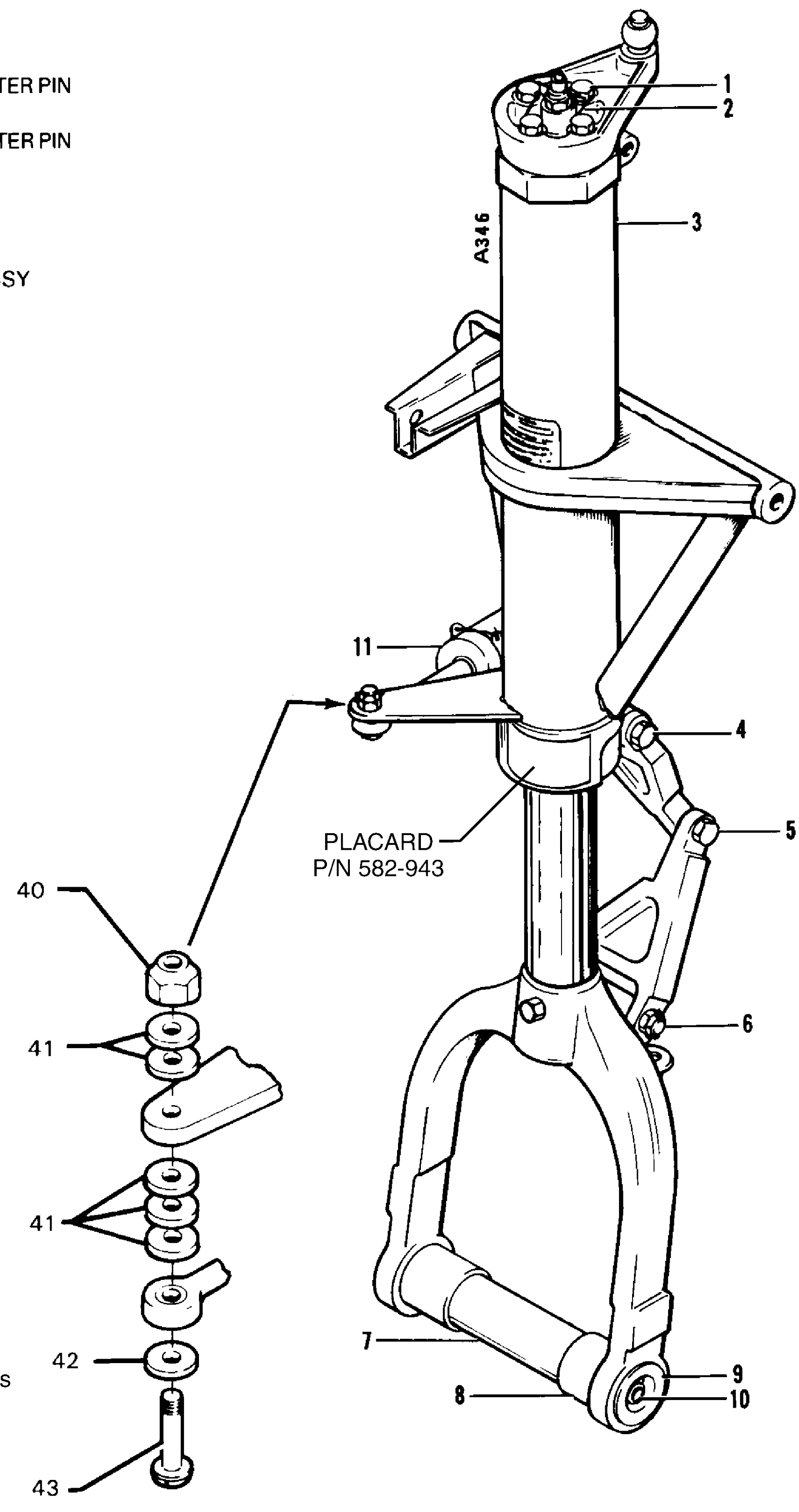
   b. Install snap ring (37) and washer (36) on piston strut.

   c Install O-rings (31 and 34) and a new wiper ring (35) on bearing (32).

   d. Lubricate piston strut using hydraulic fluid (MIL-H-5606) and slide bearing onto piston strut.

   e. Slide spacer (29) onto strut and align holes. Insert two retaining pins (28).

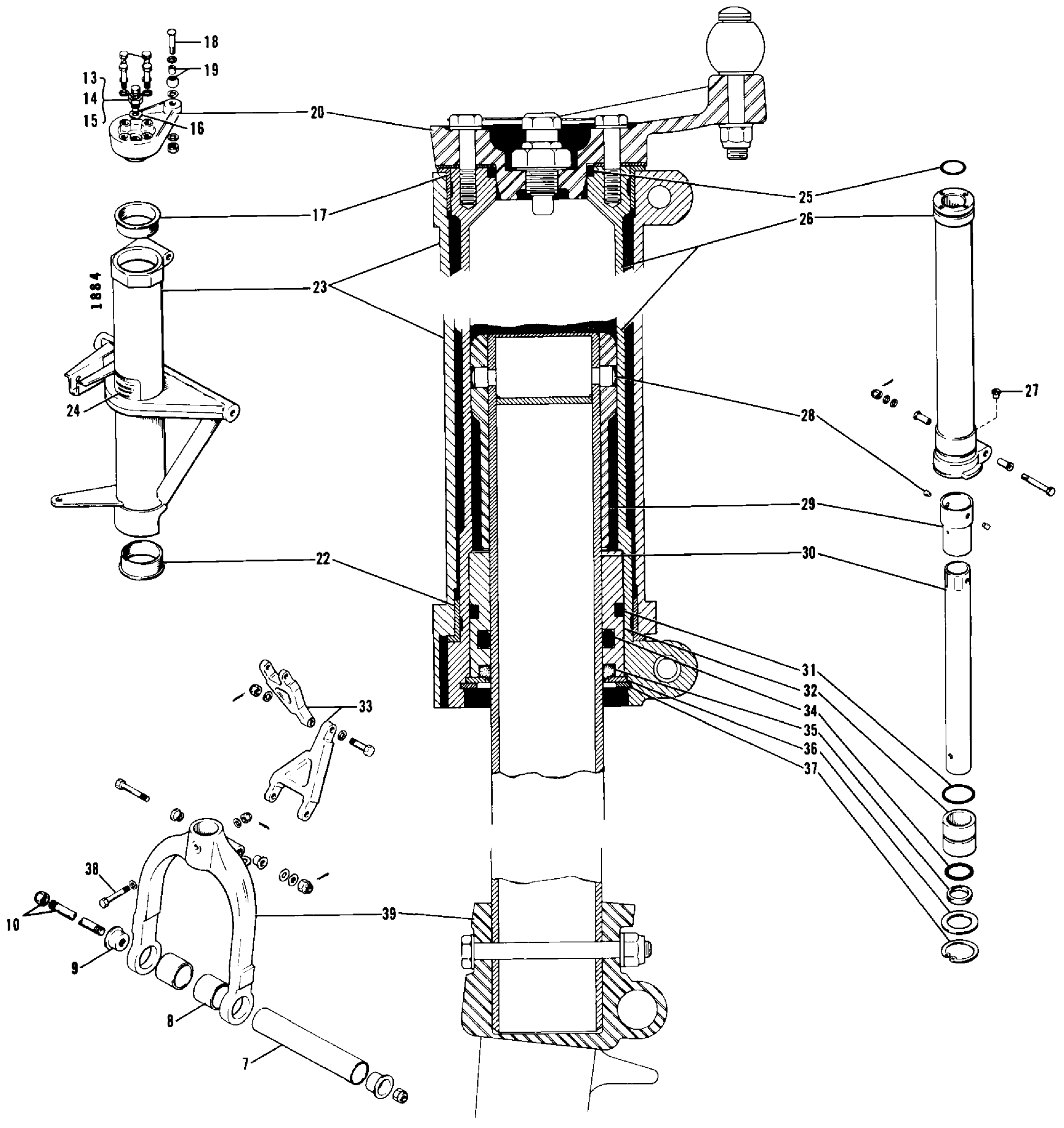
1. CAP BOLTS & WASHERS
2. SAFETY WIRE
3. TRUNNION ASSY
4. BOLT, BEARING, WASHER, NUT & COTTER PIN
5. BOLT, WASHER, NUT & COTTER PIN
6. BOLT, BUSHING, WASHER, NUT & COTTER PIN
7. AXLE
8. TUBE - SPACER
9. PLUG - WHEEL END
10. TIE ROD AND NUT (2)
11. NOSE GEAR CENTERING SPRING ASSY
12. DELETED
13. CAP - AIR VALVE
14. CORE - AIR VALVE
15. BODY - AIR VALVE
16. WASHER
17. BUSHING - SHOULDER (UPPER)
18. SCREW, WASHER AND NUT
19. ROLLER ASSY AND BUSHING
20. TILLER
21. DELETED
22. BUSHING - SHOULDER (LOWER)
23. TRUNNION ASSY
24. PLACARD
25. O-RING
26. OLEO CYLINDER
27. BEARING
28. PIN - RETAINING
29. SPACER
30. PISTON, STRUT
31. O-RING
32. BEARING
33. LINK, TORQUE
34. O-RING
35. RING - WIPER
36. WASHER
37. RING - SNAP
38. BOLT, WASHER & NUT
39. FORK
40. NUT (MS20364-428C)
41. WASHERS (5 EA.) (AN960-416)
42. WASHER (62833-123)
43. BOLT (AN24-20A)



NOTE

Hardware must be installed as shown, with bolt head down. This incorporates Piper Service Bulletin No. 893. See also AD 92-13-5.

Nose Gear Oleo Strut Assembly
Figure 1 (Sheet 1 of 2)



Nose Gear Oleo Strut Assembly
Figure 1 (Sheet 2 of 2)

f. Lubricate inner walls of oleo cylinder with hydraulic fluid. Carefully insert piston strut into cylinder far enough to permit positioning of washer (36) and snap ring (37). (Refer to paragraph b above.)

g. Install torque links (33) using appropriate hardware.

h. Remove upper and lower shoulder bushings (17 and 22) from trunnion assembly (23).

NOTE: Avoid damaging the upper and lower flanges of the bushing.

i. Slide the lower shoulder bushing down the oleo cylinder until it bottoms above mounting lug securing the upper torque link.

j. Insert the oleo cylinder into the trunnion assembly (23). The base of the trunnion must seat firmly on the lower shoulder bushing.

k. Carefully insert the upper shoulder bushing (17) between the oleo cylinder and the trunnion.

1. Place O-ring (25) into recess in top of oleo cylinder. Position bearing (21) on oleo cylinder. The tab of the bearing should be facing forward. Insert the bottom of the tiller (20) into the opening in the top of the oleo cylinder and secure in position with four bolts and washer (1) and safety.

m. Install nose gear centering spring assembly (11).

NOTE: Ascertain that bolt is installed with the head down and washers are arranged as shown in Figure 1.

n. Lubricate gear assembly. (Refer to Lubrication Chart, Section II.)

o. Compress and extend the strut several times to determine the strut will operate freely. The weight of the tire and fork should allow the strut to extend.

p. Install the air valve body (15), core (14) and cap (13) after servicing the oleo cylinder with oil and air. (Refer to Oleo Struts, Section II.)

q. Check main gear for alignment (refer to paragraph 25) and operation.

8a. LANDING GEAR. (Refer to Figure 2.)

9. REMOVAL.

NOTE: To gain access to the landing gear, remove access panels located in the forward baggage compartment.

a. Place airplane on jacks.

b. Disconnect leads to landing lights.

c. Retract the landing gear far enough to permit unlocking the downlock mechanism.

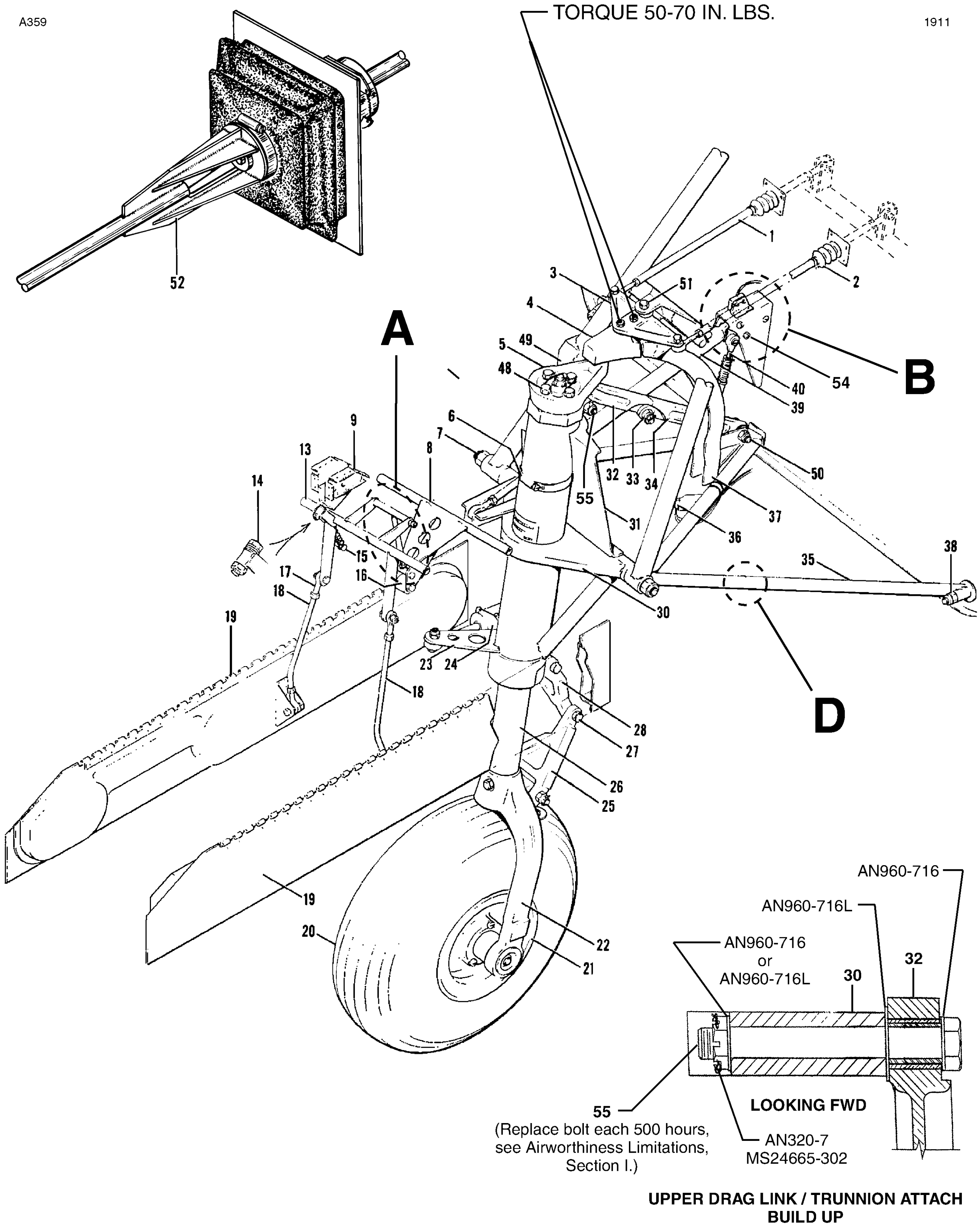
d. Disconnect downlock link assembly (40) from lower drag link (34).

e. Disconnect upper drag link (32) from the trunnion.

f. Disconnect the actuating cylinder from the trunnion.

g. Remove attaching hardware at trunnion pivot point and remove landing gear from the airplane.

h. To remove upper and lower drag links (32, 34), disconnect lower drag link from its attachment point (50).



Nose Gear Installation
Figure 2 (Sheet 1 of 3)

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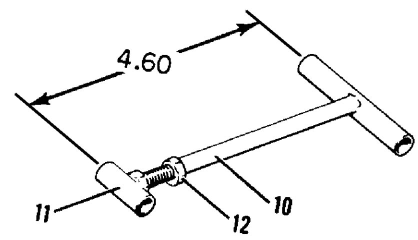
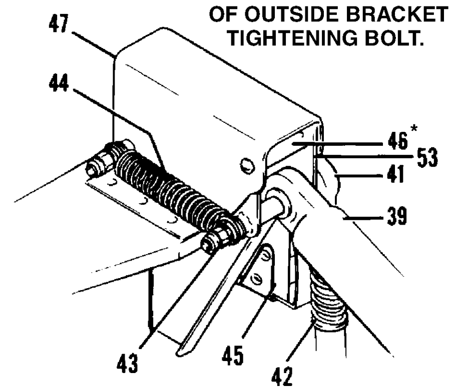
1. ROD ASSY. - STEERING
2. BOOT
3. ARM ASSY. - STEERING
4. CHANNEL ASSY. - STEERING
5. TILLER ASSY. - STEERING
6. CLAMP
7. BOLT, WASHER, NUT, & COTTER PIN
8. TUBE ASSY. - DOOR ACTUATION
9. STOP ASSY. - DOOR ACTUATION
10. LINK- UPPER
11. LINK- LOWER
12. JAM NUT
13. TUBE ASSY. - DOOR ACTUATION
14. BOLT, WASHERS, & NUT
15. SPRING
16. ROLLER
17. ROD END BEARING
18. ROD ASSY. (SEE SKETCH C.)
19. GEAR DOOR
20. TIRE
21. WHEEL
22. FORK
23. BEARING
24. SPRING ASSY. - GEAR CENTERING (SHIMMY DAMPENER)
25. TORQUE LINK - LOWER
26. ROD - PISTON
27. BOLT, WASHER, & NUT
28. TORQUE LINK - UPPER
29. NOT USED
30. TRUNNION ASSY.
31. PANEL ASSY. - ANTI-SPLASH
32. DRAG LINK ASSY. - UPPER
33. BOLT WASHER, NUT, & COTTER PIN
34. DRAG LINK ASSY. - LOWER
35. GEAR MOUNT
36. SWITCH - UP LIMIT
37. TRACK ASSY. - STEERING TILLER
38. BOLT, WASHER, & NUT
39. ACTUATING CYLINDER, EXTENSION & RETRACTION
40. LINK ASSY. - DOWNLOCK (95829-0)
41. ROD END BEARING
42. SPRING
43. BUSHING
44. SPRING, DOWNLOCK (96178-0)
45. SWITCH - GEAR DOWN
46. BUSHING
47. MOUNT ASSY. (ACTUATOR MOUNT BRACKET)
48. BOLT & WASHER
49. AIR VALVE CAP & BODY
50. BOLT, BUSHING, WASHER, & NUT
51. BOLT, WASHER, & NUT
52. BUNGEE ASSY. (1974 MODELS & LATER.)
53. LINK ASSY., RETRACTION
54. STOP BOLT, RETRACTION LINK ASSY.
55. BOLT (AN7-35 or NAS6207-50D) (SEE BUILD UP, SHEET 1.)

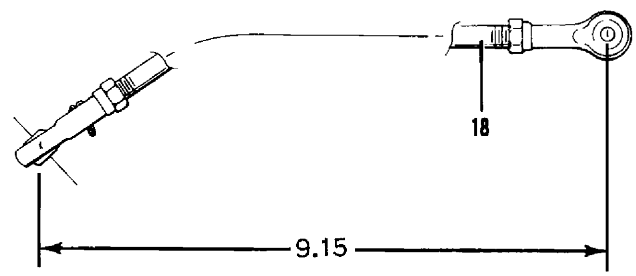


SKETCH A

* ENSURE BUSHING IS RIDING IN HOLES OF OUTSIDE BRACKET BEFORE TIGHTENING BOLT.

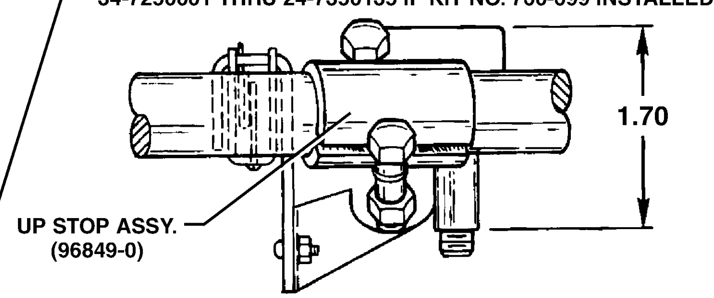


SKETCH B



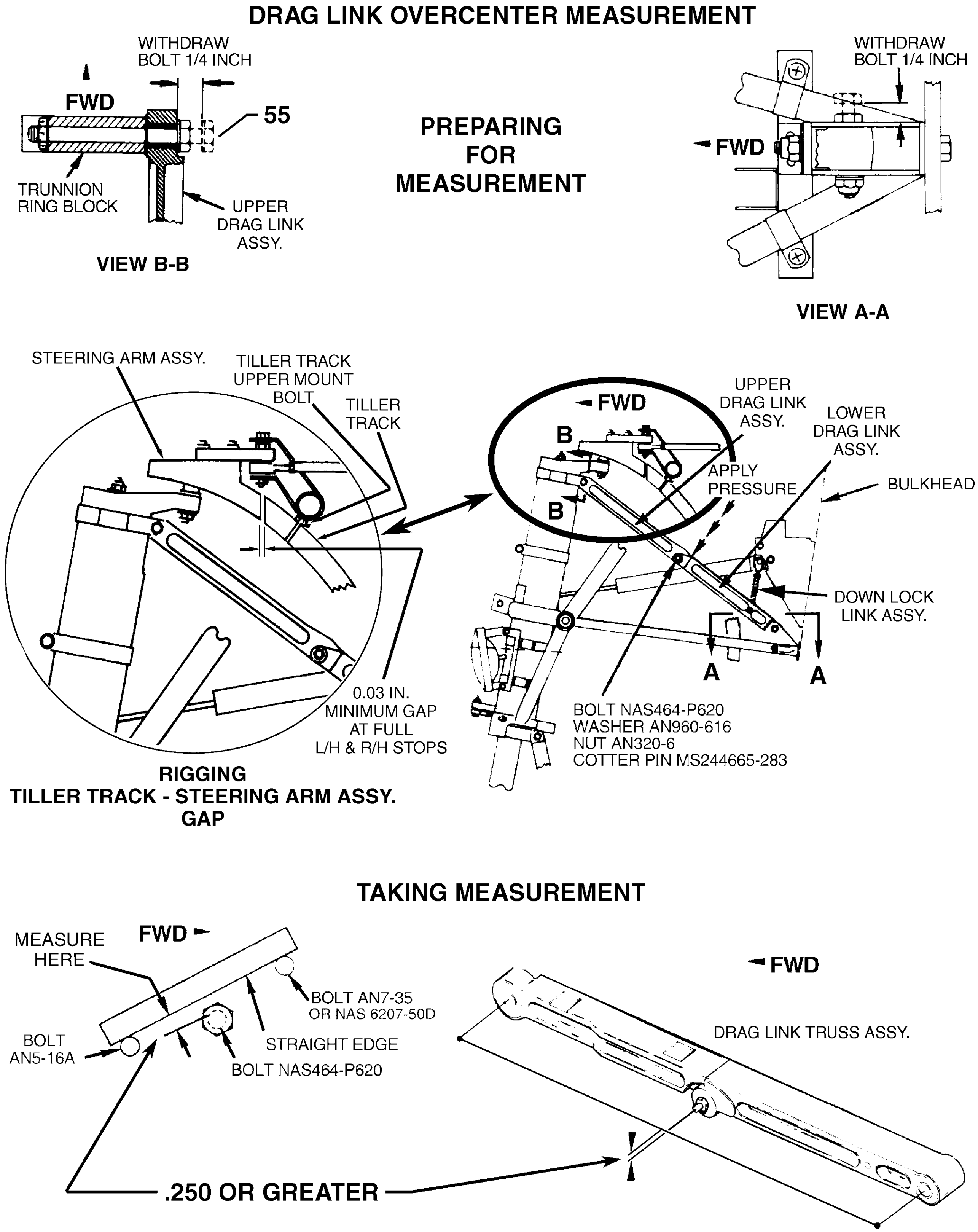
SKETCH C

S/N'S 34-7350136 THRU 34-7450220 AND ALSO 34-7250001 THRU 24-7350135 IF KIT NO. 760-699 INSTALLED.

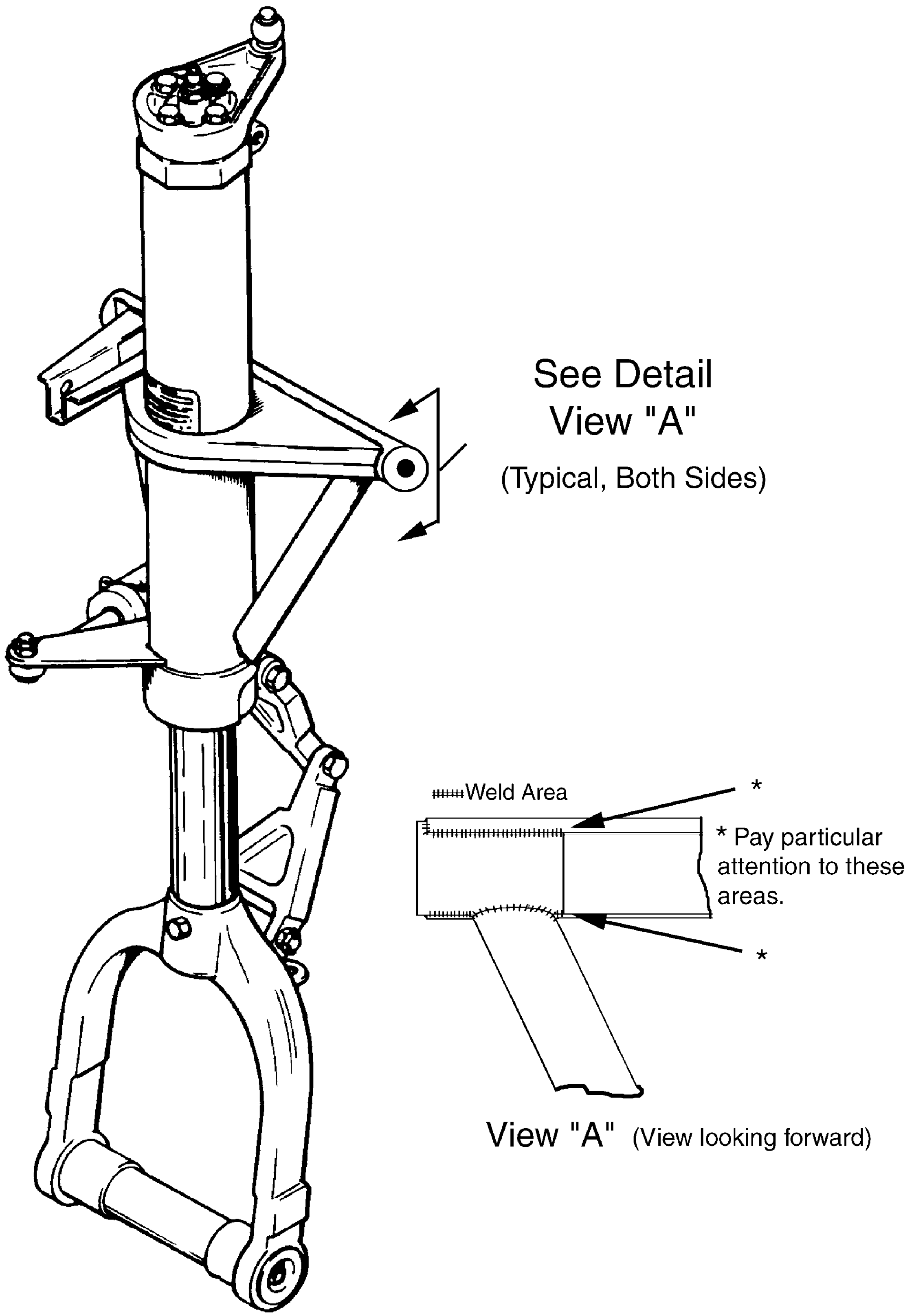


SKETCH D

Nose Gear Installation
Figure 2 (Sheet 2 of 3)



Nose Gear Installation
Figure 2 (Sheet 3 of 3)



Nose Gear Trunnion Inspection
Figure 3

10. CLEANING, INSPECTION AND REPAIR.

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.

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. (See Figure 4 for service tolerances.)
   2. Gear trunnion and actuating cylinder, drag links and downlock link assembly for cracks, dents, bends or misalignment.
   3. Downlock link assembly (40) for damaged threads and bearing.
   4. Tiller assembly (5) roller for freedom of movement and excessive wobble.

c. Check downlock link assembly (40) and spring for excess wear and corrosion. Pin and hole should be carefully inspected for signs of wear and elongation. Spring should be discarded if wear or corrosion exceeds one quarter the diameter of the spring. Remove corrosion and paint spring, if judged still usable.

d. Check downlock link assembly spring (42) and downlock spring (44) for adequate tension. This may be accomplished by observing several locking activations and checking for smooth operation with positive locking each time. If drag link (32 & 34) or retraction link (53) movement is slow or has a hesitation or jerky movement, the associated spring should be replaced.

e. Inspect upper and lower drag link assembly overcenter dimension as follows: (See Figure 2.)

   1. Unbolt the downlock link assembly (42) from the lower drag link (34). Tape the downlock link assembly up out of the way.
   2. Remove cotter pins from nuts on the three drag link bolts (33, 50, & 55) and, without removing them, backoff the nuts approximately .25 inch.
   3. Lay a “true” straightedge across the exposed grips of the upper (55) and lower (50) drag link bolts.
   4. Apply pressure to the top of the drag links to keep the overcenter stops in solid contact and then measure the perpendicular distance from the bottom of the straightedge and the top surface of the center bolt (33) grip.
   5. The measured distance must be .250 or greater.

f. Check general condition of limit switches and actuators, wiring for fraying and poor connections or conditions which could lead to failure.

g. 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.

10a. 1000 HOUR NOSE GEAR TRUNNION INSPECTION.

Beginning at 2000 hours and each 1000 hours thereafter, visually inspect the nose gear trunnion (P/N 95723-00, -05, -06) for cracks in the area of attachment to the nose gear mount assembly (see Figure 3) using supplemental lighting and a 10X magnifier.

10b. 100 HOUR NOSE GEAR DRAG LINK UPPER ATTACH BOLT INSPECTION.

a. Each 100 hours, remove the nose gear drag link upper attach bolt AN7-35 or NAS6207-50D (P/N 400-274 or 693-215, respectively), Item 55, Figure 2, 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, Section 1). Additionally, if replacing bolt, inspect associated bushings and bearings for deformation, cracking or wear, replace as required.

11. INSTALLATION AND RIGGING. (Refer to Figure 2.)

CAUTION: WHEN ASSEMBLING ANY UNITS OF THE LANDING GEAR; LUBRICATE BEARINGS, BUSHINGS, AND FRICTION SURFACES WITH THE PROPER LUBRICANT AS DESCRIBED IN SECTION II.

a. Position the landing gear assembly between the mounting points, ensuring that the tiller assembly (5) roller is properly inserted into the steering arm channel (4).

b. Align the attachment points on the trunnion with the attachment points on the gear mount assembly.

c. Install bolts, washers, and nuts, securing the trunnion to the mount, bolt heads inboard. Tighten the nuts to a snug fit, yet allowing the gear to swing freely, then install the cotter pins.

d. The drag links (32 & 34), actuator (39), and downlock link assembly (40) may be installed by the following procedure:

1. Ascertain that the upper and lower drag links are assembled.

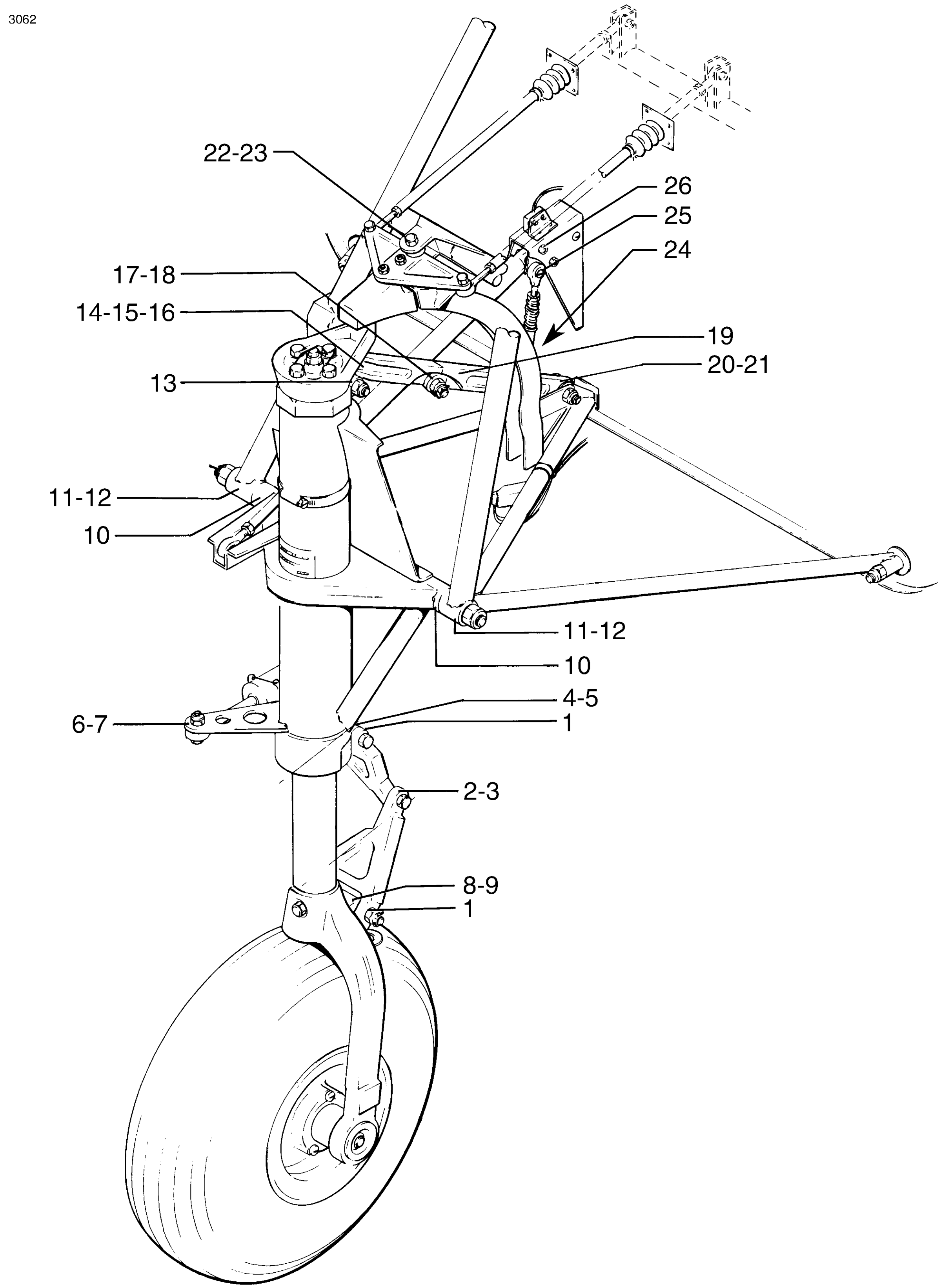
CAUTION: DRAG LINK UPPER ATTACH BOLT (55) (AN7-35 OR NAS6207-50D; P/N'S 400-274 OR 693-215, RESPECTIVELY), MUST BE REPLACED EACH 500 HOURS TIME-IN-SERVICE. SEE AIRWORTHINESS LIMITATIONS, SECTION 1.

2. Position the drag link assembly with the through center stops facing up, the upper link connection aligned with the right side of the trunnion's upper ring block and the lower link connection positioned in its bracket on the bottom rear of the nose gear mount. With the links in position, install the connecting hardware (see Figure 2, Sheet 1 for upper drag link/trunnion attach build up) and move the gear to assure free movement.
3. Install washers and nuts on the drag link attachment bolts. Inspect overcenter dimension per Figure 2, Sheet 3. If not acceptable, replace drag link assembly with acceptable parts.
4. Tighten the drag link attachment nuts by hand, then using a wrench tighten until the bolt hole aligns with the next nut castellation. Check that the links operate freely.
5. At the actuator mount assembly (see Sketch B), disconnect the downlock spring (44) from the retraction link assembly (53).
6. Position the gear in its down and locked position and check that the drag links have fully extended to their through center position with the stop surfaces in contact.
7. Adjust the rod end of the actuator (39) so that 0.25 inch of rod travel remains with gear down and locked.
8. Connect the actuator rod end to the trunnion and secure with bolt, washers and nut. The retraction link assembly (53) to which the other end of the actuator is attached should be near its stop.
9. Reconnect the downlock spring (44) to the retraction link assembly (53).
10. Connect the downlock link assembly (40) to the lower drag link.

NOTE: The rod end (41) of the downlock link assembly (40) should be already connected to the same bolt as the actuator (39) at the retraction link assembly (53) (see Sketch B).

11. In serial numbers 34-7250001 thru 34-7350135 only, with the drag links fully extended and overcenter stop faces in full contact, ensure overcenter lock of the drag links by adjusting the downlock link assembly (40) to its fully retracted position (i.e. - when the guide pin is bottomed out at the top of the slot). On airplanes equipped with an up stop, ascertain that the three pivot points in the downlock link assembly (40) and the retraction link assembly (53) are aligned.

NOTE: The downlock link assembly will move aft slightly with the remainder of the cylinder travel until the link contacts the stop. At this position, the downlock light switch must actuate.



Nose Gear Service Tolerances
Figure 4 (Sheet 1 of 3)

Item No.	Part No.	Nomenclature	Manufactured Dimension	Service Dimension	Service Tolerance	Remarks
1	67012-00	Torque link	(1) I.D. .312 .313	I.D. 312 .314	.002	
2	67012-00	Torque link	I.D. .3760 .3745	I.D. .3765 .3745	.002	
3	31796	Bushing, torque link	(3) I.D. .252 .251	I.D. .253 .251	.002	Press fit.
4	95720	Tube assembly, nose gear strut	I.D. .4385 .4370	I.D. .4385 .4370	.001	
5	452-448 (FF-411-4)	Bearing, tube assembly	(1) I.D. .313 .312	I.D. .314 .312	.002	
6	95720	Tube assembly, nose gear strut	I.D. .376 .375	I.D. .377 .375	.002	
7	452-331 (FF-310-3)	Bearing, tube assembly	(2) I.D. .251 .249	I.D. .253 .249	.004	
8	95727	Fork assembly	I.D. .4385 .4370	I.D. .4385 .4370	.001	
9	67026-07	Bushing	(1) I.D. .314 .312	I.D.. 316 .312	.004	Install with wet zinc chromate primer equivilent. Press fit.
10	95723	Trunnion assembly	I.D. .5015 .5000	I.D. .5025 .5000	.001	
11	95551	Gear mount assembly	I.D. .6900 .6880	I.D. .6890 .6880	.001	
12	452-534 (FF-604-1)	Bearing (bushing), trunnion pivot, gear mount assembly	(3) I.D. .5000 .5015	I.D. .5000 .5030	.003	
13	95723	Trunnion assembly	I.D. .438	I.D. .442	.004	
14	95728-0	Drag link assembly, upper	(2) I.D. .689 .688	I.D. .690 .688	.002	
15	452-531 (AA-620-1)	Bearing (bushing), drag link assembly	(3) I.D. .563 .562	I.D. .564 .562	.002	
16	95061-29	Bushing, drag link assembly, upper	O.D. .561 .560	O.D. .563 .560	.002	
17	95728-0	Drag link assembly, upper	(2) I.D. .500 .499	I.D. .501 .499	.002	
18	452-490 (AA-521-10)	Bearing (bushing), drag link assembly	(3) I.D. .376 .375	I.D. .377 .375	.002	
19	95729	Drag link assembly, lower	(2) I.D..3755 .3745	I.D. .3747 .3745	.002	
20	95729	Drag link assembly, lower	(2) ID. .5625 .5615	I.D. .5617 .5615	.002	

(1) - Line ream to dimension. (2) - Ream to dimension. (3) - Press fit, then ream to dimension.

Nose Gear Service Tolerances
Figure 4 (Sheet 2 of 3)

Item No.	Part No.	Nomenclature	Manufactured Dimension	Service Dimension	Service Tolerance	Remarks
21	95061-32	Bushing, drag link assembly, lower	(3) I.D. .441 .438	I.D. .442 .438	.004	
22	452-540 (FF-520-10)	Bearing (bushing), steering arm, center pivot	I.D. .376 .375	I.D. .377 .375	.002	
23	95061-28	Bushing (sleeve), steering arm, center pivot	I.D. .252 .250	I.D. .253 .250	.003	
24	95061-23	Bushing, downlock link pin	I.D. .252 .251	I.D. .253 .251	.002	
25	452-334 (M34-14-MPB)	Rod end bearing, downlock link	I.D. .191 .190	I.D. .192 .190	.002	
26	95724	Actuator mount bracket (mount assembly)	I.D. .251 .250	I.D. .252 .250	.002	

(1) - Line ream to dimension. (2) - Ream to dimension. (3) - Press fit, then ream to dimension.

Nose Gear Service Tolerances
Figure 4 (Sheet 3 of 3)

12. In serial numbers 34-7350136 thru 34-7450220:
    (a) With the drag links fully extended and overcenter stop faces in full contact;
    (b) Adjust the downlock link assembly (40) to a fully retracted position (i.e. - when the guide pin is bottomed out at the slot) and install.
    (c) Free fall the nose gear a minimum of 3 times.
    (d) Remove downlock link assembly (40) and readjust to a fully retracted position (i.e. - when the guide pin is bottomed out at the slot);
    (e) Shorten linkage by one-half turn clockwise and reinstall.

e. Rig the nose gear centering spring so that the nose gear has full left and right travel against its stops. Use a tow bar to reach full travel on airplanes with steering bungees.

f. On airplanes equipped with an up stop, set the stop to the dimension shown in Figure 2, Sketch D. Retract the gear and if necessary, readjust the stop to locate the nose gear in the proper retracted position.

   NOTE: When stop adjustments are made, cycle the gear to insure that the nose gear trunnion engages the stop under retraction pressure.

g. Retract the nose gear and check the up limit switch for actuation.

h. On airplanes with the up limit switch mounted at the up stop, adjust the rod end of the retraction cylinder to allow a maximum of .06 inches of actuator travel remaining in the retracted position. Cycle the gear fully while checking switch actuation, downlock action, and up stop action to include short pickup cycles simulating in flight gear sag pickup. Check the actuator travel left to full extension in the down and locked position. A minimum of .15 inches must remain. Check the up switch override action to insure the proper operation.

i. Let the gear free fall to determine that the downlock spring returns the body end of the retraction cylinder aft so the downlock link assembly is fully retracted and the drag link arms are overcenter.

j. With the nose gear turned full left and right against the stops, check and if necessary, adjust the clearance between the steering arm channel assembly (4) and tiller track (37). Maximum clearance is 0.06 and minimum clearance is 0.03. (See Sheet 3, Figure 2.)

k. Refer to paragraph 16 for rigging of nose gear doors.

l. Ascertain that the gear is lubricated per lubrication chart, Section II.

m. Retract gear and check door operation as per paragraph 16.

n. Check the alignment of the nose gear per paragraph 12.

o. Remove the airplane from jacks.

12. ALIGNMENT.

a. Park the airplane on a smooth level floor which will accommodate the striking of a chalk line.

b. Place airplane on jacks and level airplane laterally and longitudinally. (Refer to Leveling, Section II.)

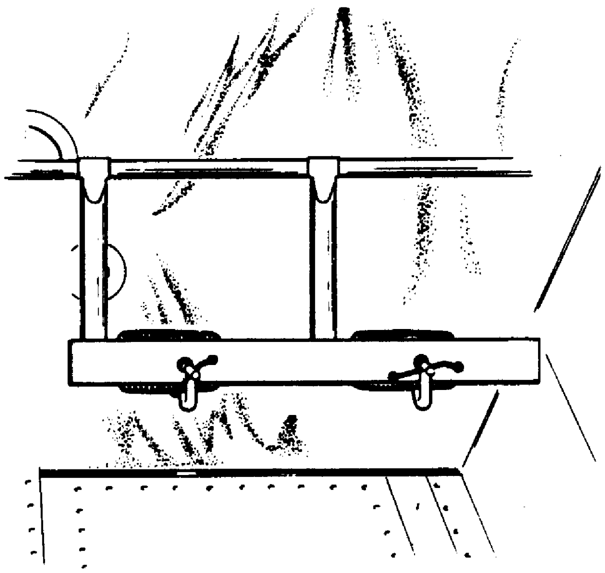
c. Extend a plumb bob from the center of the tail skid and mark the contact point on the floor.

d. 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.

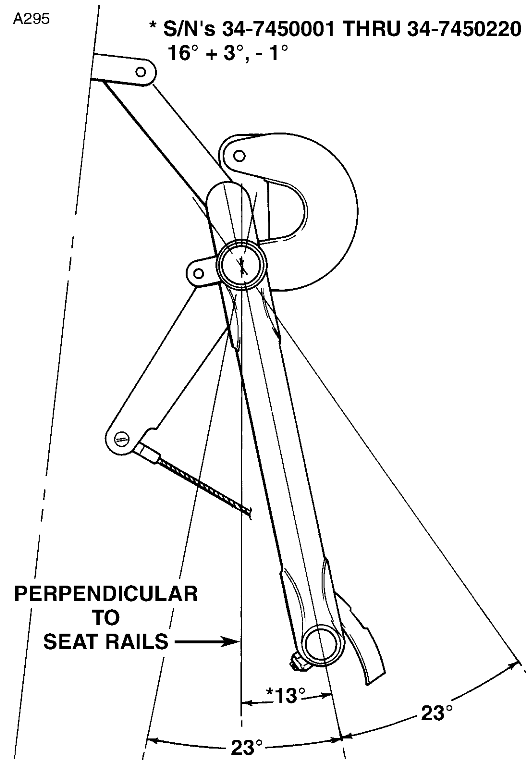
e. Clamp rudder pedals to align in a lateral position. (Refer to Figure 5.)

f. Adjust rod end bearings of each steering control rod to align the nose wheel with the chalk line and to bring rudder pedals into neutral angle fore and aft. To align nose wheel straight forward, stand in front of 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 the straightedge with the chalk line. In neutral position, the rudder pedals are tilted aft as shown in Figure 6, with the airplane level. Place a bubble protractor against a steering tube to check this angle. One end of each steering rod must be disconnected and jam nuts loosened to make this adjustment, but do not attempt to make the complete adjustment by means of one bearing, but divide the adjustment between the beatings at each end of each rod. Check that rod ends have sufficient thread engagement by determining that a wire will not go through the check hole in the rod. Reinstall rods; tighten and safety jam nuts. On airplanes equipped with steering bungees, the bungees must be installed with no load on the spring. This condition exists when the measurement taken between the facing sides of the washers at the rod ends is 13.71 inches.

g. To check nose gear steering for correct degree maximum right and left travel (see Table I, Section II), use the wheel pivot point as the center point and draw a line at that travel degree angle on each side of the chalked center line. Turn wheel to maximum travel in both directions. Should travel in one direction be excessive and not enough in the other, check steering arm and steering control rods for damage. Use a tow bar to turn the nose gear full travel left and right on airplanes equipped with steering bungees. Refer to Servicing Steering Bungees, Section II for lubrication instructions of bungee assemblies.



Clamping Rudder Pedals in Neutral
Figure 5



Rudder Pedals at Neutral Angle
Figure 6

12a. DOOR. (Refer to Figure 2.)

13. REMOVAL.

a. With nose gear extended, disconnect door retraction rods (18) from doors (19) by removing attaching hardware.

b. To remove doors, straighten bent end of hinge pins and pull the pins out from the opposite end.

c. Disconnect spring (15) from arm of upper nose gear actuating tube assembly (13).

d. Disconnect link assembly (10) from the upper nose gear actuating tube (13) and remove lower nose gear actuating tube assembly (8) with roller attached.

e. Remove upper actuating tube assembly (13).

14. CLEANING, INSPECTION AND REPAIR.

a. Clean all components with a suitable cleaning solvent.

b. Inspect doors for damage, loose or damaged hinges and brackets.

c. Inspect retraction rods for damage and rod end bearings for corrosion.

d. Check door tension spring for wear and tension below minimum allowable tolerance. Reject spring if load tension is below 12 ± 2 lbs with spring extended to 4.1 inches.

e. Check general condition of actuating tube assemblies and roller assembly.

f. Repairs to the retraction mechanism are limited to painting and replacement of component parts.

15. INSTALLATION.

a. Install upper nose gear actuating tube assembly (13) in position between two bearing blocks and secure with attaching hardware.

b. Install lower nose gear actuating tube assembly (8) in position between two bearing blocks and secure with attaching hardware.

c. Insert lower link assembly (11) into upper link assembly (10) and adjust as necessary to obtain a dimension of 4.60 inches between the center line of each link. Tighten locknut. (Refer to Sketch A.)

d. Install assembled link assembly between two upright arms of upper actuating tube assembly and secure with attaching hardware. Insert the lower link between the two upper holes in actuating tube assembly (8) and secure with attaching hardware.

e. Install roller (16) directly below link (11) 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.

f. Install four washers on stop bolt (14) and insert into bushing on upper actuating tube assembly (13)

g. Adjust both retraction rods (18) 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 (15).

h. 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.

16. ADJUSTMENT. (See Figure 2.)

a. Place airplane on jacks.

b. With link assembly and retraction rods adjusted per paragraph 15, above, the gear should swing through the door opening with a clearance of .25 inch between the gear and door at their closest point.

c. If clearance between gear and door is less than .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.

d. If doors sag when fully retracted, tighten link assembly (11). If doors are too tight, loosen link assembly.

e. Check all rod ends for adequate thread engagement for safety and tightness of jam nuts.

17. MAIN LANDING GEAR.

17a. OLEO. (See Figure 7.)

18. DISASSEMBLY. The main gear oleo assembly may be removed and disassembled from the trunnion (i.e. - strut housing) with the gear removed from or installed in the airplane.

    a. Place airplane on jacks.

    b. Place a drip pan under the main gear to catch spillage.

    c. Remove air and fluid from the oleo. Depress air valve core pin until strut pressure has diminished, remove the filter plug and with a thin hose siphon as much hydraulic fluid from the strut as possible.

    d. Disconnect brake line at the joint located in the wheel well.

    e. To remove piston tube assembly (25) from trunnion (11), remove the upper and lower torque link connecting bolt assembly (3) and separate links. Note number and thickness of spacer washer(s) between the two links (15 and 16).

    f. Compress the piston tube (25), reach up into the tube and release the snap ring (24) from the annular slot at the bottom of the trunnion.

    g. Pull piston tube (25) with component parts from trunnion.

    h. The piston tube (25) components may be removed by reaching in the tube and pushing out the upper bearing retainer pins (17). Slide off the upper bearing (18), lower bearing (20) with springs (19 and 20), wiper (22) and washer (23).

    i. To remove orifice tube (12) from the trunnion, remove locknut (6) and washer (7) from top of housing. Draw tube with spring (9) and retainer (8) from trunnion.

    j. The orifice plate (13) is removed from the bottom of orifice tube (12) by releasing snap ring (14) holding the plate in position.

    k. To remove piston tube plug (26) and spring (27) located in the bottom end of the tube, remove bolt assembly (29) and insert a rod up through the hole in the body of the fork (28) and push plug with spring from top of tube.

19. CLEANING, INSPECTION AND REPAIR. (See Figure 7.)

    a. Clean all parts with a suitable dry type cleaning solvent.

    b. Inspect landing gear oleo assembly components for the following:

        1. Bearings, especially the upper bearing (18), for excess wear, damage, gouges, scratches, or sharp edges. Check the bearing surface to ensure that it has a smooth finish.
        2. Retaining pins (17) for sharp edges or excessive wear. Check to ensure that the pins are loose and do not protrude above the bearing surface.
        3. The trunnion bore (11) should have a smooth, highly polished surface with no indication of corrosion, scratches, nicks and excessive wear.
        4. Lock and snap rings for cracks, burrs, etc.
        5. The orifice plate (13) to ensure that the hole is not restricted,
        6. The piston tube (25) for corrosion, scratches, nicks, or misalignment.
        7. Orifice tube (12) for corrosion, cracks, scratches, nicks and excess wear.
        8. Air valve (10) for general condition.

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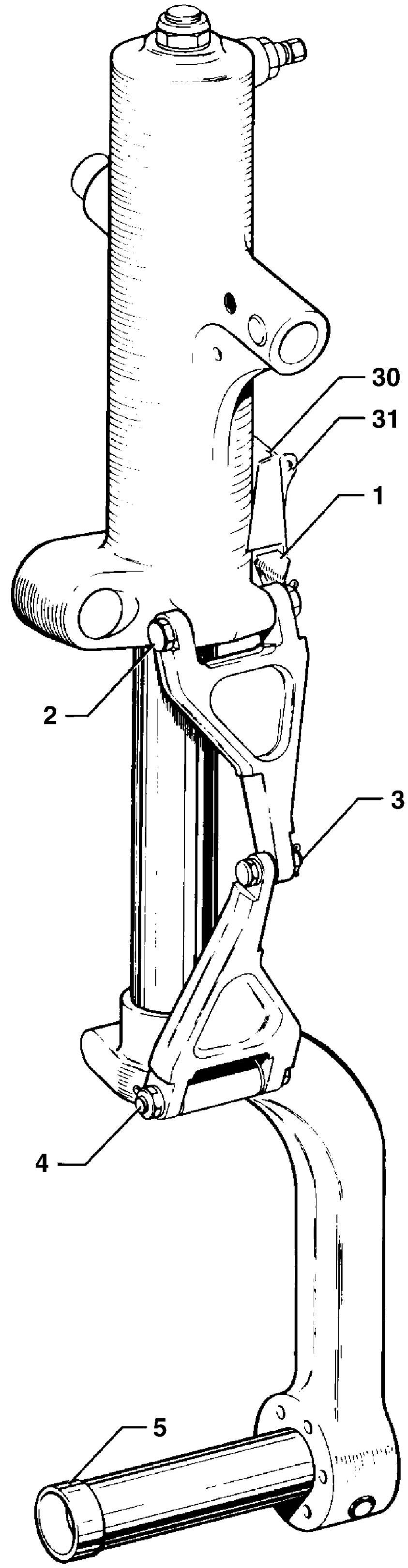
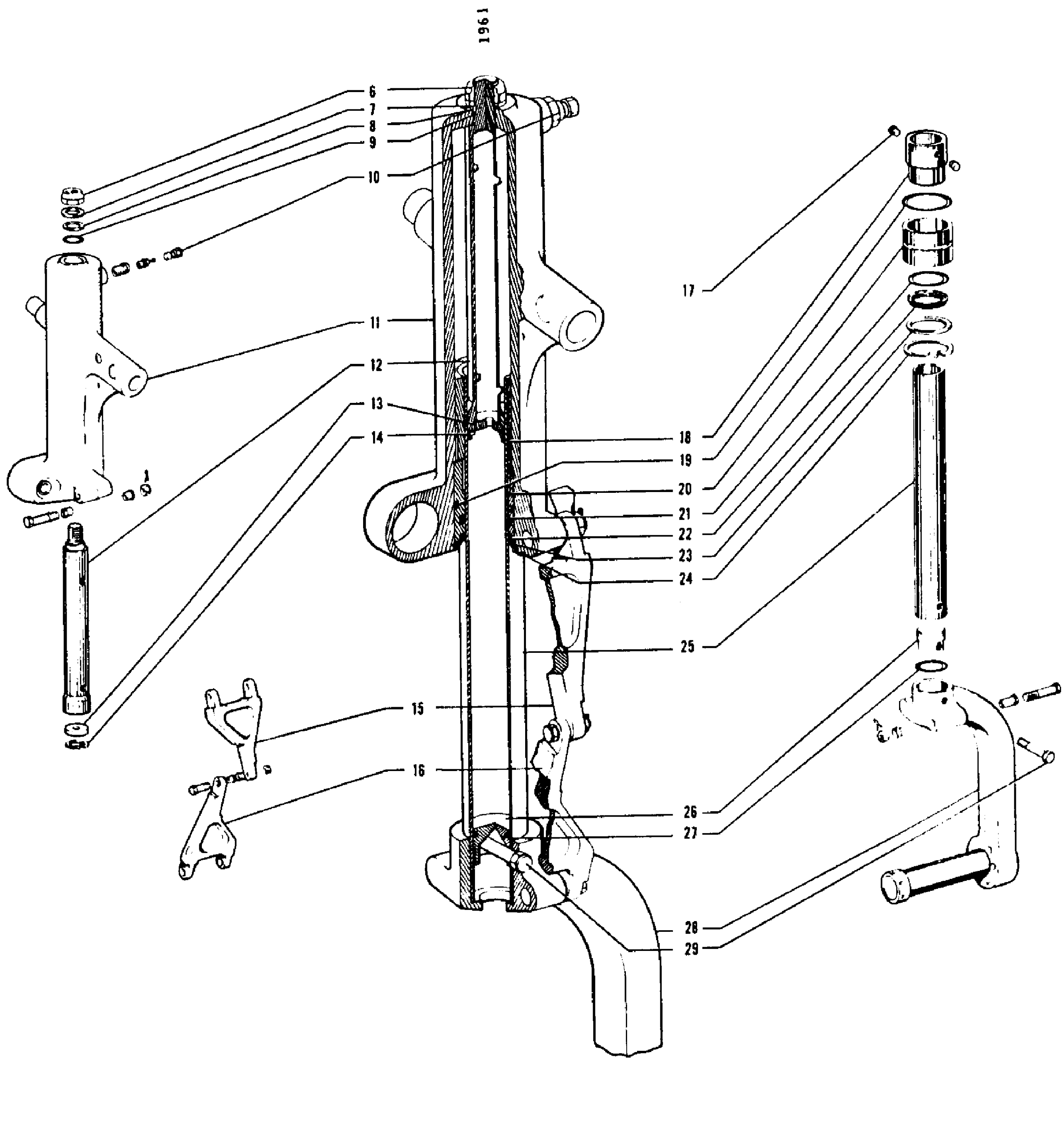


1. BRACKET, SWITCH ACTUATOR
2. BOLT, WASHERS, NUT, AND COTTER PIN
3. BOLT, WASHERS, NUT, AND COTTER PIN
4. BOLT, WASHERS, NUT, AND COTTER PIN
5. AXLE NUT
6. NUT
7. WASHER
8. RETAINER
9. O-RING
10. VALVE ASSEMBLY
11. TRUNNION (STRUT HOUSING)
12. ORIFICE TUBE
13. PLATE, ORIFICE
14. SNAP RING
15. TORQUE LINK, UPPER
16. TORQUE LINK, LOWER
17. RETAINER PIN, BEARING
18. BEARING, UPPER
19. O-RING, OUTER
20. BEARING, LOWER
21. O-RING, INNER
22. WIPER STRIP
23. WASHER
24. SNAP RING
25. PISTON TUBE
26. PLUG
27. O-RING
28. FORK ASSEMBLY
29. BOLT ASSEMBLY
30. BRACKET - SQUAT SWITCH
31. PLATE, SPRING ATTACHMENT

Main Gear Oleo Strut Assembly
Figure 7 (Sheet 1 of 2)



Main Gear Oleo Strut Assembly
Figure 7 (Sheet 2 of 2)

c. Repairs are limited to the following:

(1) Replacement of parts.

(2) Upper bearing (18). Minor dents, scratches, and nicks in the upper bearing may be polished/burnished out provided a smooth finish can be maintained and the outside diameter is not reduced below 2.246 inches.

NOTE: If the upper bearing is removed from the piston tube, ensure that the bleed holes in the bearing and piston tube are aligned upon reassembly.

(3) Trunnion bore. Minor dents, scratches, and nicks in the trunnion bore which might impede proper strut action may be polished/burnished out provided a smooth finish can be maintained and the internal diameter does not exceed 2.253 inches.

(4) For burnishing operations, use #220 grit finishing paper (open coat silicon carbide). For polishing surfaces, use crocus cloth.

(5) If after burnishing/polishing, either of the above listed parts, the stated limitations cannot be maintained, replace the parts.

19a. MAIN GEAR TRUNNION (I.E. - OLEO STRUT HOUSING) INSPECTION.

a. Airplanes which have installed main landing gear trunnions P/N 67926-030 or 67926-031 (both of which can be identified by the embossed forging number 025599-2) per Piper Service Bulletin No. 787C:

Required inspection is included as part of the routine 100 hour visual inspection of the gear for condition and security.

b. For those airplanes which have not installed main landing gear trunnions P/N 67926-030 or 67926-031 (both of which can be identified by the embossed forging number 025599-2) per Piper Service Bulletin No. 787C:

Inspect or replace the existing installed trunnions, depending upon the following trunnion times-in-service:

(1) Unknown, replace with P/N 67926-030 or 67926-031.

(2) 500 hours or more, but less than 2000 hours; each 100 hours inspect as follows:

(a) Carefully clean the trunnion of dirt and paint from the areas shown in Figure 8.

(b) In the cleaned area, inspect the housing for cracks with a suitable dye-penetrant inspection method.

(c) Replace the trunnion if any crack is detected.

(3) 2000 hour or more, but less than 2500 hours; each 10 hours inspect as follows:

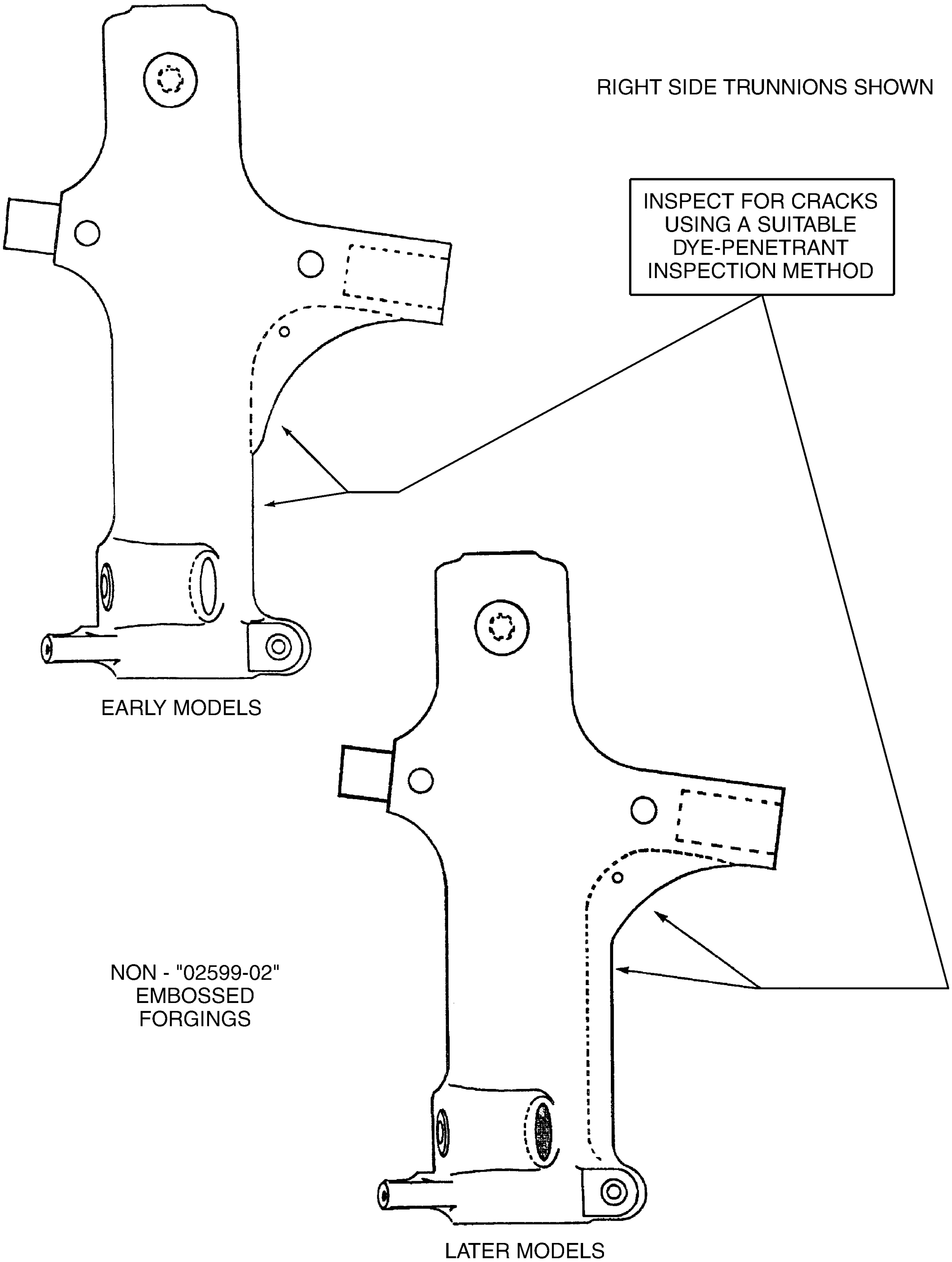
(a) Carefully clean the trunnion of dirt and paint from the areas shown in Figure 8.

NOTE: Paint may be permanently removed and an alodined surface maintained to facilitate the 10 hour inspection cycle.

(b) In the cleaned area, inspect the housing for cracks with a suitable dye-penetrant inspection method.

(c) Replace the trunnion if any crack is detected.

(4) 2500 hours or more, replace with P/N 67926-030 or 67926-031.



Main Gear Trunnion Inspection
Figure 8

20. ASSEMBLY. (Refer to Figure 5.)

a. Determine that all parts are cleaned and inspected.

b. To install the piston tube plug (26), first lubricate the plug O-ring (27) with hydraulic fluid (MIL-H-5606) and install it on the plug. Lubricate the inside wall of the tube. Insert the plug into the top of the tube (25) and push it to the fork end. Align the bolt holes of the fork, tube and plug, and install bolt assembly.

c. If desired, cement a cork in the hole in the bottom of the fork body to prevent dirt from entering between the fork and tube.

d. To assemble components of orifice tube (12), insert orifice plate (13) into the bottom of the tube and secure with snap ring (14).

e. To install tube (12) in trunnion (11), insert the tube up through the trunnion. With the end of the tube exposed through the top of the trunnion, install the O-ring (9), retainer (8), washer (7), and locknut (6). Tighten locknut only finger tight at this time.

f. Assemble components of piston tube (25) on the tube by placing, in order: snap ring (24), washer (23), lower bearing (20) with outer and inner O-ring (19 and 21) and upper bearing (18). Align the two .125 diameter holes and the lock pin holes with the corresponding holes in the piston tube and install pins (17).

g. Lubricate the wall of the cylinder trunnion (11) and tube (25), and carefully insert the tube assembly into the trunnion, guiding the orifice tube (12) into the piston tube. Install the wiper strip (22), slide the washer (23) into position and secure the assembly with snap ring (24).

h. Tighten locknut (6) at top of trunnion.

i. Ascertain that the bushings are installed in the upper and lower torque links (15 and 16) and then install links. The torque link bolt assemblies (2, 3 and 4) should be lubricated and installed with the flat of the bolt head hex adjacent to the milled stop of the wide end of the link. (Use the same thickness of spacer washers between the two links as those removed to maintain correct wheel alignment.) Tighten the bolts only tight enough to allow no side play in the links, yet be free enough to rotate.

j. On left main gear only: assemble squat switch actuator bracket (1) on bolt assembly (2). Insert a rivet through the hole provided in the bracket into the upper link and install the nut. Install squat switch bracket (30) immediately above the actuator bracket.

k. Attach spring attachment plate (31) to the mounting lug on the base of the trunnion immediately above the upper link.

l. Connect brake line and bleed the brakes per paragraph 65 or 66.

m. Lubricate gear assembly per Lubrication Chart, Section II.

n. Compress and extend the strut several times to ascertain the strut will operate freely. The weight of the gear wheel and fork should allow the strut to extend.

o. Service oleo strut with fluid and air. (Refer to Oleo Struts, Section II.)

p. Check main gear alignment (refer to paragraph 25) and gear operation.

q. Remove the airplane from jacks.

20a. LANDING GEAR. (Refer to Figure 9.)

20b. MAIN GEAR TRUNNION ATTACH FITTINGS INSPECTION.

For those airplanes which have not installed main landing gear trunnion attach fittings P/N 67040-014, 67040-015, and two (2) P/N's 67042-013 per Piper Service Bulletin No. 956: each 100 hours inspect as follows:

a. Using a calibrated torque wrench, verify that the torque on all four (4) attachment bolts on each of the four (4) main gear trunnion attach fittings is between 50 to 70 in. lbs.

b. If any bolt torque on any attach fitting is found to be less than 50 in. lbs., install new attach fittings per Part II of Piper Service Bulletin No. 956 before further flight.

NOTE: If loose bolts can be retorqued to 50 to 70 in. lbs. and there is no damage to the attach fittings or surrounding structure, the aircraft may be flown to a maintenance facility where installation of new attach fittings can be accomplished.

c. If bolt torque is within 50 to 70 in. lbs., make a logbook entry of compliance, and repeat this inspection at the next 100 hour interval.

21. REMOVAL. (Refer to Figure 9.)

a. Place the airplane on jacks.

b. The side brace link assembly may be removed by the following procedure:

1. With gear in the extended position, disconnect gear downlock spring (18).
2. Disconnect rod end (46) of actuating cylinder (24) from retraction fitting (21) on the upper side brace link (28) by removing nut, washer and bolt (47), and bushing and spring swivel (20).
3. Disconnect lower side brace link (33) from trunnion (13) by removing attachment nut, washer-and bolt (7). Note bushings on each side of end bearing.
4. Disconnect upper side brace link (28) from side brace attach bracket stud (26) by removing cotter pin, nut, washer and attachment bolt (25).
5. The side brace attach bracket may be removed by removing the cap bolts securing the fitting to the spar web.
6. Remove the assembly, and further disassemble and inspect as needed.

c. The trunnion (13) with components may be removed by the following procedure:

1. Disconnect brake line (42) at its upper end in the wheel well.
2. Disconnect gear door actuating rod (38) at the trunnion.
3. Remove access plate located on underside of wing, aft of landing gear.
4. If not previously disconnected, disconnect lower side brace link (33) from the trunnion.
5. Disconnect forward attach fitting (16) of trunnion (13) from the web of the main spar by removing the four bolts.
6. Remove retainer tube (4) in aft attach fitting (1) that supports the aft arm of the trunnion by reaching through the access opening on the underside of the wing, through the hole in the web and removing bolt (48) that secures the tube in the trunnion. Insert a hook through the bolt hole in the tube, and slide it aft from the attach fitting. Remove the tube from the wing.
7. Allow the gear to drop free from the wing.

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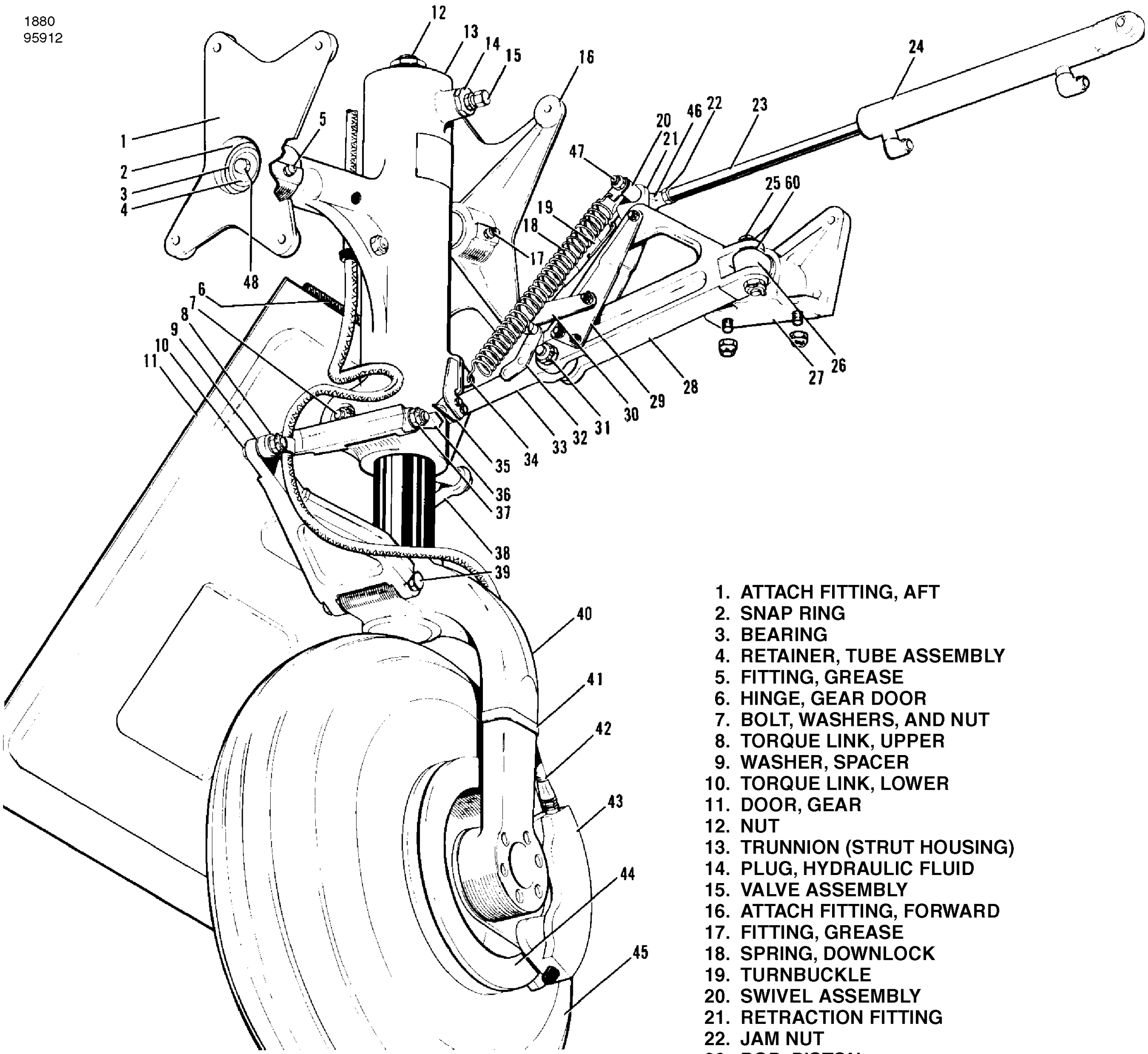
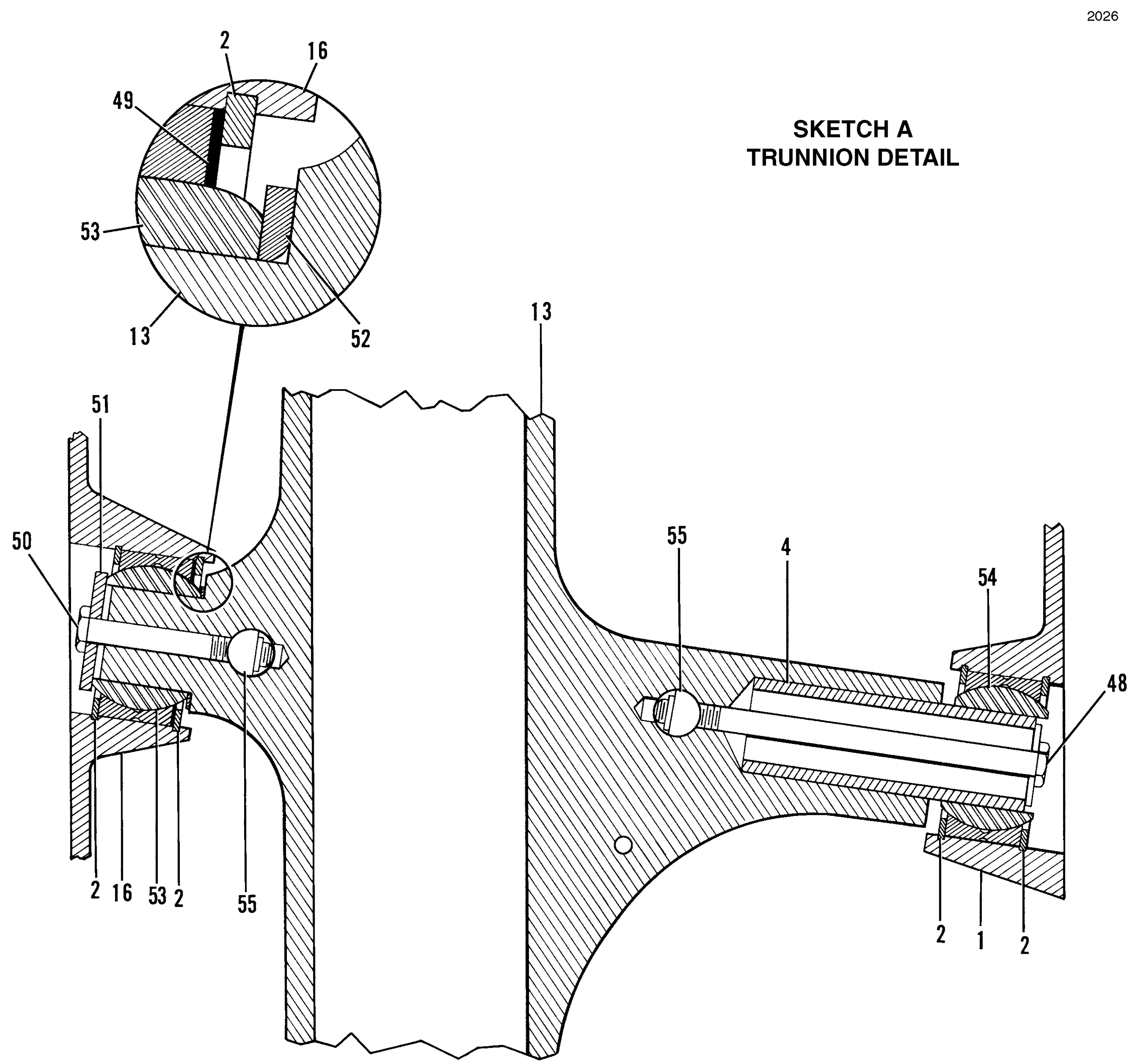


1. ATTACH FITTING, AFT
2. SNAP RING
3. BEARING
4. RETAINER, TUBE ASSEMBLY
5. FITTING, GREASE
6. HINGE, GEAR DOOR
7. BOLT, WASHERS, AND NUT
8. TORQUE LINK, UPPER
9. WASHER, SPACER
10. TORQUE LINK, LOWER
11. DOOR, GEAR
12. NUT
13. TRUNNION (STRUT HOUSING)
14. PLUG, HYDRAULIC FLUID
15. VALVE ASSEMBLY
16. ATTACH FITTING, FORWARD
17. FITTING, GREASE
18. SPRING, DOWNLOCK
19. TURNBUCKLE
20. SWIVEL ASSEMBLY
21. RETRACTION FITTING
22. JAM NUT
23. ROD, PISTON
24. ACTUATOR, EXTENSION AND RETRACTION
25. BOLT, WASHERS, NUT, AND COTTER PIN
26. STUD, SIDE BRACE ATTACH
27. ATTACH BRACKET, SIDE BRACE
28. LINK, UPPER SIDE BRACE (SEE NOTE 2.)
29. PLATE
30. HOOK, DOWNLOCK
31. BOLT, WASHERS, NUT, AND COTTER PIN
32. PIN, DOWNLOCK
33. LINK, LOWER SIDE BRACE
34. BRACKET, SPRING
35. SWITCH, SAFETY
36. ACTUATOR, SAFETY SWITCH
37. BOLT, WASHERS, NUT, AND COTTER PIN
38. ROD, GEAR DOOR
39. BOLT, WASHERS, NUT, AND COTTER PIN
40. FORK, GEAR

NOTES

1. Special landing gear attachment hardware may have been used during original assembly of the airplane due to manufacturing tolerances. Accordingly, pay special attention when removing hardware. Inspect and ensure the same diameter hardware is used upon reassembly. Standard AN4 or AN5 bolts are replaced by alternate oversized bolts NAS3004 or NAS3005, respectively, when oversized hardware is required.
2. When installing new bushings (P/N 14843-16) in link, press fit bushing and then line ream I.D. to .376/.375. If bushing is loose on installation, use LOCTITE 601.

Main Gear Installation
Figure 9 (Sheet 1 of 3)



41. CLAMP
42. HOSE, BRAKE
43. BRAKE HOUSING
44. BRAKE DISC
45. TIRE
46. ROD END BEARING
47. BOLT, WASHER, NUT, AND BUSHING
48. BOLT
49. SHIM WASHER
50. BOLT
51. WASHER
52. WASHER
53. BEARING, FORWARD SUPPORT
54. BEARING, AFT SUPPORT
55. SNAP RING
56. ROD END BEARING
57. JAM NUT
58. BRACKET, SWITCH
59. CLIP, SAFETY
60. BUSHING, TAPERED

Main Gear Installation
Figure 9 (Sheet 2 of 3)

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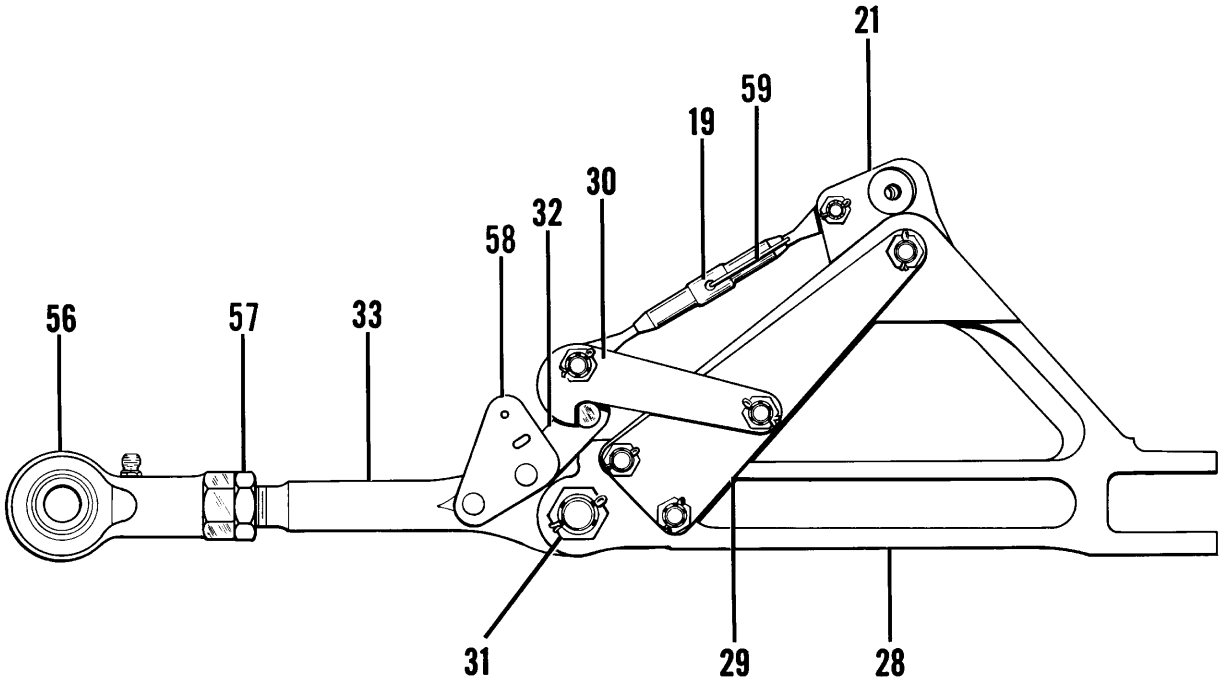


Main Gear Installation
Figure 9 (Sheet 3 of 3)

8. The aft attach fitting (1) may be removed by holding the nuts in position, reaching through the access opening, and removing the four bolts.
9. The forward attach fitting (16) may be removed from the arm of the trunnion by removing the bolt and washer from the base side of the fitting. Slide the fitting from the arm. Remove washer (52) from the arm.

d. Either bearing (53 or 54) installed in the attach fittings may be removed by removing the snap rings (2) that hold the bearing in the trunnion. Push the bearing from the trunnion.

22. CLEANING, INSPECTION AND REPAIR. (See Figure 10 for service tolerances.)

a. Clean all parts with a suitable dry type cleaning solvent.

b. Inspect the gear components for the following unfavorable conditions:

1. Bolts, bearings and bushings for excess wear, corrosion and damage.
2. Trunnion, side brace links, torque links and attachment plates for cracks, bends or misalignment.
3. Downlock hook for excessive wear of the bearing surfaces.

c. Inspect the gear downlock spring for the following:

1. Excessive wear or corrosion, especially around the hook portion 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 it's actuator, and wiring for fraying, poor connections or conditions that may lead to failures.

e. Check side brace link through 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 not less than .062 nor more than .125 of an inch through center. Should the distance exceed the required through center travel and bolt and bushings are tight, replace one or both links.

f. With side brace links assembled and checked, ascertain that when stop surfaces of the two links contact the clearance between each downlock hook and the flat of the downlock pin is not less than 0.010 of an inch. Should clearance be less than that required, the hook only may be fled not to exceed a gap of more than 0.025 of an inch. The maximum allowable clearance between each hook and the downlock pin that are service worn is 0.055 of an inch. Should clearance be more than 0.055 of an inch, replace the pin, check clearance and then if still beyond tolerance, replace hooks. The gap between each hook should be equal.

g. 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.

23. INSTALLATION. (Refer to Figure 9.)

NOTE: When assembling components of the landing gear, lubricate bearings, bushings and friction surfaces with proper lubricant as described in Section II.

a. Insert a gear support bearing (53 and 54) in each attach fitting (1 or 16) and secure with snap rings (2). Check bearing (53) for excess end play, shim as necessary with shim washers (49) (P/N 6283344).

b. The trunnion may be installed in the wheel well of the wing by the following procedure:

   1. Place spacer washer (52) and then forward attach fitting (16) on forward arm of the trunnion. Determine that barrel nut (55) is properly positioned in the arm and insert attachment bolt (50) through washer (51) and the fitting into the arm. Tighten bolt and ascertain that the bearing is free to rotate.
   2. Position aft attach fitting (1) at its attachment point in the wheel well and secure with bolts, washers and nuts. Install nuts and washers by reaching through the access hole on the underside of the wing.
   3. With the retainer tube (4) for the aft arm of the trunnion in hand, reach up through the access opening and insert the tube into the attach fitting (1) through the hole in the web.
   4. Position the trunnion up in the wheel well and install the forward attach fitting (16) with bolts and washers. (One each AN960-416 and AN960-416L washer per bolt.)
   5. Push the retainer tube into the arm of the trunnion and secure with bolt (48).
   6. Check that the gear rotates freely in its attach fittings and recheck thrust.
   7. Connect the brake line to its mating line in the wheel well and bleed brakes as explained in paragraph 65 or 66.

c. The gear side brace link assembly may be installed by the following procedure:

   1. Position link support bracket (27) with swivel stud (26) installed at its attachment point on the web of the spar and secure with bolts and washers.

      NOTE: When installing a new wing, it will be necessary to back drill two (2) holes 0.250 inch and countersink 100° x .499 through the spar cap. (Screw head should be flush with spar.) Use hole in the Support bracket as a guide in the drilling.

   2. Ascertain that the upper and lower links (28 and 33) are assembled with downlock hook (30), retraction fitting (21), etc. attached, and the through travel of the links and downlock hook clearance checked according to paragraph 22.
   3. Attach the upper link to the swivel stud of the side brace attach bracket and secure with bolt, bushing, washer, nut and cotter pin (25).
   4. The actuating cylinder rod end bearing (46) and lower side brace link (33) may be attached respectively to the retraction fitting (21) and trunnion during the adjustment of the landing gear.

d. Ascertain that the landing gear is lubricated per Lubrication Chart, Section II.

e. Check adjustment of landing gear per paragraph 24.

f. Check alignment of the wheel per paragraph 25.

g. Install the access plate on the underside of the wing and remove the airplane from jacks.

24. ADJUSTMENT.

a. Place the airplane on jacks.

b. Level the airplane laterally and longitudinally. (Refer to Leveling, Section II.)

c. Disconnect the gear door actuating rods at either the door or the trunnion, as desired, by removing the rod attachment bolt. Secure the door out of the way.

d. Adjust rod end on upper side brace link with no load on wheels, to obtain 89° angle between wheel centerline and level floor line on outboard side of gear.

e. Check that the rod end has sufficient thread engagement in the end bearing, align the flat sides of the bearing casting with the flat side of the bearing and tighten the jam nut.

f. Adjust the turnbuckle of the downlock mechanism by first ascertaining that the gear is down and locked, and then move the retraction fitting outboard until it contacts the stop slot of the side brace link. Hold the fitting in this position and turn the turnbuckle barrel until the downlock hooks make contact with the lock pin. Safety the turnbuckle.

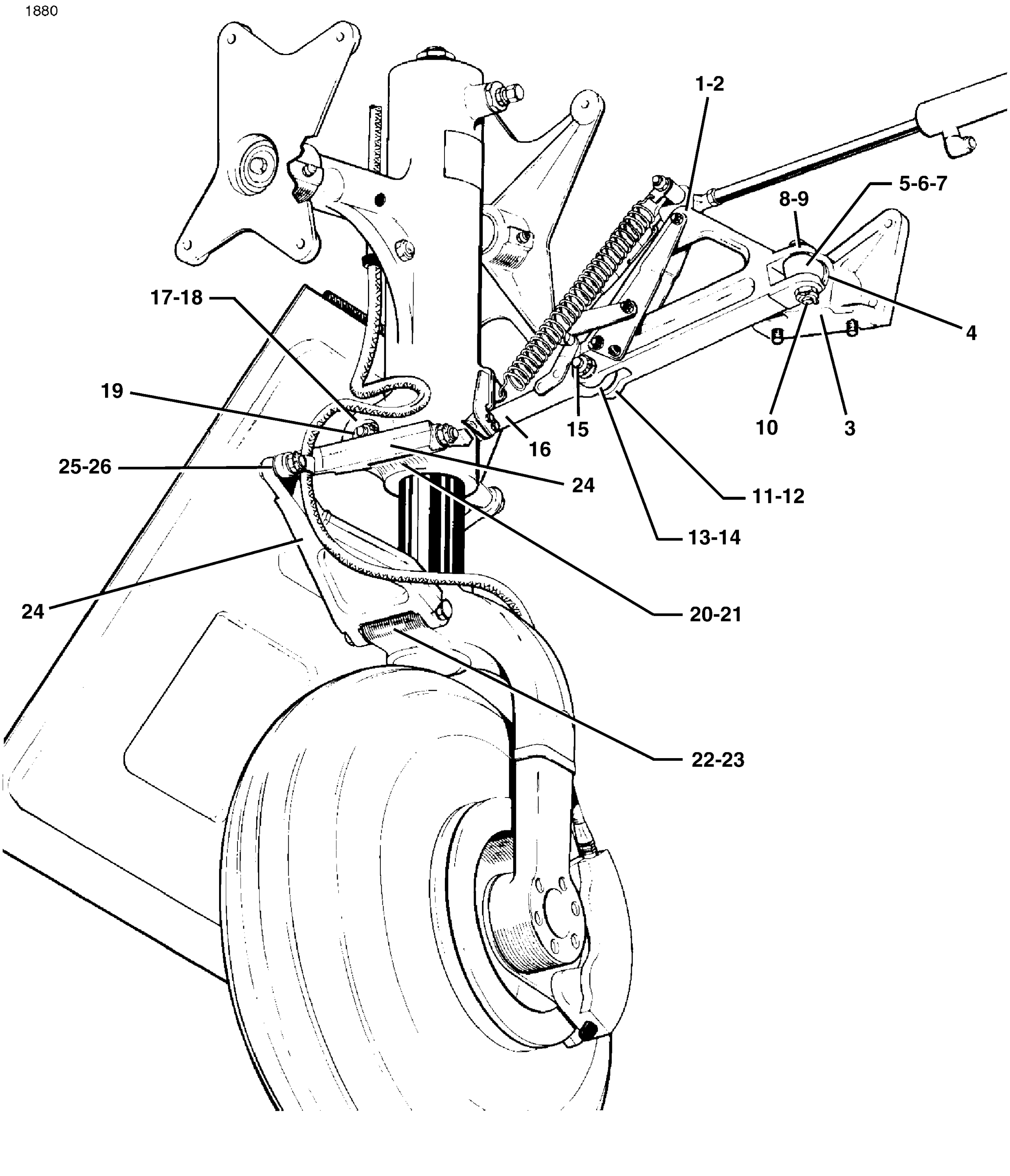
g. For easier adjustment of the downlock limit switch, it may be set at this time as explained in paragraph 34.

h. Retract and extend the gear manually several times to ascertain that the side brace link falls through center, the downlock hook falls into position and there is no binding of the gear assembly.

i. The gear should be adjusted in the up position to allow the gear fork to press lightly into the rubber bumper pad on the wing. The adjustment may be accomplished as follows:

NOTE: If it requires less than .025 of an inch to move the gear into the correct adjustment, only steps 2 and 6 thru 8 need be followed.

1. Ascertain that the rod end bearing of the actuator (i.e. - hydraulic cylinder) is disconnected from the retraction fitting.
2. Actuate the hydraulic system to bring the actuator to the up position by turning the master switch on and moving the gear selector handle to the up position. The piston of the actuator should be bottomed.
3. Raise the gear by pushing up on the retraction fitting, thus disengaging the hooks, and pushing up on the pivot point at the bottom of the side brace links to bring the links out of the locked position. Raise the gear until the fork presses lightly into the rubber pad. Retain the gear in this position.
4. Loosen the jam nut on the piston rod of the actuator and turn the rod end bearing in or out to allow a slip fit of the attachment bolt.
5. Install with the attachment bolt, bushing, spring swivel and secure with washer and nut. Install the gear downlock spring.
6. When the gear is to within .125 of an inch of correct adjustment, the rod end need not be disconnected and therefore all that will be required is to loosen the jam nut, place a wrench on the flat at the end of the piston rod and turn to obtain correct adjustment.
7. Check the rod end bearing for adequate thread engagement and tighten jam nut.
8. If the downlock limit switch is properly adjusted, retract and extend the gear hydro-electrically to ascertain that the gear operates properly.



Main Gear Service Tolerances
Figure 10 (Sheet 1 of 3)

Item No.	Part No.	Nomenclature	Manufactured Dimension	Service Dimension	Service Tolerance	Remarks
1	67514-0	Link, upper side brace	* I.D. .3645 .3625	I.D. .3647 .3623	.004	
2	63900-89	Bushing, truss assembly	* I.D. .251 .249	I.D. .252 .248	.004	Press fit.
3	95643-06 95643-07	Bracket, main gear truss	I.D. .7495 .7505	I.D. .7490 .7510	.002	
4	67026-12	Bushing, support bracket	I.D. .624 .625	I.D. .624 .625	.001	Install using Loctite 601.
5	78717-2	Stud, main gear truss bracket	O.D. .6235 .6225	O.D. .6220		
6	78717-2	Stud, main gear truss bracket	I.D. .4385 .4365	I.D. .4395 .4355	.004	
7	65003-41	Bushing, main gear truss	I.D. .373 .375	I.D. .372 .376	.004	
8	67025-02	Link, upper side brace	I.D. .4945 .4935	I.D. .4925		Line ream.
9	14843-16 (2)	Bushing, truss assembly	* I.D. .376 .375	I.D. .374		Press fit.
10	402-921 (NAS464P6-20)	Bolt, link/stud attaching	O.D. .373 .371	O.D. .373 .369	.004	
11	67514-0	Link, upper side brace	* I.D. 4945 .4935	I.D. .4925		
12	14843-16 (2 ea.)	Bushing, truss assembly	** I.D. .3745 .3755	I.D. 374		Install using Loctite 601. Rotate to ensure complete coverage.
13	67797-04 67797-05	Link assembly, lower side brace	I.D. .4925 .4905	I.D. .500		
14	65003-44 (2 ea.)	Bushing, lower side brace link	* I.D. .3745 .3755	I.D. .374		Press fit.
15	400-757 (AN26-21)	Bolt, side brace link assembly	O.D. .373 .371	O.D. .370	.003	
16	452-368 (HFX-8TG)	Rod End, lowerside brace link	I.D. .50 (+ .0015, - .0005)	I.D. .50 (+ .0030, - .0005)	.0035	
17	67926-04/-30 67926-05/-31	Trunnion, side brace attachment	I.D. .7530 .7550	I.D. .7530 .7550		
18	67026-05	Bushing, trunnion	I.D. .499 .500	I.D. .498 .502	.004	Install bushing with wet zinc chromate equivilent between bushing and trunnion.
19	400-810 (AN28-50A)	Bolt, trunnion/side brace attaching	O.D. .497 .495	O.D. .494	.003	

* Line ream to dimension.

Main Gear Service Tolerances
Figure 10 (Sheet 2 of 3)

Item No.	Part No.	Nomenclature	Manufactured Dimension	Service Dimension	Service Tolerance	Remarks
20	67926-04/-30 67926-05/-31	Trunnion, torque link attachment	I.D. .4410 .4430	I.D. .4410 .4440	.003	
21	67026-07 (2 ea.)	Bushing, trunnion	* I.D. .314 .313	I.D. .315		Press Fit. Install using Loctite 601.
22	67037-04	Strut assembly	I.D. .4385 .4370	I.D. .4395 .4370	.0025	
23	67026-07 (2 ea.)	Bushing, strut	* I.D. .314 .313	I.D. .315 .313	.002	Press Fit.
24	67012-00 (2 ea.)	Torque link	I.D. .312 .313	I.D. .312 .314	.002	
25	67012-00 (2 ea.)	Torque link	I.D. .3760 .3745	I.D. .3770 .3745	.0025	
26	31796-00 (2 ea.)	Bushing, torque link	* I.D. .252 .251	I.D. .253 .251	.002	Press Fit.

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* Line ream to dimension.

Main Gear Service Tolerances
Figure 10 (Sheet 3 of 3)

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25. ALIGNMENT. (Refer to Figure 11 and Table II.)

a. 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 center line of the strut piston and the center line of the center pivot bolt of the gear torque links. Devise a support to hold the straightedge in this position.

b. 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 is 0 ± 1/2 degrees.

NOTE: A carpenter's square, because of its especially long legs, is recommended for checking main landing gear wheel alignment.

c. 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.

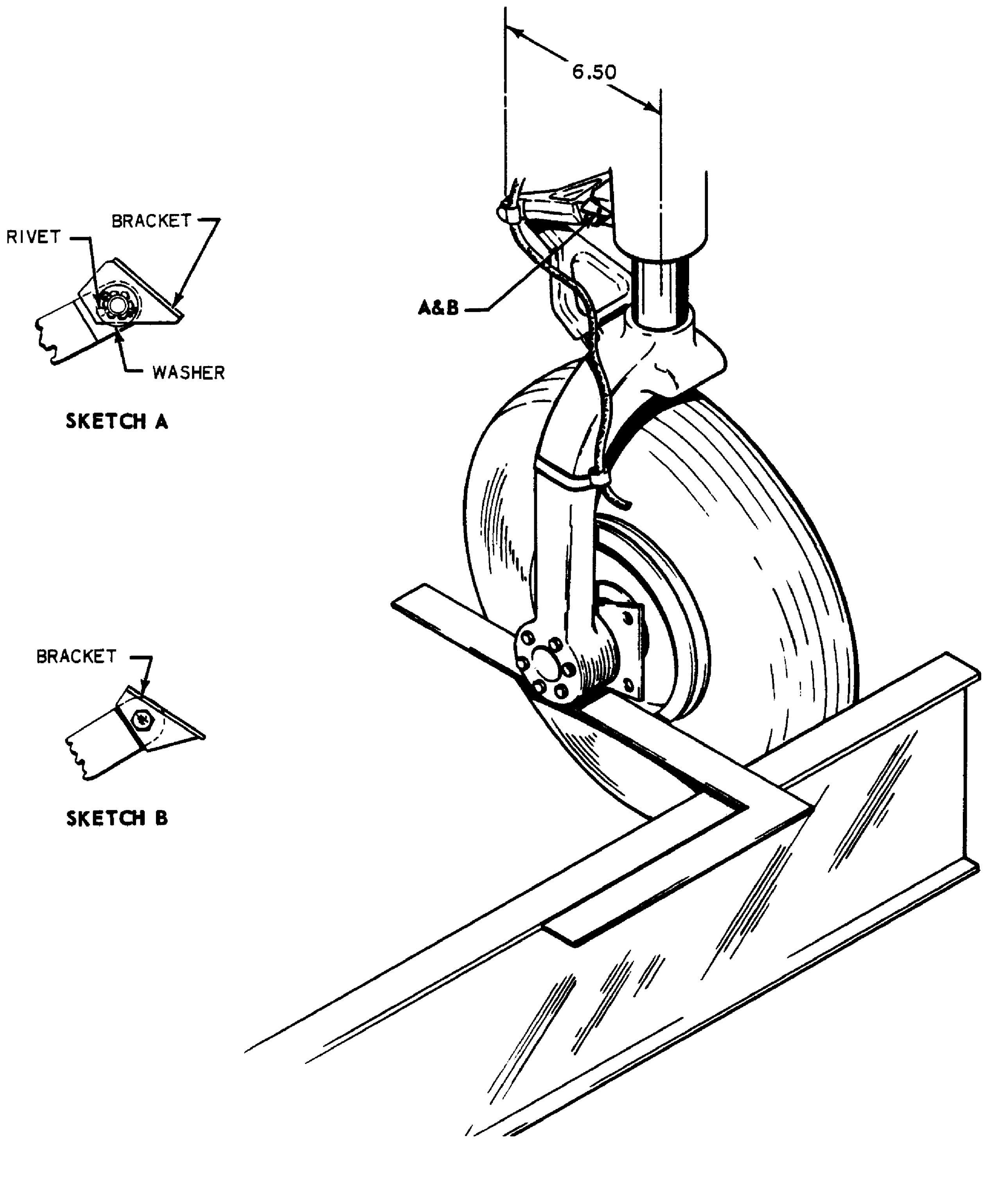
d. To rectify the toe-in and toe-out condition, remove the bolt connecting the upper and lower torque links and remove or add spacer washers to move the wheel in the desired direction. Refer to the chart on the following page.

e. 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. This will put the link connecting point on the opposite side allowing the use of spacers to go in the same direction.

f. Recheck wheel alignment. If the alignment is correct, safety the castellated nut with cotter pin.

TABLE II
TOE-OUT CORRECTION

Toe-In / Toe-Out Angle	Shim Washers	Washers Under Head	Washers 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' Maximum Allowable	AN960-416 (4)	AN960-416	AN960-416	-15
AN960-416 Washers .062 Thick AN960-416L Washers .031 Thick				



Aligning Main Gear
Figure 11

g. If a new link on the top left main gear had 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 the large machine surface of the link is inboard, the bracket is mounted with the small rivet hole next to link. (Refer to Sketch A, Figure 11.) This hole should be aligned with center line of the link and a .096 inch hole drilled .150 inch deep. Insert an MS20426AD3-3 rivet in the hole. This locking rivet is held in place by the flat washer, castellated nut and cotter pin. If link has to be reversed, then the bracket and bolt are also reversed. (Refer to Sketch B, Figure 11.)

h. Check adjustment of landing gear safety switch (squat switch) per paragraph 35.

25a. DOOR.

26. REMOVAL.

a. With the landing gear extended, disconnect the door retraction rod from the door by removing nut, washers and bolt.

b. Remove the door from the wing panel by bending the door hinge pin straight and from the other end pulling out the pin.

c. The door retraction rod may be removed from the trunnion by cutting the safety wire and removing the attachment bolt and washer. Note the number of washers between rod end bearing and trunnion.

27. CLEANING, INSPECTION AND REPAIR.

a. Clean the door and retraction rod with a suitable cleaning solvent.

b. Inspect the door for cracks or damage, loose or damaged hinges and brackets.

c. Inspect the door retraction rod and end bearing for damage and corrosion.

d. Repairs to a door may be replacement of hinge, repair of fiberglass and painting.

28. INSTALLATION.

a. 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.

b. Install the door retraction rod by positioning the rod at its attachment points at the door and trunnion. 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 trunnion, place washers between rod end bearing and trunnion not to exceed .12 of an inch to obtain proper clearance and secure with bolt. Safety bolt with MS20995C41 wire.

c. Check that the all around clearance between the door and the wing skin is not less than .032 of an inch.

29. ADJUSTMENT.

a. Place the airplane on jacks.

b. Determine that the main gear is properly adjusted for gear up as explained in paragraph 24.

c. Adjust retraction rod end at door so that door will pull up tightly when the gear is full up. Over-tightening may result in door buckling; however, if the door is too loose it will gap in flight.

d. Check all rod ends for adequate thread engagement, for safety and tightness of jam nuts.

e. Remove airplane from jacks.

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30. ADJUSTING LANDING GEAR LIMIT SWITCHES.

NOTE: All adjustments of the limit switches should be made with the airplane on jacks. Do not bend actuator springs mounted on the limit switches.

30a. NOSE LANDING GEAR.

31. UP LIMIT SWITCH. (See Item 36, Figure 2.)

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.

a. To facilitate adjustment of the limit switch, disconnect gear doors.

b. Turn the master switch on; move gear selector switch to the gear up position and raise the landing gear. Turn the master switch OFF.

c. 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.

d. Loosen the attachment screws of the switch and rotate the switch toward the actuator tang until the switch is heard to actuate. On airplanes equipped with an up stop, move the up limit switch upwards .02 to .04 inches after actuation. Retighten the switch attachment screws. Remove the block from under the gear and allow it to extend slowly.

e. Turn master switch on; raise gear and determine that gear lights function properly.

32. DOWN LIMIT SWITCH. (See Figure 12.)

The nose gear down limit switch is mounted on a bracket located on the forward side of the cabin bulkhead.

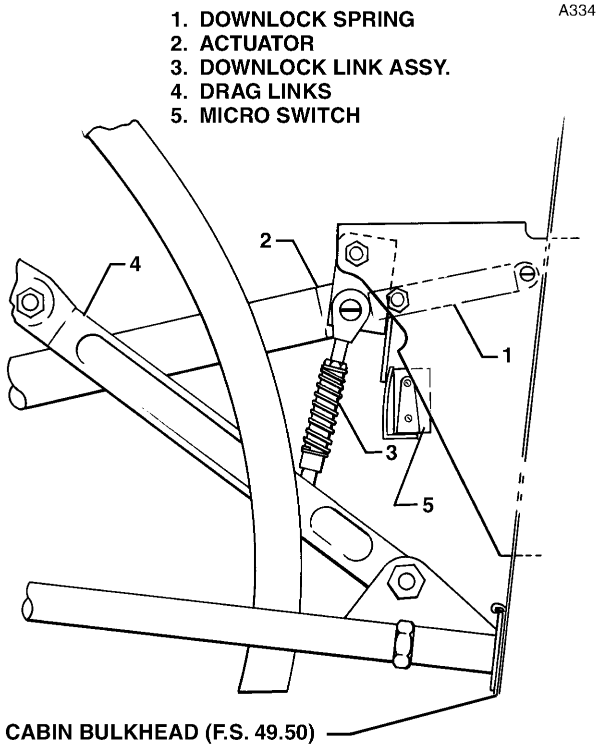
a. With landing gear in the retracted position, pull the free fall valve knob permitting the gear to extend.

b. Check to determine that the downlock spring (1) returns the body end of the actuator (2) aft.

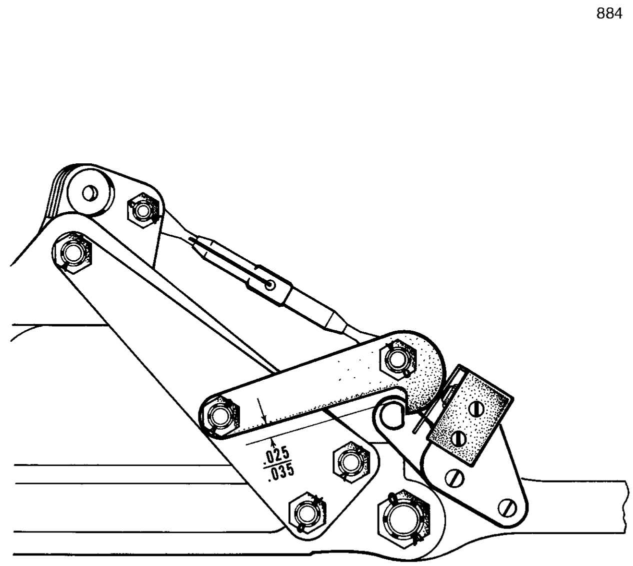
c. Ascertain that the downlock link assembly (3) is fully retracted and that the drag link arms (4) are over center.

d. In this position, the nose gear green downlock light should energize when the master switch is turned on and the gear selector lever is in the down position.

e. If the nose gear green downlock light does not energize, loosen the attachment screws of the switch (5) and rotate the switch toward the actuator tang until it is heard to actuate. Tighten the adjustment screws.



Nose Gear Down Limit Switch
Figure 12



Main Gear Down Limit Switch
Figure 13

32a. MAIN LANDING GEAR.

33. UP LIMIT SWITCH. A gear up limit switch is located in each wheel well above the gear door hinge. The red "GEAR UNSAFE" light is extinguished when all three gears have actuated their up limit switches and the gear selector is in the up position.

34. DOWN LIMIT SWITCH. (See Figure 13.)

The gear down limit switch is mounted on a bracket attached to the lower drag link of each main gear. The switch should be adjusted to allow it to actuate when the downlock hook has entered the locked position and is within .025 to .035 inch of contacting the pin thus turning the green light on in the cockpit. Adjustment, if necessary, should be made as follows:

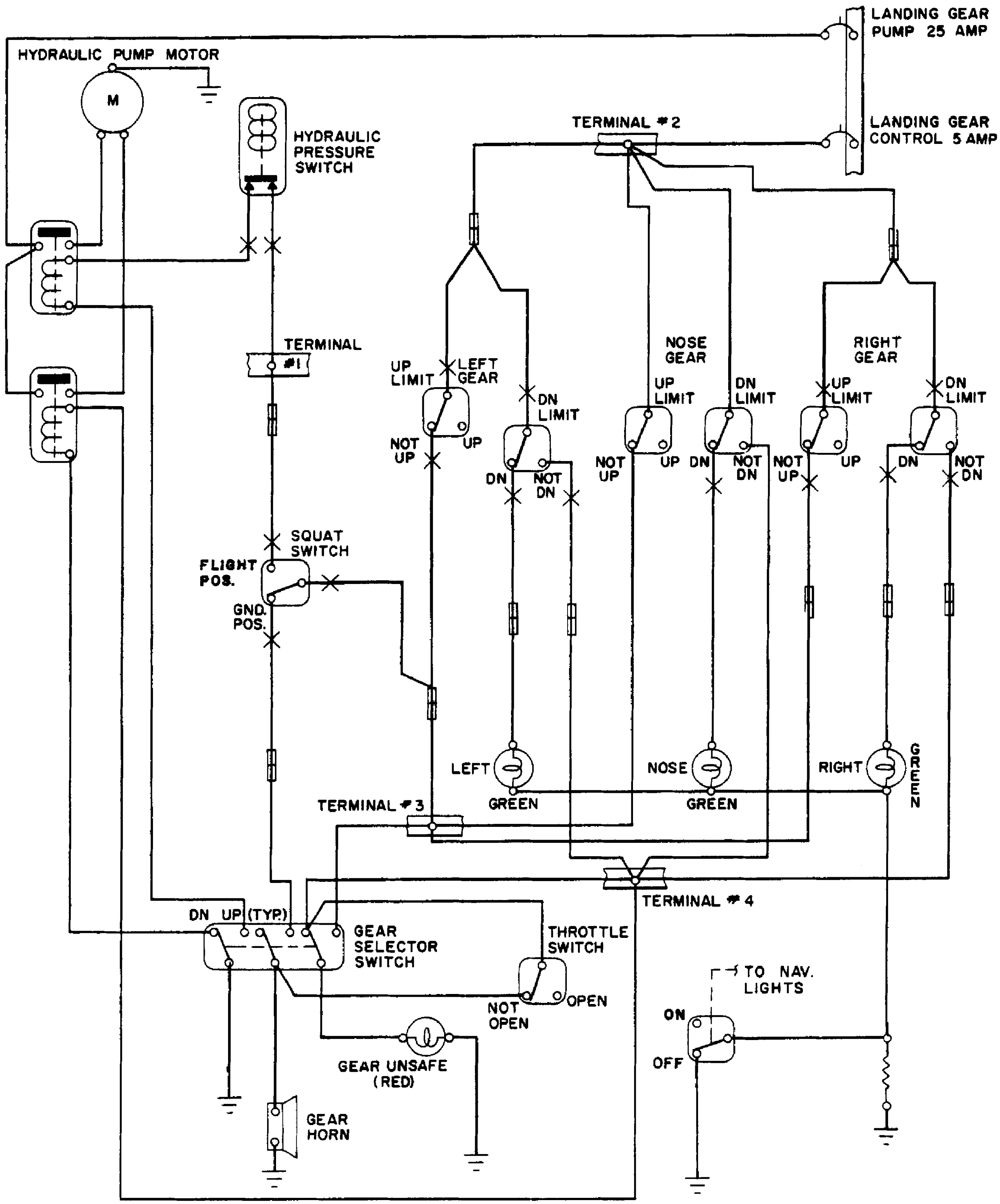
a. Determine that the main gear downlock is properly adjusted as described in paragraph 24.

b. Raise the airplane on jacks.

c. Determine that the landing gear is down and pressure is relieved from the hydraulic system. To relieve pressure, pull the free fall knob out.

d. Raise the downlock hook assembly and place a .030 inch feeler gauge between the horizontal surface of the hook that is next to the switch (the surface that contacts the downlock pin) and the rounded surface of the pin. Lower the hook and allow it to rest on the feeler gauge.

e. Loosen the attaching screws of the switch and, while pushing up on center of the link assembly, rotate the switch toward the hook until it is heard to actuate. Retighten the attaching screws of the switch.



Landing Gear Electrical Schematic
Figure 14

f. Manually move the hook assembly up from the pin until the hook nearly disengages from the pin. Then with pressure against the bottom of the link assembly, move back to determine that the switch actuates within .025 to .035 inch of full lock.

g. Turn the master switch on and raise and lower the landing gear by means of the gear selector switch to determine the gear downlock and gear unsafe annunciator lights function properly.

35. SAFETY SWITCH (SQUAT SWITCH).

The landing gear safety switch, located on the left main gear trunnion is adjusted so that the switch is actuated within the last quarter inch of gear extension.

a. Compress strut until a distance of 7.875 inches is obtained between the top of the gear fork and the bottom of the trunnion. Hold the gear at this measurement.

b. Adjust the switch as necessary to actuate at this point. Secure the switch.

c. Extend and then compress the strut to ascertain the switch will actuate within the last quarter inch of oleo extension.

36. LANDING GEAR WARNING SWITCH (Throttle Switch).

37. LANDING GEAR UP/POWER REDUCED WARNING SWITCH. This switch will automatically activate a warning horn when approaching for a landing with the landing gear up and the throttles pulled below 14 inches of manifold pressure.

38. SWITCH LOCATION. The landing gear up/power reduced warning switch is located in the control quadrant behind the throttle levers. Access to the switch is from below and behind the quadrant.

39. ADJUSTING LANDING GEAR UP/POWER REDUCED WARNING SWITCH. (See Figure 15.) The adjustment of this switch will require flying the airplane at 1000 feet AGL and at approach speed. (Refer to the Pilot's Operating Manual.) The following procedure should be used:

a. With the aid of a qualified pilot fly the airplane to an elevation of 1000 feet above the ground and come to approach speed with propellers set for high RPM. Retard the throttles to 14 ± 2 inches of manifold pressure and mark the quadrant cover adjacent to the throttle levers, in such a manner so that the levers can be returned to the same position after the airplane is landed and the engines shut down.

b. Place the airplane on jacks, (refer to Section II of this manual) and retract the landing gear.

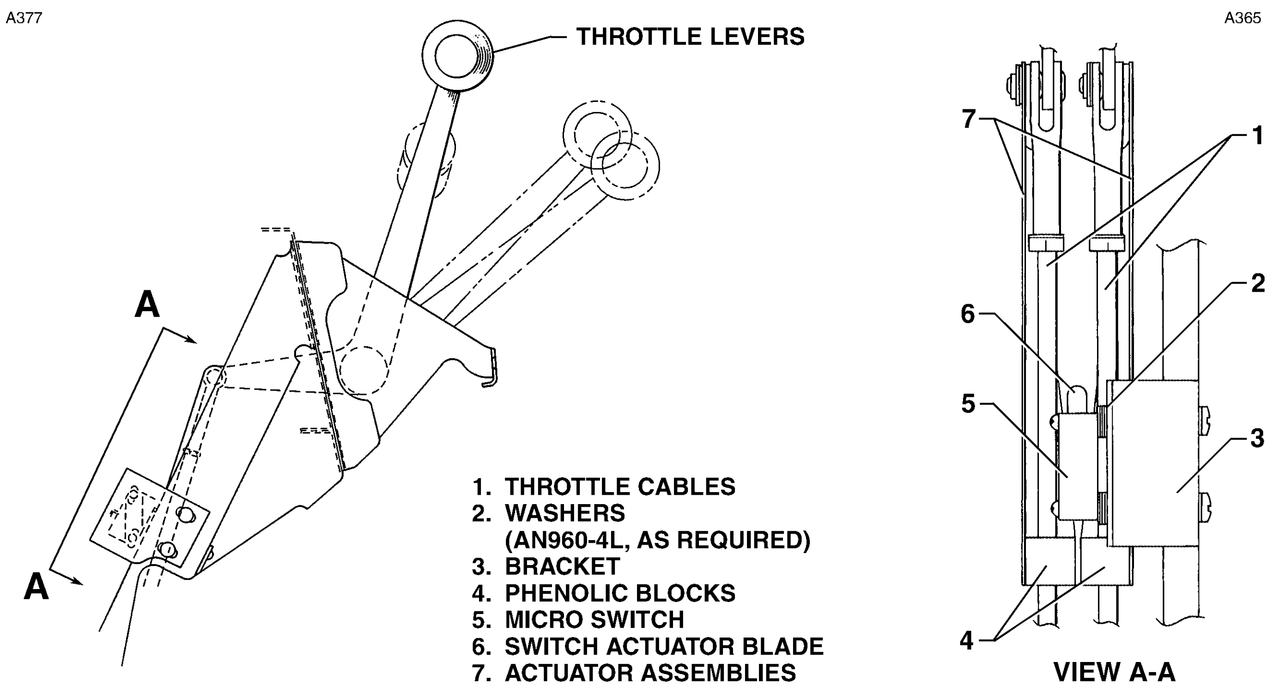
c. Reposition the throttle levers at the location which gave the 14 ± 2 inches of manifold pressure per step a.

d. With the master switch turned on, loosen the two mounting screws securing the micro switch (5) to the bracket. Move the switch in the direction necessary to make the warning horn operate (i.e. - when the switch actuator blade (6) contacts the phenolic blocks (4) and actuates the micro switch) and tighten the mounting screws.

e. With the warning horn operating, lower the landing gear to determine whether the horn ceases to operate when the gear are down and locked. Turn OFF master switch and remove airplane from jacks.

f. Flight test the airplane to insure proper operation of the gear warning horn with the gear up and power reduced below 14 ± 2 inches of manifold pressure.

40. REPLACEMENT OF LANDING GEAR UP/POWER REDUCED WARNING SWITCH. (Refer to Figure 15.) When replacing the switch it is important to determine how many washers (2) are positioned between the micro switch (5) and the bracket (3) so that an equal amount are reinstalled. This is necessary since the switch when properly positioned should be in the middle of the actuators (7) located on each throttle cable (1).



Landing Gear Up / Power Reduced Warning Switch
Figure 15

41. WHEELS.

41a. NOSE WHEEL.

42. REMOVAL AND DISASSEMBLY. (Refer to Figure 16.)

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.

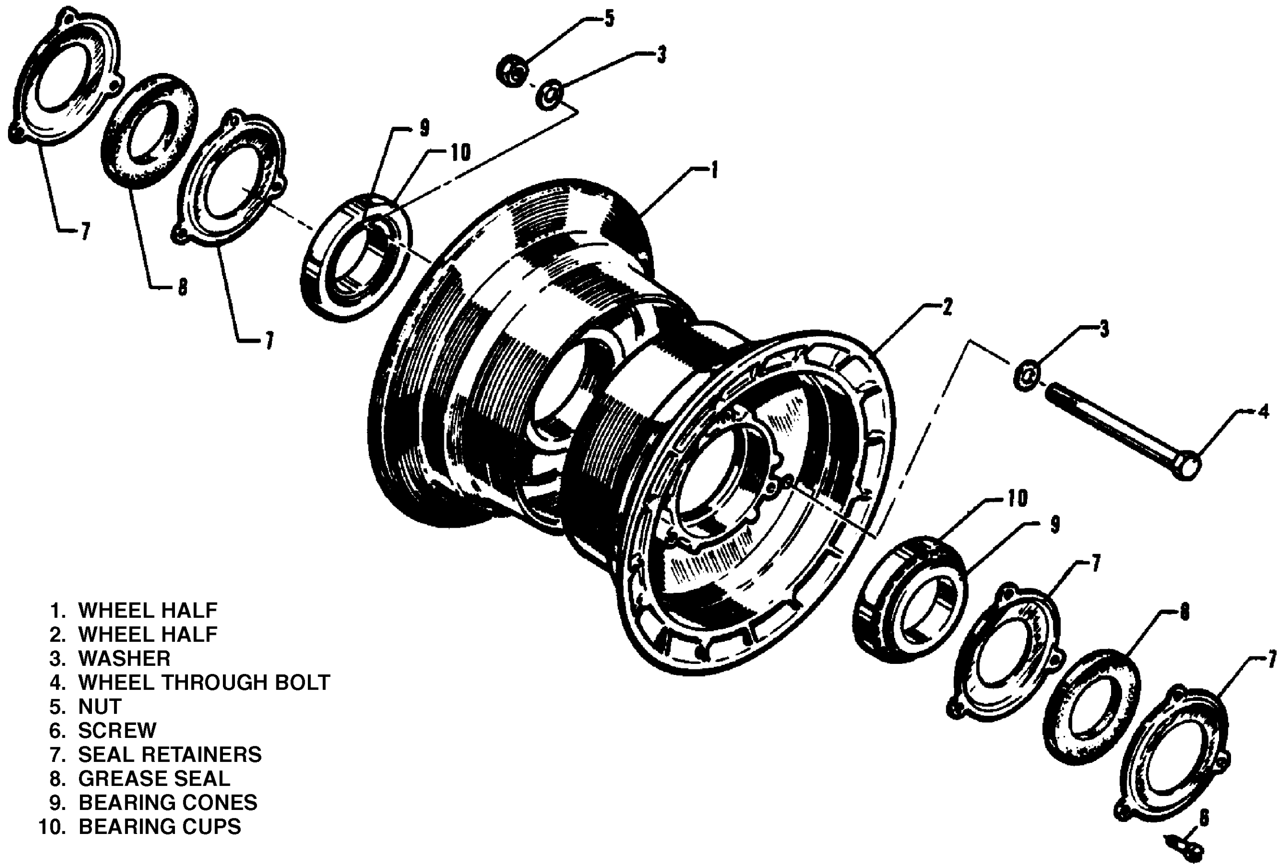
c. Lightly tap the axle tube out from the center of the wheel assembly by use of an object of near equal diameter.

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 (4). Pull wheel halves from the tire by removing the wheel half opposite the valve stem first and then the other half.

f. Remove screws (6), grease seal (8), seal retainers (7) and bearing cones (9). Remove bearing cup (10) by tapping evenly from the inside.



1. WHEEL HALF
2. WHEEL HALF
3. WASHER
4. WHEEL THROUGH BOLT
5. NUT
6. SCREW
7. SEAL RETAINERS
8. GREASE SEAL
9. BEARING CONES
10. BEARING CUPS

Nose Wheel Assembly
Figure 16

43. 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.

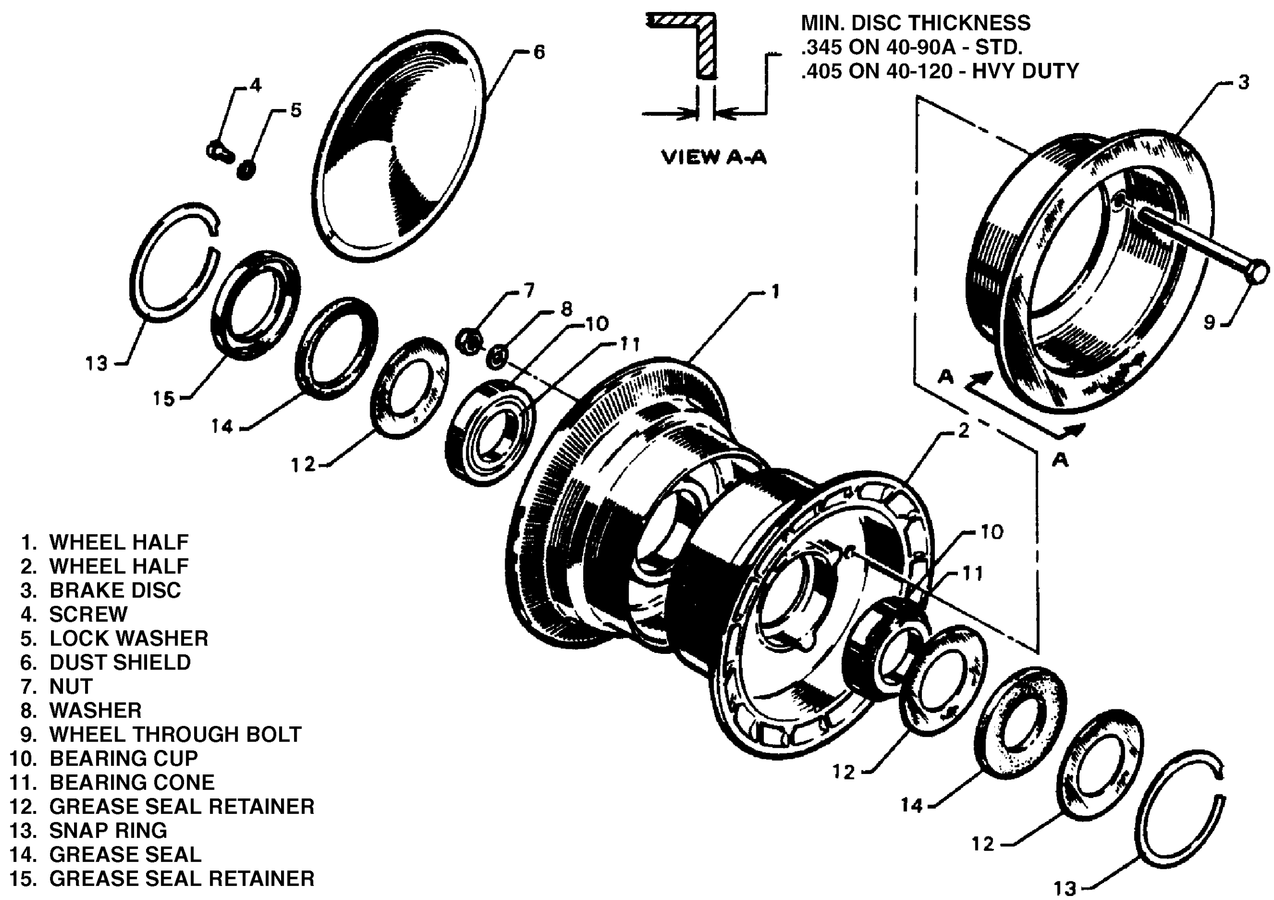
f. Replace any wheel casting having visible cracks.

44. ASSEMBLY AND INSTALLATION. (Refer to Figure 16.)

a. Carefully install bearing cups (10) into each wheel half (1 and 2). Install the tire with tube on the wheel half with the valve stem hole and then join two wheel halves. Install bolts (4) with washers (3) and nuts (5) to the valve stem side. Torque nuts to 90 in. lbs. and inflate tire. (See Table II, Section II.)

b. Lubricate bearing cones (9) and install cones, inner seal retainers (7) and grease seals (8). Secure outer seal retainer with three screws (6).

c. 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.



Main Wheel Assembly
Figure 17

44a. MAIN WHEEL.

45. REMOVAL AND DISASSEMBLY. (Refer to Figure 17.)

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.

d. The wheel halves (1 and 2) may be separated by first deflating the tire. With tire deflated, remove bolts (9). 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 (13), grease seal rings (12 and 15), felt grease seals (14) and bearing cone (11). Bearing cups (10) should not be removed unless in need of replacement. To remove bearing cups, tap evenly from the inside.

46. INSPECTION. Inspection of the main wheel assembly is the same as that given for the nose wheel, paragraph 43.

47. ASSEMBLY AND INSTALLATION. (Refer to Figure 17.)

a. Determine that the bearing cup (10) is properly installed in each wheel half. Install the tire with tube on the outer wheel half (1) and then join two wheel halves. Position the brake disc (3) in the inner wheel half and install wheel bolts (9) with nuts on valve stem side. Torque wheel nuts to 150 inch pounds and inflate tire. (Refer to Table II, Section II.)

b. Lubricate bearing cones (11) and install cones, felt grease seals (14) and grease seal rings (12 and 15). Secure with snap rings (13).

NOTE: Heavy duty wheel assemblies and brake discs may be easily identified by six (6) bolt hole pattern. Standard wheel assemblies and disc brakes have a three (3) bolt hole pattern.

c. Slide wheel on the axle and secure with axle nut. Tighten nut sufficiently to prevent side play, yet free to rotate freely. Reinstall the dust cover (6).

d. 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.

48. BRAKE SYSTEM.

49. 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 the riveted type and should be replaced if the thickness of any one segment becomes worn below .099 of an inch of if signs of uneven wear are evident.

50. REMOVAL AND DISASSEMBLY. (Refer to Figure 18.)

a. To remove brake assembly, first disconnect brake line from brake cylinder at the elbow (18).

b. Remove bolts (14) joining brake cylinder housing (1) and back plate assembly (7). Remove back plate from between brake disc and wheel.

c. Slide brake cylinder housing from torque plate (10).

d. Remove pressure plate (4) by sliding it off the anchor bolts (11) of brake cylinder housing.

e. The pistons (2) 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 19, Removal.)
2. Use a suitable arbor press and remove the anchor bolt from the cylinder body.

51. CLEANING, INSPECTION AND REPAIR.

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.

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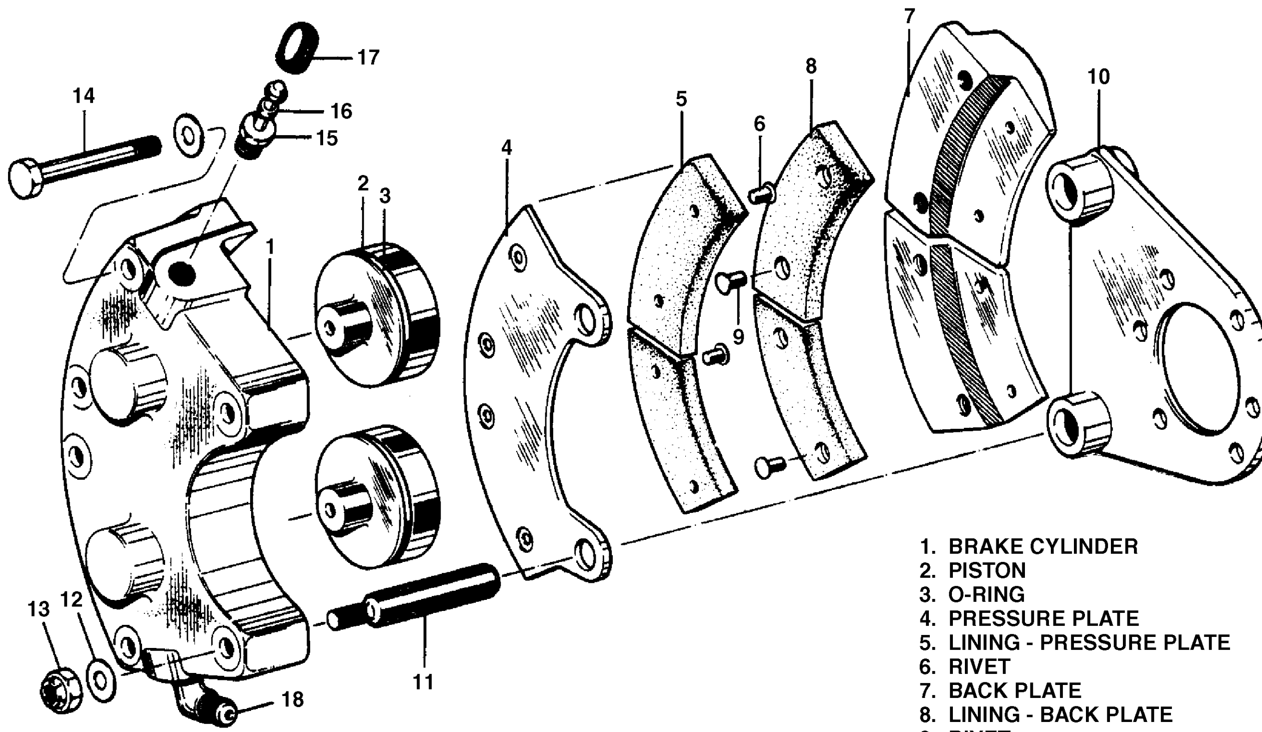


1. BRAKE CYLINDER
2. PISTON
3. O-RING
4. PRESSURE PLATE
5. LINING - PRESSURE PLATE
6. RIVET
7. BACK PLATE
8. LINING - BACK PLATE
9. RIVET
10. TORQUE PLATE ASSEMBLY
11. BOLT - ANCHOR
12. WASHER
13. NUT
14. BOLT
15. BLEEDER SEAT
16. BLEEDER SCREW
17. BLEEDER CAP
18. ELBOW

NOTE
OLDER CYLINDERS - (TAPERED HOLE (BLEEDER SEAT) TORQUE FROM 75 TO 90 INCH POUNDS. NEWER CYLINDERS - (STRAIGHT TAPERED; BLEEDER SEAT HAS O-RING) - TORQUE ONLY UNTIL O-RING SEALS HOLE.

Wheel Brake Assembly
Figure 18

d. Check the brake disc for wear, grooves, scratches pits or heat cracks. Ear of disc should not be less than 0.345 of an inch at its thinnest point. 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 should be replaced. If a heat crack exceeds .800 of an inch in length or a crack depth exceeds .210 of an inch, the disc should be replaced. If crack depth is not measurable, replace disc if crack length exceeds .400 of an inch. Should any heat crack extend into the welded seam between the flange and cup replace immediately. Should it be necessary to remove the wheel disc, refer to paragraph 45.

e. Lining may be removed from the backing plates by drilling or punching out the old rivets, and installing a new set using the proper rivets and a rivet set that will properly stake the lining and form a correct flare of the rivet.

f. The replacement linings must be conditioned as follows:

   1. For Cleveland 30-65 brakes, perform a minimum of six light pedal effort braking applications from 25 to 40 MPH, allowing the brake discs to partially cool between stops.
   2. For Cleveland 30-83 brakes, perform three consecutive hard braking applications from 45-50 MPH without allowing the discs to cool substantially between stops.

52. ASSEMBLY AND INSTALLATION. (Refer to Figure 18.)

a. If anchor bolts have been removed, they should be reinstalled as follows:

   1. Support anchor bolt in a holding fixture. (Refer to Figure 19, Step A.)
   2. Align cylinder body over anchor bolt. (Refer to Figure 19, Step B.)
   3. Using a suitable arbor press, apply pressure on the spot face directly over the anchor bolt. (Refer to Figure 19, Step C.)

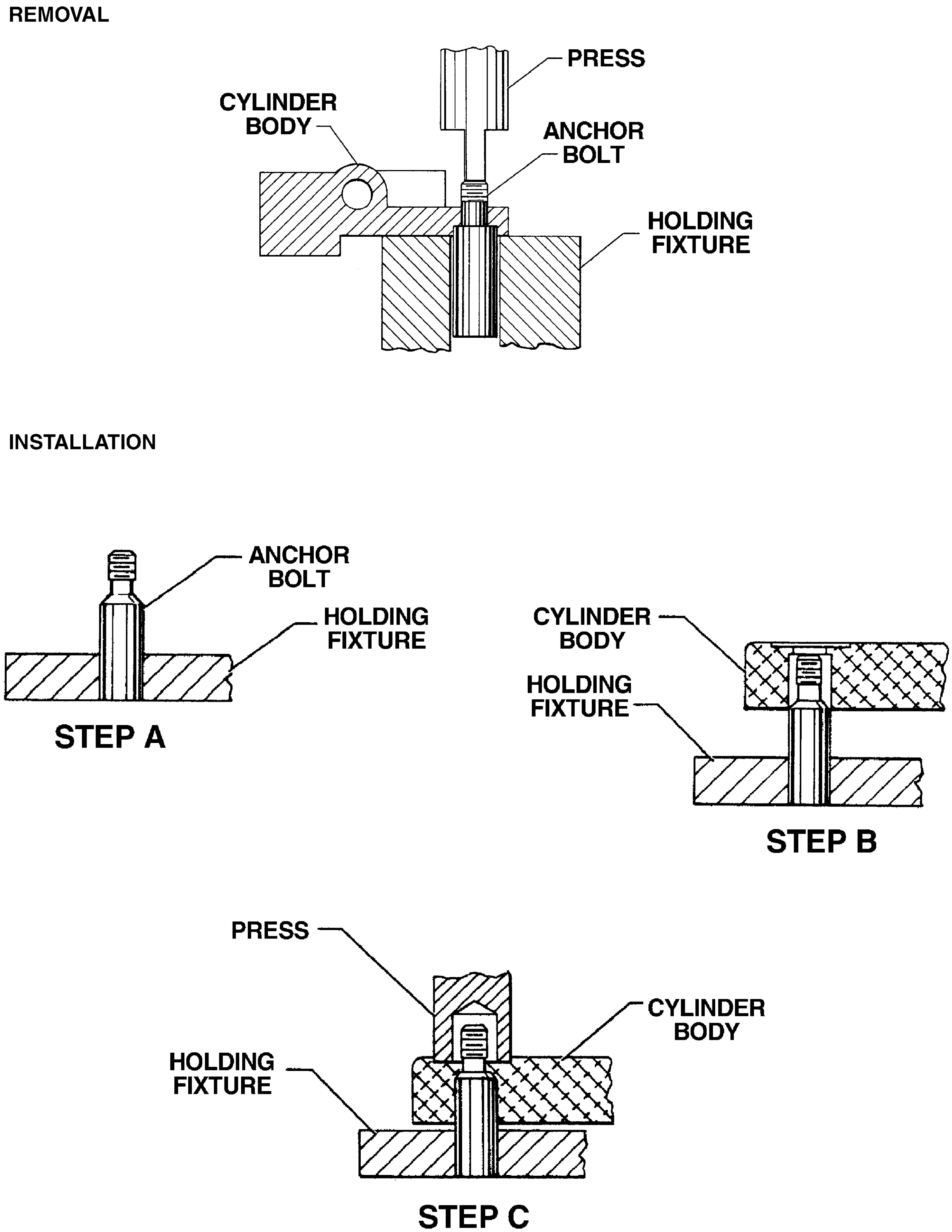
b. Lubricate piston O-rings (3) with hydraulic fluid (MIL-H-5606) and install on pistons (2). Slide piston into cylinder housing (1) until flush with surface of housing.

c. Slide pressure-plate (4) onto anchor bolts (11) of housing

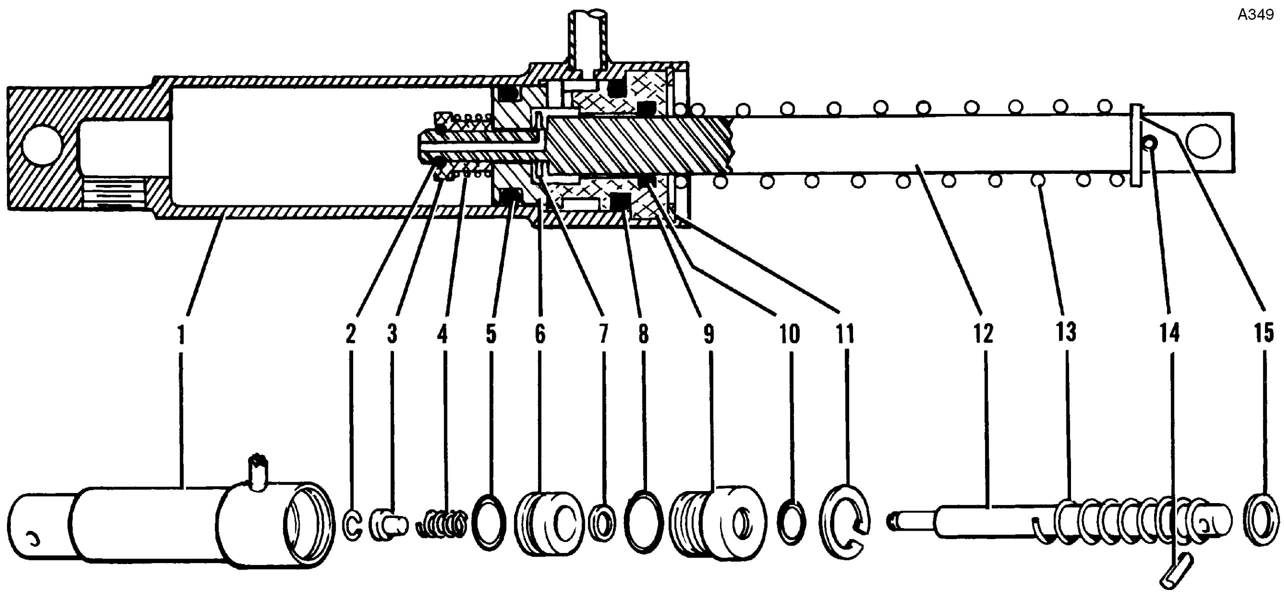
d. Slide cylinder housing on torque plate(10).

e. Position back plate (7) between wheel and brake disc. Install bolts and torque to 90 inch pounds to secure the assembly. Torque anchor bolt nuts to 60 inch pounds.

f. Connect brake line to cylinder housing and bleed brake system as described in paragraph.



Anchor Bolt Removal and Installation
Figure 19



1. HOUSING
2. SNAP RING
3. BUSHING, RETAINER
4. SPRING
5. O-RING
6. PISTON
7. DYNA SEAL
8. O-RING
9. GLAND, PACKING
10. O-RING
11. SNAP RING
12. ROD, PISTON
13. SPRING, RETAINING
14. ROLL PIN
15. WASHER

Brake Master Cylinder (Hand / Parking Brake)
Figure 20

53. BRAKE MASTER CYLINDER (HAND PARKING BRAKE).

54. REMOVAL. (Refer to Figure 21.)

a. To remove brake master cylinder (8), first disconnect inlet supply line (13) from fitting at top of cylinder and allow fluid to drain from the reservoir and line into a suitable clean container.

b. Disconnect pressure line from fitting at bottom of cylinder and allow fluid to drain from the pressure line.

c. Disconnect end of cylinder rod from the brake handle (6) by removing the cotter pin that safeties the connecting clevis pin (12). Remove clevis pin and spacer washers.

d. Disconnect the base of the cylinder from its mounting bracket by removing bolt assembly (11).

e. The handle assembly (6) may be removed by removing attachment bolt assembly securing handle to its mounting bracket.

55. DISASSEMBLY. (Refer to Figure 20.)

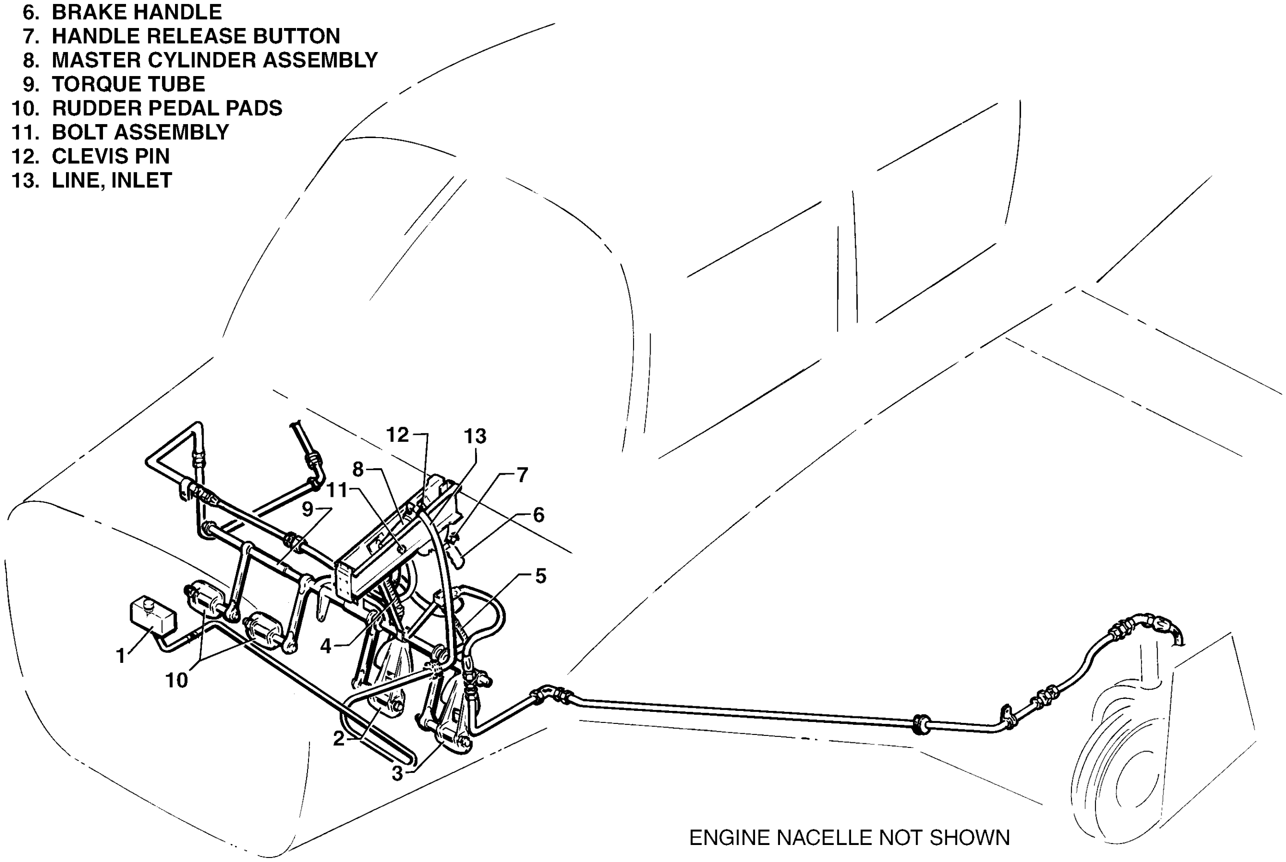
a. Remove snap ring (11) from annular slot in rod end of cylinder and withdraw piston rod assembly.

b. Disassemble piston rod assembly by removing snap ring (2) securing retainer bushing (3), spring (4), piston (6), seal (7), gland (9) and large retaining spring (13).

c. Remove O-ring from piston and gland.

1956

1. BRAKE RESERVOIR
2. RIGHT BRAKE AND RUDDER PEDAL
3. LEFT BRAKE AND RUDDER PEDAL
4. RIGHT BRAKE CYLINDER
5. LEFT BRAKE CYLINDER
6. BRAKE HANDLE
7. HANDLE RELEASE BUTTON
8. MASTER CYLINDER ASSEMBLY
9. TORQUE TUBE
10. RUDDER PEDAL PADS
11. BOLT ASSEMBLY
12. CLEVIS PIN
13. LINE, INLET



Brake System Installation
Figure 21

56. CLEANING, INSPECTION AND REPAIR.

a. Clean cylinder components using a suitable solvent, then dry thoroughly.

b. Inspect interior walls of cylinder for scratches, nicks, burrs, corrosion, etc.

c. Inspect general condition of fitting threads.

d. Check piston and valve for scratches, bum, and corrosion.

e. Repairs to the cylinder are limited to polishing out small scratches and bum and replacing washer seal and O-rings.

57. ASSEMBLY. (Refer to Figure 20.)

a. Apply a small amount of hydraulic fluid (MIL-H-5606) to component parts and O-rings.

b. Install new O-rings on inside and outside of packing gland (9) and on outside of piston (6).

NOTE: When installing teflon O-ring (5) on piston, it is suggested it be installed with the use of a cone placed against the piston. Dimensions for constructing a cone of plastic or metal are shown in Figure 16.

c. To assemble piston rod assembly, install on rod (12), in order, roll pin (14), washer (15), spring (13), packing gland (9) with O-rings, seal (10), piston (6) with O-rings, spring (4) and bushing (3). Secure these components with snap ring (2).

d. Insert piston rod assembly into cylinder (1) and secure packing gland with snap ring (11).

e. Install cylinder as explained in paragraph 58.

58. INSTALLATION. (Refer to Figure 21.)

a. Install brake handle assembly between its mounting bracket and secure with bolt, washers, nut and cotter pin. Washers should be placed on each side of the handle, between the bracket, and under the nut.

b. Place cylinder (8) between the mounting bracket and secure base end with bolt, washers, nut and cotter pin. This too should have washers placed on each side of the cylinder and under the nut.

c. Connect rod end of cylinder to the brake handle with a clevis pin and thin washers. Safety clevis with a cotter pin.

d. Connect pressure line to fitting at bottom of cylinder.

e. Connect inlet supply line (13) to fitting at top of cylinder and secure with spring clamp.

f. Bleed brake system as explained in paragraph 65.

59. BRAKE CYLINDER (TOE BRAKE).

60. REMOVAL. (Refer to Figure 23.)

a. Disconnect the upper and lower lines from the cylinder (14) to be removed and cap the lines to prevent fluid leakage or drain the fluid from the brake reservoir and master cylinder.

b. Remove cotter pins and clevis pins (4 and 16) securing brake cylinder in position, then remove brake cylinder.

61. DISASSEMBLY.

a. CLEVELAND CYLINDER NUMBER 10-27. (Refer to Figure 22.)

1. Remove the cylinder from its mounting bracket per Paragraph 60.
2. To disassemble the cylinder, first remove the piston rod assembly by removing the retaining ring (10) from the annular slot in the cylinder housing (1). Draw the piston rod assembly from the cylinder.
3. The piston rod assembly may be disassembled by first removing the roll pin (12), spring (2), and then the piston assembly (3), seal (5) and packing gland (7) and, if desired, the large return spring (11).
4. Remove the O-rings from the piston and packing gland.

b. CLEVELAND CYLINDER NUMBER 10-30. (Refer to Figure 22.)

1. Remove the cylinder from its mounting bracket per Paragraph 60.
2. To disassemble the cylinder, first remove the piston rod assembly by removing the retaining ring from the annular slot in the cylinder housing (1). Draw the piston rod assembly from the cylinder.
3. The piston rod assembly may be disassembled by first removing the retaining ring (2), sleeve (3), spring (4), and then the piston assembly, O-ring (5), and gland (8), and, if desired, the large return spring (14).
4. Remove the O-rings from the piston and packing gland.

c. GAR-KENYON CYLINDER NUMBER 17000. (Refer to Figure 22.)

1. Remove the cylinder from its mounting bracket per Paragraph 60.
2. To disassemble the cylinder, first remove the piston rod assembly by unscrewing the fitting (8) from the cylinder.
3. The piston rod assembly may be disassembled by first removing the retaining ring (2) securing the sleeve (3) and then removing the spring (4), piston (6), seal (7), fitting (8), and, if desired, the large return spring (11).
4. Remove the O-rings from the piston and fitting.

62. CLEANING, INSPECTION AND REPAIR.

a. Clean cylinder components with a suitable solvent and dry thoroughly.

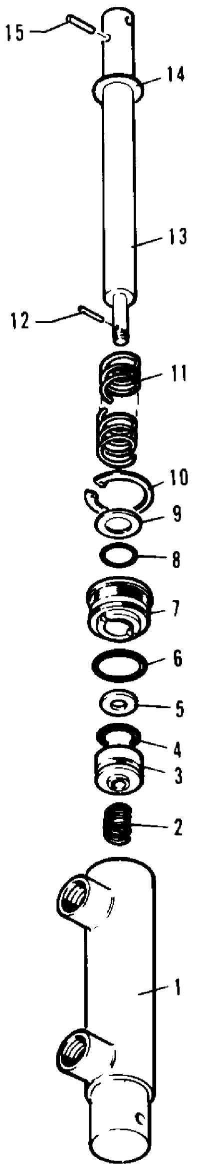
b. Inspect interior walls of cylinder for scratches, burrs, corrosion, etc.

c. Inspect general condition of fitting threads.

d. Inspect piston for scratches, bum, corrosion, etc.

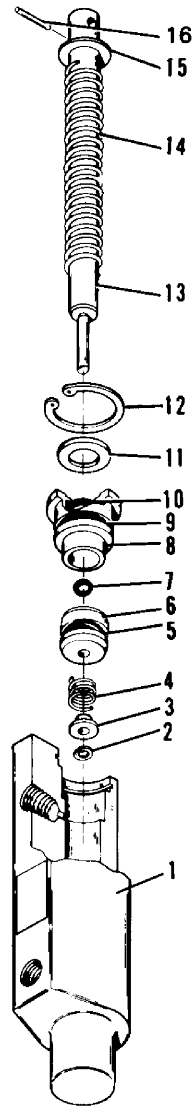
e. Repairs to the cylinder are limited to polishing out small scratches and burrs, and replacing seal and O-rings.

10-27



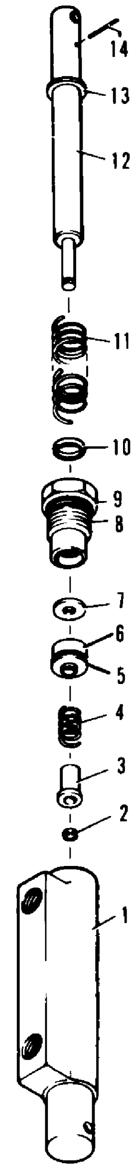
1. HYDRAULIC CYLINDER
2. SPRING
3. PISTON
4. "O" RING
5. SEAL WASHER
6. "O" RING
7. PACKING GLAND
8. "O" RING
9. WIPER WASHER
10. RETAINING RING
11. SPRING
12. ROLL PIN
13. PISTON ROD
14. WASHER
15. ROLL PIN

10-30



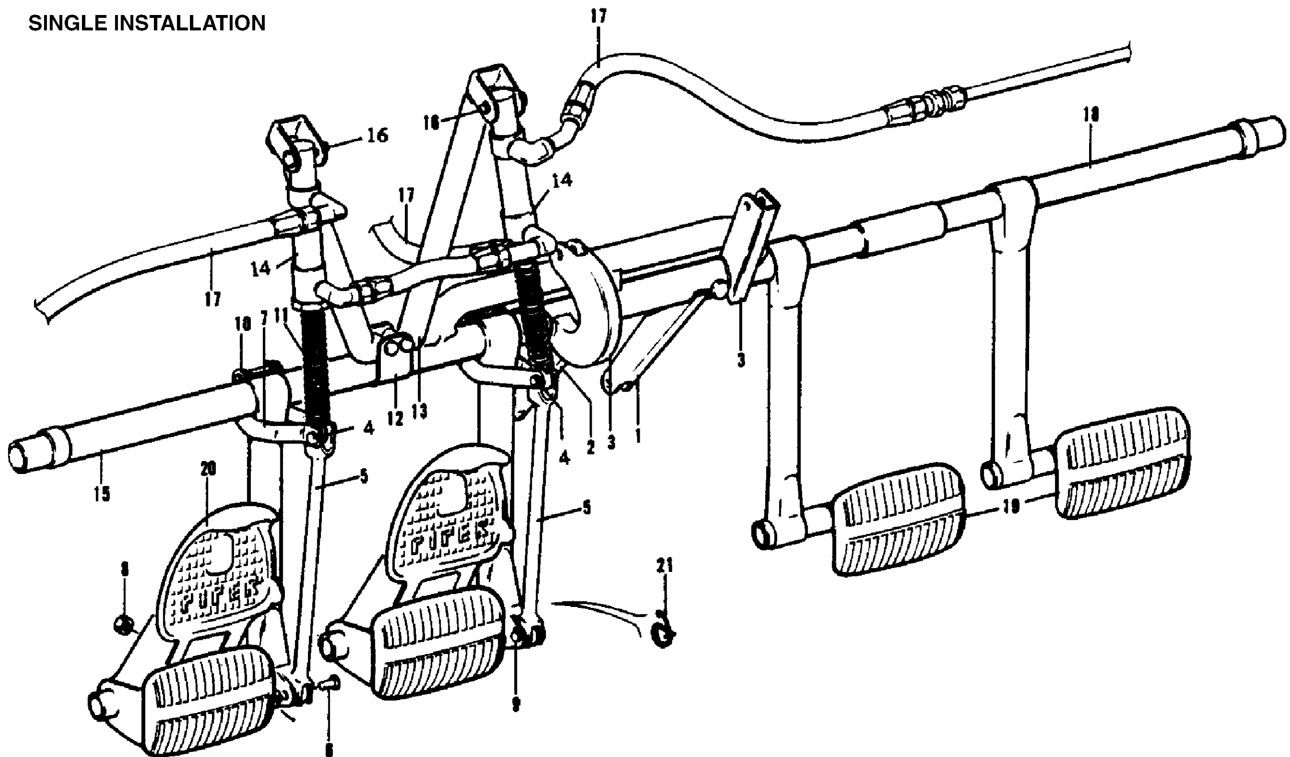
1. HOUSING
2. RETAINING RING
3. SLEEVE
4. SPRING
5. "O" RING
6. PISTON
7. "O" RING
8. GLAND
9. "O" RING
10. "O" RING
11. WASHER WIPER
12. RETAINING RING
13. ROD
14. SPRING
15. WASHER
16. ROLL PIN

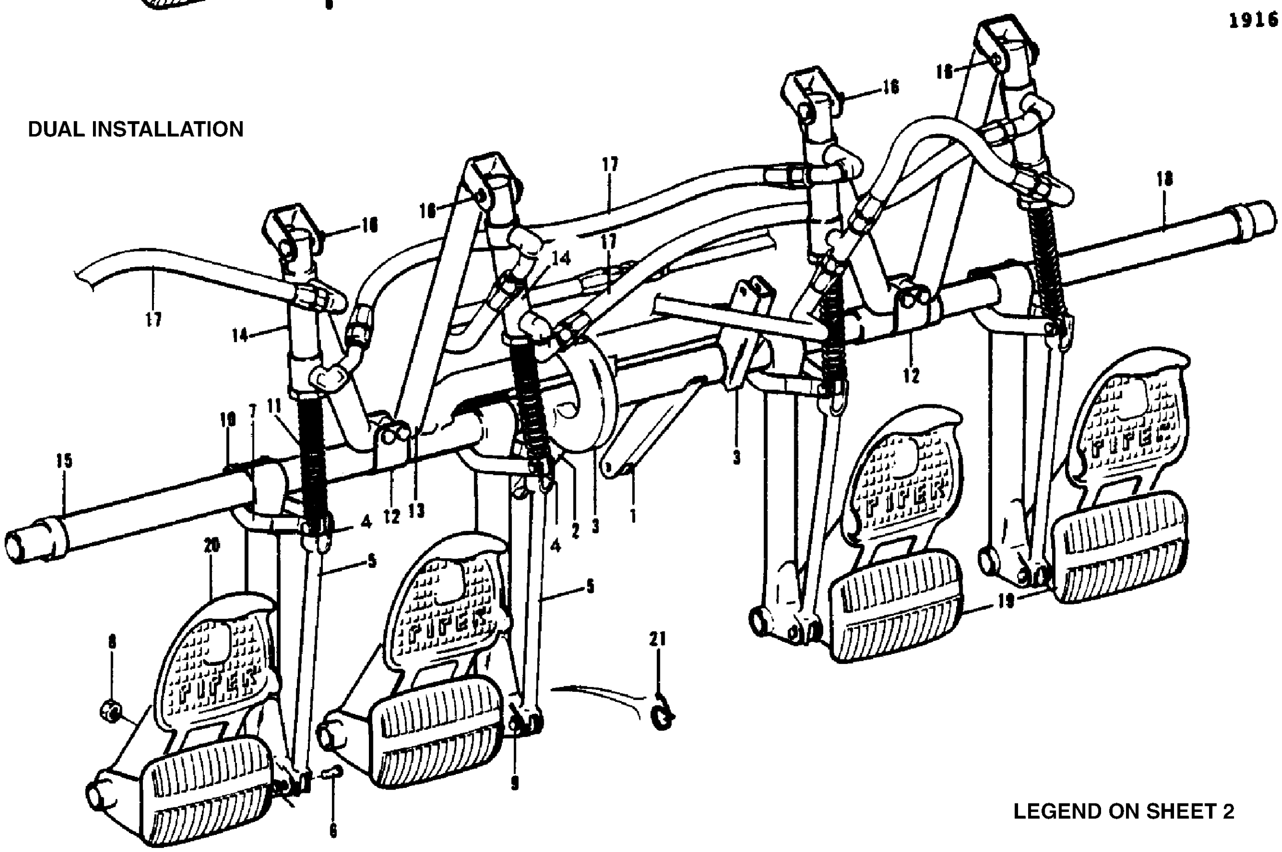
17000



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

Toe Brake Cylinder
Figure 22

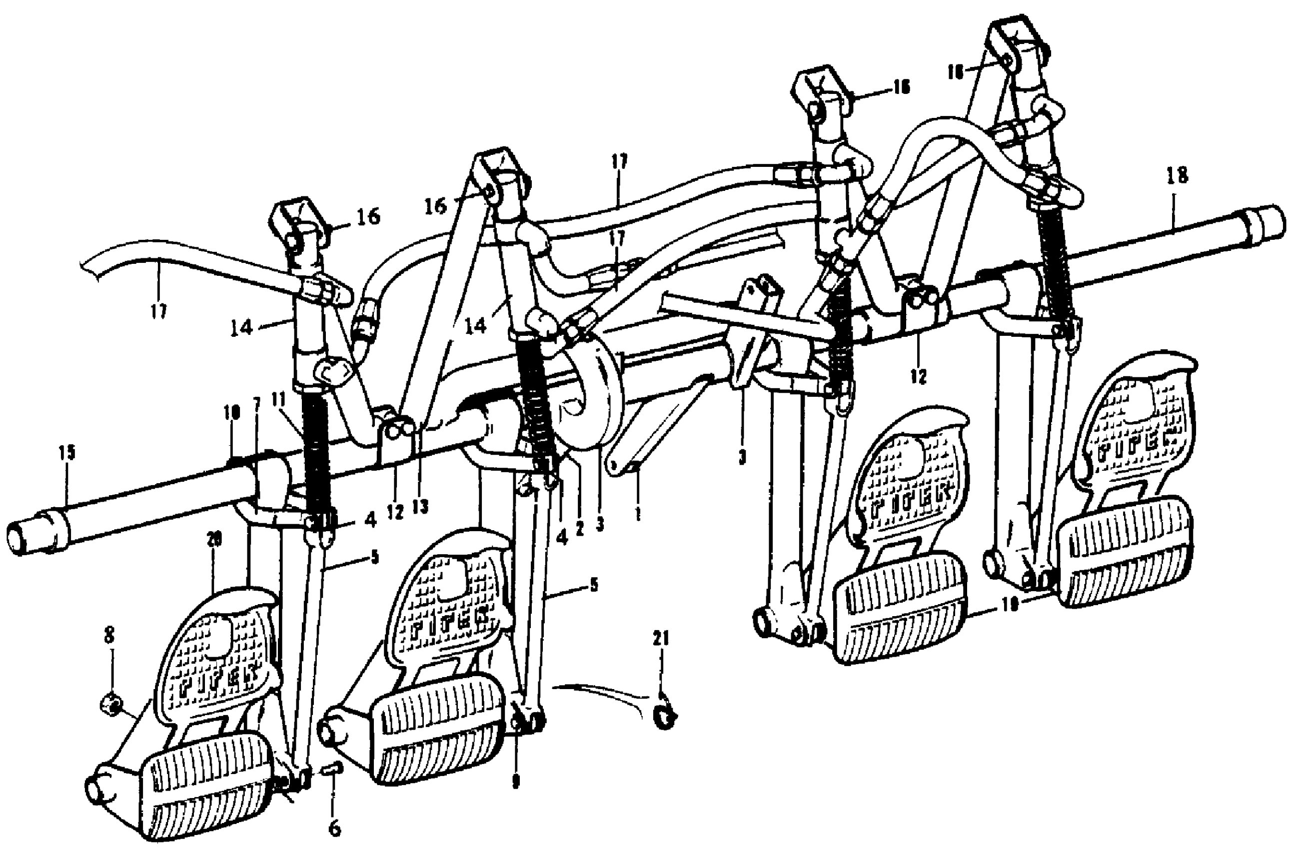




Toe Brake Installation
Figure 23 (Sheet 1 of 2)

Effectivity
34-7250001 thru 34-7350353

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. ARM, IDLER
8. NUT
9. CLEVIS PIN, WASHER & COTTER PIN
10. CLEVIS PIN, WASHER & COTTER PIN
11. SPRING, RETURN
12. BRACKET
13. BRACE ASSEMBLY
14. CYLINDER ASSEMBLY - HYDRAULIC
15. TUBE ASSEMBLY - LEFT
16. CLEVIS PIN & COTTER PIN
17. HOSE ASSEMBLY - FLEXIBLE
18. TUBE ASSEMBLY
19. PEDAL PADS
20. TOE BRAKE PEDAL
21. SPRING CLIP



Effectivity
34-7450001 thru 34-7450220

Toe Brake Installation
Figure 23 (Sheet 2 of 2)

63. ASSEMBLY. (Refer to Figure 22.)

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 CLEVELAND CYLINDER NUMBER 10-27. (Refer to Figure 22.)

1. Install new O-rings on the inside and outside of the packing gland (7) and on the outside of the piston (3).
2. To assemble the piston rod assembly, install the rod (13), in order, the roll pin (15), washer (14), spring (11), washer (9), packing gland (7) with O-ring, seal (5) piston assembly (3) with O-rings, spring (2) and roll pin (12).
3. Insert the piston rod assembly in the cylinder (1) and secure with the retaining ring (10).
4. Install the cylinder Paragraph 64.

b. CLEVELAND CYLINDER NUMBER 10-30. (Refer to Figure 22.)

1. Install new O-rings on the inside and outside of the packing gland (8) and on the outside of the piston (6).
2. To assemble the piston rod assembly, install on the rod (13), in order, the roll pin (16), washer (15), spring (14), washer (11), packing gland (8) with O-rings, seal (5), piston assembly (6) with O-ring, spring (4), sleeve (3) and retaining ring (2).
3. Insert the piston rod assembly in the cylinder (I) and secure with the retaining ring (12).
4. Install the cylinder per Paragraph 64.

c GAR-KENYON CYLINDER NUMBER 17000. (Refer to Figure 22.)

1. Install new O-rings on the inside and outside of the fitting (8) and on the outside of the piston (6).
2. To assemble the piston rod assembly, install on the rod (12), in order, the roll pin (14), return spring retainer washer return spring (11), fitting (8) with O-rings, seal (7), piston (6) with O-ring, spring (4) and sleeve (3). Secure these pieces with the retaining ring (2) on the end of the rod.
3. Insert the piston rod assembly in the cylinder (I) and secure fitting (8).
4. Install the cylinder per Paragraph 64.

64. INSTALLATION. (Refer to Figure 23.)

a. Position brake cylinder (14) at its mounting points and secure in position with clevis pin (4 and 16). Safety clevis pins with cotter pins.

b. Connect brake lines to cylinder fittings. Bleed brakes as explained in paragraph 65 or 66.

65. BRAKE BLEEDING PROCEDURE (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 insure 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 in the line.

g. Tighten both wheel bleeders.

h. Pull hand brake until a firm handle is maintained.

66. BRAKE BLEEDING PROCEDURE (PRESSURE).

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 or 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: 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 release the hand lever.

e. Repeat this procedure, if necessary, on the other gear.

f. Drain excess fluid from the reservoir to fluid level line with a syringe.

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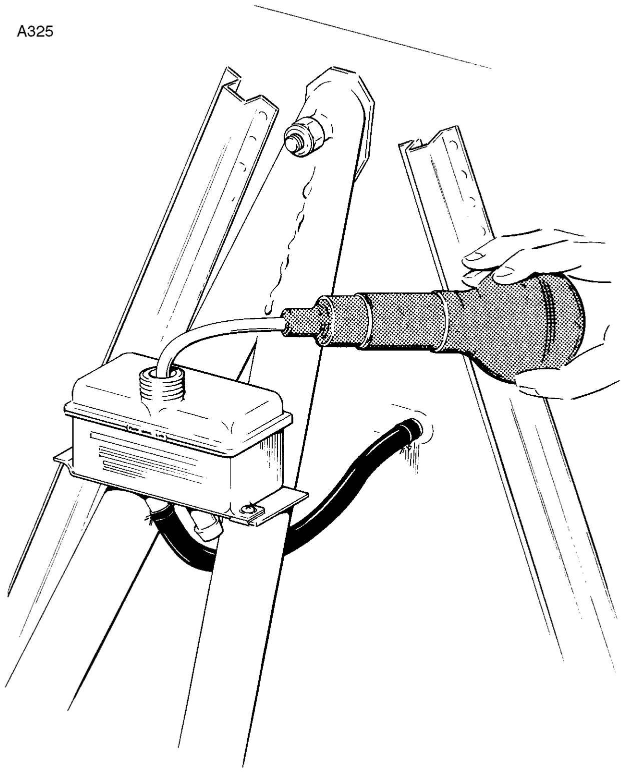
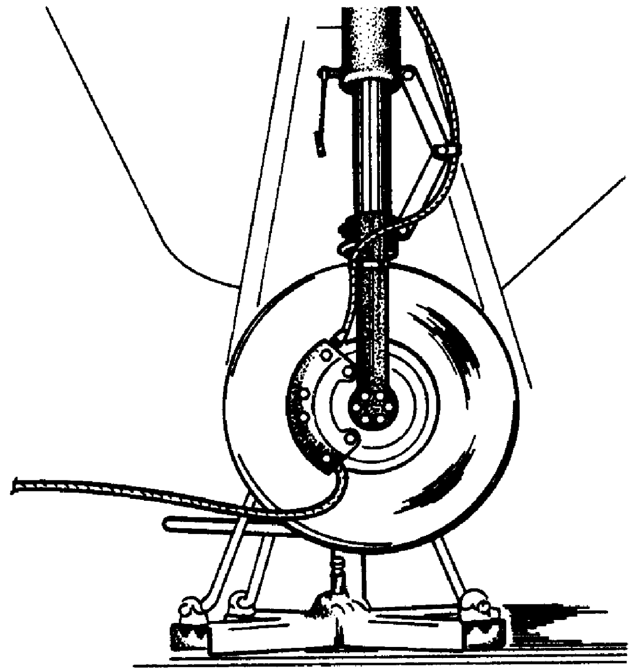


Brake Reservior
Figure 24



Bleeding Brake
Figure 25

67. BRAKE SYSTEM LEAK CHECK.

Pull for a good firm hand brake and lock parking brake mechanism. Allow system to stand for approximately 10 minutes, then by gripping the park brake handle it should not be able to be pulled aft further than the original set. Should the handle be able to be pulled towards the panel and feel spongy, a leak is present at some point in the system. This leak may appear at any one of the connections throughout the system or internally in the master brake cylinder or wheel brake assemblies.

GRIDS 2J22 THRU 2L24
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AIRPLANE SERVICE MANUAL

CARD 3 OF 4

PA-34-200

PIPER SENECA

(S/N's 34-7250001 THRU 34-7450220)

PIPER AIRCRAFT CORPORATION

PART NUMBER 753-817 October 30, 2003

Published by
Technical Publications

2926 Piper Drive
Vero Beach, Florida 32960
U.S.A.

GAMA

Member
General Aviation
Manufacturers Association

AEROFICHE REVISION STATUS

Revisions to this Service Manual 753-817 originally issued April 5, 1971 are as follows:

Revision	Publication Date	Aerofiche Card Effectivity
ORG710405	April 5, 1971	N/A
CR720613	June 13, 1972	N/A
CR031030 *	October 30, 2003	1, 2, 3, & 4

*** COMPLETE REISSUE OF SERVICE MANUAL 753-817**

This is a complete reissue of this publication. Accordingly, replace your existing Aerofiche Card Set (i.e. - Cards 1 and 2) with this set (i.e. - Cards 1, 2, 3, and 4) dated 10/30/03.

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

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INTRODUCTION

LIST OF EFFECTIVE PAGES

SECTION	PAGE	DATE	SECTION	PAGE	DATE
Intro-List of	1	Oct 30/03			
Effective Pages	2	Oct 30/03			
Intro-Table of Contents	1	Oct 30/03			
	2	Oct 30/03			
Introduction	1	Oct 30/03			
	2	Oct 30/03			
	3	Oct 30/03			
	4	Oct 30/03			
	5	Oct 30/03			
	6	Oct 30/03			
	7	Oct 30/03			
	8	Oct 30/03			
	9	Oct 30/03			
	10	Oct 30/03			
Index	1	Oct 30/03			
	2	Oct 30/03			
	3	Oct 30/03			
	4	Oct 30/03			
	5	Oct 30/03			
	6	Oct 30/03			

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TABLE OF CONTENTS

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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-34-200 Seneca Service Manual constitutes the Instructions for Continued Airworthiness. Section I contains the Airworthiness Limitations and the Inspection Program is in Section III.

2. GENERAL.

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

Genuine PIPER parts are produced and inspected under rigorous procedures to insure airworthiness and suitability for use in PIPER airplane applications. Parts purchased from sources other than PIPER, even though identical in appearance, may not have had the required tests and inspections performed, may be different in fabrication techniques and materials, and may be dangerous when installed in an airplane.

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

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

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

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

3. EFFECTIVITY.

This maintenance manual is effective for PA-34-200 Seneca airplane serial numbers 34-7250001 thru 34-7450220.

This encompasses the following model years:

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

Model Year	Serial Numbers
1972	34-7250001 thru 34-7250360
1973	34-7350001 thru 34-7350353
1974	34-7450001 thru 34-7450220

4. SERIAL NUMBER EXPLANATION.

Example: 34 72 50 001

TYPE CERTIFICATE DESIGNATION — 34

MODEL YEAR — 72

MODEL CODE — 50
50 = PA-34-200 SENECA

SEQUENCE NUMBER — 001

5. ASSIGNMENT OF SUBJECT MATERIAL.

This publication is divided into logical subject groupings based on aircraft system or task function. Refer to paragraph 14, Section Index Guide, for a complete breakdown and list. The material is arranged in ascending numerical sequence.

6. PAGINATION.

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

7. AEROFICHE EFFECTIVITY.

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

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

First number is the Aerofiche card number.
Letter is the horizontal row reference per card
Second number is the vertical column reference per card.

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

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

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

8. IDENTIFYING REVISED MATERIAL.

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

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

Example.

9. INDEXING.

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

10. LIST OF EFFECTIVE PAGES.

Each Section has a List of Effective Pages preceding the Table of Contents to identify the effective revision date for each page in that section.

11. WARNINGS, CAUTIONS AND NOTES.

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

12. ACCIDENT/INCIDENT REPORTING.

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

13. SUPPLEMENTARY PUBLICATIONS.

The following publications/sources provide servicing, overhaul and parts information for the PA-34-200 airplanes and their various components. Use them to supplement this manual.

A. PIPER PUBLICATIONS:

(1)	Parts Catalog:	P/N 753-816
(2)	Periodic Inspection Report:	P/N 230-208
(3)	Progressive Inspection Manual (50 Hour):	P/N 230-208
(4)	Autopilot Service Manuals	See Section XII

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) ALTERNATOR:

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

(2) AUTOPILOT:

See Section XII, Autoflight.

(3) BATTERY:

Vendor Address: GILL Batteries
(A Division of
Teledyne Continental Motors,
see listing under Magnetos, below)
http://www.gillbatteries.com
PH: - (800) 456-0070

(4) BRAKES AND WHEELS:

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

(5) ENGINE:

Vendor Address: Textron Lycoming PH - (717) 323-6181
652 Oliver Street FAX - (717) 327-7101
Williamsport, PA 17701
http://www.lycoming.textron.com/main.html

Overhaul Manual: DIRECT DRIVE MODELS - P/N 60294-7

Parts Catalog: IO-540- ..... - K1G5, ... ENGINES - P/N PC-615
TIO-540-AH1A ENGINES - P/N PC-615-12

Operators Handbook: O-540, IO-540 SERIES - P/N 60297-10
TIO-540 Series - P/N 60297-23

NOTE: The above Lycoming publications can be ordered as a set on CD-ROM from Avantext. See www.avantext.com or PH - (800) 998-8857.

(6) FIRE EXTINGUISHER (PORTABLE):

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

(7) FUEL PUMP:

Vendor Address: Weldon Pumps PH: - (440) 232-2282
P.O. Box 46579 FAX - (440) 232-0606
640 Golden Oak Parkway
Oakwood Village, Ohio 44146
http://www.weldonpumps.com/index.html

(8) COMBUSTION HEATER:

Vendor Address: Electro Systems, Inc. PH: - (334)-227-0152
(See listing under Alternator, above.)

(9) HI-LOK FASTENERS AND TOOLS:

Vendor Address: Hi-Shear Corporation PH: - (213) 326-8110
2600 Skypark Drive
Torrance, California 90509

(10) LANDING GEAR ACTUATOR, EXTENSION AND RETRACTION:

Vendor Address:	Parker Hannifin Corp Aircraft Wheel and Brake Division 1160 Center Road Avon, Ohio 44011 http://www.parker.com/cleveland/	PH: - (800) 272-5464
Component Maintenance Manual:	(Effective for P/N's 96860-002 and 96860-003 only.) CMSFA232-5 (011-00504)	

(11) LIGHTS - NAVIGATION, STROBE, AND STANDBY/MAP LIGHTS:

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

(12) MAGNETOS:

Vendor Address:	Teledyne Continental Motors P.O. Box 90 Mobile, AL 36601 http://www.tcmlink.com	PH: - (334-438-3411, ext. 8392) FAX - (334-433-2325
Service Support Manual:	S1200 Series Magnetos, P/N X42001-1	
or, if installed:		
Vendor Address:	Slick Aircraft Products Unison Industries Attn: Subscription Dept. 530 Blackhawk Park Ave. Rockford, IL 61104 http://www.unisonindustries.com/index4.html	PH - (815) 965-4700 FAX - (815) 965-2457
Installation, Operation and Maintenance Instructions:	F1100 MASTER SERVICE MANUAL, 4300/6300 SERIES MAGNETO MAINTENANCE AND OVERHAUL MANUAL - L-1363	

(13) PNEUMATIC DEICE SYSTEM:

Vendor Address:	De-Icing and Specialty Systems Goodrich Corporation 1555 Corporate Woods Parkway Uniontown, Ohio 44685-8799	PH - (330) 374-3040 FAX - (330) 374-2290
Technical Assistance:	Email: dssd.support@goodrich.com http://www.deicingsystems.goodrich.com/	PH - (800) 334-2377 (330) 374-3743 FAX - (330) 374-2290
Black Standard Pneumatic De-Icer Installation, Maintenance and Repair Manual:	ATA 30-10-31	

(14) PROPELLER:

Vendor Address:	Hartzell Propeller Inc. One Propellor Place Piqua, OH 45356-2634 http://www.hartzellprop.com/index2.htm	PH - (937) 778-4379 FAX - (937) 778-4321
Standard Practices:	Manual No. 202A	
Overhaul and Maintenance:	Manual No. 117D	
Aluminum Blade Overhaul:	Manual No. 133C	
Propeller Owner's Manual and Logbook:	Manual No. 115N	

(15) PROPELLER DEICE SYSTEM:

Vendor Address:	See Pneumatic Deice System, above.
Installation and Maintenance Manual for Prop De-Icing Systems:	ATA 30-60-02
Removal and Installation Manual, Standard and FASTprop™ Electrothermal Propeller De-Icers:	ATA 30-60-07

(16) PROPELLER GOVERNOR:

Vendor Address:	Hartzell Propeller Inc. One Propellor Place Piqua, OH 45356-2634 http://www.hartzellprop.com/index2.htm	PH - (937) 778-4379 FAX - (937) 778-4321
Governor Maintenance:	Manual No. 130B	

(17) VACUUM PUMPS: (For service replacement, Tempest Dry Air Pumps, only.)

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

(18) VACUUM REGULATORS:

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

(19) VOLTAGE REGULATOR:

Vendor Address: See listing under Alternator, above.

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14 SECTION INDEX GUIDE.

GRIDS 3A18 THRU 3A24
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E (cont.)

F

H

I

J

L

L (cont.)

M

P

R

S

T

V

W

GRIDS 3B6 THRU 3B24
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SECTION

VIII

POWER PLANT

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SECTION VIII

LIST OF EFFECTIVE PAGES

SECTION	PAGE	DATE
VIII-List of Effective Pages	1	Oct 30/03
	2	Oct 30/03
VIII-Table of Contents	1	Oct 30/03
	2	Oct 30/03
VIII	1	Oct 30/03
	2	Oct 30/03
	3	Oct 30/03
	4	Oct 30/03
	5	Oct 30/03
	6	Oct 30/03
	7	Oct 30/03
	8	Oct 30/03
	9	Oct 30/03
	10	Oct 30/03
	11	Oct 30/03
	12	Oct 30/03
	13	Oct 30/03
	14	Oct 30/03
	15	Oct 30/03
	16	Oct 30/03
	17	Oct 30/03
	18	Oct 30/03
	19	Oct 30/03
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	21	Oct 30/03
	22	Oct 30/03
	23	Oct 30/03
	24	Oct 30/03
	25	Oct 30/03
	26	Oct 30/03
	27	Oct 30/03
	28	Oct 30/03
	29	Oct 30/03
	30	Oct 30/03
	31	Oct 30/03
	32	Oct 30/03
	33	Oct 30/03
	34	Oct 30/03
	35	Oct 30/03
	36	Oct 30/03
	37	Oct 30/03
	38	Oct 30/03
	39	Oct 30/03
	40	Oct 30/03
	41	Oct 30/03
	42	Oct 30/03
	43	Oct 30/03
	44	Oct 30/03
	45	Oct 30/03
	46	Oct 30/03

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SECTION VIII - POWER PLANT

TABLE OF CONTENTS

SECTION VIII - POWER PLANT

TABLE OF CONTENTS (continued)

POWER PLANT

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

1. INTRODUCTION. This section covers the power plant used in the PA-34 airplane and is comprised of instructions for the removal, service and installation of the propeller, propeller governor, engine, induction system, fuel injector, fuel air bleed nozzle, ignition system and engine lubrication system.

2. DESCRIPTION. The PA-34 is powered by two Lycoming four cylinder, direct drive wet sump, horizontally opposed, fuel injected engines. The left engine (IO-360-C1E6) rotation is in the right-hand direction while the right engine (LI0-360-C1E6) rotates in the left-hand direction. The propellers are Hartzell full feathering, constant speed units controlled by a governor mounted on each engine. (See also Table I, Section II.)

   The engines are furnished with starters, alternators, voltage regulators, shielded ignition systems, vacuum pump drive, fuel pump, fuel injector and dry paper type induction air filter. The induction air box is equipped with an alternate air door that is operated manually in the event of air stoppage through the filter.

   The exhaust system is constructed of stainless steel, directing gases outboard to a heat exchanger located outboard of each engine. A heater shroud provides heat for both the cabin and defrosting.

   Service of both engines is the same, unless specifically noted otherwise.

3. TROUBLESHOOTING.

   WARNING: WHEN TROUBLESHOOTING THE ENGINE, GROUND THE MAGNETO PRIMARY CIRCUIT BEFORE PERFORMING ANY CHECKS OF THE ENGINE.

   Troubles peculiar to the power plant are listed in Table I along with their probable causes and suggested remedies.

3a. STANDARD PRACTICES - ENGINE. The following suggestions should be applied wherever they are needed when working on the power plant.

   a. To insure proper reinstallation and/or assembly, tag and mark all parts, clips, and brackets as to their location prior to their removal and/or disassembly.

   b. During removal of various tubes or engine parts, inspect them for indications of scoring, burning or other undesirable conditions. To facilitate reinstallation, observe the location of each part during removal. Tag any unserviceable part and/or units for investigation and possible repair.

      CAUTION: DUST CAPS USED TO PROTECT OPEN LINES MUST ALWAYS BE INSTALLED OVER THE TUBE ENDS AND NOT IN THE TUBE ENDS. FLOW THROUGH THE LINES MAY BE BLOCKED OFF IF LINES ARE INADVERTENTLY INSTALLED WITH DUST CAPS IN THE TUBE ENDS.

   c. Extreme care must be taken to prevent foreign matter from entering the engine, such as lockwire, washers, nuts, dirt, dust, etc. This precaution applies whenever work is done on the engine, either on or off the aircraft. Suitable protective caps, plugs, and covers must be used to protect all openings as they are exposed.

   d. Should any items be dropped into the engine, the assembly process must stop and the item removed, even though this may require considerable time and labor. Insure that all parts are thoroughly clean before assembling.

e. Never reuse any lockwire, lockwashers, tablocks, tabwashers or cotter pins. All lockwire and cotter pins must fit snugly in holes drilled in studs and bolts for locking purposes. Cotter pins should be installed so the head fits into the castellation of the nut, and unless otherwise specified, bend one end of the pin back over the stud or bolt and the other end down flat against the nut. Use only corrosion resistant steel lockwire and/ or cotter pins.

f. All gaskets, packings and rubber parts must be replaced with new items of the same type at reassembly. Insure the new nonmetallic parts being installed show no sign of having deteriorated in storage.

g. When installing engine parts which require the use of a hammer to facilitate assembly or installation, use only a plastic or rawhide hammer.

CAUTION: ENSURE THAT ANTI-SEIZE COMPOUND IS APPLIED IN THIN EVEN COATS, AND THAT EXCESS COMPOUND IS COMPLETELY REMOVED TO AVOID CONTAMINATION OF ADJACENT PARTS.

h. Anti-seize lubrication should be applied to all loose-fit spline drives which are external to the engine and have no other means of lubrication. For certain assembly procedures, molybdenum disulfide in either paste or powdered form mixed with engine oil or grease may be used.

i. Temporary marking methods are those markings which will ensure identification during ordinary handling, storage and final assembly of parts.

j. After an engine change, overhaul or any prolonged period of inactivity and prior to initial start, the engine should be pre-oiled. Pre-oiling may be accomplished as follows:

1. Fill the oil sump to the proper level.
2. Remove one spark plug from each cylinder of the engine.
3. Place the mixture control in idle cut-off, or if the engine is not equipped with idle cut-off, open throttle to full open position and put fuel and ignition switches in “OFF” position.

CAUTION: DO NOT ENERGIZE THE STARTING CIRCUIT FOR PERIODS EXCEEDING ONE MINUTE. ALLOW THE STARTER TO COOL AFTER EACH ENERGIZING.

4. Turn the engine with the starter (or external power source if available) until a minimum pressure of 20 PSI is indicated on the oil pressure gauge.
5. Energize starter for 2 or more one minute periods.
6. Turn the engine with the starter for approximately 45 seconds to check for continued oil pressure.
7. Re-install spark plugs and proceed with normal starting procedure which should not be later than three hours after pre-oiling.
8. When engine is started it should be run for about three minutes at approximately 1000 RPM before increasing power for other ground operations or take-off power.

TABLE I (Sheet 1 of 4)
TROUBLESHOOTING POWER PLANT

Trouble	Cause	Remedy
Failure of engine to start.	Lack of fuel.	Check fuel system for leaks. Fill fuel tank.
		Clean dirty lines, strainers or fuel valves.
		Check fuel selector valve for proper tank.
		Check fuel pressure with electric boost pump ON.
		Check mixture control knob for full rich.
	Overpriming.	Open throttle and unload engine by engaging starter. Mixture in idle-cut-off.
	Incorrect throttle setting.	Open throttle to one-eighth (1/8) of its range.
	Defective spark plugs.	Clean and adjust or replace spark plugs.
	Defective ignition wire.	Check with electric tester and replace defective wires.
	Defective battery.	Replace with charged battery.
	Improper operation of magneto breaker.	Clean points. Check internal timing of magnetos.
	Lack of sufficient fuel flow.	Disconnect fuel line at fuel injector and check fuel flow.
	Internal failure.	Check oil screens for metal particles. If found, complete overhaul of engine may be indicated.
Failure of engine to idle properly.	Incorrect idle mixture.	Adjust mixture.
	Leak in the induction system.	Tighten all connections in the induction system.
		Replace any parts that are defective.
	Incorrect idle adjust-ment.	Adjust throttle stop to obtain correct idle.

TABLE I (Sheet 2 of 4)
TROUBLESHOOTING POWER PLANT

Trouble	Cause	Remedy
Failure of engine to idle properly. (cont.)	Uneven cylinder compression.	Check condition of piston rings and valve seats.
	Faulty ignition system.	Check entire ignition system.
	Insufficient fuel pressure.	Adjust fuel pressure.
Low power and uneven running.	Mixture too rich; indicated by sluggish engine operation, red exhaust flame at night. Extreme cases indicated by black smoke from exhaust.	Readjustment of fuel injector by authorized personnel is indicated.
	Mixture too lean; indicated by overheating or backfiring.	Check fuel lines for dirt or other restrictions.
		Check fuel injection nozzles.
	Leaks in induction system.	Tighten all connections.
		Replace defective parts.
	Defective spark plugs.	Clean and gap or replace spark plugs.
	Improper fuel.	Fill tank with fuel of recommended grade.
	Magneto breaker points not working properly.	Clean points. Check internal timing of magnetos.
	Defective ignition wire.	Check wire with electric tester. Replace defective wire.
	Defective spark plug terminal connectors.	Replace connectors on spark plug wire.
Failure of engine to develop full power.	Leak in the induction system.	Tighten all connections and replace defective parts.
	Throttle lever out of adjustment.	Adjust throttle lever.
	Improper fuel flow.	Check strainer, gauge and flow at fuel injector inlet.
	Restriction in air scoop.	Examine air scoop and remove restrictions.
	Improper fuel.	Drain and refill tank with recommended fuel.

TABLE I (Sheet 3 of 4)
TROUBLESHOOTING POWER PLANT

Trouble	Cause	Remedy
Failure of engine to develop full power. (cont.)	Faulty ignition.	Tighten all connections. Check system with tester.
		Check ignition timing.
Rough engine	Cracked engine mount.	Replace or repair mount.
	Defective mounting bushings.	Install new mounting bushings.
	Uneven compression.	Check compression.
Low oil pressure.	Insufficient oil.	Fill sump with recommended oil.
	Air lock or dirt in relief valve.	Remove and clean oil pressure relief valve.
	Leak in suction line or pressure line.	Check gasket between accessory housing and crankcase.
	Dirty oil strainers.	Remove and clean oil strainers.
	Defective pressure gauge.	Replace gauge.
	Stoppage in oil pump intake passage.	Check line for obstruction Clean suction strainer.
	High oil temperature.	See “High Oil Temperature,” below.
High oil temperature.	Insufficient air cooling.	Check air inlet and outlet for deformation or obstruction.
	Insufficient oil supply.	Fill oil sump to proper level with specified oil.
	Low grade of oil.	Replace with oil conforming to specifications.
	Clogged oil lines or strainers.	Remove and clean oil strainers.
	Excessive blow-by.	Usually caused by worn or stuck rings.
	Failing or failed bearing.	Examine sump for metal particles. If found, overhaul of engine is indicated.
	Defective temperature gauge.	Replace gauge.

TABLE I (Sheet 4 of 4)
TROUBLESHOOTING POWER PLANT

Trouble	Cause	Remedy
Excessive oil consumption.	Low grade of oil.	Fill tank with oil conforming to specifications.
	Failing or failed bearings.	Check sump for metal particles.
	Worn piston rings.	Install new rings.
	Incorrect installation of piston rings.	Install new rings.
	Failure of rings to seat (new nitrided cylinders).	Use mineral base oil. Climb to cruise altitude at full power and operate at 75% cruise power setting with high oil temperature until oil consumption stabilizes.

4. ENGINE COWLING.

5. REMOVAL.

The procedure for removing the cowling is the same for both engines.

a. Release the fasteners securing the two side access panels.
b. Remove the screw fasteners that secure the top cowling and then remove the top cowling assembly.
c. Disconnect the flex hoses from the cowling scoop takeoffs.
d. Disconnect the cowl flap control.
e. Support the bottom cowling and remove the attaching screws.
f. The nose cowling may be removed by removing the attaching screws and splitting the cowl.

6. CLEANING, INSPECTION AND REPAIR.

a. The cowling should be cleaned with a suitable solvent and then wiped with a clean cloth.
b. Inspect the cowling for dents, cracks, loose rivets, damaged or missing fasteners, and damaged fiberglass areas.
c. Repair all defects to prevent further damage. Fiberglass repair procedures may be accomplished according to Fiberglass Repairs, Section IV.

7. INSTALLATION.

a. Position the two nose cowling halves on the front of the engine and secure with screw fasteners.
b. Position the bottom cowling and secure with screw fasteners to the aft nacelle and nose cowl.
c. Connect the cowl flap control.
d. Connect the flex hoses to the cowling scoop takeoffs.
e. Position the top cowling and secure with attaching screw fasteners.
f. Secure the side cowls to the lower cowling with fasteners.

8. ENGINE COWL FLAPS. The cowl flaps are all metal flaps located on the rear of the bottom cowlings. They are operated manually through a push-pull control from the cockpit. The cowl flaps are connected to the engine cowlings with full length piano type hinges.

9. OPERATION AND ADJUSTMENT. The cowl flaps operate through three (3) positions: closed, intermediate, and open. These positions are controlled by a spring loaded lock located at the control levers. The controls are located on the pedestal below the throttles. When the control levers are in the up position the flaps are closed. The cowl flaps may also be released from the closed position and allowed to streamline.

To operate the cowl flaps, depress the lock and move the control 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. To adjust the cowl flaps proceed with the following steps:

a. Place the control in the up position.
b. Ascertain that the control lock is engaged.
c. Check the cowl flap to visually determine that the flap is flush with the bottom of the engine cowling.

d. If the flap is not flush, disconnect the push-pull control from the arm on the inboard side of the flap.

e. Loosen the jam nut on the clevis end and adjust the clevis to get a flush fit between the cowl flap and engine cowling.

f. Reconnect the control to the flap and operate the cowl flap through its full range a few times, then place the control in the closed position and visually check the flap to determine if it is flush with the engine cowling.

g. If the cowl flap is not flush, repeat steps d. through f.

h. When the adjustment is completed, tighten the clevis jam nut and secure the push-pull control to the cowl flap.

TABLE II
PROPELLER SPECIFICATIONS

Blade Angle	Low Pitch (High RPM)	13.5°
	High Pitch (Low RPM)	79°-81° (Feathered)
RPM Setting	Engine Static High RPM	2700 RPM max.
Torque	**Item**	**Required Torque (Dry)**
	Spinner Bulkhead (Aft) Without Damper	20-22 foot-pounds
	Spinner Bulkhead (Aft) With Damper	28-30 foot-pounds
	Propeller Mounting Bolts	60-70 foot-pounds
	Spinner Bulkhead Check Nut	25-30 foot-pounds
	Spinner Attachment Screws	35-40 foot-pounds
	Spinner Bulkhead Jam Nut	100-350 inch-pounds

TABLE III
AIR CHARGE PRESSURE VS. TEMPERATURE [1]

No Feather Assist Spring [2]				Feather Assist Spring [3]			
Temp. °F	Press. (PSI)	Temp. °C	Press. (Bar)	Temp. °F	Press. (PSI)	Temp. °C	Press. (Bar)
100	86	38	6.0	70 to 100	41	21 to 38	2.9
90	84	32	5.8	40 to 70	38	4 to 21	2.6
80	82	27	5.7	0 to 40	36	-18 to 4	2.5
70	80	21	5.6	-30 to 0	33	-34 to -18	2.3
60	78	16	5.4				
50	76	10	5.3				
40	74	4	5.2				
30	72	1	5.0				
20	70	-7	4.9				
10	68	-12	4.7				
0	66	-18	4.6				
-10	64	-23	4.5				
-20	62	-29	4.3				
-30	60	-34	4.2				

NOTE: Do not check pressure with propeller in feather position.

(1) See also latest revision of Hartzell Propeller Owner's Manual No. 115N.
(2) No "U" in propeller model number.
(3) "U" in propeller model number.

10. PROPELLER.

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.)

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.

11. REMOVAL. (Refer to Figure 1.)

a. Insure master and magneto switches are off.

b. Move fuel selector to off position.

c. Place mixture control in idle cut-off.

d. Note position of components to facilitate reinstallation.

e. Remove screws from the spinner assembly and remove spinner.

f. Remove the safety wire from the six propeller mounting nuts on studs and remove studs.

g. Place a drip pan under propeller to catch oil spillage, remove propeller.

12. CLEANING, INSPECTION AND REPAIR. (Refer to Figure 2.)

a. Check for oil and grease leaks.

b. Clean the spinner, propeller hub interior and exterior, and blades with a non-corrosive solvent.

c. Inspect the hub parts for cracks.

d. Steel hub parts should not be permitted to rust. Use aluminum paint to touch up if found necessary.

e. Check all visible parts for wear and safety.

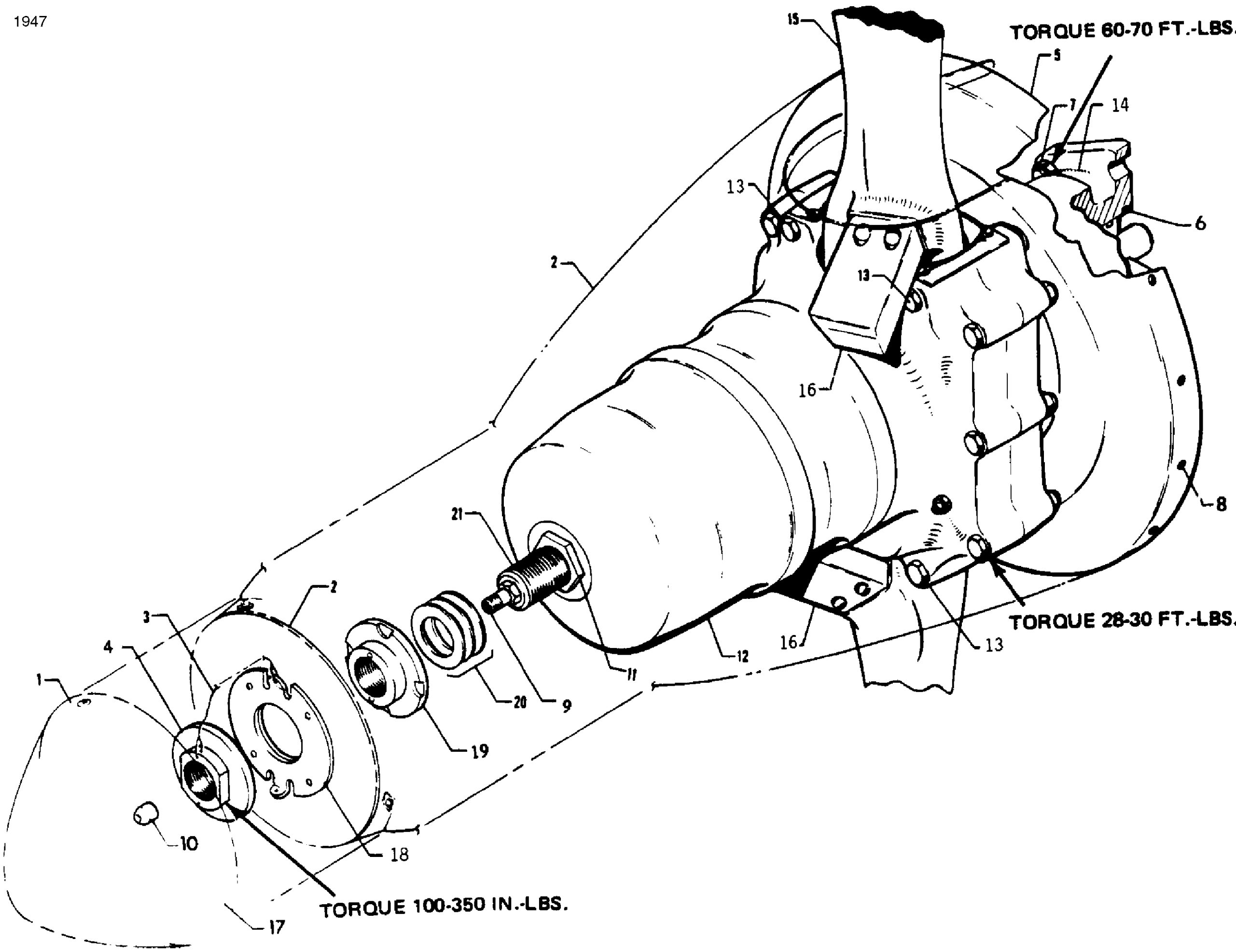
f. Check blades to determine whether they turn freely on the hub pilot tube. This can be done by rocking the blades back and forth through the slight freedom allowed by the pitch change mechanism. If they appear tight and are properly lubricated, the pitch change mechanism should be removed so that each blade can be checked individually. If blades are tight, the propeller should be disassembled.

g. Inspect blades for damage or cracks. Nicks in 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.

h. It is recommended that for severe damage, internal repairs and replacement of parts, the propeller should be referred to the Hartzell Factory or Service Station.

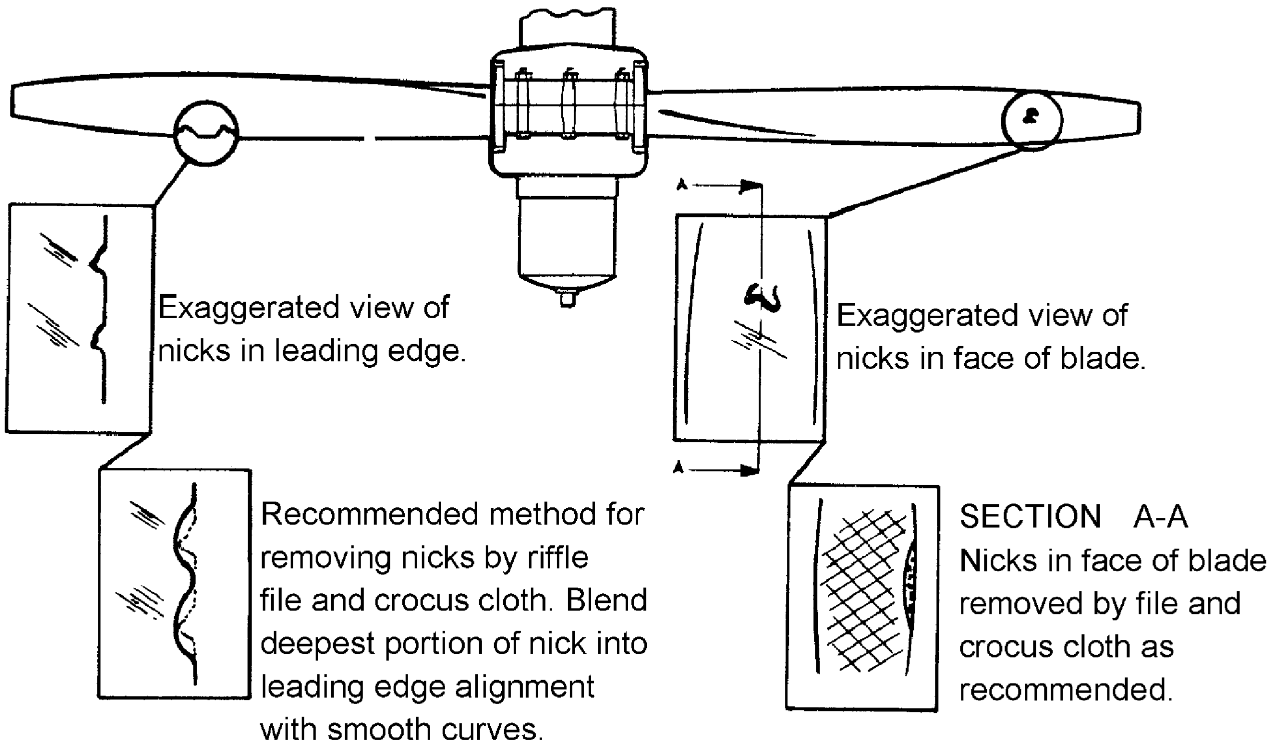
i. Grease blade hub through zerk fittings. Remove one of the two fittings for each propeller blade, alternate the next time. Apply grease through the zerk fitting until fresh grease appears at the fitting hole of the removed fitting. Care should be taken to avoid blowing out hub gaskets.

j. Check condition of propeller mounting nuts on studs.



1. CAP, SPINNER
2. SPINNER ASSY.
3. SAFETY WIRE (.041)
4. JAM NUT, SPINNER (TORQUE TO 100-350 IN.-LBS.)
5. BULKHEAD, AFT
6. O-RING
7. MOUNTING BOLT, PROPELLER
8. SCREW, SPINNER ATTACHMENT
9. AIR VALVE
10. CAP, AIR VALVE
11. CHECK NUT
12. PROPELLER -DOME
13. BOLT, BULKHEAD
14. SAFETY WIRE (.041)
15. BLADE, PROPELLER
16. COUNTERWEIGHT
17. SCREW, CAP ATTACHMENT
11. DOUBLER, SPINNER
19. CENTER NUT
20. SPACERS (AS REQ.)
21. LOW PITCH STOP

Propeller Installation
Figure 1



Typical Nicks and Removal Methods
Figure 2

13. INSTALLATION. (Refer to Figure 1.)

a. Insure master and magneto switches are off.

b. Place fuel selector to off position.

c. Place mixture control in idle cut-off.

d. Observe the starter ring gear to make sure it is mounted properly on the engine crankshaft flange. One of the bushings on the crankshaft is stamped with an O-mark and it must be inserted in the starter ring gear hole, likewise identified with an O-mark.

e. Wipe crankshaft and propeller pilot tube to assure that no chips or foreign matter enter the propeller mechanism.

f. Check interior of propeller hub for proper seating of O-ring. Wipe inside of hub to remove any traces of dirt. Check to see that O-ring is covered with grease.

g. Raise propeller into position so that each stud mates with an engine flange bushing, and screw each stud in a few turns at a time until all are tight. Torque to 60 to 70 foot pounds.

h. Check the propeller blade track as given in paragraph 14.

i. Safety the propeller mounting bolts with MS20995-C41 safety wire.

j. Install the spinner, torque cap bolts 35 to 40 inch pounds.

14. 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 .0625 inch may be an indication of bent blades or improper propeller installation. Check blade track as follows:

    a. 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.

    b. 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 .0625 inch.

    c. 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.

15. PROPELLER GOVERNOR.

16. REMOVAL.

    a. Remove the upper engine cowl. (Refer to paragraph 5.)

    b. Disconnect the control cable end from the governor control arm.

    c. Remove the governor mounting stud nuts. It will be necessary to raise the governor as the nuts are being removed before the nuts can be completely removed.

    d. Remove the mounting gasket. If the governor is not to be replaced immediately or is going to be repaired, cover the mounting pad to prevent dirt, dust and foreign objects entering the oil passages.

17. INSTALLATION.

    a. Clean the mounting pad thoroughly, making very certain that there are no foreign particles in the recess around the drive shaft.

    b. Place the governor mounting gasket in position with the raised portion of the screen facing away from the engine.

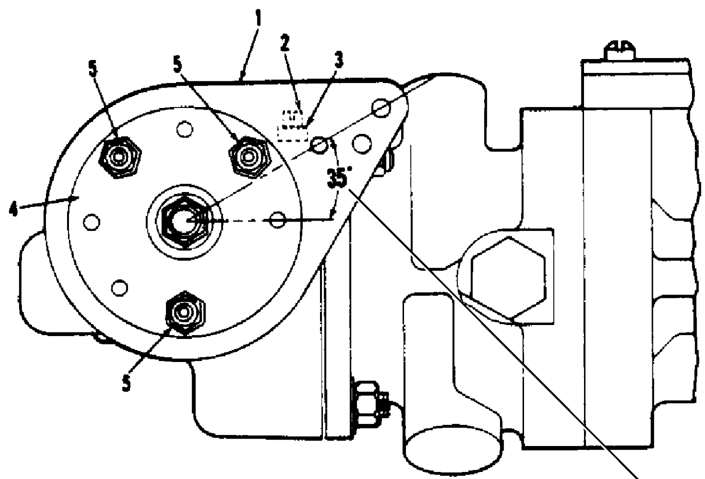
    c. Align the splines on the governor shaft with the engine drive and slide the governor into position.

    d. With the governor in position, raise the governor enough to install washers and start mounting nuts. Torque nuts evenly.

    e. Connect the control cable end to the governor control arm. The ball stud is installed in the inner hole of the control arm.

    f. Adjust governor control per paragraph 18.

    g. Install engine cowl.



Propeller Governor
Figure 3

18. RIGGING AND ADJUSTMENT. (Refer to Figure 3.)

a. Start engine, park 90° to wind direction and warm in normal manner.

b. To check high RPM, low pitch setting, move the propeller control all the way forward. At this position the governor speed control arm (1) should be against the high RPM fine adjusting screw (2). With the throttle full forward, observe engine RPM, which should stabilize between 2625 and 2700 RPM. A take-off must be conducted during which the engine RPM should reach 2700 RPM and remain steady.

c. If the engine RPM does not read 2700 RPM in flight, the high RPM setting must be adjusted as follows:

1. Land, shut down the engine and remove the upper cowling.
2. Adjust the governor by means of the fine adjustment screw (2) for 2700 RPM. To do this, loosen the high RPM fine adjustment screw locknut and turn the screw in a clockwise direction to decrease engine 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.

3. Install the upper cowling and repeat step b to ascertain proper RPM setting.
4. After setting the proper high RPM adjustment, run the self-locking nut on the fine adjustment screw against the base projection to lock.
5. Ascertain that the governor control arm (1) is adjusted to the proper angle on the control wheel (3) as shown in Figure 3.

d. 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.

e. 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.

GRIDS 3C22 THRU 3C24
INTENTIONALLY BLANK

19. ENGINE.

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

WARNING: GROUND THE MAGNETO PRIMARY CIRCUIT BEFORE WORKING ON THE ENGINE.

20. REMOVAL. (Refer to Figure 4.)

CAUTION: TAG ALL HOSES, LINES, AND WIRES AS THEY ARE DISCONNECTED TO FACILITATE REINSTALLATION. CAP OPEN FUEL, OIL, VACUUM LINES, AND FITTINGS TO PREVENT CONTAMINATION.

a. Turn off all electrical switches in the cockpit and then disconnect the battery ground wire at the battery.

b. Move the fuel selector lever in the cockpit to OFF.

c. Remove the engine cowling. (Refer to paragraph 5.)

d. Remove the propeller. (Refer to paragraph 11.)

e. Disconnect the starter positive lead at the starter and their attachment clamps.

f. Disconnect the governor control cable at the governor and cable attachment clamps.

g. Disconnect the heater hose at the heat exchanger.

h. Disconnect the throttle and mixture cables at the injector. (The injector may be removed if desired.)

i. Disconnect cylinder temperature sender wire at No. 2 cylinder.

j. Disconnect the fuel pump supply line at the right side of the pump. Disconnect the pump vent line.

k. Disconnect both lines from the oil cooler.

l. Disconnect the magneto "P" leads at the magnetos.

m. Disconnect the engine vent tube at the engine.

n. Disconnect the engine oil temperature lead at the aft end of the engine.

o. Disconnect the tachometer drive cable at the engine.

p. Untie the ignition harness, hoses and lines at the aft end of the engine.

q. Disconnect the vacuum pump lines at pump and remove fittings from pump.

r. Disconnect the oil pressure line at the engine.

s. Disconnect the fuel flow line at the right rear engine baffle.

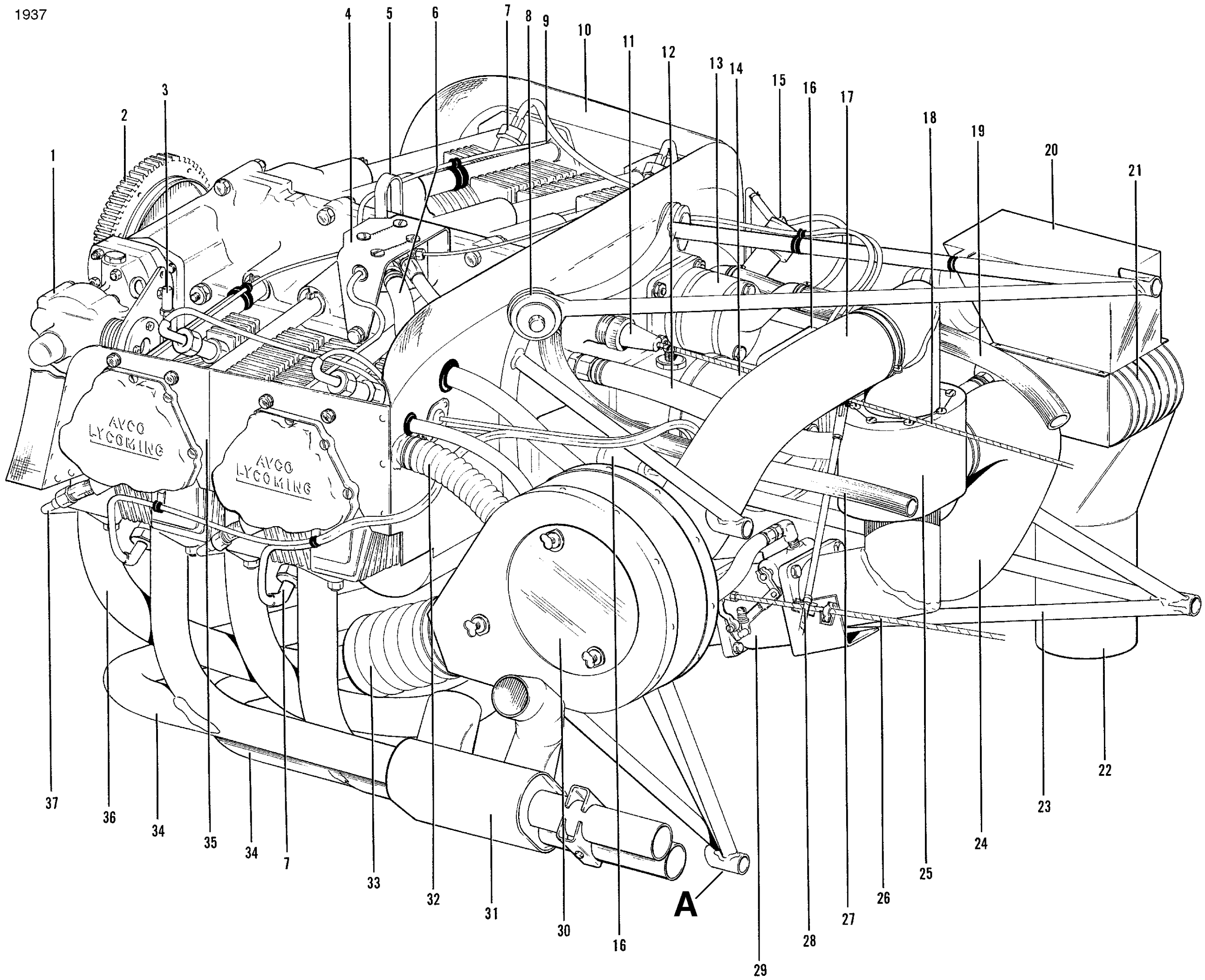
t. Disconnect the manifold pressure line at the right rear side of the engine.

u. Disconnect the alternator leads and the cable attachment clamps.

CAUTION: PLACE A TAIL STAND UNDER THE TAIL OF THE AIRPLANE BEFORE REMOVING AN ENGINE.

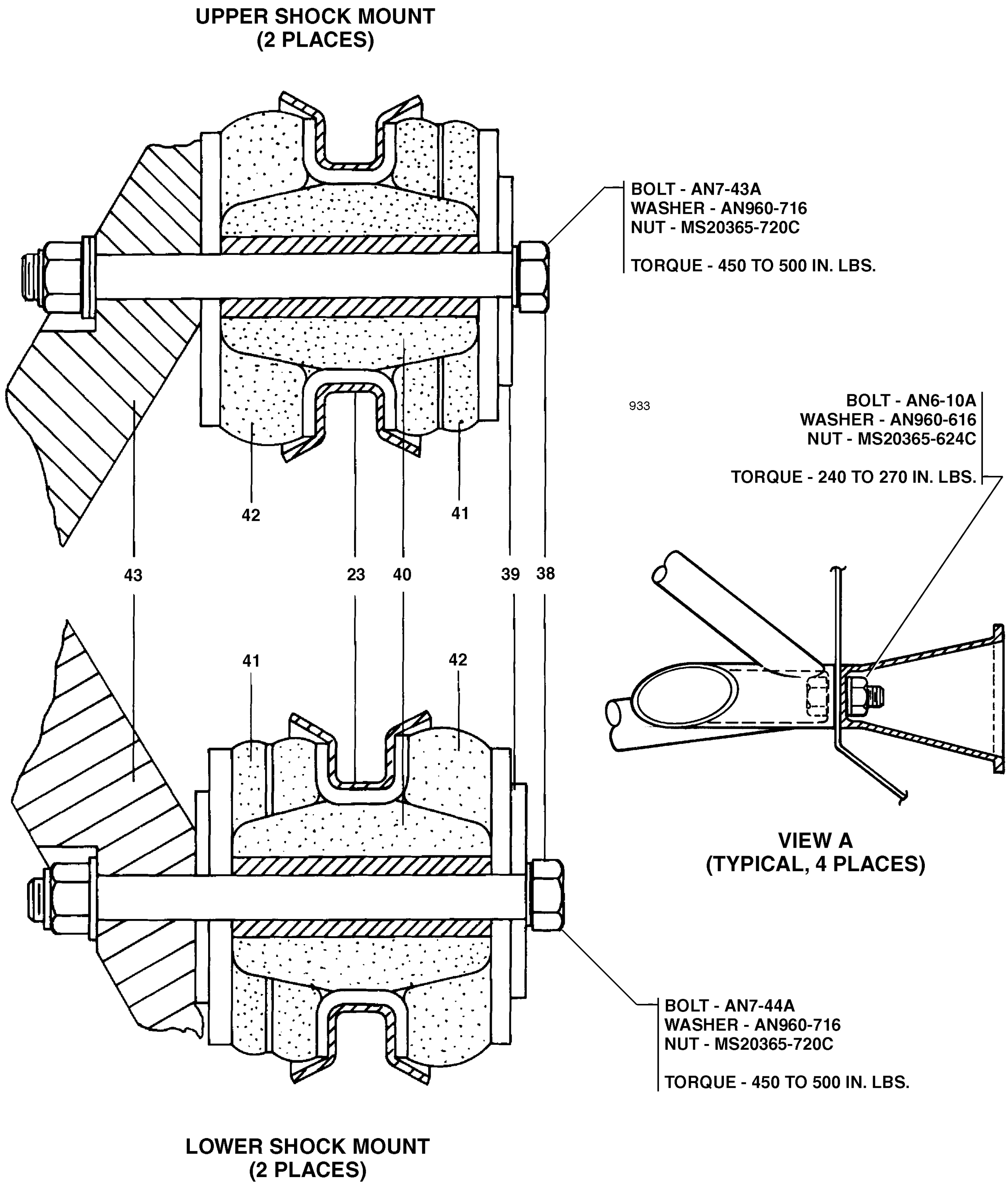
v. Attach a one-half ton (minimum) hoist to the hoisting straps and relieve the tension from the engine mounts.

w. Check the engine for any attachments remaining to obstruct its removal.



1. PROPELLER GOVERNOR
2. STARTER RING GEAR
3. GOVERNOR CONTROL
4. FLOW DIVIDER
5. LIFTING STRAP
6. FUEL PRESSURE
7. SPARK PLUG
8. SHOCK MOUNT (4 PLACES)
9. INJECTOR NOZZLE
10. BAFFLE ASSEMBLY
11. TACHOMETER CABLE CONNECTION
12. OIL COOLER RETURN
13. VACUUM PUMP
14. OIL FILTER
15. OIL FILLER
16. MAGNETO, RIGHT
17. INJECTOR INLET HOSE
18. TACHOMETER CABLE
19. VACUUM LINE
20. OIL COOLER AIR BOX
21. OIL COOLER
22. OIL COOLER EXHAUST
23. ENGINE MOUNT ASSEMBLY
24. ALTERNATE AIR DUCT
25. ALTERNATE AIR BOX
26. THROTTLE CONTROL CABLE
27. ENGINE BREATHER
28. ALTERNATE AIR CONTROL CABLE
29. FUEL INJECTOR
30. AIR FILTER BOX
31. HEAT EXCHANGER
32. FUEL PUMP COOLING HOSE
33. AIR FILTER INLET
34. EXHAUST STACK
35. BAFFLE ASSEMBLY, LEFT
36. INTAKE TUBE
37. OIL RETURN
38. BOLT
39. WASHER
40. SPACER
41. SHOCK MOUNT HALF
42. SHOCK MOUNT HALF
43. ENGINE

Engine Installation
Figure 4 (Sheet 1 of 2)



Engine Installation
Figure 4 (Sheet 2 of 2)

x. Drain the engine oil and then close drain.

y. Remove the four engine mount assemblies and swing the engine free, being careful not to damage any attaching parts.

21. INSTALLATION. (Refer to Figure 4.)

a. Attach a one-half ton (minimum) hoist to the engine hoisting straps and swing the engine into alignment with its attaching points.

b. Insert an engine mount bolt, with washer against head, in the engine mount and slide half of the mount assembly on the bolt. Repeat this procedure for the other three attachment points.

c. Position the mounting lugs of the engine so that they align with the engine mount attaching points, then move the engine rearward onto the mounts.

d. Slide onto each mounting bolt the forward half of the mount, spacer and spacer washer. Install washer and nut, and torque the nuts of the bolts as specified in Figure 4.

e. Connect the alternator leads and secure cable with clamps.

f. Install and connect cylinder head temperature sender and wire as follows:

1. In serial numbers 34-7350343 thru 34-7450220, and in 34-7250001 thru 34-7350342 with Kit No. 760-764 installed: at the No. 2 cylinder on both engines.
2. In serial numbers 34-7250001 thru 34-7350342 as originally delivered: at the No. 3 cylinder head on the left engine, and the No. 2 cylinder head on the right engine.

g. Connect the manifold pressure line at the right rear side of the engine.

h. Connect the fuel flow line at the right rear engine baffle.

i. Connect the oil pressure line.

j. Install the line fitting in the vacuum pump and install lines.

k. Connect the tachometer drive cable.

l. Connect the oil temperature lead.

m. Connect the engine vent tube.

n. Connect the oil cooler.

o. Connect the magneto “P” leads. Check that magneto switch is OFF.

p. Connect the fuel pump supply and vent line.

q. Install the injector.

r. Connect the throttle and mixture cables to the injector. Check adjustment of the control by referring to paragraph 24.

s. Connect the heater hose to the heat exchanger.

t. Connect the governor control cable and secure with clamps.

u. Connect the starter positive lead and secure cables with clamps.

v. Secure the ignition harness, lines, hoses, wires, etc. that may be loose.

w. Install the propeller. (Refer to paragraph 13.)

x. Install the cowling. (Refer to paragraph 7.)

y. Install the proper grade and amount of engine oil.

z. Pre-oil the engine prior to initial start.

aa. Turn on the fuel valve; open the throttle full and turn on the electric fuel pump. Check the fuel lines for leaks.

ab. Perform an engine operational check.

22. ENGINE SHOCK MOUNTS.

23. REPLACING. See Figure 4 for the proper arrangement of the engine shock mount assemblies. The lower shock mounts are installed opposite of the top shock mounts. Torque shock mount bolts as specified in Figure 4 and safety.

24. ADJUSTMENT OF THROTTLE AND MIXTURE CONTROLS. The throttle and mixture controls are adjusted so that when the throttle arm on the injector is rotated aft against its full throttle stop and the mixture arm is rotated forward against its full rich stop, the cockpit lever control of the throttle should be against or within 0.015 of the forward stop and the mixture lever 0.032 to 0.047 of an inch from the forward stop.

a. At the injector, disconnect the ball joints of the throttle and/or mixture control cable from the control arm. (The throttle and mixture control arms should not need to be reset on their shafts.)

b. Loosen the jam nut securing the ball joints.

c. Adjust the linkage by rotating the ball joints to obtain the correct distance of spring back of the cockpit control when the throttle or mixture control arm contacts its stop.

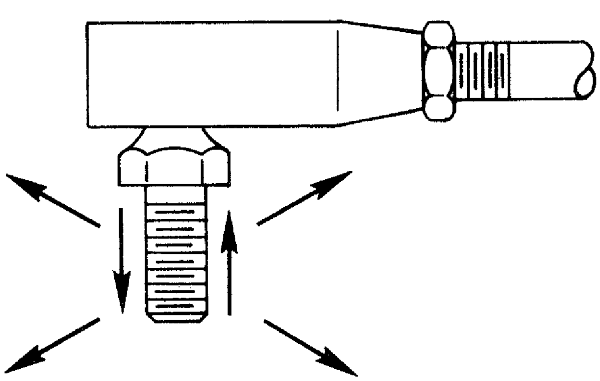
d. Reconnect the ball joint to its control arm and secure jam nut.

e. Pull the throttle and mixture control levers in the cockpit full aft to ascertain that the injector idle screw contacts its stop and the mixture control arm contacts its lean position.

25. THROTTLE AND MIXTURE CONTROL ATTACHMENTS 100 HOUR INSPECTION. (See Figure 5.)

NOTE: In serial numbers 34-725001 thru 34-7450187 only, installation of Kit No. 760-890 (one kit each engine) will improve the service life of these control attachments.

Each 100 hours, inspect the throttle and mixture control attachment joint assembly (P/N 31747-000, two each engine) for excessive wear per Figure 5.



INSPECTION INSTRUCTIONS

Firmly grasp the unit and pull, twist, and rotate the ball end. If excessive wear exists, replace the unit with a new joint assembly (P/N 31747-000).

Throttle and Mixture Control Attachments Inspection
Figure 5

26. ALTERNATE AIR DOOR.

The alternate air door is located in the induction airbox 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 any inspection:

a. Check that air door seals are tight and hinge is secure.

b. Actuate the door by operating the control lever in the cockpit to determine that it is not sticking or binding.

c. Check the cockpit control cable for free travel.

d. Check that when the control lever in the cockpit is in the open position, the cable is adjusted to allow approximately .0625 to .125 of an inch between the actuating arm roller and the door when fully closed.

26a. ALTERNATE AIR DOOR 100 HOUR INSPECTION.

NOTE: Installation of Kit No. 760-722V relieves this inspection requirement and the requirements of AD 72-17-1.

In serial numbers 34-7250001 thru 34-7350074 only for aircraft with original 96780-00 or 96780-01 induction airboxes still installed: each 100 hours time-in-service, remove the airboxes, disassemble, and inspect as follows:

a. Remove the induction airbox assembly from each engine.

b. Remove the airbox valve shaft from each airbox assembly. Inspect each valve for any evidence of excessive wear or cracks in the area where the shaft mates to the valve assembly.

(1) Should inspection reveal such a condition, proceed as follows before further flight:

(a) Replace the affected part(s) with a serviceable part of the same part number, or;

(b) Install Kit No. 760-722V.

NOTE: This kit replaces both induction airbox assemblies on both engines.

(2) If each valve is still servicable, reassemble each airbox assembly, install and rig per Alternate Air Door, above.

27. FUEL INJECTOR.

28. MAINTENANCE.

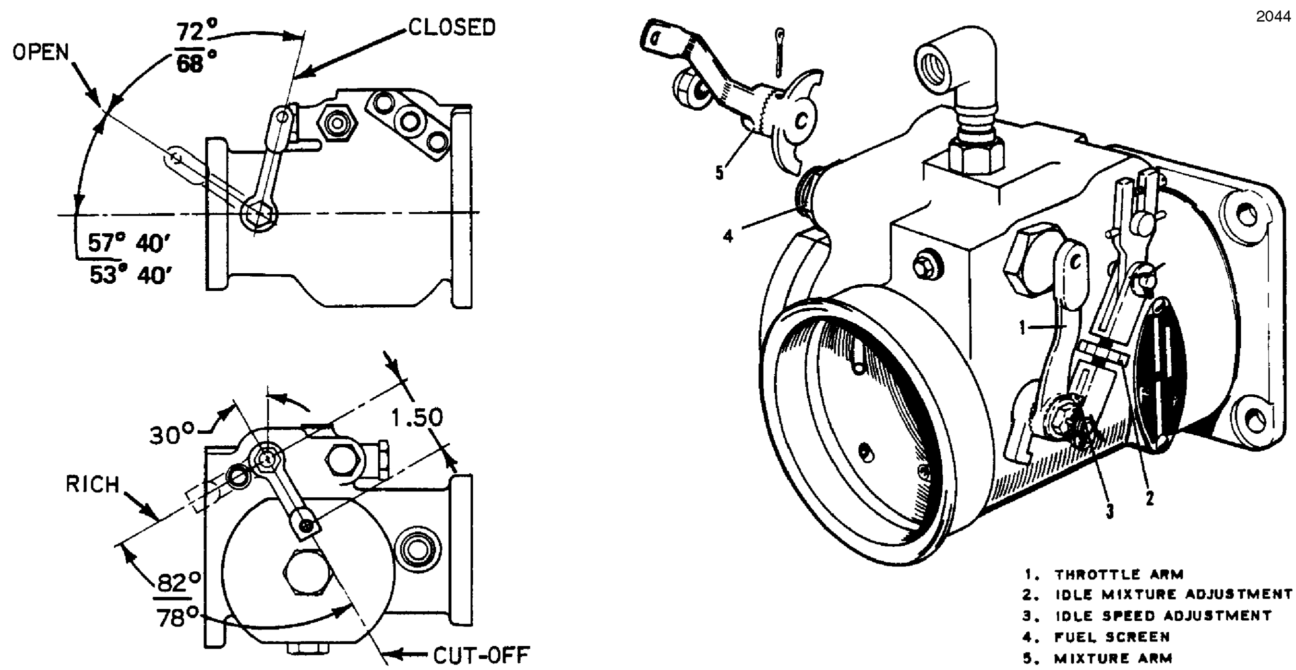
In general, little attention is required between injector overhauls. However, it is recommended that the following items be checked during periodic inspection of the engine.

a. Inspect fuel injector attachments for loose nuts and torque all nuts to 135-150 inch-pounds. Seat “Pal” nuts finger tight against plain nuts, then tighten an additional 1/3 to 1/2 turn.

b. Check all fuel lines for tightness and evidence of leakage. A slight fuel stain adjacent to the air bleed nozzles is not cause for concern.

c. Check throttle and mixture control rod ends and levers for tightness and lock.

d. Remove and clean the injector inlet strainer at the first 25 hours of operation and each 50 hour inspection thereafter. Check the screen for distortion or openings in the strainer. Replace for either of these conditions. Clean screen assembly in solvent and dry with compressed air. Damaged strainer O-rings should be replaced. To install the screen assembly, place the gasket on the screen assembly and install the assembly in the throttle body and tighten to 35-40 inch pounds torque.



Fuel Injector
Figure 6

29. ADJUSTMENT OF IDLE SPEED AND MIXTURE. (Refer to Figure 6.)

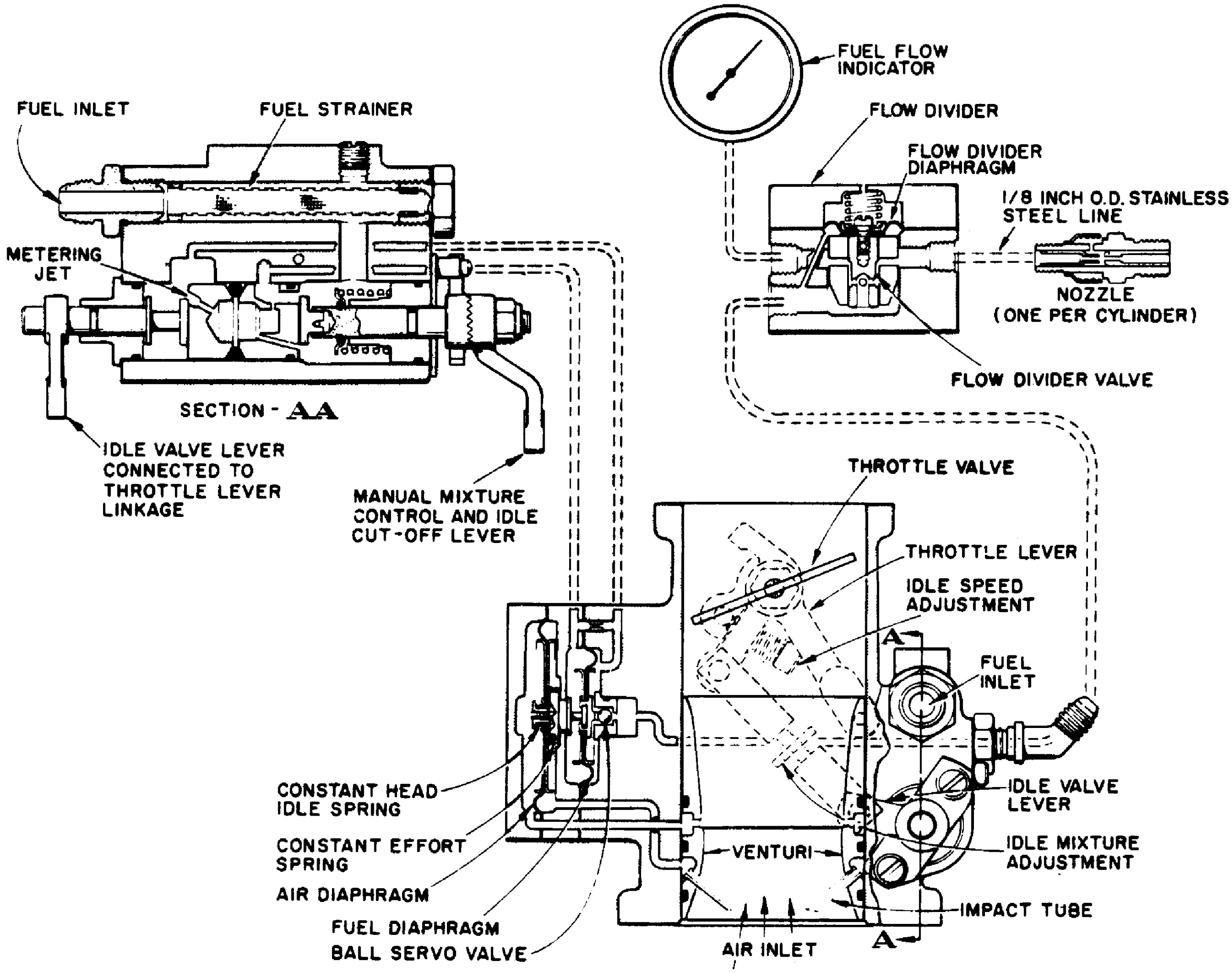
a. Start the engine and warm up in the usual manner until oil and cylinder head temperatures are normal.

b. Check magnetos. If the "mag-drop" is normal, proceed with idle adjustment.

c. Set throttle stop screw so that the engine idles at 550-600 RPM. If the RPM changes appreciably after making the mixture adjustment during the succeeding steps, readjust the idle speed to the desired RPM.

d. When the idling speed has been stabilized, move the cockpit mixture control lever with a smooth, steady pull toward the "Idle-CutOff" position and observe the tachometer for any change during the leaning process. Caution must be exercised to return the mixture control to the "Full Rich" position before the RPM can drop a point where the engine cuts out. An increase of more than 10 RPM while "leaning out" indicates an excessively rich idle mixture. An immediate decrease in RPM (if not preceded by a momentary increase) indicates the idle mixture is too lean.

e. If the above indicates that the idle adjustment is too rich or too lean, turn the idle mixture adjustment in the direction required for correction, and check this new position by repeating the above procedure. Make additional adjustments as necessary until a check results in a momentary pick-up of approximately 5 (never more than 10) RPM. Each time the adjustment is changed, the engine should be run up to 2000 RPM to clear the engine before proceeding with the RPM check. Make final adjustment of the idle speed adjustment to obtain the desired idling RPM with closed throttle. The above method aims at a setting that will obtain maximum RPM with minimum manifold pressure. In case the setting does not remain stable, check the idle linkage; any looseness in this linkage would cause erratic idling.



RSA Fuel Injector System Funtional Schematic
Figure 7

30. FUEL-AIR BLEED NOZZLES.

31. REMOVAL. The nozzles must be carefully removed as they or the cylinders may be damaged.

a. Remove the lower engine cowl.

b. Disconnect the fuel line from the nozzle.

c. Carefully remove the nozzle, using the correct size deep socket.

d. Clean and inspect the nozzle as given in paragraph 32.

32. CLEANING AND INSPECTION.

a. Clean the nozzle with acetone or equivalent and blow out all foreign particles with compressed air in the direction opposite that of fuel flow. Do not use wire or other hard objects to clean orifices.

b. Inspect the nozzle and cylinder threads for nicks, stripping or cross-threading.

c. Inspect for battered or rounded hexagons.

33. INSTALLATION.

a. Install nozzle and torque 60 inch-pounds.

CAUTION: START NOZZLES AND LINE COUPLINGS BY HAND TO PREVENT THE POSSIBILITY OF CROSS-THREADING.

b. Connect fuel line to nozzle.

c. Install the engine cowl.

34. IGNITION SYSTEM MAINTENANCE.

35. MAGNETOS.

WARNING: GROUND THE MAGNETO PRIMARY CIRCUIT BEFORE WORKING ON THE ENGINE.

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

NOTE: Magneto service information provided in this manual applies solely to Bendix Series 1200 Magnetos and is based on Bendix's original "Installation, Operation, and Maintenance Manual, Form L-609-3" which may not be current. Teledyne Continental Motors currently owns the Bendix Magneto product line and publishes magneto service information for the 1200 series as "S-1200 Magneto Manual, P/N X-42001-1," which should be consulted if Bendix magnetos are still installed.

NOTE: If Slick magnetos are installed, the service information provided in this manual is not applicable. Consult Slick's "F-1100 Master Service Manual" for installation, operation, and maintenance instructions.

36. INSPECTION.

NOTE: Comply with Bendix Service Bulletin No. 608 at first opportunity, but no later than next magneto overhaul. Install self-locking cam retaining screw (10-391213) and torque 21-25 inch pounds. If self-locking screw is removed at any time, always replace with new self-locking screw and torque to the specified value.

a. 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.

b. 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.

c. Should the trouble appear definitely associated with the magneto, the most effective measure is to install a replacement magneto which is known to be in satisfactory condition and send the suspected unit to the overhaul shop for test and repair.

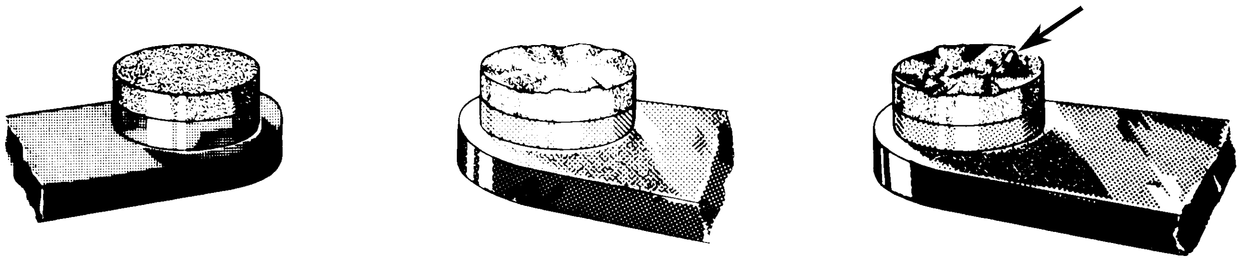
d. Should this not be possible, a visual inspection may disclose the source of trouble. Remove the harness securing nuts and washers and separate outlet plate from the magneto. Inspect for the presence of moisture and foreign matter on the rubber grommet and high tension outlet side of the distributor block. Check height of block contact springs, (0.422 maximum from top of the block tower to the spring). Also check for broken leads or damaged insulation. If either is present, remove magneto and replace with one known to be in satisfactory condition.

e. Remove the breaker cover securing screws and nuts, and separate cover from magneto housing. Check contact assemblies to see that cam follower is securely riveted to its spring. Examine the contact points for excessive wear or burning. Figure 8 shows how the average contact point will look when surfaces are separated for inspection. Desired contact surfaces have a dull gray, sand-blasted (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.

NORMAL POINT IS SMOOTH AND FLAT. SURFACE HAS DULL GRAY "SANDBLASTED" APPEARANCE.

MINOR IRREGULARITIES - SMOOTH ROLLING HILLS AND DALES WITHOUT ANY DEEP PITS OR HIGH PEAKS. THIS IS A NORMAL CON-DITION OF POINT WEAR.

WELL DEFINED MOUND EXTENDING NOTICEABLY ABOVE SURROUNDING SURFACE. REJECT POINTS.



Contact Points
Figure 8

f. Minor irregularities or roughness of point surfaces are not harmful (refer to Figure 8, 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 8, 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 ,the complete contact assembly should be replaced.

g. 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 Scintilla 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.

h. Check the capacitor mounting bracket for cracks or looseness. Using the Scintilla 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.

i. Check magneto to engine timing as follows:

   1. Connect Scintilla 11-9110-1 Timing Light or equivalent across the main contact assembly.
   2. Slowly bring the engine up to number one cylinder advance firing position as instructed in paragraph 39. At this instant the timing light should go out. If it does, the magneto is properly timed to the engine. If the timing light does not go out, removal of the magneto for internal timing check and inspection is recommended.

37. REMOVAL. Before removing the magneto, make sure magneto switches are off.

WARNING: THE MAGNETO IS NOT INTERNALLY GROUNDED; WHEN THE GROUND LEAD IS DISCONNECTED, THE MAGNETO IS HOT. WHEN THE “P” LEAD IS REMOVED THE MAGNETO IS GROUNDED INTERNALLY. BUT, REMOVING THE HARNESS ASSEMBLY TERMINAL PLATE FIRST AND INSTALLING IT LAST MINIMIZES THE DANGER OF STARTING THE ENGINE ACCIDENTALLY WHEN THE GROUND LEAD IS REMOVED FROM THE MAGNETO.

a. Remove the harness assembly terminal plate from the magneto.

b. Remove the “P” lead at the magneto.

c. Disconnect the ground lead at the magneto.

d. Remove the nuts and washers and draw the magneto from the engine.

38. TIMING PROCEDURE (Internal Timing).

a. Remove the cover to the contact(s), distributor block, etc.

b. To internally time the contact assembly of the single breaker magnetos, proceed as follows:

1. Loosen the nut securing the drive plate to the magneto shaft sufficiently in order to install the 11-8465 Rotor Holding Tool under the nut and flat washer as shown in Figure 9. Tighten the nut securely.
2. Remove the timing inspection plug from the top of the magneto. Turn rotating magnet in direction of normal rotation until applicable timing mark on distributor gear is approximately aligned with mark on block (Refer to Figure 11.) Then turn it back until magnet locates in its neutral position.
3. With magnet in its neutral position, install the timing plate assembly and the pointer assembly of the 11-8150-1 Timing Kit to breaker compartment of magneto. (Refer to Figure 10.) Align pointer assembly with the 0° mark on timing plate.

   CAUTION: TIGHTEN ADJUSTING KNOB OF ROTOR HOLDING TOOL ONLY ENOUGH TO HOLD MAGNET SHAFT FIRMLY IN DESIRED POSITION. OVERTIGHTENING THE ADJUSTING KNOB MAY CAUSE DAMAGE TO DRIVE END BEARING.

   Loosen adjusting knob of 11-8465 Rotor Holding Tool and turn rotating magnet in normal direction of rotation until pointer indexes with the respective E gap mark (15° ± 2°). Tighten adjusting knob of 11-8465 Tool. Using a timing light, adjust contact points to just open.
4. Loosen adjusting knob of 11-8465 Holding Tool and turn rotating magnet until cam follower of contact assembly is on high point of cam lobe. Tighten adjusting knob of Holding Tool and measure contact clearance. (Main contact points - 0.016 ± 0.003) If dimension does not fall within limits read just contact points and recheck to be sure points open within “E” gap tolerance. If points do not open within tolerance, refer to S-1200 Magneto Manual, P/N X42001-1.
5. The retard contact assembly on dual contact magnetos is adjusted to open a predetermined number of degrees after the main contact assembly opens. The degree of retard for any particular magneto is stamped in the bottom of the breaker compartment. At the exact position of the rotating magnet that the main contact assembly opens, lock the 11-8465 Holding Tool. Move the pointer of the 11-8150-1 Timing Kit back to zero. Unlock the Holding Tool and advance rotating magnet until pointer of Timing Kit indexes with the required degree of retard, Lock the Holding Tool in this position. Using a timing light, adjust retard contact assembly to just open. Tolerance of retard is +2°, -0°. Unlock Holding Tool Now, turn rotating magnet until cam follower is on high point of cam lobe. Point clearance should be 0.016 ± 0.006. If dimension is not within limits, readjust contact assembly and recheck to ensure that points will open within retard degree tolerance. Replace contact assembly if retard degree tolerance and contact clearance cannot be obtained.
6. Remove pointer assembly and timing plate assembly from magneto.

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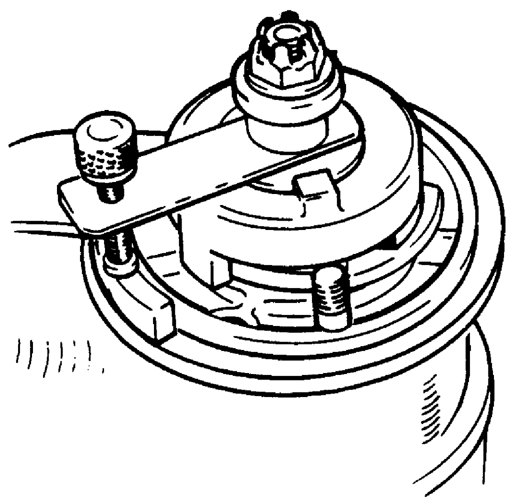

Rotor Holding Tool Installed
Figure 9

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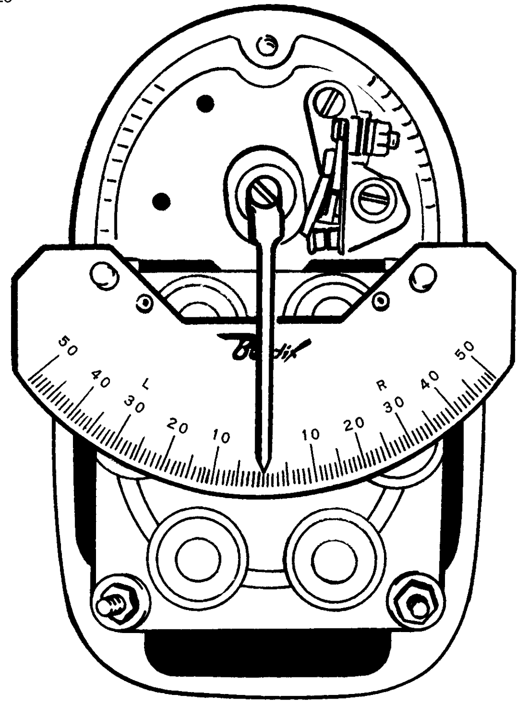

Timing Kit Installed
Figure 10

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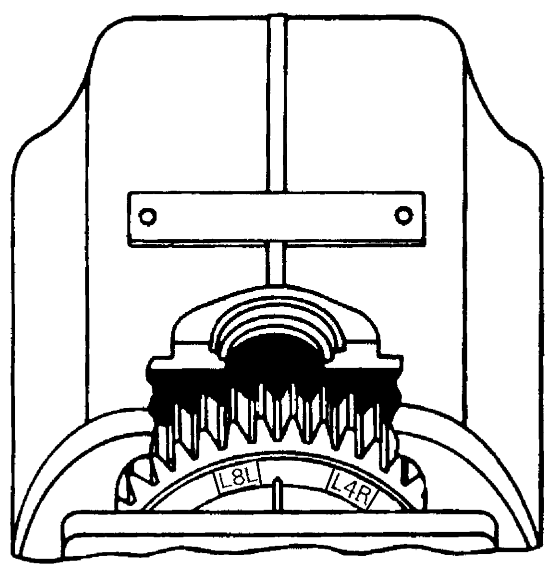


Aligning Timing Marks
(Single Contact Assembly Magneto)
Figure 11

c. If the distributor block was not removed from the housing, the internal timing may be checked by turning the magneto in the normal rotation to number one firing position (keyway up and points just opening). At this position, the reference line on the distributor block should line up with the L mark on the gear. On single contact magnetos the line should favor the L mark if possible

d. If the distributor block was removed from the housing, the distributor gear alignment and internal check may be accomplished as follows:

1. Turn rotating magnet in direction of rotation until it is located in firing position (keyway up and points just opening). Tighten adjusting knob of 11-8465 Rotor Holding Tool Apply a light coating of Bendix Grease P/N 10-27165 to teeth of distributor gear, if needed. The large distributor gear incorporates two timing marks, L for left hand rotation and R for right hand rotation.
2. With distributor gear assembled to block, turn gear until raised rib on block lines up with the L mark. Assemble block and gear into housing, meshing the distributor gears together. The rib should favor the L mark if possible (refer to Figure 11).

   NOTE: The raised rib must align within a halt tooth of the L or R mark depending on rotation.

3. Secure distributor block to housing with studs and washers. Tighten studs finger tight. Loosen the 11-X465 Rotor Holding Tool and turn rotating magnet in reverse direction of rotation until timing light indicates contact assembly had just opened and check to make certain timing marks align within tolerance indicated above. Tighten block securing studs first 4-8 inch pounds torque and then final torque to 20 inch pounds.
4. Insert the tip of your small finger through timing hole in housing and against large distributor gear teeth. Rock distributor gear back and forth slightly. There must be perceptible backlash between teeth of large and small gears. This check should be made at three different points, 120° apart on gear. If backlash is not evident, replace large distributor gear.
5. Install the breaker cover and complete reassembly of the magneto. Refer to the manufacturer's publications for complete disassembly and reassembly procedures.

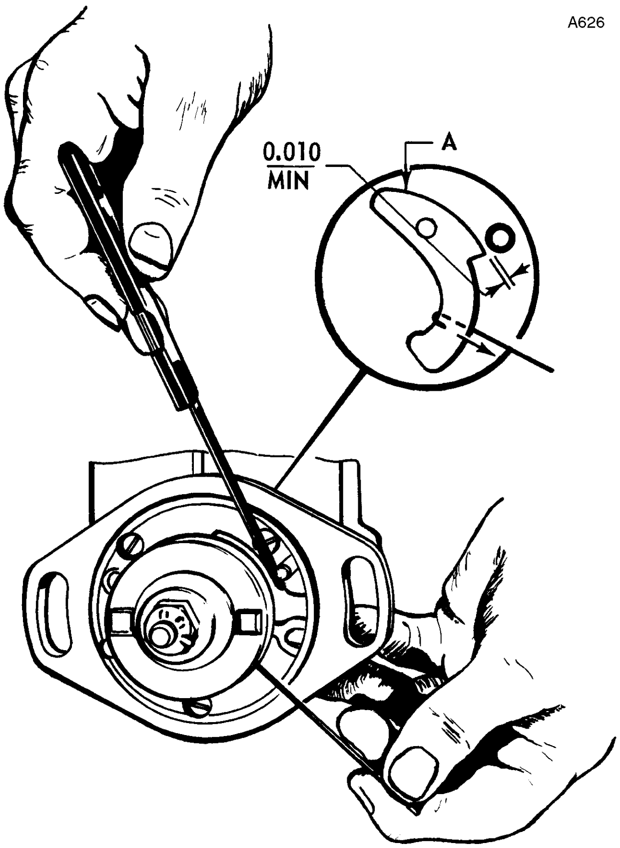
e. On the magneto employing the impulse coupling, check clearance between each flyweight and each stop pin as follows:

1. Bend the end of a stiff piece of wire into a right angle 0.125 inch long (maximum).
2. Hold magneto as shown in Figure 12. Pull heel of flyweight outward with the hooked wire and make certain that feeler gauge of 0.010 inch minimum thickness will pass between stop pin and the highest point of the flyweight.

   NOTE: A true and accurate check of the clearance between flyweight and stop pin can only be obtained by pulling the flyweight outward as described above. Do not attempt the check by pushing in on flyweight at point "A".

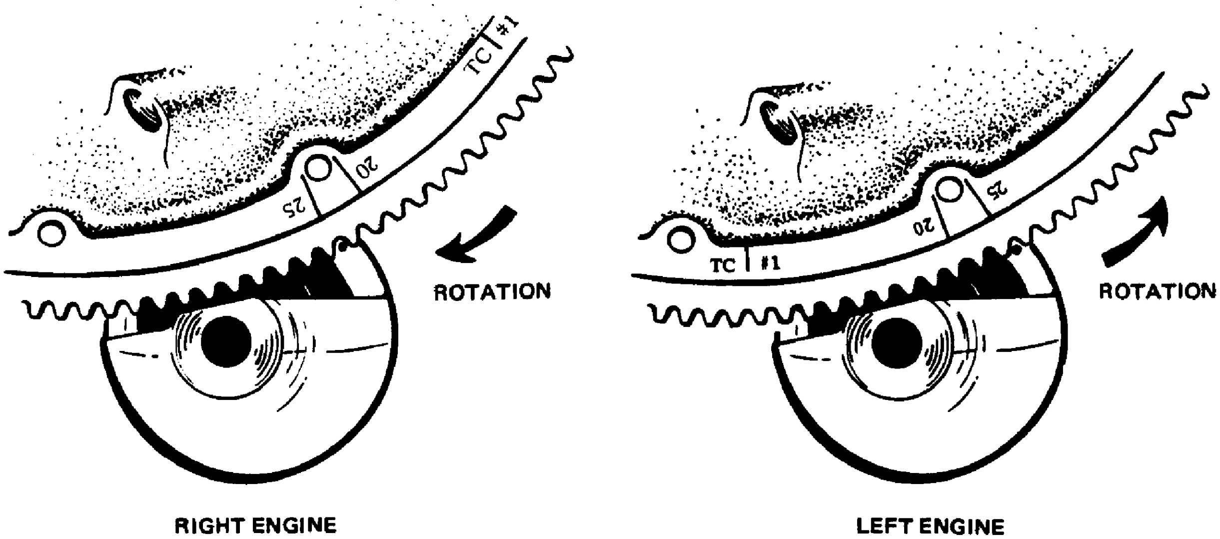
f. Install and time magneto, removed from engine, in accordance with paragraph 39.

g. Secure external switch leads to the breaker cover terminals. Connect harness assembly to the magneto.



Checking Flyweight Clearance on Impulse Coupling
Figure 12

228



Engine Timing Marks
Figure 13

39. INSTALLATION AND TIMING PROCEDURE (Timing Magneto to Engine.) Although only the left magneto is equipped with an impulse coupling, the timing procedure, in the following paragraphs, is the same for both magnetos.

   a. Remove the spark plug from No. 1 cylinder and place a thumb over the spark plug hole. Rotate the crankshaft in direction of normal rotation until the compression stroke is reached, this is indicated by a positive pressure inside the cylinder tending to push the thumb off the spark plug hole. Continue rotating the crankshaft in direction of normal rotation until the advance timing mark (25) on the frontface of the starter ring gear is in exact alignment with the small hole located at the two o'clock position on the front face of the starter housing (Refer to Figure 13.)

      NOTE: Verify correct engine timing for the airplane being worked on by checking the engine dataplate.

      NOTE: The advance timing mark on the top face of the starter ring gear is marked at both 20° and 25° BTC. Use only the 25° BTC mark when timing the magnetos to the engine.

      NOTE: If the crankshaft is accidentally turned in the direction opposite normal rotation, repeat the above procedure as accumulated backlash will make the final timing incorrect.

   b. At this point, the engine is ready for assembly of the magnetos. Remove the inspection plugs from both magnetos and turn the drive shafts in direction of normal rotation (counterclockwise facing the coupling) until the applicable timing mark on the distributor gear is approximately aligned with the mark on the distributor block. (Refer to Figure 14.) Being sure that the gear does not move from this position, install gaskets and magnetos on the engine. Secure with clamps; tighten only finger tight.

229

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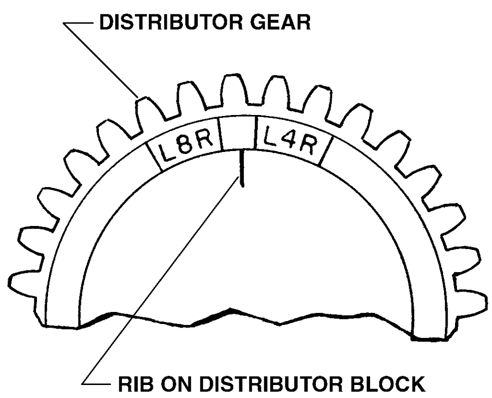
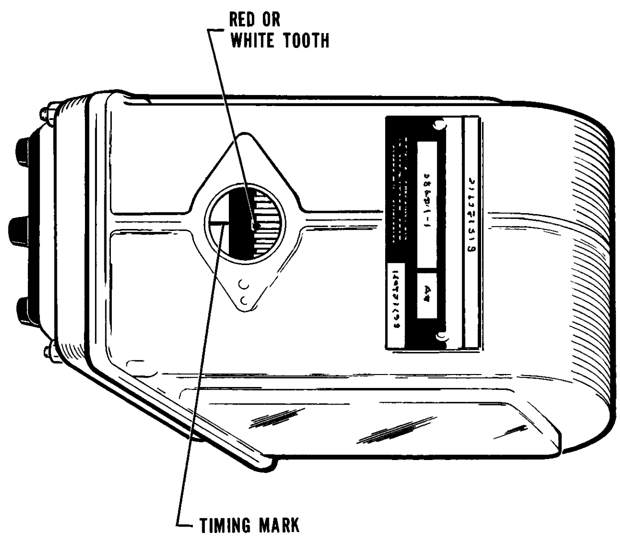


Magneto Timing Marks
Figure 14



Magneto Timing Marks
Figure 15

c. Using a battery powered timing light attach the positive lead to a suitable terminal connected to the ground terminal of the magneto and the negative lead to any unpainted portion of the engine. Rotate the magneto in its mounting flange to a point where the light comes on, then slowly turn it in the opposite direction until the light goes out. Bring the magneto back slowly until the light just comes on. Repeat this with the second magneto.

NOTE: AC timing lights operate in the reverse manner as described above, the light goes out when the breaker points open.

d. After both magnetos have been timed, check, as described below, to ascertain that both magnetos are set to fire together.

e. Back off the crankshaft a few degrees, the timing lights should go out. Bring the crankshaft slowly back in direction of normal rotation until the timing mark and the hole in the starter housing are in alignment. At this point, both lights should go on simultaneously. Tighten nuts to specified torque.

f. After magnetos have been properly timed, replace breaker cover and secure.

g. Install the ground lead and the retard spark lead on the left magneto.

h. Place the harness terminal plate on the magneto and tighten nut around the plate alternately to seat cover squarely on magneto. Torque nuts to 18 to 22 inch pounds.

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40. HARNESS ASSEMBLY.

41. INSPECTION.

a. Check lead assemblies for nicks, cuts, mutilated braiding, badly worn section or any other evidence of physical damage. Inspect spark plug sleeves for chafing or tears and damaged or stripped threads on coupling nuts. Check compression spring to see if it is broken or distorted. Inspect grommet for tears. Check all mounting brackets and clamps to see that they are secure and not cracked.

b. Using an ohmmeter, buzzer, or other suitable low voltage device, check each lead for continuity. If continuity does not exist. wire is broken and must be replaced.

c. For electrical test of harness assembly, use a high voltage, direct current tester such as TAKK Model 86 or 86A or an equivalent direct current high voltage tester capable of delivering a test potential of 10,000 volts. Connect ground lead to 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 same manner.

d. Minor repair of the harness assembly, such as replacement of contact springs, spring retainer assemblies, insulating sleeves or of one lead assembly, can be accomplished with the harness assembly mounted on the engine. However, should repair require replacement of more than one lead assembly or of a cable outlet plate, the harness should be removed from the engine and sent to an overhaul shop.

42. REMOVAL.

a. Disconnect the clamps that secure the wires to the engine and accessories.

b. Loosen the coupling nuts at the spark plugs and remove the insulators from the spark plug barrel well. Use caution when withdrawing the insulator not to damage the insulator spring.

c. Place a guard over the harness insulators.

d. Remove the harness assembly terminal plate from the magneto.

e. Remove the harness from the airplane.

43. MAINTENANCE.

a. To replace contact springs, spring retainer assemblies or insulating sleeves, proceed as follows:

1. Using a Scintilla 11-7073 Needle or a mechanical pencil with the lead retracted, hook the end of the contact spring as shown in Figure 16.
2. Using the needle or pencil, unscrew the spring.

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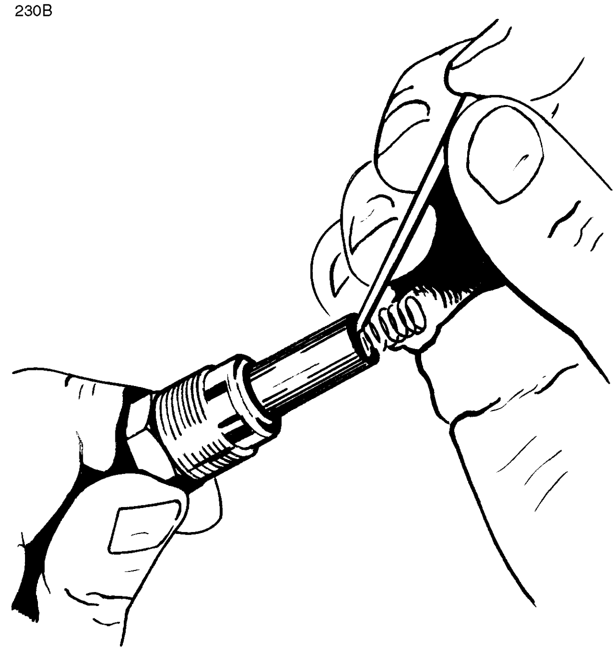

Removing Spring From Lead Assembly
Figure 16

3. Slide insulating sleeve and spring retainer assembly off end of lead assembly.
4. Replace defective component and reassemble as follows:
   (a) Fabricate a tool as shown in Figure 17 for installing the insulating sleeves over cable terminals.
   (b) Push the tool thru insulating sleeve and spring retainer assembly as shown in Figure 18. Screw the cable terminal into the tool.
   (c) Work insulating sleeve and spring retainer assembly into position over the cable and unscrew the tool. Install contact spring on cable terminal.

   NOTE: It may be necessary to lubricate cable and insulating sleeve with a thin film of DC200 (200,000 centistokes) or commercial grade alcohol to facilitate assembly.

b. To replace one of the lead assemblies proceed as follows:
1. Remove clamps and brackets from applicable lead assembly. Cut cable ties from assembly and discard.
2. Cut off condemned lead flush with outer surface of cable outlet plate.
3. Grip eyelet of lead with a pair of pliers and pull short length of conductor out of grommet and cable outlet plate.
4. Using a three inch long, 0.270 inch diameter drift, applied at outer surface of plate, drive out tapered ferrule and remaining pieces of insulation and shielding.
5. To determine what length the new lead assembly should be cut to, proceed as follows:
   (a) Measure the length of the condemned lead assembly. Move coupling nut back on lead assembly and measure from outer end of ferrule at spark plug end. (Refer to Figure 19.)
   (b) To the length determined in step (a), add 1.750 inches.

   NOTE: Spare part leads are supplied in various length. Use a lead which is longer than, but nearest to, the desired length.
6. Cut lead assembly to the length determined in step 5. Mark ferrule on spark plug end of lead with a metal stamp, scribe or rubber stamp to correspond with correct cylinder number.
7. Starting at spark plug location, thread new cable thru grommets and clamps as necessary for correct routing of cut end of cable to magneto location.

   CAUTION: USE CARE NOT TO NICK OR CUT INSULATION WHEN REMOVING BRAID.
8. Using electrician's scissors, carefully remove 1.250 inch of outer braid from end of lead. (Refer to Figure 20.)
9. Using a scribe or similar pointed tool, unbraid .375 inch of braided shielding. (Refer to Figure 21.) Wrap a single thickness of electrical tape around unbraided strands to facilitate insertion of lead end thru hole in cable outlet plate.
10. Remove cable outlet plate from magneto. Support plate securely and, using suitable cutting pliers, split and remove eyelets from leads adjacent to lead being replaced. When splitting eyelet make certain that wire strands are not cut. Removal of eyelets on adjacent leads will allow grommet to be pulled away from outlet plate to facilitate insertion of new lead.
11. Pass the taped end of new lead through hole in outlet plate. Remove electrical tape from lead and install tapered end of ferrule under the unbraided strands of shielding. Form strands of shielding evenly as shown in Figure 22 and pull lead assembly back through cable outlet plate until ferrule binds in the outlet well. Position the Scintilla 11-7074 Ferrule Seating Tool (Figure 23) over the wire and firmly seat the ferrule by tapping the seating tool with a hammer or by using an arbor press.

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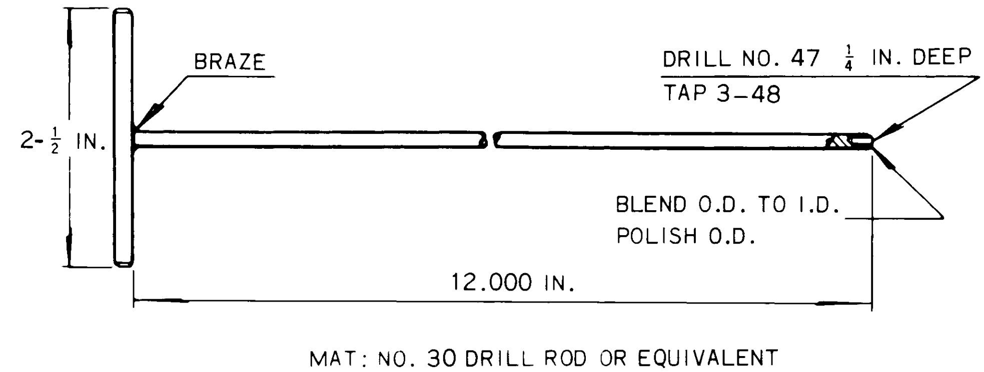

Assembly Tool
Figure 17

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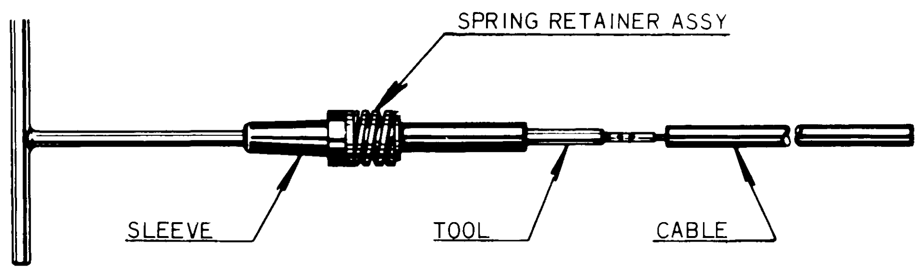

Using Assembly Tool
Figure 18

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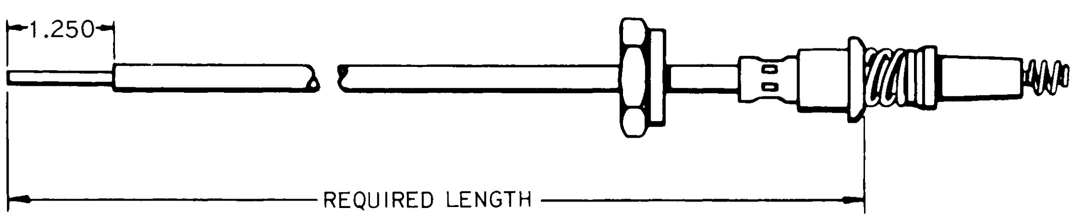
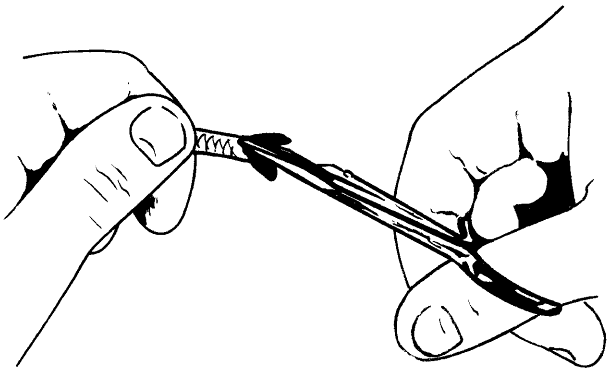


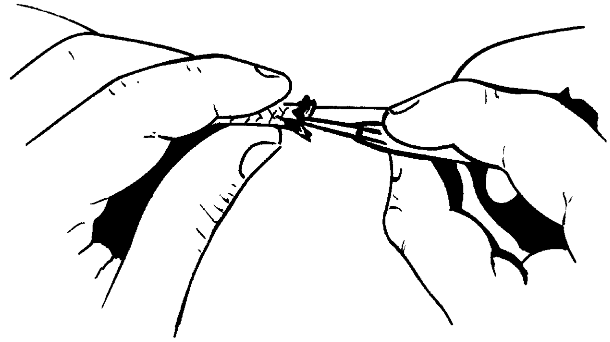
Measuring Lead Assembly Length
Figure 19

231A



Cutting Metallic Braid
Figure 20

231B



Unbraiding Metallic Shielding
Figure 21

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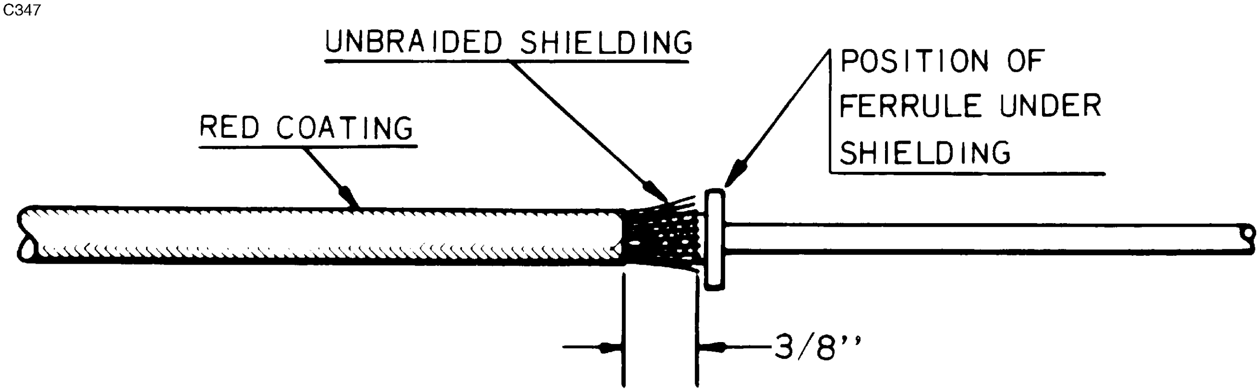
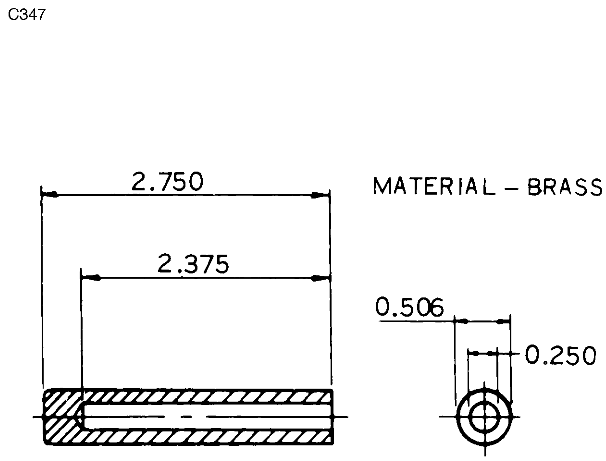
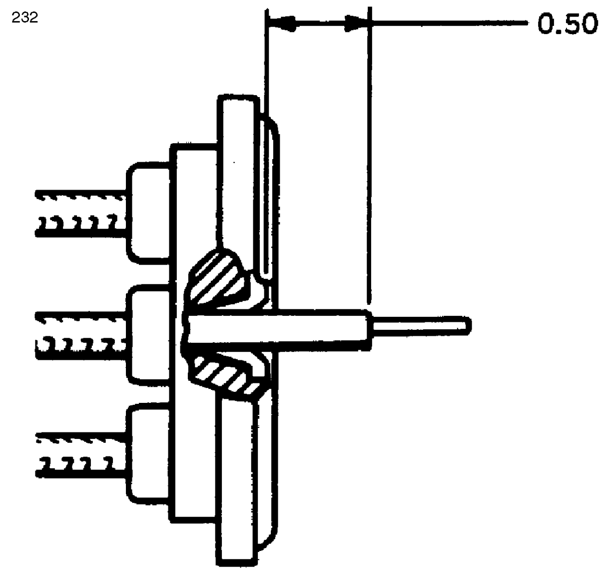


Forming Shielding Around Ferrule
Figure 22



Ferrule Seating Tool
Figure 23



Measuring Wire From Top of Ferrule
Figure 24

12. Measure .500 inch from tapered ferrule and strip remaining insulation from wire. (Refer to Figure 24.)
13. Insert Scintilla 11-7073 Needle (Figure 25) thru small hole of grommet and over stripped end of wire. (Refer to Figure 26.) Slide grommet down needle until it seats tightly against the tapered ferrule.
14. Cut wire .375 inch from top of grommet outlet (refer to Figure 27). Double wire over as shown in A of Figure 28. Slide eyelet over doubled wire until it is firmly seated in recess of grommet outlet.
15. Using the “AB” groove of Scintilla 11-4152 Crimping Tool, or equivalent, crimp eyelet to wire. Approximately .031 of an inch of wire should extend from end of eyelet after crimping. (Refer to B of Figure 28.)

    NOTE: If the crimping tool is not available, a satisfactory connection can be made by soldering with Kester Flux 709 or equivalent and a non-corrosive solder. After soldering, clean solder joints using denatured alcohol.

16. Install clamps and cable ties as necessary to secure lead to the engine.

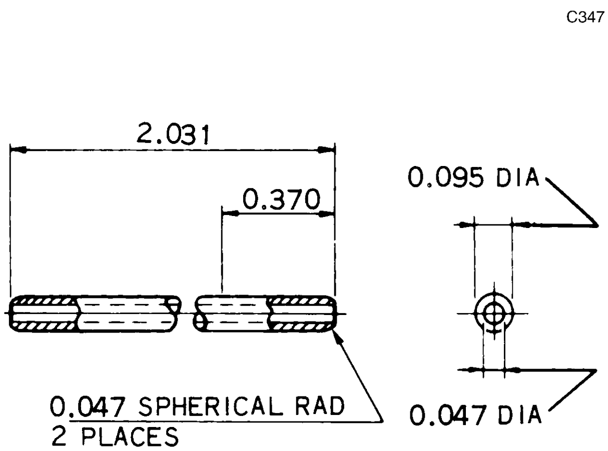
44. INSTALLATION OF HARNESS. Before installing harness on magneto, check mating surfaces for cleanliness. Spray entire face of grommet with a light coat of Plastic Mold Spray, SM-O-O-TH Silicone Spray or equivalent. This will prevent harness grommet from sticking to magneto distributor block.

    a. Place the harness terminal plate on the magneto and tighten nuts around the plate alternately to seat cover squarely on magneto. Torque nuts to 18 to 22 inch-pounds.

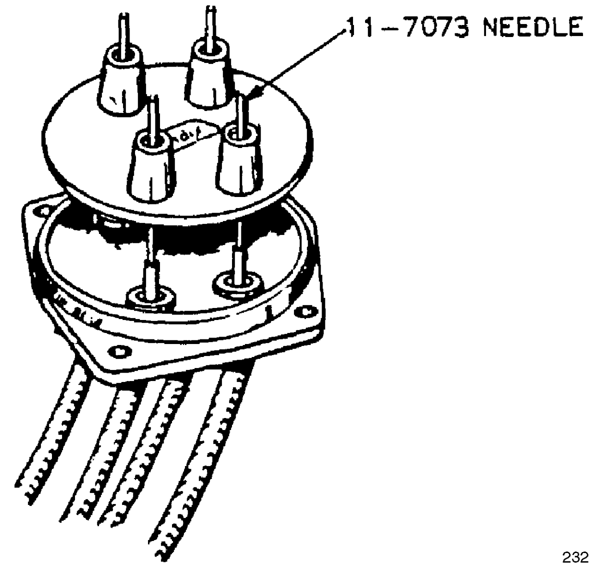
    b. Route ignition wires to their respective cylinders.

    c. Clamp the harness assembly in position.

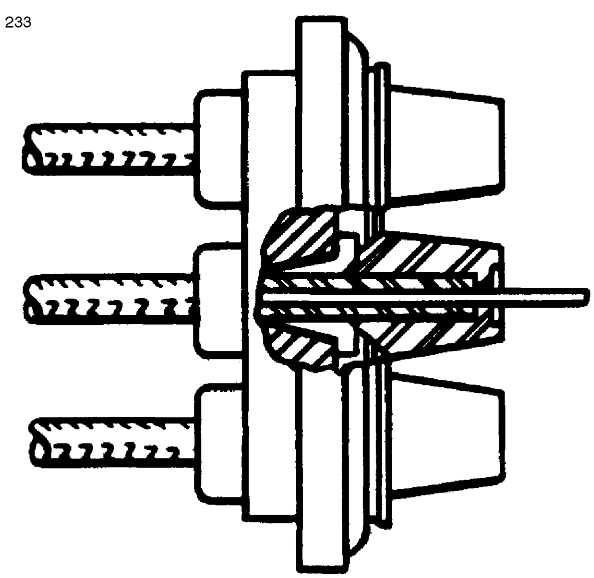
    d. Connect the leads to the spark plugs.



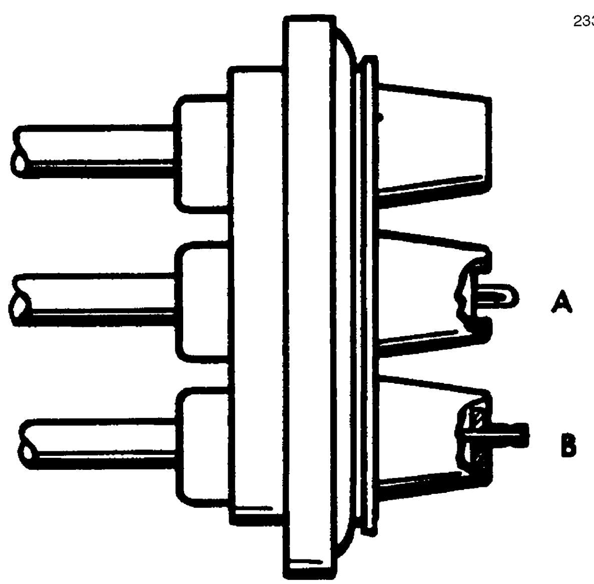
Needle
Figure 25



Installing Grommet Over Lead Assemblies
Figure 26



Lead Assembly Installed in Grommet
Figure 27



Wire Doubled Over For Installation of Eyelet
Figure 28

45. SPARK PLUGS.

46. REMOVAL.

CAUTION: 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 CENTER LINE 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.

a. Loosen the coupling nut on the harness lead and remove the terminal insulator from the spark plug barrel well.

b. 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.

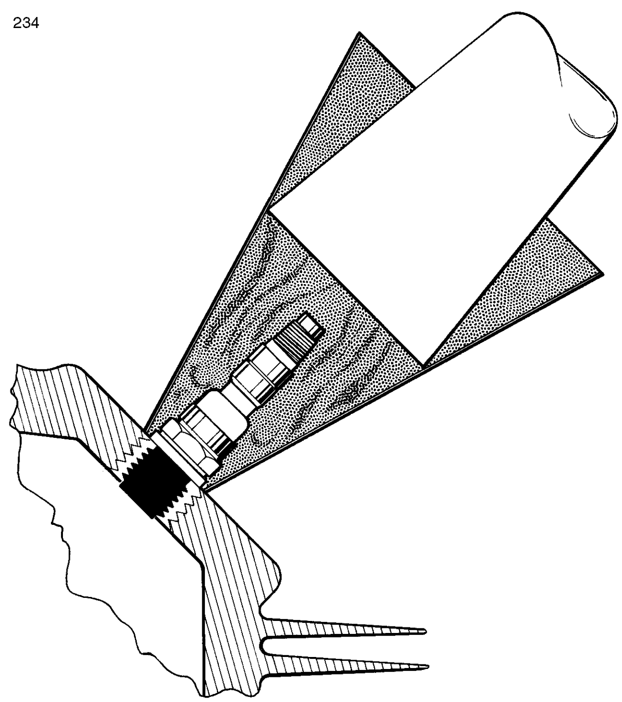
NOTE: Torque indicating handle should not be used for spark plug removal because of the greater torque requirement.

c. Place spark plugs in a tray that will identify their position in the engine as soon as they are removed.

NOTE: Spark plugs should not be used if they have been dropped.

d. 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 CO_2 bottle. (Refer to Figure 29.) 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 CO_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.

e. Do not allow foreign objects to enter the spark plug hole.



Removing Frozen Spark Plug
Figure 29

47. INSPECTION AND CLEANING.

a. Visually inspect each spark plug for the following non-repairable defects:

1. Severely damaged shell or shield threads nicked up, stripped or cross-threaded.
2. Badly battered or rounded shell hexagons.
3. Out-of-round or damaged shielding barrel.
4. Chipped, cracked or broken ceramic insulator portions.
5. Badly eroded electrodes worn to approximately 50% of original size.

b. Clean the spark plug as required, removing carbon and foreign deposits.

c. Set the electrode gap at .015 to .018 inches.

d. Test the spark plug both electrically and for resistance.

48. INSTALLATION. Before installing spark plugs, ascertain that the threads within the cylinder are clean and not damaged.

CAUTION: MAKE CERTAIN THE DEEP SOCKET IS PROPERLY SEATED ON THE SPARK PLUG HEXAGON AS DAMAGE TO THE PLUG COULD RESULT IF THE WRENCH IS COCKED TO ONE SIDE WHEN PRESSURE IS APPLIED.

a. Apply anti-seize compound sparingly on the threads and install gasket and spark plugs. Torque 360 to 420 inch pounds.

b. Carefully insert the terminal insulator in the spark plug and tighten the coupling unit.

49. LUBRICATION SYSTEM.

50. OIL PRESSURE RELIEF VALVE.

The function of the oil pressure relief valve, which is located between the upper right engine mounting lug and No. 3 cylinder, is to maintain engine oil pressure within specified limits by withdrawing a portion of the oil from the circulating system and returning the oil to the sump should the pressure become excessive. This valve is not adjustable; however, particles of metal or other foreign matter lodged between ball and seat will result in a drop in oil pressure. It is advisable, therefore, to disassemble, inspect and clean the relief valve if excessive pressure fluctuations are noted.

The oil pressure relief valve is by no means to be confused with the oil cooler bypass which is located on the oil pressure screen housing mounting pad. The sole purpose of the bypass valve is to serve as a safety measure, permitting pressure oil to bypass the oil cooler entirely in case of an obstruction within the cooler.

51. OIL SCREENS AND FILTERS. Instructions for cleaning and inspecting oil screens and filters can be found in Section II of this manual.

52. EXHAUST SYSTEM 25 HOUR INSPECTION.

NOTE: Installation of Kit No. 760-764v relieves this requirement, as well as the requirements of AD 73-14-2.

NOTE: In serial numbers 34-7250001 thru 34-7250214 only, either Kit No. 760-607 or 760-611 (see Piper Service Spares Letter No. SP-318) must be installed before Kit No. 760-764v, above, can be installed.

In serial numbers 34-7250001 thru 34-7350342 only, for those airplanes which have not installed Kit No. 760-764v; each 25 hours:

a. Remove the 96500-34 and 96500-35 Nose Cowlings, open the cowl doors (on both engines) and inspect the exhaust system (tubes and shrouds) on both engines for evidence of cracking using a four power (4X) glass with 100 watt light and inspection mirror, giving special attention to welds, angles, bends and crossover tube expansion joints. See Figure 30 for inspection areas. If no cracks are found, make appropriate log book entry.

b. If cracks are detected, replacement is recommended, either the entire exhaust stack assembly or the individual component part, as applicable. See Parts Catalog P/N 753-816 for material identification.

c. Repair of the damaged part is also an option. If repair is elected, the procedures specified in the latest revision of FAA AC 43.13-1 apply, using either of the following two methods.

   (1) Heliarc

   (2) Gas weld (using type 347 wire rod).

d. Make appropriate logbook entry upon completion of inspection, and replacement or repair, as appropriate.

53. HEAT EXCHANGER 100 HOUR INSPECTION.

In serial numbers 34-7350343 through 34-7450220, and in serial numbers 34-7250001 thru 34-7350342 with Kit No. 760-764v installed; beginning at 1000 hours time-in-service and each 100 hours thereafter:

a. Remove left and right engine cowlings.

b. Remove coupling at inlet end of tailpipe, disconnect supports at opposite ends and remove tailpipes.

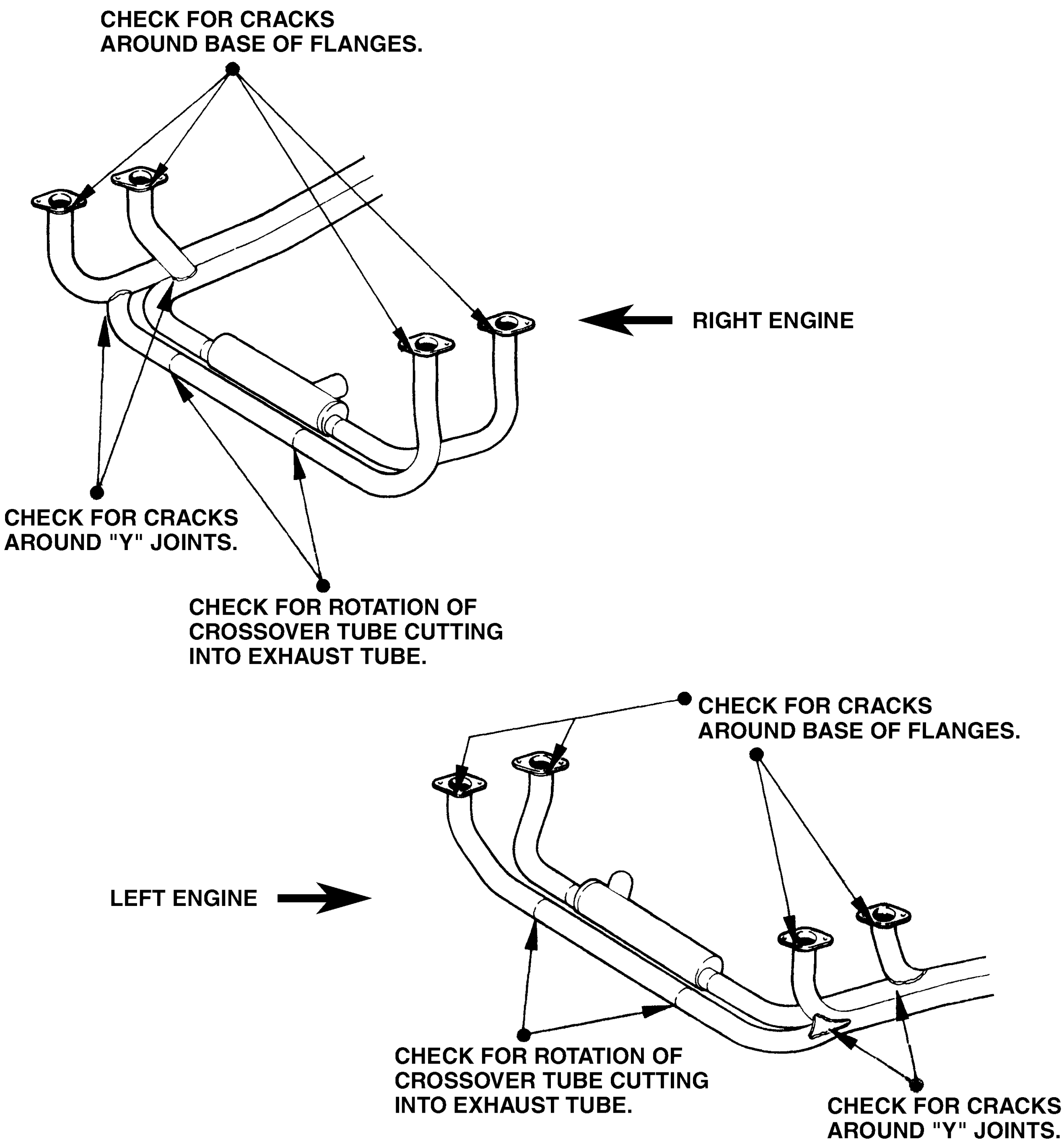
c. The exhaust system features heat exchangers at the inlet port of each exhaust tailpipe to provide cabin heat. The heat exchanger consists of a perforated baffle tube assembly with a cone-shaped deflector attached to its inlet end.

   (1) Drill a .50 inch diameter hole in the center tip of each cone shaped deflector.

   (2) In order to simplify this procedure fabricate a drill guide of phenolic or wood approximately 2.40 inches in diameter and approximately one (1) inch thick. A suitably sized pilot hole should be made in the center of the guide so that a pilot hole can be made in each cone shaped deflector. Enlarge the holes accordingly until the final .50 inch diameter holes have been drilled into the cone shaped deflectors.

d. Through the .50 inch diameter holes borescope each heat exchanger, if there are any signs of cracking or buckling in the baffled tube assembly, deflector or welds, the tailpipe must be replaced before further flight.

e. Make appropriate logbook entry upon completion of inspection, and replacement of tailpipe, as appropriate.



Effectivity
See Paragraph 52

Exhaust System 25 Hour Inspection
Figure 30

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GRIDS 3E6 THRU 3E24
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SECTION

IX

FUEL SYSTEM

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SECTION IX

LIST OF EFFECTIVE PAGES

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SECTION IX - FUEL SYSTEM

TABLE OF CONTENTS

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FUEL SYSTEM

1. INTRODUCTION. The fuel system components covered in this section consist of fuel tanks, fuel selector valves, gascolator and electric fuel pumps. Each wing contains interconnected aluminum inboard and outboard fuel tanks, having a combined capacity of 49 U.S. gallons, for a total capacity of 98 U.S. gallons.

   This section also provides instructions for removal, repair, cleaning, reassembly and testing of repairable components of the fuel system. A troubleshooting chart to assist in isolating and correcting troubles which may occur is also included.

2. DESCRIPTION. An independent fuel system is incorporated into each wing permitting each engine to operate from its own fuel supply. However, the two systems are interconnected by means of a crossfeed that will permit fuel from one set of tanks to be drawn by the opposite engine in the event of an emergency.

   Fuel tanks form an integral part of the wing surface when installed. The inboard and outboard fuel tanks in each wing are interconnected allowing fuel from the outboard tank to flow into the inboard tank as the fuel from the inboard tank is being consumed.

   Fuel pressure and fuel flow for each system are indicated on their respective gauges located in the instrument panel. A fuel quantity gauge for each system, also located in the instrument panel, indicates the amount of fuel remaining as transmitted by electric fuel quantity sending units located in the wing tanks.

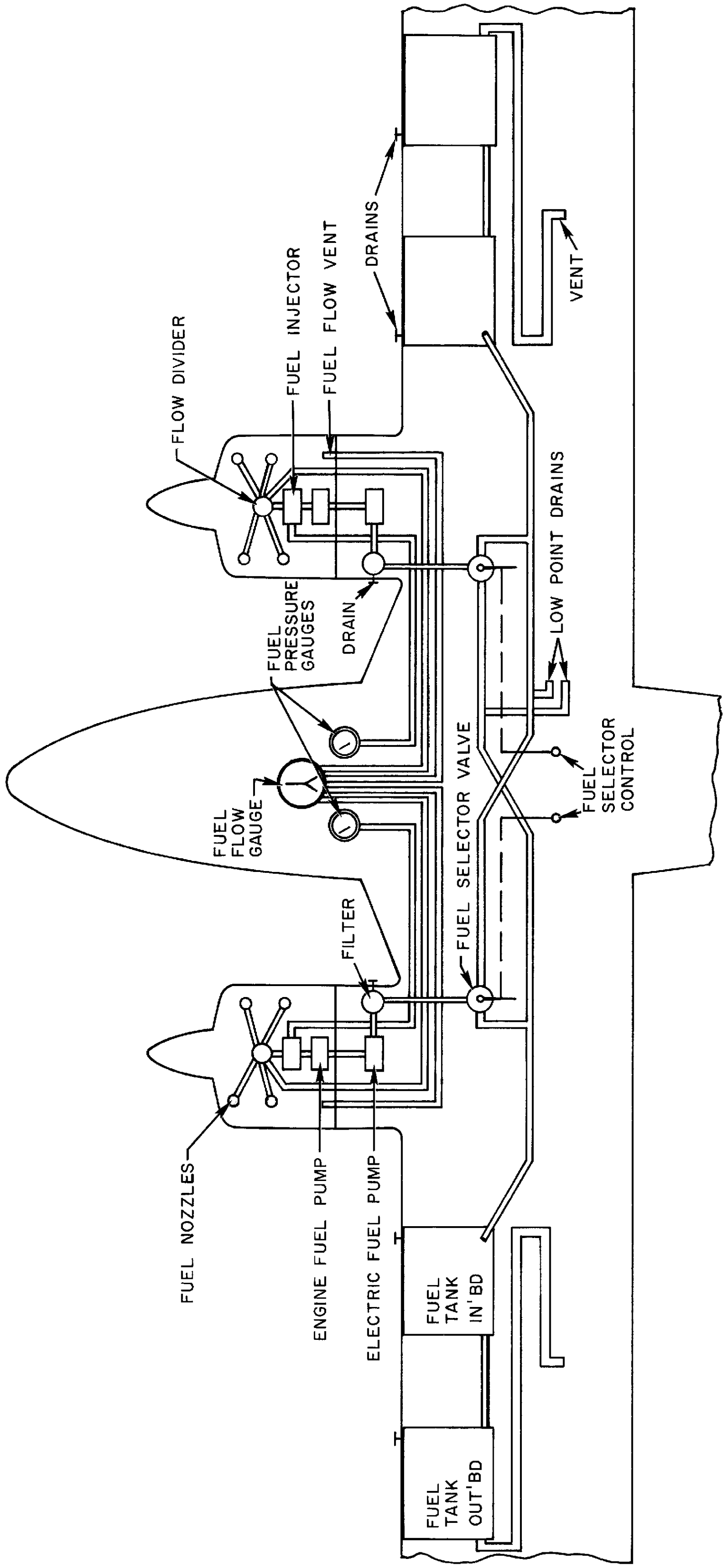
   Fuel for each engine is drawn through a finger screen located in the inboard fuel tank to a selector valve. From the selector valve, the fuel goes through a gascolator (fuel filter) to the electric pump and into the engine driven pump which forces the fuel through the injector unit.

   An anti-icing additive (MIL-I-27686) has been approved for use in the PA-34-200. Refer to Section II of this manual for usage instructions and CAUTIONS to be observed.

3. TROUBLESHOOTING. Table I, below, lists troubles which may occur in the mechanical or electrical portions of the fuel system, the probable cause and a suggested remedy. When troubleshooting, first check from the fuel supply or power source to the item affected. If the suggested remedy does not eliminate the problem, the trouble probably exists inside the component involved. It will then be necessary to remove the defective component for repair, or replace it with an identical serviceable unit.

TABLE I
TROUBLESHOOTING FUEL SYSTEM

Trouble	Cause	Remedy
Failure of fuel to flow.	Fuel line blocked.	Flush fuel system.
	Fuel vent cap blocked.	Check and clean vent hole in cap.
	Mechanical or electrical fuel pump failure.	Check and replace if necessary.
	Fuel selector valve in improper position.	Reposition as required.
		Check for obstructions in the fuel selector leverage mechanism.
		Check fuel selector cable for freedom of movement.
	Damaged fuel selector valve.	Replace fuel selector valve.
Fuel quantity gauge fails to operate.	Broken wire.	Check and repair.
	Gauge inoperative.	Replace gauge.
	Fuel sender float partially or completely filled with fuel.	Replace sender
	Circuit breaker open	Check and reset.
	Float and arm assembly of fuel sender sticking.	Check.
	Bad ground	Check for good contact at ground lip or rear of gauge.
No fuel pressure indication.	Fuel selector valve stuck.	Check fuel selector valve.
	Fuel tanks empty.	Check fuel tanks and fill.
	Defective gauge.	Replace gauge.
	Fuel selector valve in improper position.	Reposition fuel selector valve lever.
Low pressure or pressure surges.	Obstruction in inlet side of pump.	Trace lines and locate obstruction.
	Faulty diaphragm in pump.	Rebuild or replace pump.
	Air in line to pressure gauge.	Bleed line.



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Fuel System Installation
Figure 1

4. FUEL TANKS.

5. INSPECTION AND REPAIR. Fuel tanks should be completely drained before inspection. (Refer to Draining Fuel System, Section II.) Each tank should be carefully inspected for signs of leaks as indicated by telltale stains. In the event a fuel leak is detected, the fuel tank must be removed as explained below, and repaired as follows.

WARNING: SLOSHING OF FUEL TANKS IS PROHIBITED.

a. If the tank being inspected has previously been sloshed, the interior of the tank should be inspected for signs of peeling or chipping sealer. Particular attention should be given the area around the filler neck (outboard tank only) as a result of the metal nozzle of the gas filler hose nicking the sealer. This inspection can best be accomplished using a mirror and inspection light through the filler neck. If peeling and/or chipping has occurred and separated material is found, the sloshing material must be completely removed or tank replaced.

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

c. After leak repairs, test the integrity of the repair using a water and soap solution and apply 1.5 pounds of air pressure.

NOTE: Replace the fuel tank if it cannot be successfully repaired by above procedures.

6. INBOARD FUEL TANK.

6a. REMOVAL.

a. Locate and remove cover from access hole located on underside of wing between wing sta. 138 and wing sta. 161.

b. With fuel completely drained from tank, loosen clamps on hose connections on fuel line and fuel vent line and slide hose connections away from fuel tank.

c. 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.

d. The tank is now free to be removed.

7. INSTALLATION.

a. 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.

b. Using access hole located on underside of wing, slide hose on interconnecting fuel line and fuel vent line into position and tighten clamps. (Refer to Figure 2.)

c. Fill fuel tanks and check for leaks, unrestricted fuel flow, accurate sender indications on fuel quantity gauge, and that ground wire is securely attached to interconnecting fuel line, fuel vent line and wing rib at wing sta. 138.

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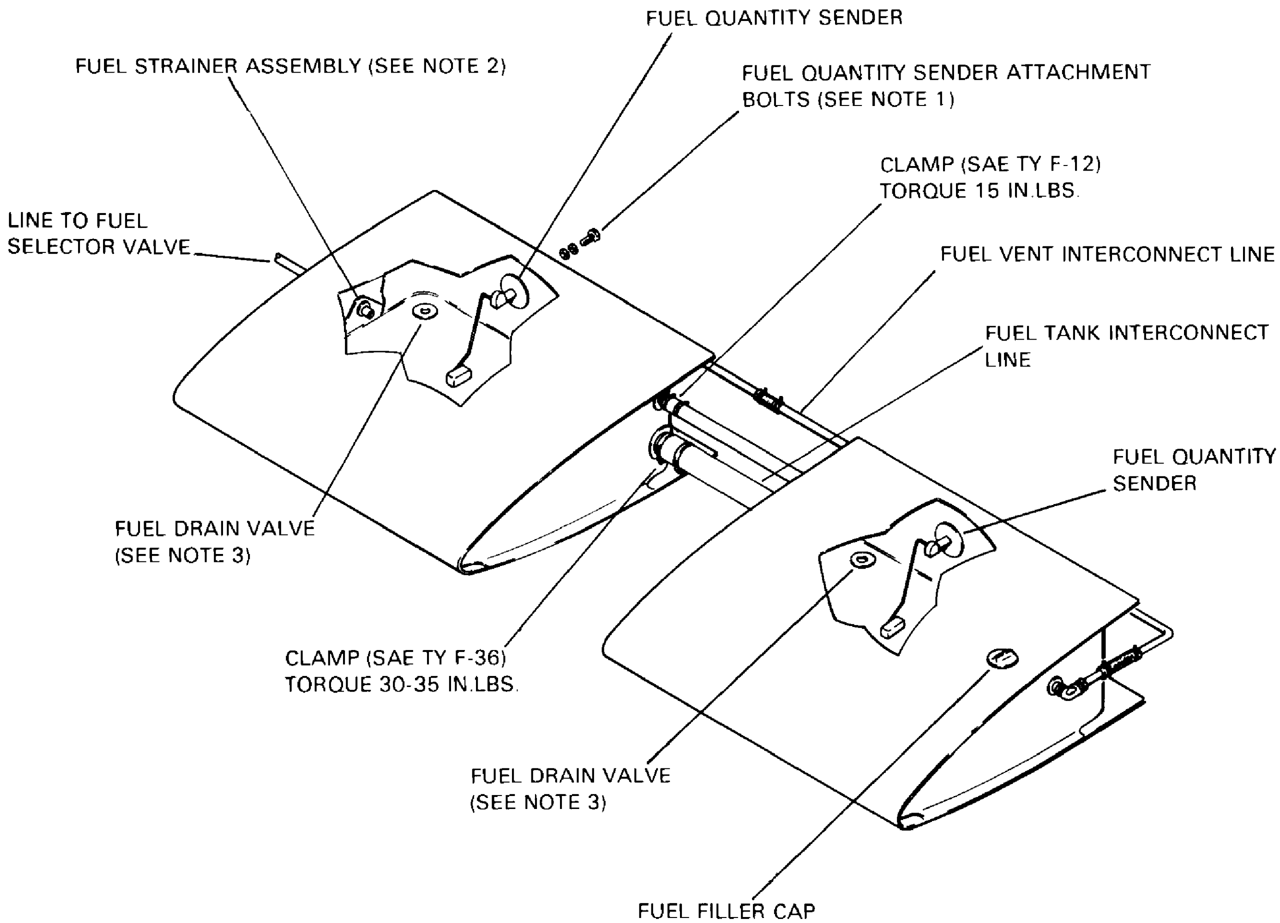


NOTES:

1. Apply Lubon #404 very sparingly to screw threads only. Torque bolts 20-25 IN.LBS.
2. Apply Tite Seal #3 or Lubon #404 to all male pipe threads. Do not allow sealant to enter system.
3. When installing drain valve, apply thread lube (Fleet Supplies, Inc.) to male pipe thread. Do not allow to enter system.

Fuel Tank Installation
Figure 2

8. OUTBOARD FUEL TANK.

8a. REMOVAL.

a. Using the same access hole described in Inboard Fuel Tank - Removal, above, and with fuel completely drained from the tank, loosen clamps on hose connections on fuel line and fuel vent line. Slide hose connections away from fuel tank.

b. 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.

c. The tank is now free to be removed.

NOTE: If the interconnecting fuel line and fuel vent line are being removed, first disconnect the ground wire attached to the rib at wing sta. 138.

9. INSTALLATION.

a. 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.

b. Using access hole located on underside of wing, slide hose on interconnecting fuel vent line into position and tighten clamps. (Refer to Figure 2.)

c. Slide hose connection on interconnecting fuel line into position and tighten clamps. (See Figure 2.)

d. Fill the fuel tank and check for leaks and unrestricted fuel flow, accurate sender indications on fuel quantity gauge, and that ground wire is securely attached to interconnecting fuel line, fuel vent line and wing rib at wing sta. 138.

10. INSPECTION OF FUEL SYSTEM. Fill tanks with fuel. Inspect tanks and fuel line connections for leaks. If fuel tanks leak, follow instructions given in paragraph 5. If fuel line connections leak, tighten clamps or replace hose connections after first draining tanks.

10a. FUEL TANK VENT OBSTRUCTION TEST. Perform this test whenever an outboard fuel tank has been removed and reinstalled and/or any portion of the fuel tank vent line or its inter-connects have been removed/replaced or disconnected/reconnected.

a. Remove the fuel cap. Install a short piece of 1/4 inch I.D. hose over the external tank vent located just aft of the outboard corner of the inboard tank. Assure that the ice hole (aft side of the vent tube) is covered by the hose.

b. Determination that the fuel vent line is free from obstruction can be made by placing the hose in the mouth and blowing through the hose. There will be no difficulty in blowing through the hose if the vent line is free from obstruction. Should there be no hose available, the same determination can be made by blowing directly into the end of the vent line.

c. If the test reveals that the fuel vent is clear, no further action is required; remove hose, install fuel cap and make appropriate log book entry.

d. If there is difficulty in blowing through the vent line during the check described in paragraph b, above, check those portions of the vent system which have been most recently removed/replaced or disconnected/reconnected for obstructions such as plugs which were not removed or other foreign objects in the ends of the lines/connections.

11. FUEL QUANTITY SENDER UNIT.

NOTE: Inboard and outboard fuel tanks in each wing are interconnected and have a total capacity of 49.00 gallons. Fuel quantity sender units mounted in each fuel tank transmit electrically the cumulative quantity of fuel in each set of tanks, to fuel quantity gauges mounted in the instrument panel.

12. FUEL QUANTITY SENDER/GAUGE CHECK (Installed). Fuel quantity sender units and fuel quantity gauges can be checked while mounted in the airplane by using the following procedure:

a. Put the fuel selector levers in the "OFF" position. Completely drain fuel tanks that relate to the fuel quantity sender and gauge to be checked. (Refer to Draining Fuel System, Section II.)

b. Level airplane laterally, (Refer to Leveling, Section II) and position the aircraft with a 1° nose up attitude.

NOTE: The electrical system should supply 12 to 14 volts to the gauge.

c. With the master switch in the "OFF" position, the gauge needle should be centered on the white dot to the left of the "O" radial mark, with a maximum deviation of 1/4 needle-width. If not within this tolerance the gauge should be replaced.

d. With the master switch in the "ON" position, and no fuel in the tanks, the gauge needle should be centered on the white dot to the left of the "O" radial mark, with a maximum deviation of 1/4 needle-width. If not within this tolerance the gauge should be replaced.

e. Place 2-1/2 gallons of fuel in the wing fuel tank that relates to the gauge and sender unit being checked.

Table II
SENDER/FUEL QUANTITY GAUGE TOLERANCES

Actual Fuel in Tank (U.S. Gallons)	Gauge Reading * (U.S. Gallons)
49 FULL	F
42.5	40
32.5	30
22.5	23
12.5	10
2.5	Not More Than Zero
0 EMPTY	White Dot

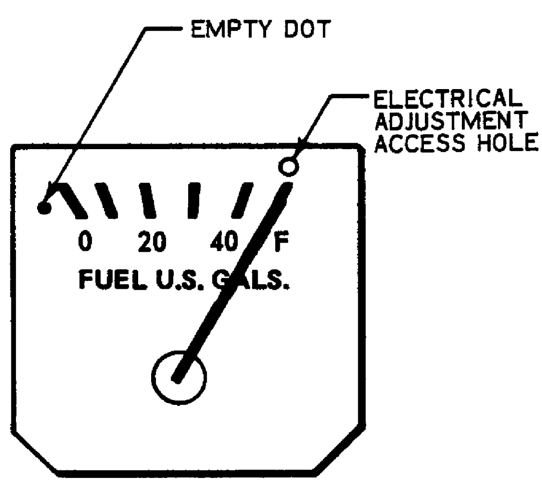
* ± 1 needle-width

f. With 12 to 14 volts DC supplied to the electrical system and the master switch in the "ON" position, the needle should be centered on the "O" radial mark - plus O, minus 1 needle-width.

g. If the needle does not read within the above tolerance, remove the sender wire from the rear of the gauge, and check the resistance to ground through the sender circuit. If the resistance is not within 5 ± 1 ohms, replace the inboard sender. Then recheck as specified above.

h. Add fuel to the tanks in accordance with the information given in Table II, until tanks are full. Observe the gauge reading at each 10 gallon increment.

i. With the tanks full and master switch ON, the needle should be centered on the "F" radial mark within ± 1 needle-width. If not within this tolerance adjust the electrical adjustment (Refer to Figure 3) just sufficiently to bring it within tolerance - do not center the needle.



Fuel Gauge
Figure 3

13. GASCOLATOR. (Refer to Figure 4.)

    NOTE: The gascolator should be inspected at periodic intervals as explained in Section II, Servicing Fuel System.

14. REMOVAL.

    a. Determine that fuel selector valve lever is in the off position. Remove cowling necessary to gain access to the gascolator.

    b. Drain remaining fuel from gascolator by opening drain valve located on the bottom of the bowl assembly.

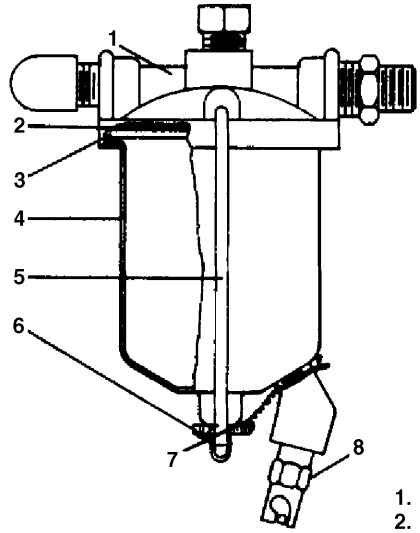
    c. Cut safety wire and loosen bail nut. Pivot bail wire to one side and remove strainer bowl from strainer cover.

       NOTE: If screen and gasket do not fall free from strainer cover, remove plug from top of cover and using a blunt object, gently prod the screen until it falls free from cover.

15. CLEANING.

    a. Clean screen and bowl thoroughly using acetone or other suitable dry type cleaning solvent. Dry using a light blast of compressed air. Replace screen if any signs of damage or deterioration are evident.

    b. Discard gasket and replace it with a new one at reassembly.



1. BODY
2. SCREEN
3. GASKET
4. BOWL
5. BAIL WIRE
6. BAIL NUT
7. WIRE, SAFETY
8. DRAIN, FITTING

Gascolator
Figure 4

16. REASSEMBLY.

    a. Place screen and new gasket on top flange of bowl assembly. Carefully insert bowl, screen and gasket into the recess in the strainer cover.

    b. Reposition bail wire and tighten bail nut as follows: Tighten hand tight and then tighten one nut flat with a wrench.

    c. Safety bail nut to adjacent drain valve elbow.

    d. Determine that the drain valve on the bowl is closed and place the fuel selector valve lever in the desired position. Replace cowling.

17. FUEL Selector Valve.

CAUTION: NO FIELD DISASSEMBLY OR REPAIR OF FUEL SELECTOR VALVES IS AUTHORIZED. MAINTENANCE IS LIMITED TO REMOVAL AND REPLACEMENT OF THE WHOLE UNIT.

18. REMOVAL.

a. The fuel selector valve need not be removed unless any of the following conditions exist:

1. Failure of selector lever to seat in detent.
2. Signs of leakage.
3. Difficulty in moving fuel selector lever.

b. In the event it is necessary to remove the fuel selector valve, remove access plate located forward of the main spar on the underside of the wing, and outboard of the nacelle.

c. Drain appropriate fuel tank. (Refer to Draining Fuel Tank, Section II.)

d. Disconnect control cable from valve selector lever. Disconnect fuel lines and mounting hardware, and remove fuel selector valve.

19. LEAK TEST.

a. Connect the inlet port of the valve assembly to a 25 psi air source.

b. Plug the right hand port and close the left hand port by placing the control lever to the right.

c. Apply pressure to 25 psi. There shall be no evidence of leakage either through the port or around the fitting and lever when submerged in kerosene or a similar petroleum base fluid for 30 seconds.

d. Depressurize, remove the plug from the right hand port, place on left hand port and close right hand port by placing the lever to left.

e. Repeat step c.

f. Disconnect and wipe fluid from exterior.

20. INSTALLATION.

a. Position fuel selector valve and install mounting hardware.

b. Connect fuel lines.

c. Connect control cable to valve selector lever.

21. CLEANING FUEL SYSTEM.

a. To flush fuel tank and selector valve, disconnect the fuel line from the injector.

b. Select a fuel tank, turn on the electric pump and flush fuel through the system until the tank is empty. Agitation of the fuel within the tank during this operation will help pick up and remove dirt and other foreign matter from the fuel tank and selector valve.

c. Repeat this procedure for each fuel tank.

d. When all tanks are flushed, clean gascolator and fuel tank finger screens.

22. ELECTRIC FUEL PUMP.

23. REMOVAL AND INSTALLATION. There is one electric rotary vane type fuel pump for each engine. The pump is mounted in a bracket on the aft side of the firewall. To remove pump, proceed as follows:

    a. Remove rectangular hatch assembly located on the top of the nacelle, aft of the firewall.

    b. Remove fuel line and nut from forward side of firewall. Remove fuel line between pump and filter.

    c. Remove top strap holding pump in position and withdraw pump through hatch opening.

    d. Do not attempt to disassemble or repair fuel pump. If fuel pump proves to be defective it should be replaced.

    e. Reinstall pump in reverse order of removal.

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GRIDS 3F18 THRU 3F24
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SECTION

X

INSTRUMENTS

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SECTION X

LIST OF EFFECTIVE PAGES

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SECTION X - INSTRUMENTS

TABLE OF CONTENTS

SECTION X - INSTRUMENTS

TABLE OF CONTENTS (cont.)

SECTION X - INSTRUMENTS

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INSTRUMENTS

1. GENERAL. The instrumentation in the Seneca is designed to give a quick and actual indication of the attitude, performance and condition of the airplane. Maintenance, other than described herein shall be done by the instrument manufacturer or an authorized repair station.

Instruments/Gauges are either face mounted or cluster mounted. Removal and installation instructions for both types are given below.

NOTE: Many of the original equipment engine gauges described herein were manufactured by Stewart Warner or the A.C. Spark Plug Company and are no longer available. See PA-34-200 Parts Catalog, P/N 753-816, for Rochester replacement gauges.

Specific information about each instrument or gauge is presented in separate sections based on how the specific instrument/gauge is driven - i. e. - non-electrical and electrical. Each section contains maintenance and troubleshooting information for the instruments and their associated systems, as applicable.

1a. REMOVAL AND INSTALLATION OF FACE MOUNTED INSTRUMENTS.

Special care should be taken when any operation pertaining to the instruments is performed.

NOTE: Tag instrument connections for ease of installation.

a. Remove the face panel.

b. With the face panel removed, the mounting screws for the individual instruments will be exposed. Remove the connections to the instrument prior to removing the mounting screws of the instrument to be removed.

CAUTION: DO NOT USE THREAD LUBE OR PIPE DOPE ON FITTINGS OR IN PORTS. SUCH SUBSTANCES CAN CAUSE CONTAMINATION WHICH SHORTENS THE LIFE EXPECTANCY OF THE GYRO AND CAN CAUSE PREMATURE FAILURES. ANY EVIDENCE OF THREAD LUBE WILL VOID THE WARRANTY. MAKE SURE THAT ALL VACUUM LINES ARE CLEAN AND FREE OF FOREIGN PARTICLES AND/OR RESIDUE BEFORE CONNECTING LINES TO GYRO INSTRUMENTS.

NOTE: Use of LPS Heavy-Duty Silicone Lubricant (P/N 197-510) is permissable on the threads of male fittings only. The LPS lubricant must be allowed to dry before installation and care must be taken during application to ensure lubricant does not enter fitting passage or lines.

c. Install instruments in the reverse of removal. After the installation is completed and before replacing the instrument face panel, check all components for security and clearance of the control column.

1b. REMOVAL AND INSTALLATION OF CLUSTER MOUNTED INSTRUMENTS.

a. Remove the face panel by springing the plastic material from the channels.

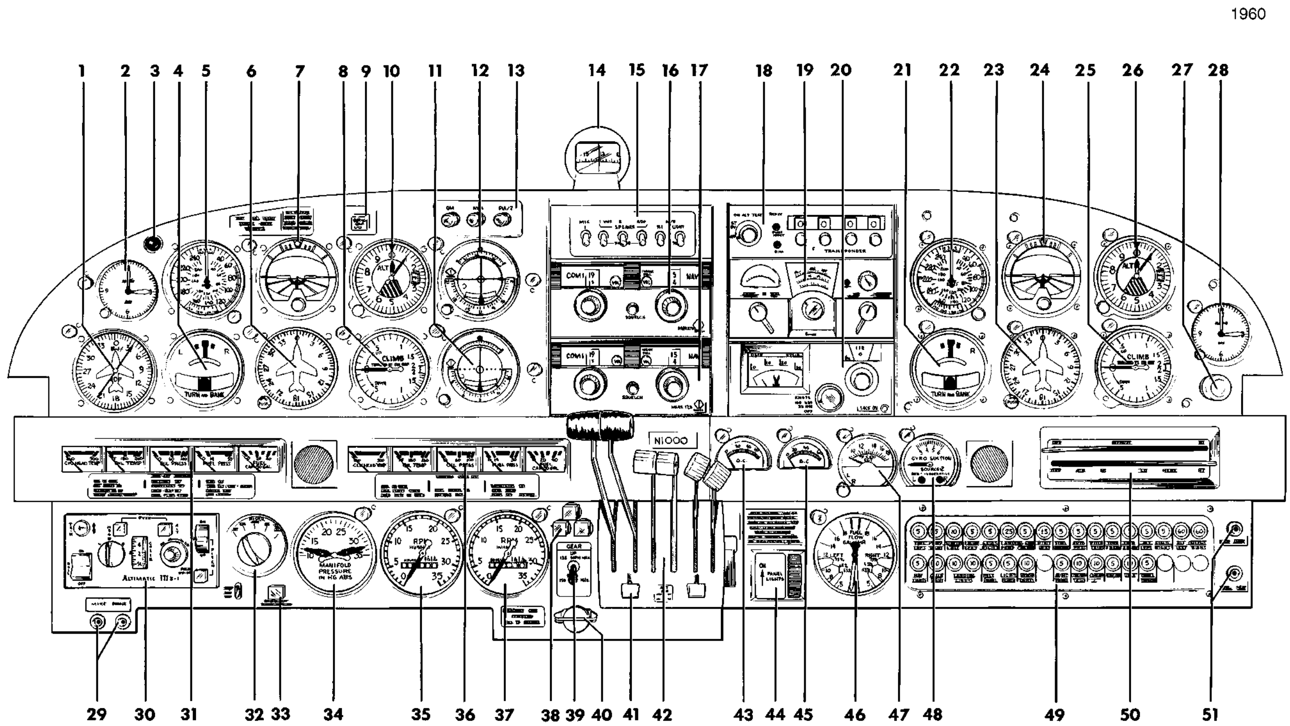
b. With the face panel held in a vertical position the screws securing the clusters are accessible. Remove the screws and the lens of the cluster to be repaired.

c. Remove the plastic light seals adjacent to the instrument to be replaced.

d. Remove the wires or tube to the instrument. Tag wires so they can be returned to the same terminal on the replacement instrument.

e. Remove nuts and insulating washers on electrical instruments, then move instrument aft. Mechanical instruments have only one large nut and lock washer.

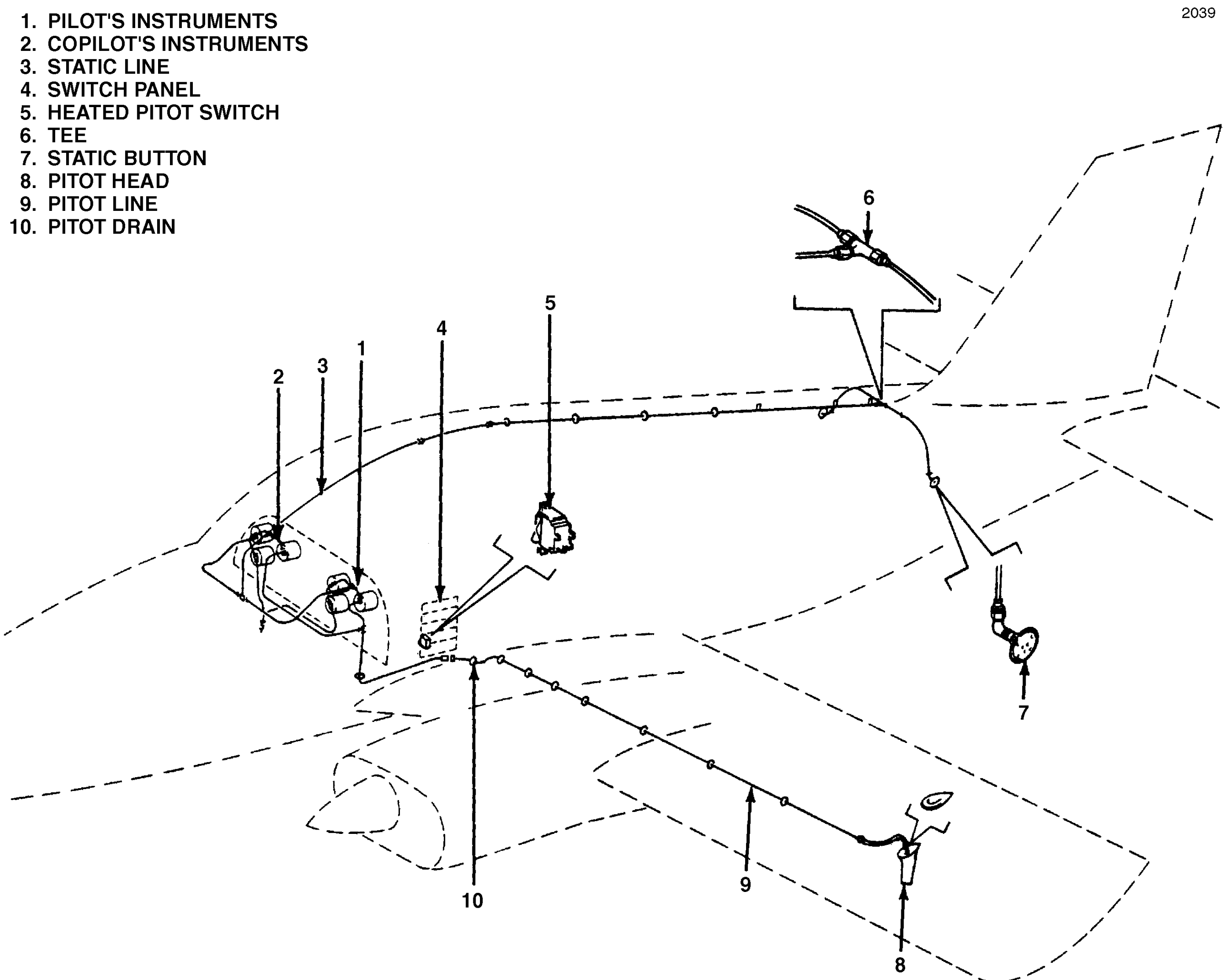
f. Reinstall instrument in the reverse order of removal. Check all mountings and connections for security.



1. ADF INDICATOR
2. CLOCK
3. STALL WARNING LIGHT
4. TURN AND BANK INDICATOR
5. AIRSPEED INDICATOR
6. DIRECTIONAL GYRO
7. ATTITUDE GYRO
8. VERTICAL SPEED INDICATOR
9. GEAR UNSAFE LIGHT
10. ALTIMETER
11. OMNI INDICATORS
12. OMNI AND GLIDE SLOPE INDICATORS
13. MARKER BEACON RECEIVER LIGHTS
14. MAGNETIC COMPASS
15. AUDIO CONTROL PANEL
16. NAV/COM TRANSCEIVER (NO. 1)
17. NAV/COM TRANSCEIVER (NO. 2)
18. TRANSPONDER
19. ADF RECEIVER
20. DME CONTROL AND INDICATOR
21. TURN AND BANK INDICATOR (COPILOT)
22. AIRSPEED INDICATOR (COPILOT)
23. DIRECTIONAL GYRO (COPILOT)
24. ATTITUDE GYRO (COPILOT)
25. VERTICAL SPEED INDICATOR (COPILOT)
26. ALTIMETER (COPILOT)
27. CIGAR LIGHTER
28. CLOCK (COPILOT)
29. MIKE AND PHONE JACKS
30. ALTIMATIC IIIB-1 AUTOPILOT
31. ENGINE AND FUEL INSTRUMENT CLUSTER - LEFT
32. OMNI-COUPLER
33. PITCH TRIM
34. MANIFOLD PRESSURE GAUGE
35. TACHOMETER - LEFT ENGIINE
36. ENGINE AND FUEL INSTRUMENT CLUSTER - RIGHT
37. TACHOMETER - RIGHT ENGINE
38. LANDING GEAR DOWN LIGHTS
39. LANDING GEAR SELECTOR
40. EMERGENCY LANDING GEAR EXTENSION KNOB (FREE FALL VALVE CONTROL)
41. ALTERNATE AIR CONTROL
42. CONTROL QUADRANT
43. AMP METER - LEFT
44. PANEL LIGHT SWITCH
45. AMP METER - RIGHT
46. FUEL FLOW AND PRESSURE GAUGE
47. EGT GAUGE
48. GYRO SUCTION GAUGE
49. CIRCUIT BREAKER PANEL
50. HEAT AND DEFROST CONTROLS
51. MIKE AND PHONE JACKS (COPILOT)

Instrument Panel
Figure 1

1. PILOT'S INSTRUMENTS
2. COPILOT'S INSTRUMENTS
3. STATIC LINE
4. SWITCH PANEL
5. HEATED PITOT SWITCH
6. TEE
7. STATIC BUTTON
8. PITOT HEAD
9. PITOT LINE
10. PITOT DRAIN



Pitot-Static System Installation
Figure 2

2. NON-ELECTRICAL INSTRUMENTS.
3. VACUUM SYSTEM.
4. GENERAL. The vacuum system employed to operate the gyro instruments is comprised of two engine driven dry vacuum pumps, two vacuum regulator valves, two check valves, and the necessary tubing on each engine. When the dry type vacuum pumps are installed, the need for oil-air separators and the hardware necessary for their installation is eliminated. A vacuum gauge is used to constantly monitor the system. If suction is lost from either vacuum pump or from any other malfunction, the check valves automatically close and vacuum is supplied by one pump. In this case one of two red malfunction buttons appears on the face of the vacuum gauge, indicating that vacuum is not available from that side. Air filters are incorporated in the system to increase the life of the gyros. They are mounted behind the instrument panel in the upper corners of the baggage compartment and should be replaced at each 100 hours of operation.
5. VACUUM SYSTEM SERVICE TIPS. The following information is intended to aid in diagnosing vacuum system service symptoms on those components which are serviced by removal and replacement. These items include hoses, clamps, gyro filters, vacuum regulating valves, and vacuum gauges.

   a. Hoses and Clamps

      1. These items should be examined periodically and inspected carefully whenever maintenance activities cause hose disconnections to be made at the pumps, manifold, regulators, tube assemblies, gyros and/or vacuum gauge.
      2. Ends of hoses should be examined for rubber separation and slivers of rubber on inside diameter of hoses. These slivers can and do become detached. If this happens, the vacuum pump(s) will suck in the loose particles and eventually ingest them. This can cause pump failure.
      3. Replace old, hard, cracked or brittle hose. Sections of the inner layers may separate, causing pump failure.
      4. Ensure hoses are clear and clean by blowing them out with shop air. Remove from aircraft as required.

         CAUTION: DO NOT WIGGLE HOSE FROM SIDE TO SIDE DURING INSTALLATION. WIGGLING COULD CAUSE PARTICLES TO BE CUT FROM INNER WALL OF HOSE WHICH WOULD DAMAGE THE PUMP.

      5. Where hose clearance is tight, making it difficult to reinstall it onto a fitting or barb, spray the fitting or barb with silicone. Let dry, then install hose by pushing it straight on.

         CAUTION: WHEN REPLACING ANY OF THE THREADED FITTINGS, DO NOT USE PIPE DOPE, THREAD LUBE, OR TAPE. PIPE DOPE / TAPE PARTICLES INGESTED BY THE VACUUM PUMP COULD CAUSE THE PUMP TO FAIL. USE ONLY LPS HEAVY DUTY SILCONE LUBRICANT (P/N 197-510), LETTING IT DRY BEFORE ASSEMBLY.

      6. Hose clamps and fittings should be replaced when broken, damaged or corroded.

b. Vacuum Gauges:

NOTE: Vacuum gauge failure in a properly operating vacuum system does not impair safety of flight.

1. Vacuum gauges seldom require service and usually are replaced when malfunctions occur.
2. If the vacuum gauge malfunctions in a manner to cause an incorrect reading in normal cruise conditions, the gauge must be checked by comparing the reading with a gauge of known accuracy. If the gauge is indicating correct values and the system vacuum level is not in accordance with the specified vacuum, then and only then should the regulator be reset.
3. Visual examination of the gauge performance should cover the following steps:
   (a) With engine stopped and no vacuum applied to the gauge, its pointer should rest against the internal stop in the 9 o'clock position. Any other displacement from this position suggests need for replacement.
   (b) A slight overshoot, during engine startup, not to exceed half an inch (1/2") of mercury, is normal and is not cause to replace gauge.
   (c) With engine operating at normal cruise RPM, the gauge should read from 4.9 inches to 5.1 inches of mercury (vacuum).
   (d) At 1200 RPM, the vacuum gauge reading should be more than four inches of mercury.

c. Vacuum Filter(s):

1. Vacuum filter(s) must be serviced on a scheduled basis, not to exceed 100 hours, or sooner as condition indicates.
2. The latest system installation employs a large central filter (two, if optional copilot DG and attitude indicator are installed) and differential vacuum gauge that continuously monitors the filter condition while indicating vacuum readings.

   NOTE: The latest systems which employ a central filter in combination with a differential vacuum gauge will indicate a decline in panel gauge reading when the filter becomes clogged and vacuum declines below the recommended value. The filters should be replaced when gauge reading declines below the recommended value; do not adjust regulator. NEVER ADJUST THE VACUUM REGULATOR WITHOUT FIRST INSTALLING A NEW CLEAN AIR FILTER.

d. Vacuum Regulator:

1. The vacuum regulating valve seldom needs replacement. Symptoms that suggest replacement are:
   (a) Chatter as indicated by rapid fluctuation of the vacuum gauge needle or an audible sound.
   (b) Non-repeatability of the vacuum gauge reading when the panel gauge is not suspect or has been checked against a known test gauge (cruise RPM only).
2. All modes of regulator malfunction tend to increase the vacuum power applied to the gyros. Thus, although excess vacuum is applied a loss of vacuum does not occur.
3. The gyros themselves act as a limiting device to keep the vacuum power applied from exceeding safe levels.

   NOTE: If the panel gauge has been checked and found OK and the vacuum gauge reading does not repeat within the 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 service.

6. VACUUM (SUCTION) GAUGE.

7. GENERAL. The suction gauge is mounted to the left of the right control column. This gauge is calibrated in inches of mercury and indicates the differential pressure across the pilot's attitude gyro. As the system becomes clogged or lines obstructed, the gauge will show a decrease in pressure. Do not reset the regulator until the filter and line have been checked. The gauge also has two red malfunction indicator buttons. Whenever vacuum is not available from one of the vacuum sources, the appropriate red button appears at the face of the gauge.

8. PITOT-STATIC SYSTEM. Pitot pressure for the airspeed indicator is sensed by the pitot mast mounted under the left wing. Static pressure for the altimeter, vertical speed and airspeed indicators is sensed by two static pressure units, one located on each side of the rear part of the fuselage.

An alternate static source control valve is located below the instrument panel, to the right of the power quadrant. If one or more of the pitot-static instruments malfunctions, these pressure systems should be checked for leaks, dirt or water. If moisture is present, the static system can be drained by turning on the alternate static system. The selector valve is located at the low point of the system. Another drain is provided in the lower left front side panel to drain moisture from the pressure line running between the pitot mast and the instrument.

NOTE: When any connections in the static system are opened for checking, system must be rechecked per FAR 23.1325.

8a. VACUUM FILTER(S). One or two central air filters are installed in the vacuum system of these airplanes. The filter on the aft, left, side of the frame assembly at F.S. 49.5 supports the pilot's Directiona Gyro and Attitude Indicator. If installed, the filter on the aft, right, side of the frame assembly at F.S. 49.5 supports the co-pilot's Directiona Gyro and Attitude Indicator. Removal and installation instructions are the same for both filters.

NOTE: The filter(s) should be cleaned or the replaced, as required, at each 100 hour inspection. Refer to Parts Catalog, P/N 753-816, for correct part number.

NOTE: The filter(s) should be replaced on condition when vacuum gauge readings decline below the recommended value; do not adjust regulator. NEVER ADJUST THE VACUUM REGULATOR WITHOUT FIRST INSTALLING A NEW CLEAN AIR FILTER.

a. Removal:

1 Remove the trim access panel from the aft wall of the nose baggage compartment.

2. Disconnect the hose clamps and remove the hose from the filter.

3. Remove the nut and lock washer from the forward side of the frame assembly, and remove the filters.

b. Installation:

1 Place the filter in the same position as it was prior to removal and secure with the lock washer and nut. Be sure that the bushing is properly installed. The nut and lock washer are installed through the forward baggage compartment.

2. Connect the hoses to the filter and secure with hose clamp.

3. Install and secure the trim panels previously removed.

9. VACUUM REGULATORS.

10. GENERAL. Two vacuum regulator valves are incorporated in the system to control vacuum pressure to the gyro instruments. A manifold check valve assembly assures vacuum if one engine or pump should fail.

11. ADJUSTING. (See Figure 3.)

NOTE: Do not reset the regulator until the filter and lines have been checked

a. Remove nacelle cover(s), remove safety from adjustment check nut and loosen check nut.

b. Adjust regulator screw in accordance with the direction desired, tighten check nut and run engine to check results.

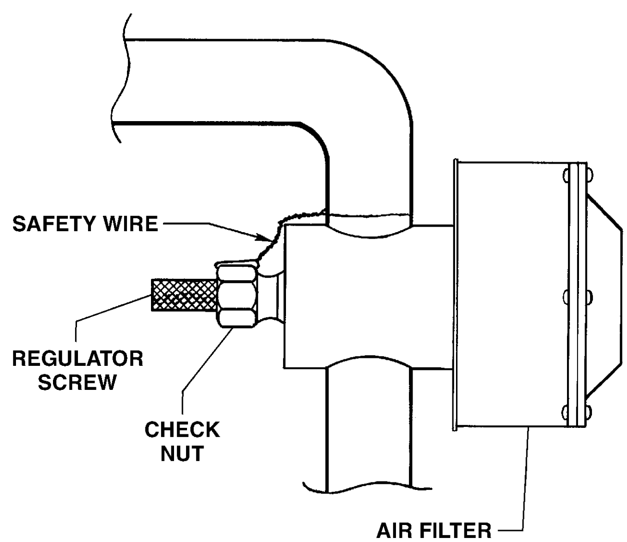
NOTE: The vacuum indication on ground with one engine at a time running at 2000 RPM or more should be within .1 IN. Hg. of each other. Vacuum with both engines operating 2700 RPM should not exceed 5.2 IN. HG. When dual flight instruments are installed, the individual vacuum regulators should be checked at 2700 RPM.

c. When the recommended vacuum indications are attained, tighten the check nuts and resafety, restore aircraft to airworthy condition.

12. REMOVAL AND INSTALLATION.

a. To remove the regulator valve, disconnect the three lines, remove the mounting screws and remove the valve.

b. Replace regulator in reverse order given for removal. Check complete vacuum system for proper operation.



Vacuum Regulator
Figure 3

13. VACUUM PUMP.

14. GENERAL. The vacuum pump is of the rotary vane, positive displacement dry type. This unit consists essentially 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. A pump is mounted on the accessory section of each engine. The pumps differ to account for engine rotation, the starboard engine gets a clockwise pump, the port engine gets a counterclockwise pump.

14a. INSPECTION. (See Figure 4.)

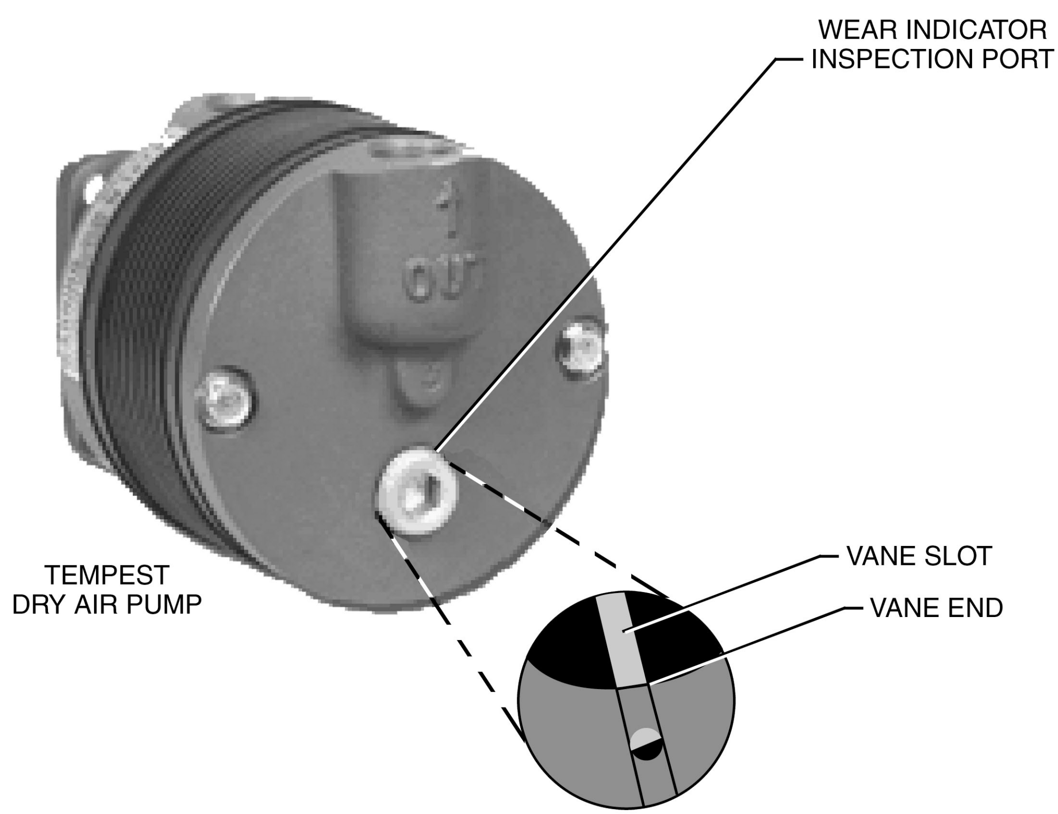
Effective for service replacement Aero Accessories, Inc., Tempest Dry Air Pumps only.

NOTE: These pumps were adopted as service replacements in 2002.

The vacuum pump(s) feature a wear indicator inspection port on the back cover which allows direct observation of pump vane wear. Beginning at 500 hours time-in-service, and each 100 hours thereafter, remove the inspection port plug and observe vane wear as shown in Figure 4.

a. As the vanes wear, they slide outboard in the vane slots in the rotor.

b. When the portion of the vane that can be observed in the inspection port covers less than half of the inspection port, replace the pump.



Effectivity
Tempest Dry Air Pump Only

Vane Wear Inspection
Figure 4

15. REMOVAL.

a. Remove the top portion of the engine cowling. (See Section VIII, Engine Cowling, Removal.)

b. Loosen hose clamp and remove hose from pump fittings.

c. Remove four retaining nuts, lock washers and plain washers used to secure pump to engine; then remove pump.

15a. INSTALLATION.

NOTE: Change the vacuum system filter when installing a new pump.

a. If required, install fittings on pump per Replacing Pump Fittings, below.

CAUTION: ONLY PUMP MOUNTING GASKET AUTHORIZED AND APPROVED FOR USE WITH ORIGINAL EQUIPMENT AIRBORNE VACUUM PUMP IS AIRBORNE GASKET B3-1-2, PIPER P/N 751-859. USE OF ANY OTHER GASKET MAY RESULT IN OIL SEEPAGE OR LEAKAGE AT MOUNTING SURFACE.

b. Place pump gasket in its proper place and align spline on pump drive with spline on engine drive assembly.

c. Secure pump to engine with four plain washers, lock washers and retaining nuts. Torque nuts 40 to 50 inch-pounds.

d. Connect hoses to pump and secure with hose clamps.

e. Check hose connections and mounting hardware for security.

f. Reinstall the top portion of the engine cowling. (See Section VIII, Engine Cowling, Installation.)

16. REPLACING PUMP FITTINGS.

a. The handling procedures for securing the pump while installing or removing fittings are as follows:

1. Use two soft wood blocks in a vise to protect pump from vise jaws.
2. The pump square mounting flange must be held between the wood blocks at right angles to the vise jaws.

CAUTION: DO NOT APPLY VISE PRESSURE TO OUTSIDE DIAMETER OR OVERALL LENGTH OF THE PUMP.

3. Use only enough vise pressure to hold pump firmly.

CAUTION: WHEN REPLACING ANY OF THE THREADED FITTINGS, DO NOT USE PIPE DOPE, THREAD LUBE, OR TAPE. PIPE DOPE / TAPE PARTICLES INGESTED BY THE VACUUM PUMP COULD CAUSE THE PUMP TO FAIL. USE ONLY LPS HEAVY DUTY SILCONE LUBRICANT (P/N 197-510), LETTING IT DRY BEFORE ASSEMBLY.

b. If used, LPS silicone lubricant is permissable on the threads of male fittings only. The LPS lubricant must be allowed to dry before installation and care must be taken during application to ensure lubricant does not enter fitting passage or lines.

c. Use the following steps for fitting installation:

1. Secure pump as noted above.
2. Insert fittings in pump ports and hand tighten firmly.
3. Using a wrench, tighten each fitting from one-half to two additional turns.

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17. Directional Gyro.

18. GENERAL. Both air and electric Directional Gyros are used, depending on the option package installed. Both types are displacement type gyros with “FREE” rotors mounted in Gimbal Assemblies. It is important that if a Magnetic Slaving System, Flight Director, or AutoPilot is coupled to the D.G., the A.F.C.S. manufacturer’s Service Manual should be consulted.

    AIR DRIVEN D.G.: The air driven D.G. is driven by the pneumatic system, which is supplied by engine driven dry-pneumatic pumps either on pressure or vacuum. It is of prime importance to realize that air VOLUME, and not air pressure, spins the gyro rotor. The air filter can become contaminated and restrict airflow, reducing gyro rotor speed, while the pressure regulator will automatically adjust air pressure within proper limits. (THE GYRO AIR FILTER MUST BE CLEAN OR REPLACED, BEFORE ADJUSTING GYRO AIR PRESSURE.) Airflow directed at the gyro rotor vanes, causes the rotor to spin approximately 17,000 to 22,000 R.P.M., thus, providing the gyroscopic ability to remain rigid in space. The instrument case moves freely about the spinning gyro rotor in three dimensions by the use of a Gimbal Assembly, and the displacement or Azimuth readings are presented on the instrument face. This results in a positive and stable presentation.

    Since the D.G. has no reference to Magnetic North, it must be set from the Magnetic Compass. The D.G. will agree only with the Magnetic Heading from which it was set, since all other subsequent Magnetic Compass Headings are subject to deviation, Northerly Turning, acceleration, deceleration, dip and other errors. Due to precession, inherent or apparent, the D.G. must be caged at least every 15 minutes while in a level attitude, even though drift may not appear, to ensure rotor position is correct in relation to Earth’s surface.

19. TROUBLESHOOTING. Unless an obvious malfunction of the instrument (such as constantly spinning dial) requires repair or replacement of the Directional Gyro, service is restricted to the instrument installation and power (air/electric) requirements. Typical installation examples of gyro instrument malfunctions are due to installation system problems such as: restricted airflow due to air line kinks or leaks, contaminated air filters, deteriorating electrical grounds, sagging instrument panel shock mounts, systems regulators, faulty vacuum pressure gauges, etc. Excessive precession is a common complaint and usually results from installation problems such as described above, or can be the result of Pilot operating error.

    While D.G. precession can only be exactly measured under closely controlled conditions in an approved gyro overhaul facility, any complaint of abnormal precession should be initially confirmed on the Compass Rose. (Normal precession of the D.G. is plus or minus 3° in 10 minutes or plus or minus 4° in 10 minutes if four (4) Cardinal Headings are used and the total precession does not exceed 12°.)

    When confirming precession complaints on the Compass Rose, aircraft position must be established by nose wheel alignment with the Compass Rose lines. Under no conditions should the Magnetic Compass be used for comparison, otherwise, the deviation of the Magnetic Compass Heading can be read mistakenly as precession. Finally, only after abnormal precession has been confirmed and the system installation proven good, should the instrument be “pulled” for replacement or repair.

20. REMOVAL AND INSTALLATION. Refer to Removal and Installation of Face Mounted Instruments, above.

21. GYRO HORIZON.

22. GENERAL. Both air and electric Attitude Horizons are used, depending on the option package installed. Both types are displacement type gyros with “FREE” rotors mounted in Gimbal Assemblies. It is important to consult the A.F.C.S. Manufacturer’s Service Manual if a, Flight Director, or AutoPilot is coupled to the Attitude Horizon.

23. AIR DRIVEN ATTITUDE HORIZON. The air driven Attitude Horizon is driven by the pneumatic system, which is supplied by engine driven dry pneumatic pumps either on pressure or vacuum. It is of prime importance to realize that air VOLUME, and not air pressure, spins the gyro rotor. The air filter can become contaminated and restrict air flow, reducing gyro rotor speed, while the pressure regulator will automatically adjust air pressure within proper limits. (THE GYRO AIR FILTER MUST BE CLEAN OR REPLACED, BEFORE ADJUSTING GYRO AIR PRESSURE.) Air flow directed at the gyro buckets, causes the rotor to spin approximately 17,000 to 22,000 R.P.M., thus, producing the gyroscopic ability to remain rigid in space. The instrument case moves freely about the spinning gyro rotor in three dimensions by the use of a Gimbal Assembly. The resulting displacement in both pitch and roll is mechanically displayed on the instrument face, providing an artificial horizon reference which portrays airframe attitude at any given moment. The display is stable and can show minute attitude changes of only 1°. Unlike the Directional Gyro, the erection mechanism activity can be seen by a rapidly wobbling and leveling horizon bar, when power is first applied. The instrument can be adjusted for parallax through a knob on the instrument face, the other knob when held to the “IN” position engages forks which cage the gyro rotor.

24. OPERATIONAL LIMITATIONS. Unlike the D.G., the A.H. has no attitude limits. If, however pitch reaches 90° the “polar effect” is reached and the Horizon Bar display will rotate 180° to an inverted position and will again rotate 180° when the aircraft is again right side up. The modern-day A.H. will not be damaged by such an extreme attitude and will correct itself in a short time. There are no roll limitations to the present A.H. Another important, but not widely understood, operating limitation of air driven instruments is erection of the Horizon Bar from a full stop, and from a residual running condition. This can lead to wasted service time, and invalid operating complaints. When the gyro rotor is at rest and power is applied, the erection mechanism exerts maximum authority and rapid and noticeable erection results. However, if power is removed from the spinning rotor (engine shut down while briefly discharging passengers) the gyro rotor continues to rotate at high speed, but the erection mechanism is not functional. When power is again applied to the air driven A.H., the erection mechanism again begins to function, but due to gyro rigidity-because of high rotor speed, erection of the instrument is considerably longer than normal. In flight the air-driven A.H. exhibits small errors at roll out after a coordinated turns, skids, and small pitch changes after acceleration and deceleration. The electric A.H. exhibits small errors in pitch and roll after roll out from a coordinated turn, and also small pitch changes after acceleration or deceleration. In both cases the erecting mechanisms quickly return the gyro to its proper position. The electric A.H. is considered generally more efficient in operation and less subject to error than the air driven A.H.

25. TROUBLESHOOTING. Unless an obvious malfunction (such as inability to erect, spinning, or great horizon bar displacement - none of which can be corrected by manually caging the instrument) requires repair or replacement of the instrument, service is restricted to the instrument installation and power source. Typical installation examples of A.H. malfunctions are due to such problems as: restricted air flow due to air line kinks or leaks, contaminated air filters, deteriorating electrical grounds, sagging instrument panel shock mounts, systems regulators, faulty vacuum/ pressure gauges. Only after the system has proven to be good, should the instrument be “pulled” for replacement or repair.

26. REMOVAL AND INSTALLATION. Refer to Removal and Installation of Face Mounted Instruments, above.

27. RATE OF CLIMB INDICATOR.

28. GENERAL. The rate of climb indicator measures the rate of change 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. Due to the lag of the instrument, the aircraft will be climbing or descending before the instrument gives the correct rate. The instrument will continue to read after the aircraft has assumed level flight. In rough air this should not be considered a malfunction.

29. TROUBLESHOOTING. See Table I.

30. REMOVAL AND INSTALLATION. Refer to Removal and Installation of Face Mounted Instruments, above.

NOTE: When any connections in the static system are opened for check, system must be rechecked per Part FAR 23.1325.

TABLE I
TROUBLESHOOTING RATE OF CLIMB 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.
	Pitot-Static head frozen over.	
	Water in static line.	Check individual instruments for obstruction in lines.
	Obstruction in pitot head.	Clean lines and head.
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.
	Defective mechanism.	Replace instrument.
Rate of climb indicates when aircraft is banked.	Water in static line.	Disconnect static lines and blow out lines from cockpit out to pitot head.
Pointer has to be set before every flight.	Temperature compensator inoperative.	Replace instrument.
Pointer cannot be reset to zero.	Diaphragm distorted.	Replace instrument.
Instrument reads very low during climb or descent.	Case of instrument or line broken or leaking.	Replace instrument.

31. SENSITIVE ALTIMETER.

32. GENERAL. The altimeter indicates altitude in feet above sea level. The indicator has three pointers and a dial scale, the long 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 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. The altimeter consists of a sealed diaphragm that is connected to the pointers through a mechanical linkage. 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 to indicate a higher altitude.

33. TROUBLESHOOTING. See Table II.

TABLE II
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 sensor.
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 screw, if missing.
Cracked or loose cover glass.	Case gasket hardened.	Replace/repair instrument.
Dull or discolored markings.	Age.	Replace/repair instrument.
Barometric scale and reference markers out of synchronization with pointers.	Drift in mechanism.	Refer to latest revision AC 43.13-1.
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 sensor.
Altimeter changes reading as aircraft is banked.	Water in static line.	Remove static lines from all instruments, and blow line clear from cockpit to sensor.
Altimeter requires resetting frequently.	Temperature compensator inoperative.	Change instrument.

34. REMOVAL AND INSTALLATION. Refer to Removal and Installation of Face Mounted Instruments, above.

NOTE: When any connections in the static system are opened for check, system must be rechecked per Part FAR 23.1325.

35. AIRSPEED INDICATOR.

36. GENERAL. The airspeed indicator provides a means of indicating the speed of the airplane passing through the air. The airspeed indication depends on the differential pressure between pitot air 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 and miles per hour, and also has the necessary operating range markings for safe operation of the airplane.

37. TROUBLESHOOTING. See Table III.

38. REMOVAL AND INSTALLATION. Refer to Removal and Installation of Face Mounted Instruments, above.

NOTE: When any connections in static system are opened for checking, system must be checked per FAR 23.1325.

TABLE III
TROUBLESHOOTING AIRSPEED INDICATOR AND TUBES

Trouble	Cause	Remedy
Pointers of static instruments do not indicate properly.	Leak in instrument case or in static lines.	Check for leak and seal.
Pointer of instrument oscillates.	Defective mechanism.	Replace instrument.
Instrument reads high.	Pointer not on zero.	Replace instrument.
	Leaking static system.	Find leak and correct.
Instrument reads low.	Pointer not on zero.	Replace instrument.
	Leaking static system.	Find leak and correct.
	Pitot-Static head not aligned correctly.	Realign pitot-static head.
Airspeed changes as aircraft is banked.	Water in static line.	Remove lines from static instruments and blow out lines from cockpit to pitot-static head.

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39. MAGNETIC COMPASS.

40. GENERAL. The magnetic compass is a self-contained instrument. This instrument has an individual light which is connected to the instrument lighting circuit. The compass correction card is located in the card holder mounted on the instrument. The compass should be swung whenever instruments or radios are changed and at least once a year.

41. ADJUSTING. Before attempting to compensate compass, every effort should be made to place the aircraft in simulated flight conditions; check to see that the doors are closed, flaps in retracted position, engines running, throttles set at cruise position and aircraft in level flight attitude. Aircraft master switch, alternators, radios should be on. All other cockpit controlled electrical switches should be in the off position.

   a. Set adjustment screws of compensator on zero. Zero position of adjusting screws is when the dot of the screw is lined up with the dot of the frame.

   b. Head aircraft on a magnetic North heading. Adjust N-S adjustment screw until compass reads exactly North.

   c. Head aircraft on a magnetic East heading and do the same as Step b, adjusting E-W adjusting screw.

   d. Head aircraft on a magnetic South heading and note resulting South error. Adjust N-S adjusting screw until one-half of this error has been compensated. No compensation adjustments shall be made with the combustion heater operating.

   e. Head aircraft on a heading of magnetic West and do same as Step d, adjusting E-W adjustment screw.

   f. Head aircraft in successive magnetic 30 degree headings and record compass readings on appropriate deviation card. Deviations must not exceed ± 10° on any heading. An additional deviation card will have to be made out for aircraft with combustion heater installed. This second deviation card shall be accomplished under the above conditions, except the combustion heater shall be operating.

42. TROUBLESHOOTING. See Table IV.

TABLE IV
TROUBLESHOOTING MAGNETIC COMPASS

Trouble	Cause	Remedy
Excessive card error.	Compass not properly compensated.	Compensate instrument. (See Magnetic Compass, Adjusting, above.)
	External magnetic interference.	Locate magnetic interference and eliminate, if possible.
Excessive card oscillation.	Insufficient liquid.	Replace/repair instrument.
Card sluggish.	Weak card magnet.	Replace/repair instrument.
	Excessive pivot friction or broken jewel.	Replace/repair instrument.
Liquid leakage.	Loose bezel screws.	Replace/repair instrument.
	Broken cover glass.	Replace/repair instrument.
	Defective sealing gaskets.	Replace/repair instrument.
Discolored markings.	Age.	Replace/repair instrument.
Defective light.	Burned out lamp or broken circuit.	Check lamp or continuity of wiring.
Card sticks.	Altitude compensating diaphragm collapsed.	Replace/repair instrument.
Card does not move when compensating screws are turned.	The gears that turn compensating magnets may be stripped.	Replace/repair instrument.
Compass swings erratically when radio transmitter is keyed.	Normal.	

43. MANIFOLD PRESSURE GAUGE.

44. GENERAL. The manifold pressure gauge is a vapor proof, absolute pressure type instrument. Pressure from the intake manifold of each engine is transmitted to the instrument through individual lines. On later aircraft or aircraft which have had Piper Kit No. 760-765V installed, there are two in line filters which are located in the lines ahead of the instrument panel at both sides of the fuselage. They are accessible from within the cockpit and should be checked for moisture and/or replaced at each 100 or annual inspection.

45. TROUBLESHOOTING. See Table V.

46. REMOVAL AND INSTALLATION. Refer to Removal and Installation of Face Mounted Instruments, above.

TABLE V
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.	Disconnect lines and blow out.

47. TACHOMETER INDICATOR.

48. GENERAL. Each tachometer is connected to the engine accessory cover by a flexible cable and provides an indication of crankshaft speed in revolutions per minute. The instrument has a recording mechanism for recording the time that the engine is in actual operation. The right hand tachometer has a reversing drive to correct for the counter rotation of the right hand engine.

NOTE: Tachometer P/N 62177-3 must be used with Hartzell Propeller HC-C2YK-2CLGF/FJC7666A or HC-C2YK-2CGF/FC7666A. Tachometer P/N 62177-9 must be used with all other propellers.

49. TROUBLESHOOTING. See Table VI.

50. REMOVAL AND INSTALLATION. Refer to Removal and Installation of Face Mounted Instruments, above.

TABLE VI
TROUBLESHOOTING TACHOMETER

Trouble	Cause	Remedy
No reading on indicator, either permanent or intermittent.	Broken drive cable.	Replace cable.
	Loose cable connections.	Tighten cable.
Pointer oscillates excessively.	Rough spot on, or sharp bend in cable.	Repair or replace.
	Excessive friction in instrument.	Replace instrument.
Indicator changes in climb.	Excessive clearance in speed cup.	Replace instrument.
Pointer goes all the way to stop, more noticeable in cold weather.	Excessive lubricant in instruments.	Replace instruments.
Pointer jumps at idle.	Speed cup hitting rotating magnet.	Replace instrument.
Tachometer cable breaks.	Cable bent too sharply.	Reroute cable, replace shaft.

51. ENGINE OIL PRESSURE GAUGE.

52. GENERAL. The oil pressure gauge is mounted in the cluster on the instrument panel. This gauge will indicate the amount of oil pressure available at the pressurized engine oil passage in psi.

53. TROUBLESHOOTING. See Table VII.

54. REMOVAL AND INSTALLATION. Refer to Removal and Installation of Cluster Mounted Instruments, above.

TABLE VII
TROUBLESHOOTING OIL PRESSURE GAUGE

Trouble	Cause	Remedy
Excessive error at zero.	Pointer loose on shaft.	Replace instrument.
	Overpressure or seasoning of bourdon tube.	
Excessive scale error.	Improper calibration adjustment.	Replace instrument.
Excessive pointer oscillation.	Air in line or rough engine relief.	Disconnect line and fill with light oil.
		Check for leaks. If trouble persists, clean and adjust relief valve.
Sluggish operation of pointer or pressure fails to build up.	Engine relief valve open.	Clean and check.
	Line restriction to instrument.	Clean and check.
	Loss of oil in engine or other engine failure.	Shut down engine refer to Table I, Section VIII.
NOTE: Gauge will take longer to indicate in cold weather.		

55. FUEL PRESSURE GAUGE.

56. GENERAL. The fuel pressure gauge instrument is mounted in the cluster on the instrument panel. This gauge is connected to the fuel system at the injector fuel inlet fitting.

57. TROUBLESHOOTING. See Table VIII.

58. REMOVAL AND INSTALLATION. Refer to Removal and Installation of Cluster Mounted Instruments, above.

TABLE VIII
TROUBLESHOOTING FUEL PRESSURE GAUGE

Trouble	Cause	Remedy
No fuel pressure indication.	Fuel valve stuck. Fuel valve off.	Check valve.
	No fuel in tanks.	Check fuel, fill.
	Defective fuel pump.	Check pump for pressure build-up.
		Check diaphragm and relief valves in engine pump.
		Check for obstruction in in electric pump.
		Check bypass valve.
		Air leak in intake lines.
	Defective gauge.	Replace gauge.
Pressure low or pressure surges.	Obstruction in inlet side of pump.	Trace lines and locate obstruction.
	Faulty bypass valve.	Replace.
	Faulty diaphragm.	Replace or rebuild pump.
Needle fluctuation.	Surge dome on pump filled with fuel.	Remove and empty.
	Air in line.	Loosen line at gauge, turn on electric pump.
		Purge line of air and retighten.
High fuel pressure with engine shut off right after flight.	Fuel in line expanding due to heat build up in cowling.	Normal.

59. ELECTRICAL INSTRUMENTS.

60. TURN AND BANK/PICTORIAL RATE INSTRUMENTS.

61. GENERAL Unlike the familiar “FREE” gyro rotor found in the Directional and Attitude gyros both the Turn and Bank, and Pictorial Rate Indicator have captive gyro rotors, the axis of which are attached to the instrument housings. Since the spinning gyro rotors are literally forced to follow airframe movement, the gyro resists changing position by exerting precession forces created by the spinning gyro. The greater the RATE OF CHANGE, the greater the precession forces; thus, the Turn and Bank and the Pictorial Rate Indicator ONLY MEASURE MOVEMENT - NOT POSITION OR DISPLACEMENT. The gyro rotor forces of the Turn and Bank are presented on the instrument face by a vertical turn needle, and on the Pictorial Rate Indicator by a pictorial artificial horizon. Although the visual displays are different, the gyro rotor rate detection designs are the same. The gyro rotor is mounted at a 60° angle to detect both YAW and ROLL MOTION, but the 60° tilt favors the YAW AXIS. Due to the great sensitivity of the rate-gyro, the turn needle/artificial/horizon displays are mechanically damped to slow or average minute yaw and roll forces to the human operators ability to interpret and respond to the displays. The “BALL” portion of both instruments is free to roll within the inclined glass tube display on lower instrument face. The glass tube is filled with non-freezing liquid to dampen the movements of the ball within the tube. It must be realized the “BALL” portion of both instruments ONLY INDICATES SIDE FORCES.

62. TROUBLESHOOTING. See Table IX.

63. REMOVAL AND INSTALLATION. Refer to Removal and Installation of Face Mounted Instruments, above.

TABLE IX
TROUBLESHOOTING TURN AND BANK INDICATOR

Trouble	Cause	Remedy
Instrument will not operate.	No power to instrument.	Reset circuit breaker.
		Check circuit and repair.
	Instrument malfunction.	Repair instrument.
	Foreign matter lodged in instrument.	Replace instrument.
Incorrect sensitivity.	Out of calibration.	Replace instrument.
Incorrect turn rate.	Out of calibration.	Replace instrument.
Ball sticky.	Flat spot on ball.	Replace instrument.
Ball not in center when aircraft is correctly trimmed.	Instrument not level in panel.	Level instrument.

64. FUEL QUANTITY INDICATOR.

65. GENERAL. The two fuel quantity gauges are mounted in the clusters on the instrument panel. These instruments are calibrated in U.S. gallons. Two transmitter units are installed in each fuel tank. Each unit contains a resistance strip and a movable control arm. The position of this arm is controlled by a float and this position is transmitted electrically to the indicator gauge to show the amount of fuel in the tank. The two transmitters in each tank are connected in series, the outboard sender must be insulated from airframe ground.

66. TROUBLESHOOTING. See Table X.

67. REMOVAL AND INSTALLATION. Refer to Removal and Installation of Cluster Mounted Instruments, above.

TABLE X
TROUBLESHOOTING FUEL QUANTITY INDICATOR

Trouble	Cause	Remedy
Fuel gauge fails to indicate.	Broken wiring.	Check and repair.
	Gauge not operating.	Replace.
Fuel gauge indicates empty when tanks are full.	Incomplete ground.	Check ground connections at inboard transmitter in wings.
Fuel gauge indicates full with tanks empty.	Partial short to ground.	Check wiring.
	Float arm stuck.	Replace fuel transmitter.
Fuel gauge indicates incorrectly.	Intermittent electrical connection.	Check ground at inboard transmitter and electrical connections.
	Faulty transmitter.	Replace fuel transmitter.

68. OIL TEMPERATURE INDICATOR.

69. GENERAL. The oil temperature indicator is mounted in the instrument cluster on the instrument panel. This instrument will provide a temperature indication of the engine oil in degrees Fahrenheit. The instrument has a temperature bulb located in the oil screen assembly, on the engine accessory section.

70. TROUBLESHOOTING. See Table XI.

71. REMOVAL AND INSTALLATION. Refer to Removal and Installation of Cluster Mounted Instruments, above.

TABLE XI
TROUBLESHOOTING OIL TEMPERATURE INDICATOR

Trouble	Cause	Remedy
Instrument fails to show any reading.	Broken or damaged bulb. Wiring open.	Check engine unit and wiring to instrument.
Excessive error.	Improper calibration adjustment.	Replace instrument.
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.

72. AMMETERS.

73. GENERAL. The ammeters are mounted in the instrument panel. This instrument measures the current going into the entire electrical system including the battery charging demand.

74. TROUBLESHOOTING. Refer to Section XI, Table II.

75. REMOVAL AND INSTALLATION. Refer to Removal and Installation of Cluster Mounted Instruments, above.

76-79. See paragraph 1a or 1b, above.

80. EXHAUST GAS TEMPERATURE (EGT) GAUGE.

81. GENERAL. This dual 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. When troubleshooting this instrument be certain the system being checked coincides with the system selected on the indicator.

The EGT probe is mounted in the exhaust stack below the number 2 cylinder.

82. REMOVAL OF EGT PROBE AND GAUGE.

a. Disconnect wires from the EGT gauge at the instrument panel.

b. Remove four bolts which secure the gauge to the instrument panel and remove the gauge.

c. Remove wires from the wire harness going to the engine.

d. Loosen the nut or clamp which secures the EGT probe to the exhaust system and remove the probe.

83. CLEANING AND INSPECTION. Unless mechanical damage such as broken glass, bent or broken pointer, or broken case, the following checks should be performed before removing the instrument.

a. Remove probe from exhaust stack 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.

b. Disconnect lead wires at instrument and measure length and diameter. Resistance with lead wires connected to probe should be 3.3 ohms. Clean connections with steel wool before reassembly.

CAUTION: DO NOT CONNECT OHMMETER ACROSS METER. IT WILL BURN OUT THE MOVEMENT OF THE METER.

c. 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. Before making this check, make sure that the adjustment screw, which is located in the rear of the instrument case, is in the center of its travel. If this screw has been turned to either end of full travel, it will shut the instrument off and no indication will be shown on the pointer. If meter still does not read, replace it.

84. TROUBLESHOOTING. See Table XII.

TABLE XII
TROUBLESHOOTING EGT GAUGE

Trouble	Cause	Remedy
Gauge inoperative.	Master Switch OFF.	Turn switch ON.
	Circuit Breaker OUT.	Push breaker IN.
	Defective gauge, probe or wiring.	Check probe and lead wires for chafing, breaks or shorting between wires 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 or replace defective leads.

TABLE XIII
TROUBLESHOOTING CHT 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.

85. CYLINDER HEAD TEMPERATURE (CHT) GAUGE.

86. GENERAL. The cylinder head temperature gauge is in the instrument cluster, located on the instrument panel. This instrument 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 thru the instruments circuit breaker.

87. TROUBLESHOOTING. See Table XIII.

88. REMOVAL AND INSTALLATION. Refer to Removal and Installation of Cluster Mounted Instruments, above.

89. FUEL FLOW GAUGE.

90. GENERAL. The fuel flow gauge is a non-electric differential pressure gauge mounted in the bottom of the instrument panel.

This instrument measures flow by reading the pressure drop across a fixed orifice located in the fuel divider. With a constant fuel pressure being supplied by the engine driven pump, and putting a fixed orifice in the fuel divider head, and then measuring the pressure drop downstream of the orifice against a constant static pressure, the resultant pressure can be calibrated in gallons per hour flow. The constant static pressure is supplied by a vent line running to the engine compartment. The vent line to the engine compartment automatically compensates the instrument for altitude.

91. TROUBLESHOOTING. See Table XIV.

92. REMOVAL AND INSTALLATION. Refer to Removal and Installation of Face Mounted Instruments, above.

TABLE XIV
TROUBLESHOOTING FUEL FLOW GAUGE

Trouble	Cause	Remedy
Pointer oscillates.	Air in fuel line.	Purge line.
Gauge reads low at altitude.	Vent line restricted.	Check line and fittings.
Pointer does not return to zero.	Fuel in diaphragm of gauge.	Replace gauge.

93. AUTOPILOT SYSTEM.

See Section XII.

TABLE XV
INSTRUMENT MARKINGS

Fuel Flow	
Green Arc (Normal Operating Range)	0 to 19.7 GPH
Red Line	19.7 GPH
Tachometer	
Green Arc (Normal Operating Range)	500 to 2200 RPM and 2400 to 2700 RPM
Radial Red Line (Maximum)	2700 RPM
Cylinder Head Temperature	
Green Arc (Normal Operating Range)	200° to 475° F
Radial Red Line (Never Exceed)	475° F
Oil Pressure	
Green Arc (Normal Operating Range)	60 to 90 PSI
Yellow Arc (Caution)	25 to 60 PSI
Radial Red Line	
Minimum	25 PSI
Maximum	90 PSI
Oil Temperature	
Green Arc (Normal Operating Range)	75° to 245° F
Radial Red Line (Never Exceed)	245° F
Airspeed Indicator	
Green Arc (Normal Operating Range)	76 to 190 MPH
Yellow Arc (Caution Range - Smooth Air)	190 to 217 MPH
White Arc (Flaps Extended Range)	69 to 125 MPH
Radial Red Line (Never Exceed - Smooth Air)	217 MPH
Radial Red Line (Minimum Control Speed- Single Engine)	80 MPH
Radial Blue Line (Best R/C Speed Single Engine)	105 MPH

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SECTION

XI

ELECTRICAL SYSTEM

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SECTION XI

LIST OF EFFECTIVE PAGES

SECTION	PAGE	DATE
XI-List of	1	Oct 30/03
Effective Pages	2	Oct 30/03
XI-Table of Contents	1	Oct 30/03
	2	Oct 30/03
	3	Oct 30/03
	4	Oct 30/03
XI	1	Oct 30/03
	2	Oct 30/03
	3	Oct 30/03
	4	Oct 30/03
	5	Oct 30/03
	6	Oct 30/03
	7	Oct 30/03
	8	Oct 30/03
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	68	Oct 30/03
	69	Oct 30/03
	70	Oct 30/03

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SECTION XI - ELECTRICAL SYSTEM

TABLE OF CONTENTS

SECTION XI - ELECTRICAL SYSTEM

TABLE OF CONTENTS (cont.)

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ELECTRICAL SYSTEM

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

1. INTRODUCTION. This section contains instructions and schematics for correcting difficulties which may arise in the operation of the electrical system.

The instructions are organized so the mechanic can refer to: Description and Principles of Operation for a basic understanding of the various electrical systems; Troubleshooting for a methodical approach in locating the difficulty; Corrective Maintenance for removal, repair and installation of components; and Adjustments and Test for operation of the repaired system. Schematics for the individual systems are located at the end of this section. For information concerning electronic/avionics equipment, refer to Section XII, Electronics.

2. DESCRIPTION. 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 60-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. Warning lights on the switch panel (see Figure 1) illuminate to indicate that an overvoltage relay has tripped. The loads from the electrical bus system (see Table I) are protected by manual reset type circuit breakers mounted on the lower right hand instrument panel.

2a. PRECAUTIONS. Observe the following precautions when testing or servicing the electrical system.

a. 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, ammeter or accessories, will cause severe damage to the units and/or wiring.

b. The alternator must not be operated on open circuit with the rotor winding energized.

c. 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.

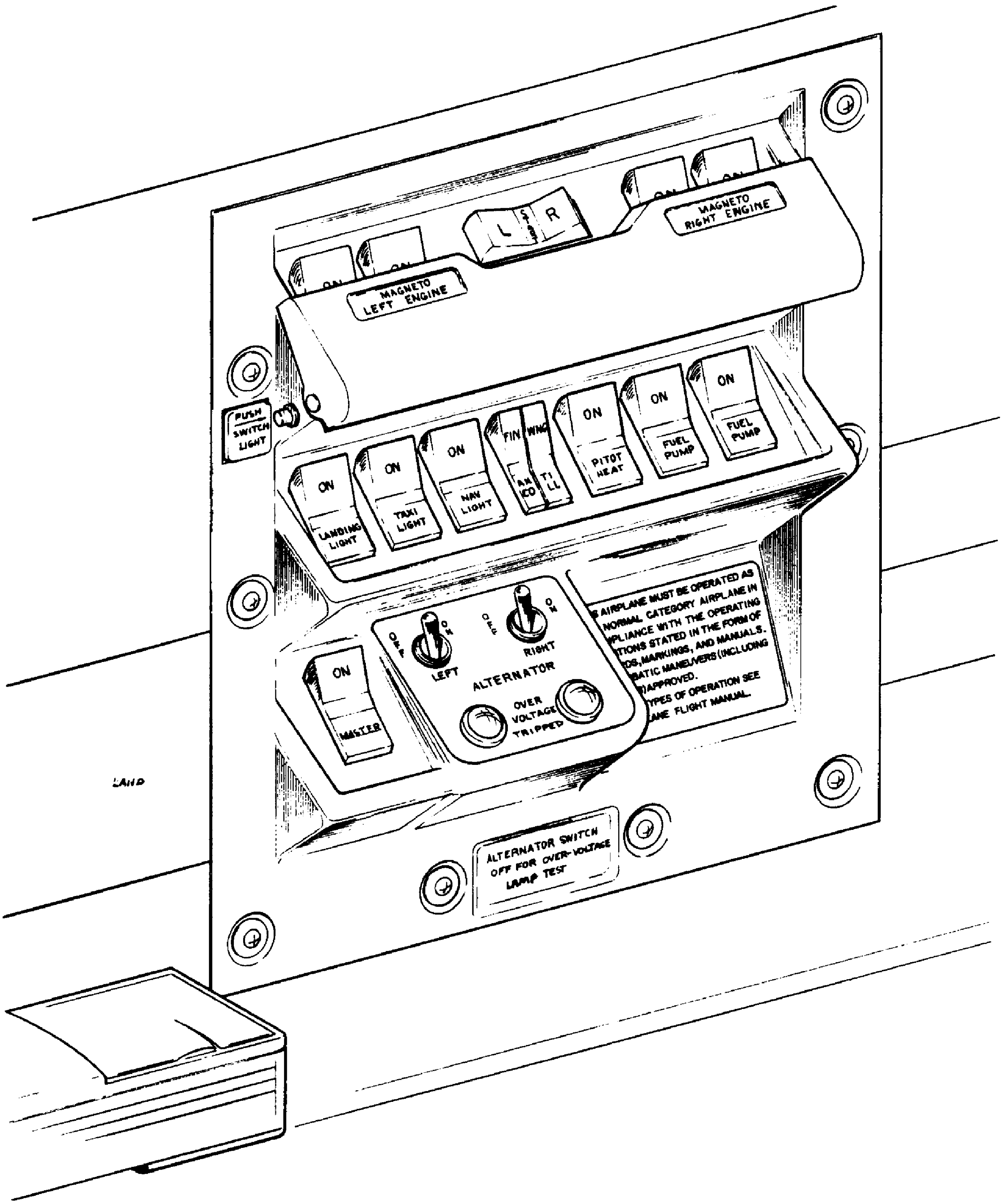
d. Grounding of the alternator output terminal may damage the alternator and/or circuit and components.

e. 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. These aircraft are negative ground.

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

3. TROUBLESHOOTING. Troubleshooting guidance is presented under the Alternator, Starter, and Battery sections in the form of Tables listing potential troubles, their probable causes, and suggested remedies. Wiring diagrams included at the end of this section should also be consulted as part of the troubleshooting process.

After the trouble has been corrected, check the entire electrical system for security and operation of its components.



Switch Panel
Figure 1

TABLE I
ELECTRICAL SYSTEM COMPONENT LOADS

Duty Cycle Continuous	Duty Cycle Intermitant	Equipment	Circuit Breaker	Load (Amps)	Optional
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	Electric Pitch Trim	5	5.0	
	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 approx.	
	X	Stall Warning Heat		7.5	X
	X	Starter		175 .0	
	X	Starter Solenoid	10	10.0	
X		Turn & Bank		0.5	

4. ALTERNATOR SYSTEM. The alternators are located on the front lower right side of each engine and utilizes a belt drive from the engine crankshaft. Many advantages both in operation and maintenance are derived from this system. The main advantage is that full electrical power output is available regardless of engine RPM.

   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.

Located on the instrument panel are four circuit breakers which control both generating systems. Two are marked “alternator output” and the others “alternator field.” The “output” circuit breakers are 60-ampere, and protect the alternators and electrical system from overloads. The ‘’field’’ circuit breakers for the voltage regulators and field wiring of each alternator are 5-amperes each. If either the “output” or “field’’ circuit breakers trip, it will result in a complete shut down of power from the particular generating system. After a one or two minute cool-down period, the breakers can be reset manually. If tripping recurs, and holding the breakers down will not prevent their continued tripping, this indicates a short in the generator circuit.

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.

4a. TROUBLESHOOTING. See Table II, below.

TABLE II (Sheet 1 of 5)
TROUBLESHOOTING ALTERNATOR

Trouble	Cause	Remedy
Zero output indicated on ammeter regardless of RPM (refer to alternator system test procedure).	Open field circuit.	With master switch turned on check for battery voltage (12V) from ship's main bus 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. Interruption of voltage through any of these points isolates the faulty component or wire which must be replaced.
	Open output circuit.	With master switch turned on check for battery voltage (12V) from ship's main bus through entire output circuit to alternator battery post. Measure voltage from ground (-) to the following points (+) in sequence: bus bar, output circuit breaker (60A), ammeter, and alternator battery post. Interruption of voltage through any of these points isolates the faulty component or wire which must be replaced.

TABLE II (Sheet 2 of 5)
TROUBLESHOOTING ALTERNATOR

Trouble	Cause	Remedy
CAUTION: TURN MAGNETO SWITCH TO OFF BEFORE TURNING PROP.		
Zero output indicated on ammeter regardless of RPM (refer to alternator system test procedure). (cont.)	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. (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 (refer to alternator test procedure), set throttle at 2300 RPM. Check voltage at bus bar (convenient checkpoint, 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.
	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. Examine crimped terminal ends for signs of deterioration at clamp or strands of broken wire at crimp. Tighten any loose binding posts or replace bad wire terminals.

TABLE II (Sheet 3 of 5)
TROUBLESHOOTING ALTERNATOR

Trouble	Cause	Remedy
Output indicated on ammeter does not meet minimum values specified in alternator system test procedure. (cont.)	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 and replacement of the rectifier is recommended.
Field circuit breaker trips.	Short circuit in field circuit.	Disconnect field wiring at terminal of alternator. Turn on master switch. If breaker continues to trip, proceed to disconnect each leg of field circuit, working from the alternator towards the circuit breaker until breaker can be reset and will hold. Replace component or wire which was isolated as defective.
	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.	

TABLE II (Sheet 4 of 5)
TROUBLESHOOTING ALTERNATOR

Trouble	Cause	Remedy
CAUTION: TURN MAGNETO SWITCH TO OFF BEFORE TURNING PROP.		
Field circuit breaker trips. (cont.)	Short circuit in field winding of alternator.	Internal short circuiting of the field can occur at various positions of the rotor, therefore, reconnect field, reset breaker, breaker, pull propeller slowly by hand turning alternator rotor through 360° of travel. Observe circuit breaker for signs of tripping.
Output circuit breaker trips.	Short circuit in output circuit.	Disconnect wiring at battery post of alternator. Turn on master switch. Reset breaker and if breaker continues to trip proceed to disconnect each leg of output 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.
	Shorted alternator diode.	Disconnect wiring at battery post of alternator. Turn on master switch. Reset breaker and if breaker fails to retrip, this isolates short circuit to alternator. Refer to Paragraphs 6 and 7.
	Battery installed with reversed polarity.	Remove battery and reinstall with correct polarity.

TABLE II (Sheet 5 of 5)
TROUBLESHOOTING ALTERNATOR

Trouble	Cause	Remedy
Output circuit breaker trips. (cont.)	Battery charged backwards.	Remove battery. Connect load such as landing light lamp or similar load and discharge battery. Recharge with correct polarity and test each cell for signs of damage due to reversed charging.
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.	Defective voltage-regulator.	Replace voltage-regulator.
	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.

5. ALTERNATOR AND COMPONENTS.

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.)

6. DESCRIPTION. (Refer to Figure 2.)

The principal components of the alternator are the brush holder assembly (a), the slip ring end head (b), the rectifiers (c), the stator (d), the rotor (e) and the drive end head (f).

a. The brush and holder assembly contains two brushes, two brush springs, a brush holder and insulator. One brush is connected to a terminal stud and is insulated from ground. The other brush is connected to ground thru the brush holder. The brush and holder assembly can easily be removed for inspection or brush replacement purposes.

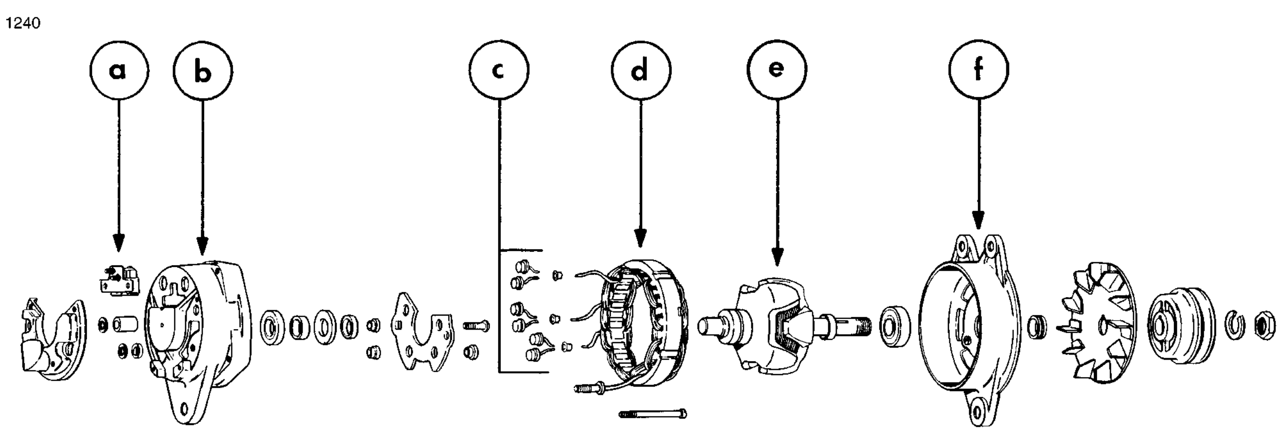
b. The slip ring end head provides the mounting for the rectifiers and rectifier mounting plate, output and auxiliary terminal studs, and the brush and holder assembly. The slip ring end head contains a roller bearing and outer race assembly and a grease seal.

c. The rectifiers used in these units are rated at 150 peak inverse voltage (PIV) minimum for transient voltage protection. Three positive rectifiers are mounted in the rectifier mounting plate while the three negative rectifiers are mounted in the slip ring end head. Each pair of rectifiers is connected to a stator lead with high temperature solder. The stator leads are anchored to the rectifier mounting plate with epoxy cement for vibration protection.

d. The stator contains a special lead which is connected to the center of the three phase windings. The stator has been treated with a special epoxy varnish for high temperature resistance.

e. The rotor contains the slip ring end bearing inner race and spacer on the slip ring end of the shaft. The rotor winding and winding leads have been specially treated with a high temperature epoxy cement to provide vibration and temperature resistance characteristics. High temperature solder is used to secure the winding leads to the slip rings.

f. The drive end head supports a sealed, prelubricated ball bearing in which the drive end of the rotor shaft rotates.



Alternator - Exploded View
Figure 2

7. CHECKING ALTERNATOR SYSTEM. Two ammeters are used which enable an independent output check of each alternator, as well as the electrical output-input of the battery. Should either alternator show no output on its ammeter, check the appropriate circuit breakers. If a further check of the ammeters show no output from both alternators, switch to the auxiliary voltage regulator and overvoltage relay. If switching to the auxiliary system indicates no electrical output, further check the alternator system. (Refer to appropriate electrical schematic, see Electrical Schematic Index, below.)

   a. Ascertain that the ammeters are operating properly.

   b. Disconnect the battery lead (+) at the alternator.

   c. Disconnect field leads at the alternator.

   d. Ascertain that all electrical units are off and battery is fully charged.

   e. Turn on the master switch.

   f. To check the alternator output circuit, connect a voltmeter or 12 volt test light to the battery lead and to ground. If a reading of approximately 12 volts registers on the voltmeter or the test lights, the battery circuit is operational.

   g. Should there be no indication of voltage, trace back through the output circuit until voltage is indicated. (Refer to appropriate electrical schematic, see Electrical Schematic Index, below.) A component that allows no voltage to pass through it should be replaced.

   h. Check the field circuit by the following procedure:

   1. 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.

   i. If voltage is indicated at both the battery lead and field lead, the alternator should be checked for possible malfunction. (Refer to Paragraph 9.)

8. SERVICE PROCEDURES. Since the alternator and regulator are designed for use on only one polarity system, the following procedures must be observed when working on the charging circuit. Failure to observe these service procedures will result in serious damage to the electrical equipment.

   a. When installing a battery, always make absolutely sure the ground polarity of the battery and the ground polarity of the alternator are the same.

   b. When connecting a booster battery, make certain to connect the negative battery terminals together and the positive battery terminals together.

   c. When connecting a charger to the battery, connect the charger positive lead to the battery positive terminal and the charger negative lead to the battery negative terminal.

   d. Never operate the alternator on open circuit. Make absolutely certain all connections in the circuit are secure.

   e. Do not short across or ground any of the terminals on the alternator or regulator.

   f. Do not attempt to polarize the alternator.

9. 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, in this section, the complete overhaul is covered step-by-step to provide detailed information on each operation. In actual practice, use these operations used as required.

10. DISASSEMBLY.

   a. Remove the two Number 10-24 screws holding the brush holder assembly in the slip ring end head. Remove the brush and holder assembly from the end head.

   b. Remove the safety wire from the through bolts. Hold the pulley with a strap wrench and remove the pulley nut. The pulley must be removed with a puller. Remove the fan, woodruff key and spacer from the shaft.

   c. Remove the four through bolts and tap the drive end head lightly to separate the drive end head and rotor, as a unit, from the stator and slip ring end head.

   d. Remove the nuts, lock washers, flat washers and insulators from the output and auxiliary terminal studs. Note carefully the correct assembly of the insulator washers and bushings. Using the special tools shown in Figure 4, support the end head and press out the three negative rectifiers. The end head can now be separated from the stator assembly.

   e. To remove the slip ring end bearing and grease seal, it will be necessary to have a hook type or impact type bearing puller as shown in Figure 3. Do not remove the bearing unless replacement is necessary.

   NOTE: The inner race of the slip ring end bearing is pressed onto the rotor shaft. When bearing replacement is necessary, always replace the complete bearing assembly, including the inner race.

   f. To remove the drive end head from the rotor shaft, use a puller that grips on the bearing retainer plate as shown in Figure 5. Do not attempt to remove by supporting the end head and pressing on the shaft, as this may result in distortion of the end head or stripping of the retainer plate screws. Remove the three retainer plate screws and press the bearing out of the end head. (See Figure 6.)

11. INSPECTION AND TESTING OF COMPONENTS. Upon completion of the disassembly, all parts should be cleaned and visually inspected for cracks, wear or distortion and any signs of overheating or mechanical interference.

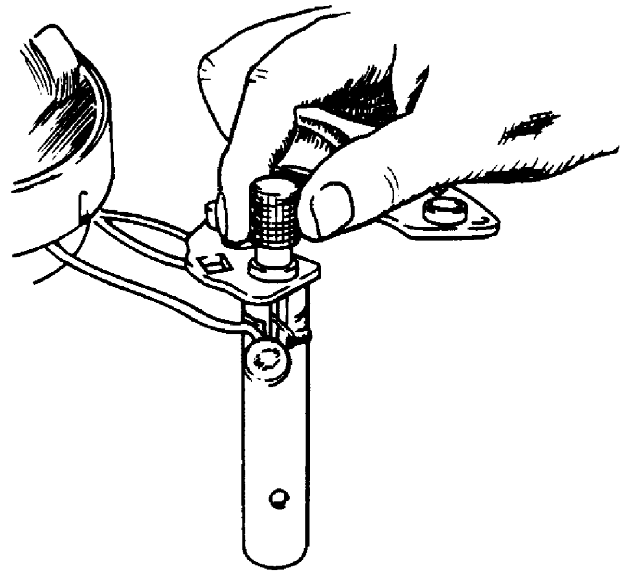
   a. Rotor: The rotor should be tested for grounded or shorted windings. The ground test can be made with test probes, connected in series with a 110 volt test lamp, an ohmmeter or any type of continuity tester. (Refer to Figure 7.) There must not be any continuity between the slip rings and the rotor shaft or poles. To test for shorted turns in the rotor winding, connect a voltmeter, ammeter and rheostat as shown in Figure 8, or use an ohmmeter. Rotor current draw and resistance are listed in the Alternator Service Test Specifications paragraph. Excessive current draw or low ohmmeter reading indicates shorted windings. No current draw or infinite ohmmeter reading would indicate an open winding.

   b. Rectifiers: A diode rectifier tester will detect and pinpoint open or shorted rectifiers without going through the operation of disconnecting the stator leads. However, if a tester is not available, test probes and a No. 57 bulb, connected in series with a 12 volt battery, can be used in the following manner. Touch one test probe to a rectifier heat sink and the other test probe to a lead from one of the rectifiers in that heat sink. Then reverse the position of the leads. The test bulb should light in one direction and not light in the other direction. If the test bulb lights in both directions, one or more of the rectifiers in that heat sink is shorted. To pinpoint the defective rectifier, the stator leads must be disconnected and the above test repeated on each rectifier. Open rectifiers can only be detected, when using the test bulb, by disconnecting the stator leads. The test bulb will fail to light in either direction if the rectifier is open.

361

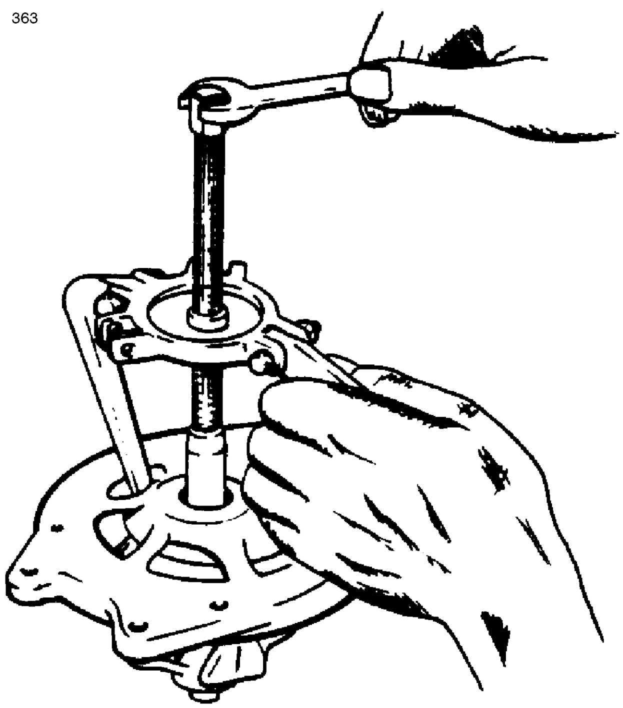
Removing Slip Ring End Bearing
Figure 3

362



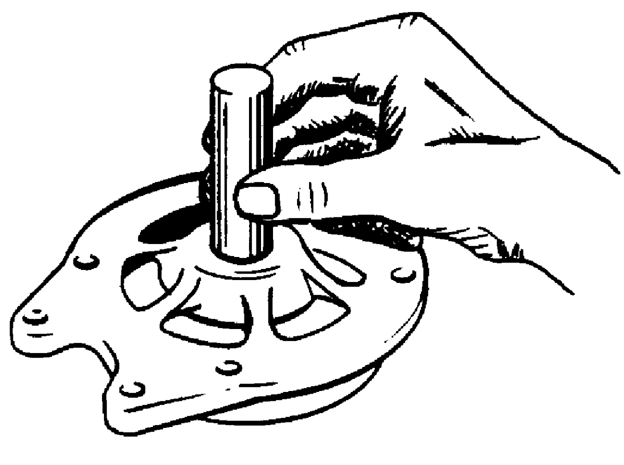
Removing Rectifier
Figure 4

363



Removing Drive End Head
Figure 5

364



Removing End Head Bearing
Figure 6

c. Stator: The stator can be tested for open or grounded windings with a 12 volt test bulb, described in the rectifier section, or an ohmmeter, in the following manner. Separate the stator from the slip ring end head just far enough to insert a fold of rags or blocks of wood. In other words, insulate the stator from the end head. To test for grounded windings, touch one test bulb or ohmmeter probe to the auxiliary terminal or any stator lead, and the other test bulb or ohmmeter probe to the stator frame. If the test bulb lights, or ohmmeter indicates continuity, the stator is grounded. To test for open windings, connect one test probe to the auxiliary terminal or the stator winding center connection and touch each of the three stator leads. The test bulb must light, or the ohmmeter must show continuity. Due to the low resistance in the stator windings, shorted windings are almost impossible to locate. However, shorted stator windings will usually cause the alternator to “growl” or be noisy during operation and will usually show some signs of overheating. If all other electrical checks are normal and alternator fails to supply its rated output, the stator should be replaced to determine whether or not it is the faulty component.

d. Bearings and Seals: Whenever the alternator is overhauled, new bearings and oil or grease seals are recommended, even though the bearings and seals appear to be in good condition. A faulty seal can cause an alternator to fail within a very short period of time.

12. ASSEMBLY.

a. Press the ball bearing into the drive end head using a flat block approximately two inch square so that the pressure is exerted on the outer race of the bearing. Install the retainer plate. With the snap ring and retainer cup in place on the rotor shaft, use a tool that fits over the shaft and against the inner bearing race, and press until the inner bearing race is against the snap ring retainer cup. (Refer to Figure 9.)

CAUTION: USE AN ARBOR PRESS, DO NOT HAMMER. RECONNECT THE STATOR LEADS TO THE RECTIFIERS. WHEN SOLDERING THESE CONNECTIONS, USE PLIERS AS A HEAT DAM ON THE LEAD BETWEEN THE SOLDER JOINT AND THE RECTIFIER. TOO MUCH HEAT WILL DAMAGE THE RECTIFIERS.

b. Carefully install the rectifiers in the slip ring end head or rectifier mounting plate by supporting the unit and using the special tools illustrated in Figure 10.

c. Reassemble the rectifier mounting plate studs and insulators, making sure they are in the correct order. (Refer to Figure 11.)

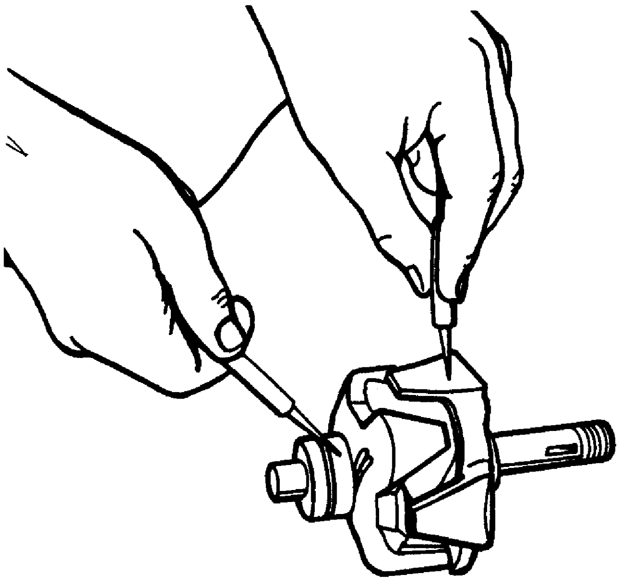
d. After the slip ring end head is completely assembled, the stator and rectifier leads must be secured to the rectifier mounting plate with epoxy. Make sure the stator leads are positioned so that they do not interfere with the rotor.

e. Install the slip ring end bearing and oil seal. Make sure the lip of the oil seal is toward the bearing. Stake the seal in place. Correct assembly of bearing, seal, inner race and spacer is shown in Figure 12.

f. Assemble the alternator and install the through bolts. Spin the rotor to make sure there is no mechanical interference. Torque the through bolts to 30 to 35 inch pounds. Safety wire should be installed after the unit has been bench tested for output. Install spacer, woodruff key, fan, pulley, lock washer and nut. Torque the nut to 35 foot pounds, using a strap wrench to hold the pulley.

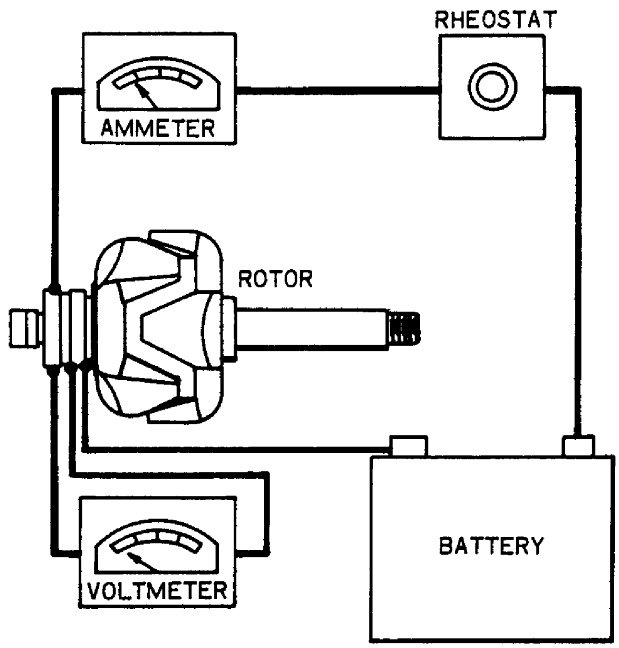
g. Install the brush and holder assembly and retaining screws. Spin the rotor and check for interference between the brush holder and rotor. Check between the field terminal and ground with an ohmmeter. The ohmmeter must indicate the amount of rotor resistance listed on Table III.

365



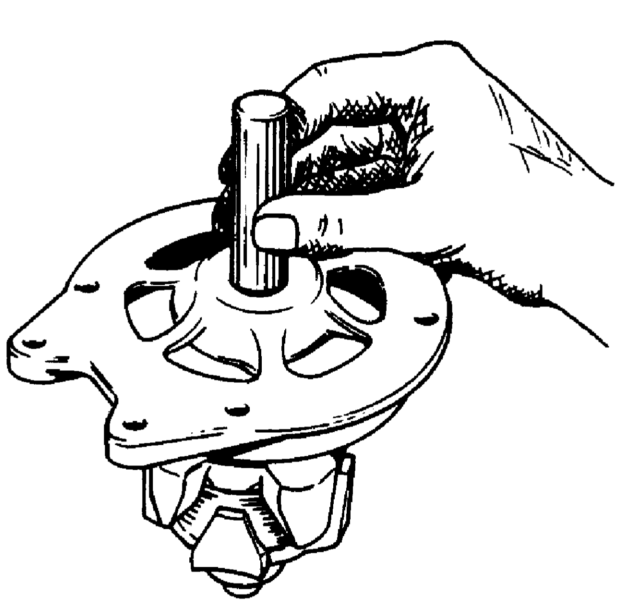
Testing Rotor for Ground
Figure 7

365



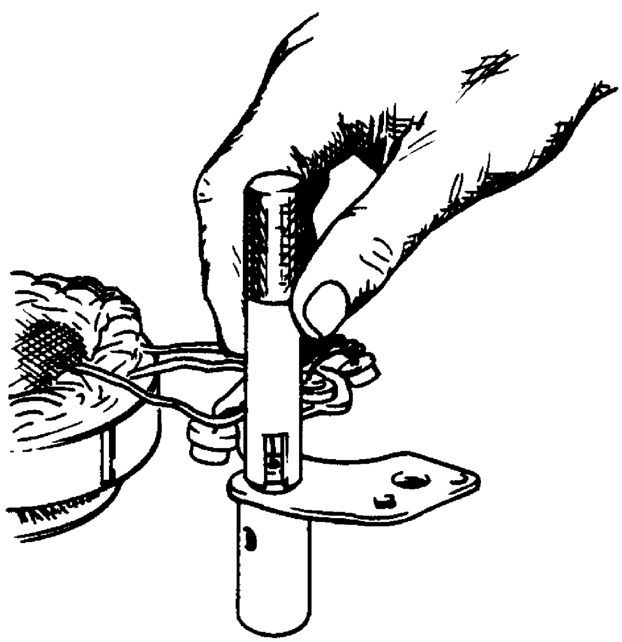
Testing Rotor for Shorts
Figure 8

366



Installing Bearing
Figure 9

367



Installing Rectifier
Figure 10

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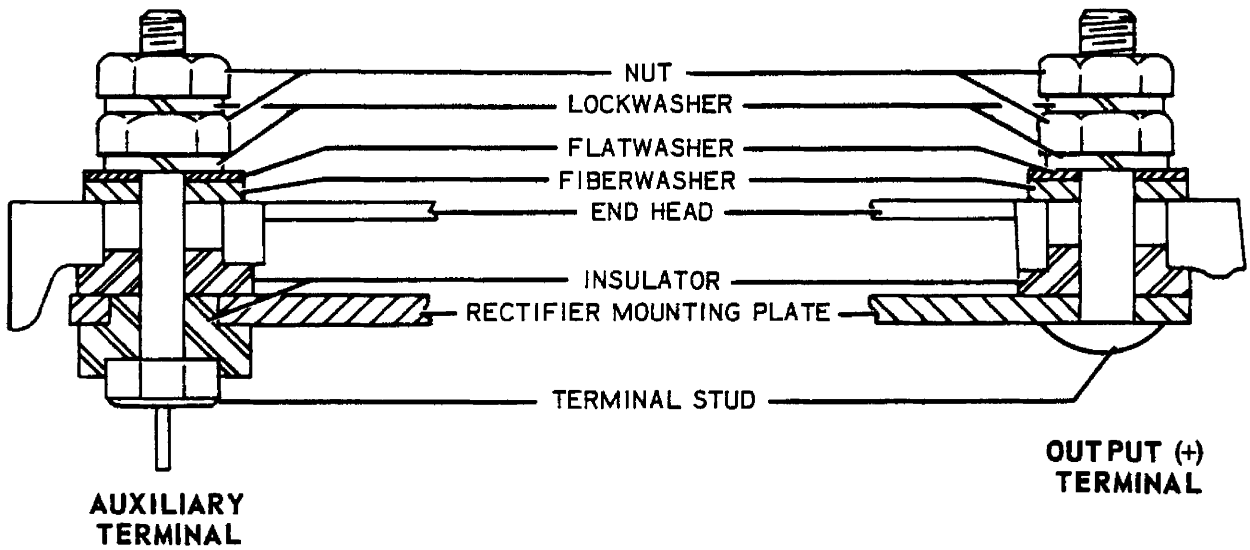
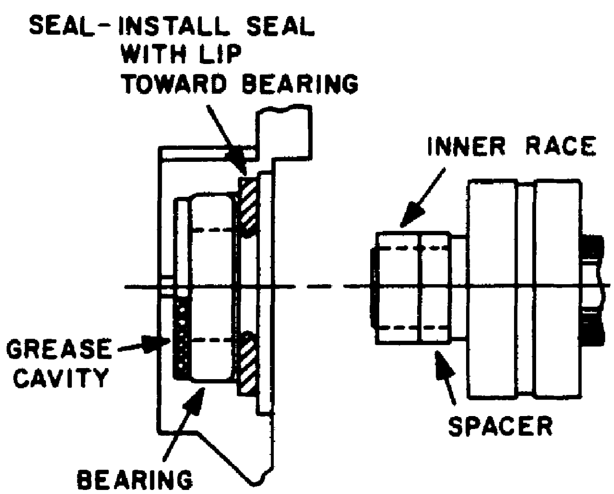


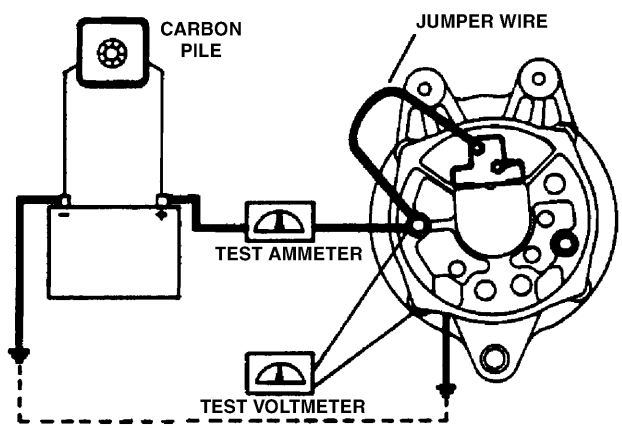
Terminal Assembly
Figure 11

369



Slip Ring End Bearing Assembly
Figure 12

370



Testing Alternator
Figure 13

13. TESTING.

a. Wiring connections for bench testing the alternator are shown in Figure 13. Refer to the Alternator Service Test Specifications paragraph for output test figures. Adjust the carbon pile if necessary, to obtain the specified voltage.

b. After bench testing the alternator, install the safety wire and install the alternator on the engine.

NOTE: Always refer to appropriate electrical schematic, see Electrical Schematic Index, below, when installing the alternator or testing the alternator.

14. PRECAUTIONS. The following precautions are to be observed when testing or servicing the electrical system.

a. 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, ammeter or accessories, will cause severe damage to the units and/or wiring.

b. The alternator must not be operated on open circuit with the rotor winding energized.

c. 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.

d. Grounding of the alternator output terminal may damage the alternator and/or circuit and components.

e. 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. These aircraft are negative ground.

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

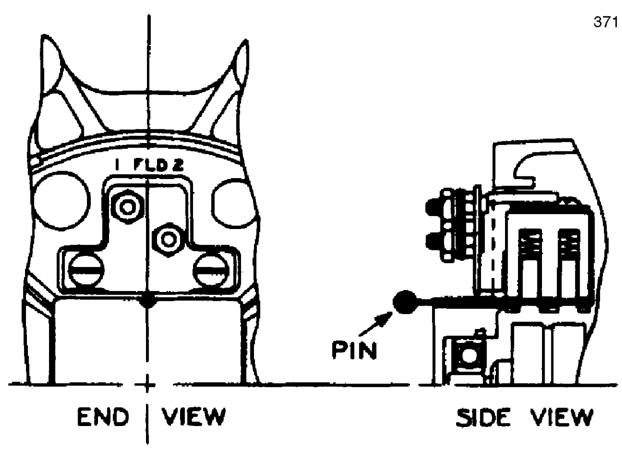
15. ALTERNATOR SERVICE.

a. Bearings: These units have a sealed ball bearing at the drive end and a two-piece roller bearing at the slip ring end. The inner race is pressed onto the rotor shaft and the rest of the bearing is in the slip ring end head. When the unit is assembled, the inner race aligns with the bearing. When the bearing is replaced, the new inner race must be installed on the rotor shaft.

b. Lubrication: The slip ring end bearing should be lubricated whenever the alternator is disassembled. The bearing should be thoroughly cleaned and repacked with Shell Alvania No. 2 or an equivalent bearing lubricant. The cavity behind the bearing should be packed one-third to one-half full with the same lubricant.

c. Brushes: These units have a separate brush holder assembly that is installed after the alternator has been assembled. The brush holder has a small hole that intersects the brush cavities. Use a pin or a piece of wire, as shown in Figure 14 to hold the brushes in the holder during assembly. Remove the pin after the brush holder retaining screws have been tightened. Make a continuity check to be sure the brushes are seated against the slip rings.

d. Drive Pulley: Torque the drive pulley retaining nut to 35 foot-pounds.



Brush Installation
Figure 14

16. ALTERNATOR SERVICE TEST SPECIFICATIONS. Specifications for the 14-volt Prestolite alternators installed as original equipment on PA-34-200 airplanes are as shown in Table III, below.

TABLE III
ALTERNATOR SERVICE TEST SPECIFICATIONS

Alternator Model	**Prestolite ALY 6408**	
Voltage	12 Volts (V)	
Rated Output	60 amperes	
Ground Polarity	Negative	
Rotation	Bi-Directional	
Rotor:		
Current Draw (77° F)	3.0 to 3.3 amps @ 12.0 V	
Resistance (77° F)	3.6 to 3.9 ohms	
Output Test (77° F)		
Volts	12.8	14.2
Amperes Output	10.0	65.2
Field Amperes	3.15	3.45
RPM (minimum)	1730	5000

TABLE IV
ALTERNATOR BELT TENSION

Width of Belt	**Condition**	**Torque indicated at Alternator Pulley**
3/8 inch	New	11 to 13 ft. lbs.
3/8 inch	Used	7 to 9 ft. lbs.
1/2 inch	New	13 to 15 ft. lbs.
1/2 inch	Used	9 to 11 ft. lbs.

17. CHECKING ALTERNATOR BELT TENSION.

If properly installed, tensioned and checked periodically, the alternator drive belt will give very satisfactory service. However, an improperly tensioned belt will wear rapidly and may slip and reduce alternator output Consequently, a belt should be checked for proper tension at the time it is installed, again after 25 hours operation and at each 100 hour inspection thereafter.

There are two satisfactory methods of checking alternator belt tension; however the first method described will be found preferable by most maintenance personnel because it is technically simple and requires little time for accomplishment.

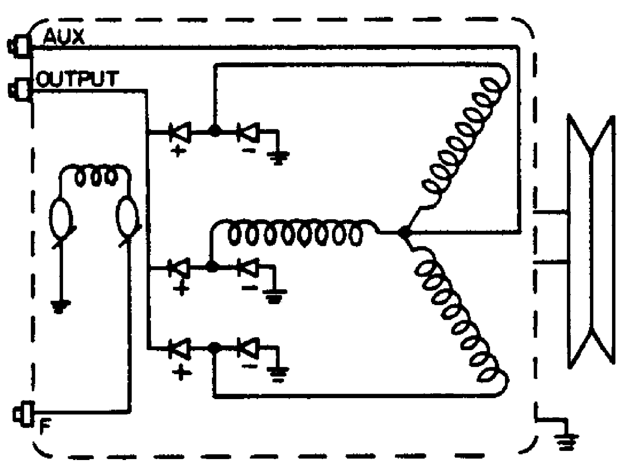
a. Torque method: This method of checking belt tension consists of measuring torque required to slip the belt at the small pulley and is accomplished as follows:

   1. Apply a torque indicating wrench to the nut that attaches the pulley to the generator and turn it in a clockwise direction. Observe the torque shown on the wrench at the instant the pulley slips.
   2. Check the torque indicated in step (1) with torque specified in Table IV, above. Adjust belt tension accordingly.

b. Deflection method: Belt tension may be checked by measuring the amount of deflection caused by a predetermined amount of tension; this is accomplished in the following manner:

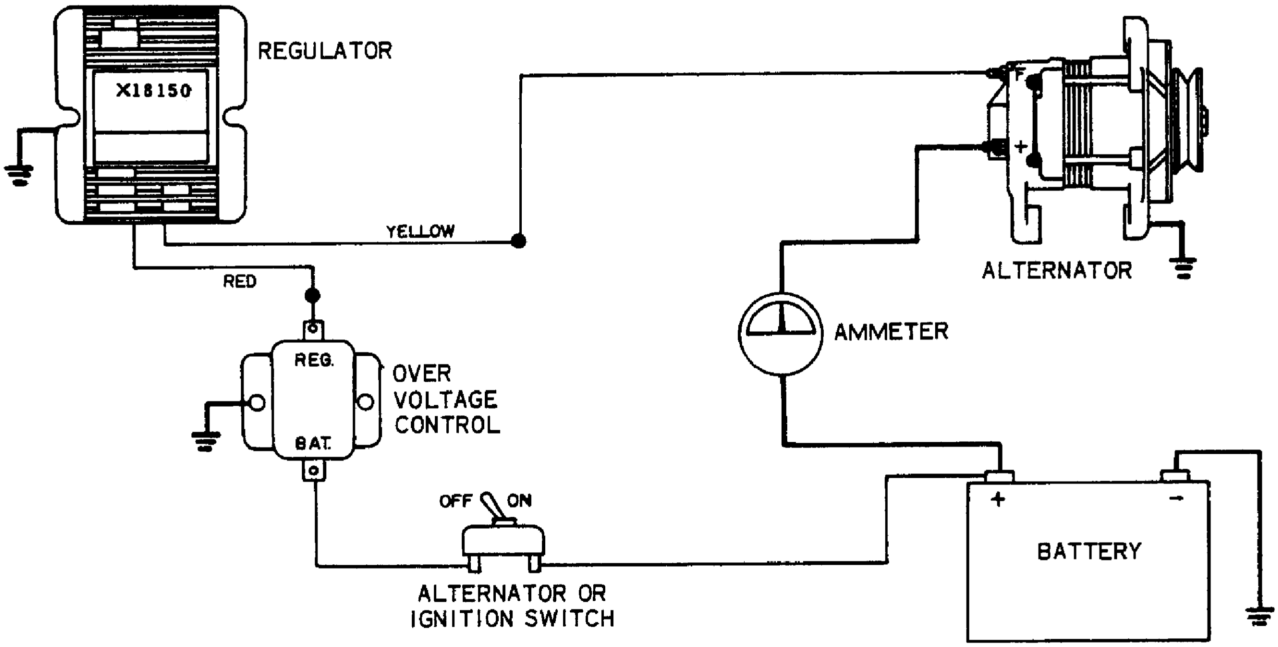
   1. Attach the hook of a small spring-scale to the belt at the approximate mid-point between the ring gear support and the alternator.
   2. Pull on the scale until a reading of 14 pounds is obtained. (10 pounds for used belts)
   3. Measure the distance the belt has moved with the 10 to 14 pound load applied. The distance (deflection) should be 0.31 inch. If less than 0.31 inch, the belt is too tight.

   NOTE: The higher tension specified for a new belt is to compensate for the initial stretch that takes place as soon as it is operated. These higher tension values should not be applied to belts which previously have been used.



Internal Wiring Diagram
Figure 15

372



Overvoltage Control Installation
Figure 16

18. VOLTAGE REGULATOR.

19. CHECKING VOLTAGE REGULATOR. The regulator is a fully transistorized unit in which all of the components are encapsulated in epoxy, which makes field repair of the unit impractical, and if it does not meet the specifications, it must be replaced. The regulator may be tested by the following procedure:

    a. Be sure that the battery is fully charged and in good condition.

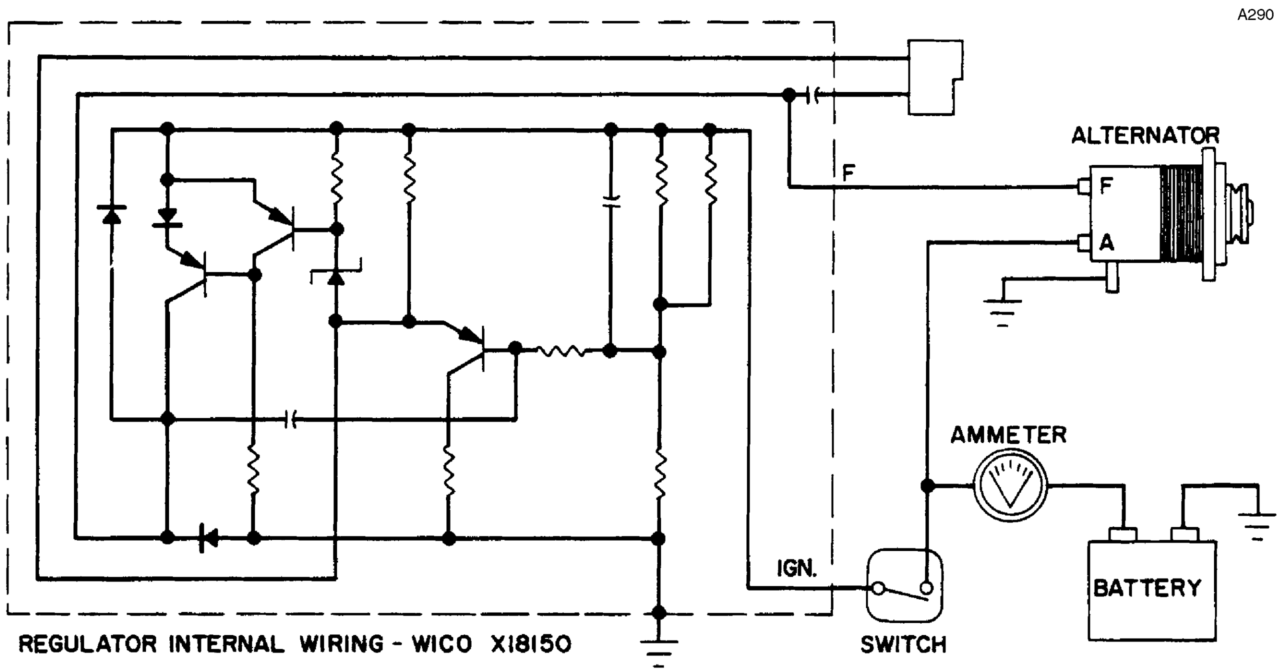
    b. Check the alternator according to the manufacturer's instructions, to determine if it is functioning properly. This test must be done with the regulator out of the circuit. After completing this test, reconnect the regulator into the circuit.

    c. Use a good quality accurate voltmeter with at least a 15 volt scale.

    d. Connect the positive voltmeter lead to the red wire at the regulator harness connector, or terminal block. Connect the negative voltmeter lead to the regulator housing.

    NOTE: Do not connect the voltmeter across the battery, because the regulator is designed to compensate for resistance contained within the wiring harness.

    e. With the alternator turning at sufficient rpm to produce a half load condition, or approximately 25-amperes output, the voltmeter should read between 13.8 to 14.6 volts. The ambient temperatures surrounding the voltage regulator should be between 50°F to 100°F while this test is being made.



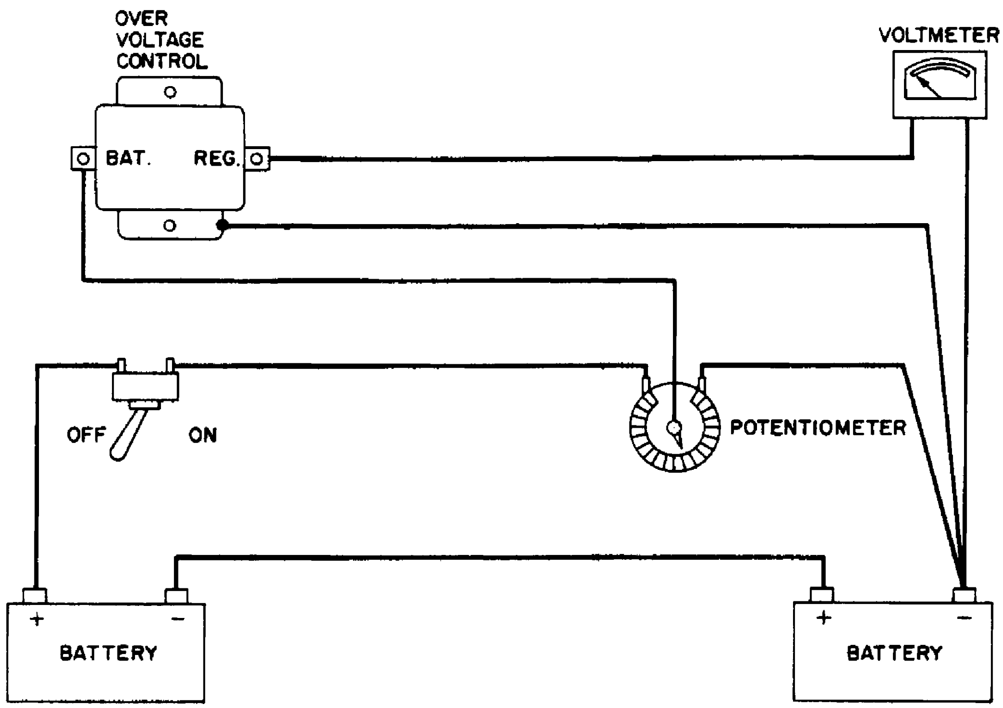
Regulator Circuit Schematic - Typical
Figure 17

f. The voltage regulator heat sink, or case, is the ground connection for the electronic circuit. Therefore, if this unit is tested on the bench, it is most important that a wire, No. 8 or larger, be connected between the regulator case and the alternator. If the regulator does not regulate between 13.8 to 14.6 volts, one of the following conditions may exist:

1. Regulates, but out of specification. The regulator is out of calibration and must be replaced.
2. The voltmeter continues to read battery voltage.
   (a) Poor or open connections within the wiring harness.
   (b) The regulator is “open.”
3. Voltage continues to rise.
   (a) Regulator housing not grounded.
   (b) Regulator shorted, must be replaced.

g. These are some of the things to look for in case of failure:

1. Poor or loose connections.
2. Poor ground on the regulator housing.
3. Shorted alternator windings.
4. A grounded yellow wire (this will cause instantaneous failure).
5. Disconnecting the regulator while the circuit is energized.
6. Open circuit operation of the alternator (the battery disconnected).



Testing Overvoltage Control
Figure 18

20. OVERVOLTAGE RELAY.

21. CHECKING OVERVOLTAGE RELAY. 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:

    a. B+ is connected to “Bat” of the overvoltage control.

    b. B- is connected to the frame of the overvoltage control.

    c. Be sure both connections are secure and connected to a clean bright surface.

    d. Connect the positive lead of the voltmeter to the “Bat” terminal of the overvoltage control.

    e. Connect the negative lead of the voltmeter to the frame of the overvoltage control.

    f. 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.

    g. If the overvoltage control does not operate between 16.5 and 17.5 volts, it must be replaced.

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22. STARTERS.

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.)

23. DESCRIPTION. The gear reduction starting motor consists of six major components: the Commutator End Head Assembly, the Armature, the Frame and Field Assembly, the Gear Housing, the Pinion Housing, and the Bendix Drive Assembly. Refer to Figure 19.

24. OPERATION. When the starting circuit is energized, battery current is applied to the starting motor terminal. Current flows through the field coils, creating a strong magnetic field. 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 created in the field windings begins to turn the armature.

The gear cut on the drive end of the armature shaft extends through the gear housing, where it is supported by a roller bearing. The gear mates with the teeth of the reduction gear that drives the bendix shaft. The shaft is keyed to the reduction gear. The Bendix drive is held in position on the shaft by a "spirol" pin. The shaft is supported in the gear housing by a closed end roller bearing and in the pinion housing by a graphitized bronze bearing.

When the armature turns the reduction gear, the Bendix drive pinion meshes with the flywheel ring gear by inertia and action of the screw threads within the Bendix sleeve. A detent pin engages in a notch in the screw threads which prevents demeshing if the engine fails to start when the starting circuit is de-energized.

When the engine reaches a predetermined speed, centrifugal action forces the detent pin out of the notch in the screw shaft and allows the pinion to demesh from the flywheel.

24a. TROUBLESHOOTING. See Table V, below.

25. INSPECTION. The starting circuit should be inspected at regular intervals, the frequency of which should be determined by the amount of service and the condition under which the aircraft is operated. It is recommended that such inspection be made at each 100 hours and include the following:

a. 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.

b. 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:

1. Voltage loss from insulated battery post to starting motor terminal - 0.3 volt maximum.
2. 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.

TABLE V (Sheet 1 of 2)
TROUBLESHOOTING STARTER

Trouble	Cause	Remedy
Starter fails to operate.	Low battery charge.	Check and recharge if necessary.
	Defective or improper wiring or loose connections.	Refer to electrical wiring 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 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.
	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.	
		A new brush should be run in until at least 50 percent 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 side next to the brush. Pull sandpaper in the direction of rotation, being careful to keep it in the same contour as the commutator.
	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 or replace with a new part.

TABLE V (Sheet 2 of 2)
TROUBLESHOOTING STARTER

Trouble	Cause	Remedy
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 "Starter fails to operate," above.	Same remedies listed for these troubles.
Excessive arcing of motor brushes.	Binding, worn, or improperly seated brush or brushes with excessive side play.	See information above 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.

c. No lubrication is required on the starting motor except at the time of overhaul. Then lubricate the entire shaft under Bendix Drive, fill grooves in armature shaft at drive end and pack gear box with 1.3 to 2.0 ounces of Lithium Soap Base Grease 1925 Molytex "O" or equivalent.

d. The starting motor should be operated for a few seconds with the ignition switch off, or in airplanes with a combination starter and ignition switch, by disconnecting the magneto "P" leads. This is to determine that the pinion engages properly and that it turns freely without binding or excessive noise. After checking the system, reconnect the "P" leads. Then the engine should be started two or three times to see that the pinion disengages properly when the engine is shut down.

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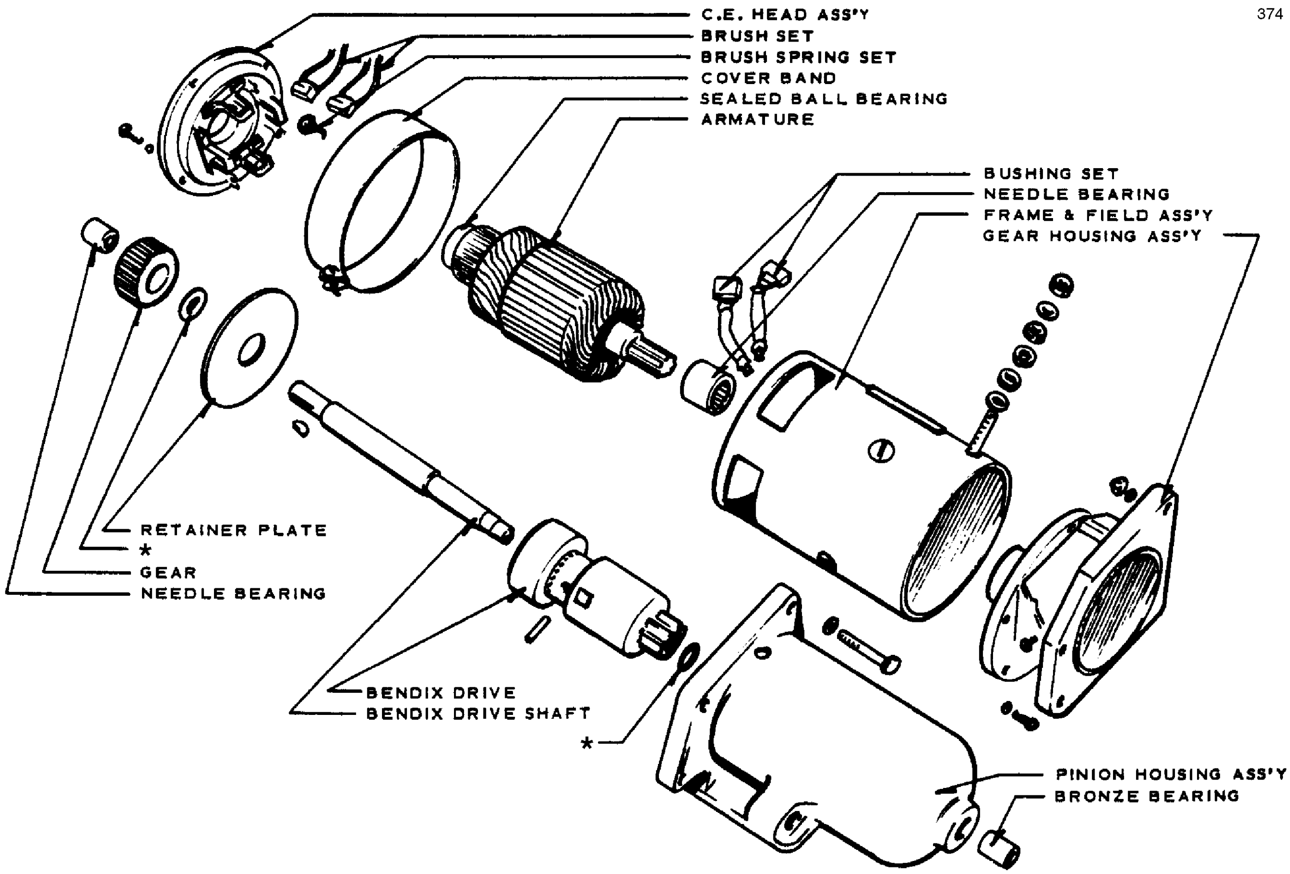


Starter - Exploded View
Figure 19

26. OVERHAUL. If during the above inspection any indication of starting motor difficulty is noted, the starting motor should be removed from the engine for cleaning and repair.

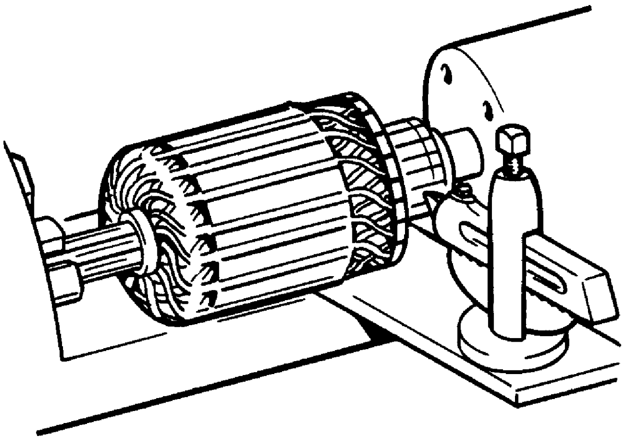
27. REMOVAL. To remove the starting motor from the engine, first disconnect the ground cable from the battery post to prevent short circuiting. Disconnect the lead from the starting motor terminal, then take out the mounting bolts. The motor can then be lifted off and taken to the bench for overhaul.

28. DISASSEMBLY.

    a. Remove the frame screws from the commutator end head and pull end head and armature from frame. Lift the brushes and lock in elevated position with brush springs. Use a puller to remove the end head from the armature. Use a special bearing puller to remove the sealed ball bearing from the armature shaft.

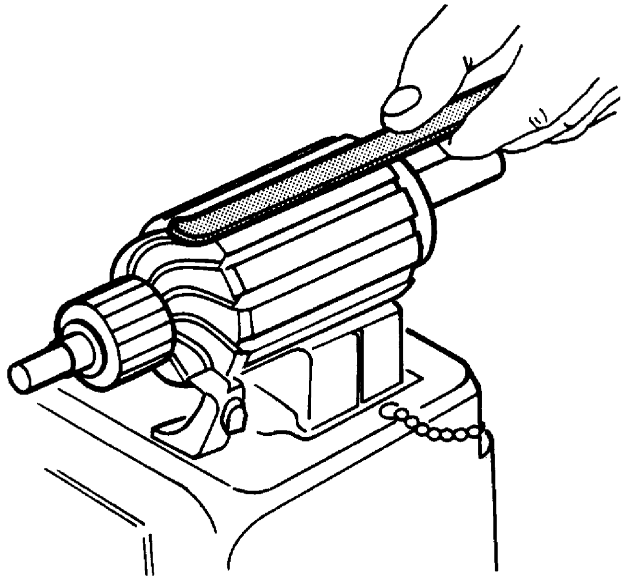
    b. Remove the frame screws that secure the gear housing to the frame. Remove bolts and nuts holding the gear housing to the pinion housing and separate the two units. Pull Bendix shaft from pinion housing. Do not lose the steel spacer that is located on the pinion end of the shaft. Remove reduction gear, woodruff key and steel spacer from shaft.

375



Turning Motor Commutator
Figure 20

376



Testing Motor Armature for Shorts
Figure 21

c. Turn the Bendix pinion until it locks in the extended position. Locate “spirol” pin and use a punch to remove. Slide drive assembly off the shaft. Do not attempt to disassemble the drive and do not dip it in cleaning solvent.

d. To remove the roller bearings from the gear housing, use an arbor press and the correct bearing arbor. DO NOT hammer out. Each part should be cleaned and inspected for excessive wear or damage. Bearings should be checked for proper clearance and evidence of roughness or galling. Oil and dirt should be removed from insulation and the condition of the insulation checked.

29. BRUSHES. Check the brushes to see that they slide freely in their holders and make full contact on the commutator. If worn to half their original length or less, they should be replaced.

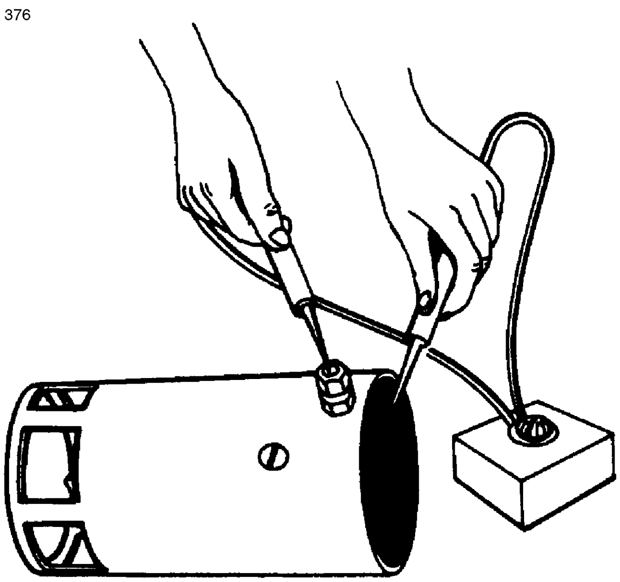
30. ARMATURE.

a. Check the commutator for uneven wear, excessive glazing or evidence of excessive arcing. If only slightly dirty, glazed or discolored, the commutator can be cleaned with 00 or 000 sandpaper. If the commutator is rough or worn, it should be turned in a lathe. Refer to Figure 20. The armature shaft should be inspected for rough bearing surfaces and rough or damaged splines.

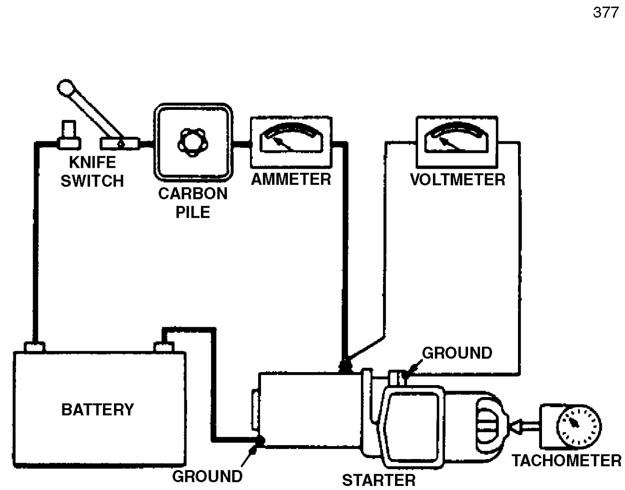
b. To test the armature for grounds, a set of test probes connected in series with a 110 volt light should be used. Touch one probe to a commutator segment and the other to the armature core. If the test lamp lights, the armature is grounded and should be replaced.

c. To test for shorted armature coils, a growler is used. (Refer to Figure 21.) The armature is placed on the growler and slowly rotated by hand while a steel strip is held over the core so that it passes over each armature core slot. If a coil is shorted, the steel strip will vibrate.

d. A quick check for opens can be made by inspecting the trailing edge (in direction of rotation) of the commutator segments for excessive discoloration. This condition indicates an open circuit.



Testing Motor Fields for Ground
Figure 22



No-Load Test Hook-up
Figure 23

31. FIELD COILS.

    a. Check the field coils for grounds (refer to Figure 22) by placing one test probe on the frame and the other on the starter terminal. Be sure the brushes are not accidentally touching the frame. If the lamp lights, the fields are grounded. Repair or replace.

    b. Inspect all connections to make sure they are clean and tight and inspect insulation for deterioration.

32. BRUSH HOLDERS.

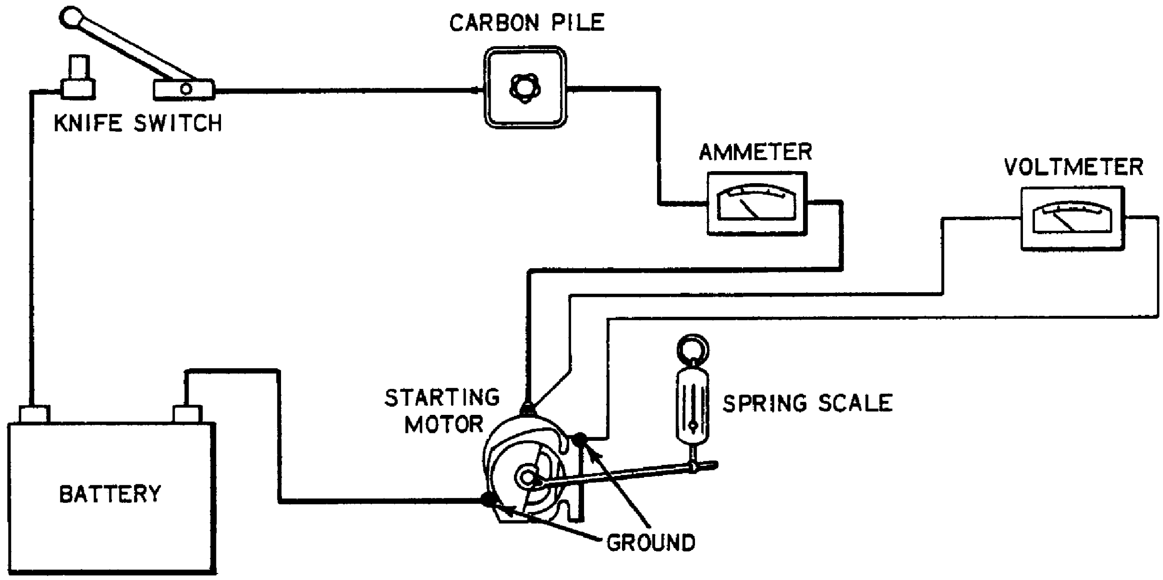
    a. To test brush holders, touch one test probe to the brush plate and the other to each brush holder.

    b. The test lamp should light when the grounded brush holders are touched and should not light when the insulated brush holders are touched.

33. GEAR AND PINION HOUSING. Inspect housings for cracks and bearings for excessive wear. Remove rust, paint or grease from mounting surfaces.

34. BENDIX DRIVE. The Bendix Drive should be wiped clean with a dry cloth. The pinion should turn smoothly in one direction and should lock in the other direction. Replace drive if it fails to check as above or if the pinion teeth are excessively worn or damaged.

378



Stall-Torque Hook-up
Figure 24

35. ASSEMBLY.

a. When assembling the starting motor, always use an arbor press and the proper bearing arbor for installing graphitized bronze and roller bearings. The Bendix shaft should have a thin film of Lubriplate #777 or equivalent on the Bendix portion of the shaft. End play should be .005 to .050 of an inch.

b. New brushes should be properly seated when installing by wrapping a strip of 00 sandpaper around the commutator (with the sanding side out) 1-1/4 to 1-1/2 times maximum. Drop brushes on sandpaper covered commutator and turn the armature slowly in the direction of rotation. Dust should be blown out of the motor after sanding.

NOTE: The spring tension is 32 to 40 ounces with new brushes. This tension is measured with the scale hooked under the brush spring near the brush and the reading is taken at right angles to the line of force exerted by the brush spring.

c. Check the position of the pinion to be sure the unit will mesh properly with the flywheel ring gear. See specifications for unit for correct dimensions. Refer to paragraph 37.

36. BENCH TESTS.

a. After the starting motor is reassembled, it should be tested to see that the no-load current at a certain voltage is within specifications as given in paragraph 37. To make this test, connect as shown in Figure 23. If current is too high, check the bearing alignment and end play to make sure there is no binding or interference. Two or three sharp raps on the frame with a rawhide hammer will often help to align the bearings and free the armature.

b. If no difficulty is indicated in the above test, a stall torque test may be made to see if the starting motor is producing its rated cranking power. Make test connections as shown in Figure 24.

c. If torque and current are not within specifications, check the seating of the brushes and internal connections for high resistance. If these checks are made and found to be in good order, replace frame and field assembly and retest starter.

37. STARTING MOTOR CONTROL CIRCUIT.

a. Inspect the control circuit wiring between the battery, solenoid and manual starting switches for breaks, poor connections and faulty insulation. Tighten all connections and make sure solenoid is firmly mounted and makes a good ground connection.

b. Check the voltage loss across the switch contacts during normal starting. If loss is in excess of 0.2 volts per 100-amperes, the solenoid should be replaced.

c. If solenoid fails to operate when the manual starting switch is turned on or if it fails to release when the manual starting switch is released, it should be removed and tested to specifications. If either opening or closing voltages are not within specifications, replace the solenoid.

38. STARTING MOTOR SERVICE TEST SPECIFICATIONS. Specifications for the 12-Volt Prestolite starting motors installed as original equipment in the PA-34-200 are as shown in Table VI.

TABLE VI
STARTING MOTOR SERVICE TEST SPECIFICATIONS

Prestolite Motor Model	Left Engine - MZ-4206 Right Engine - MZ-4216
Brush Tension	
Minimum	32 oz.
Maximum	40 oz.
No-Load Test (77° F)	
Volt	10
Max. Amps	75
Min. RPM	2000
Stall Torque	
Amps	560
Min. Torque, ft. lbs.	38.0
Approx. Volts	4.0
Pinion Position *	
Drive at rest	1.748 - 1.855 in.
Drive extended	2.388 - 2-495 in.

* This dimension is measured from the centerline of the mounting hole nearest the drive end head to the edge of the pinion.

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39. BATTERY.

39a. TROUBLESHOOTING. See Table VIII, below.

40. SERVICING. The battery is located in the left forward portion of the nose section. It is enclosed in a fiberglass box with a vent system and a drain. The vents allow fresh air to enter the box and draw off fumes that may accumulate due to the charging process of the battery. The drain is clamped off from the bottom of the fuselage and should be opened occasionally to drain any accumulation of liquid or during cleaning of the box. The battery should be checked for fluid level, but must not be filled above the baffle plates. A hydrometer check should be performed to determine the percent of charge in the battery. All connections must be clean and tight.

CAUTION: ALWAYS REMOVE THE GROUND CABLE FIRST AND INSTALL LAST TO PREVENT ACCIDENTAL SHORT CIRCUITING OR ARCING.

41. REMOVAL.

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

b. Disconnect the battery cables.

c. Lift the battery from the box.

42. INSTALLATION.

a. Ascertain that the battery and battery box have been cleaned and are free of acid.

b. Install the battery in box.

c. Connect the positive lead to the positive battery terminal and secure.

d. Connect the ground cable to the negative battery terminal and secure.

e. Install access panel.

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

TABLE VII
HYDROMETER READING VS. BATTERY CHARGE

Hydrometer Reading	Percent of Charge
1280	100
1250	75
1220	50
1190	25
1160	Little Useful Capacity
1130 or below	Discharged

TABLE VIII (Sheet 1 of 2)
TROUBLESHOOTING BATTERY

Trouble	Cause	Remedy
Discharged battery.	Battery worn out.	Replace battery.
	Low electrical system voltage.	Check voltage regulator voltage.
	Standing too long.	Remove and recharge battery if left in unused airplane three (3) 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.	Check voltage regulator voltage.
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. Check voltage regulator voltage.
Electrolyte runs out of vent plugs.	Too much water added to battery and charging rate too high.	Drain and keep at proper level and check voltage regulator voltage.
Excessive corrosion inside container.	Spillage from over-filling.	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.

TABLE VIII (Sheet 2 of 2)
TROUBLESHOOTING BATTERY

Trouble	Cause	Remedy
Leaking battery jar.	Frozen.	Replace.
Battery polarity reversed.	Connected backwards on airplane or 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.

44. BATTERY BOX CORROSION PREVENTION. 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:

a. Remove the box drain cap from the under side of the fuselage and drain off any electrolyte that may have overflowed into the box.

CAUTION: DO NOT ALLOW SODA SOLUTION TO ENTER BATTERY.

b. 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.

c. Rinse the battery and box with clean water and dry.

d. As necessary, paint the battery box with an acid resistant paint. Allow paint to dry thoroughly.

e. Place the cap over the battery box drain.

f. Reinstall the battery.

44a. EXTERNAL POWER RECEPTACLE. The external power receptacle is located on the left side of the nose section.

CAUTION: IF AIRCRAFT BATTERY IS WEAK, CHARGING CURRENT WILL BE HIGH. DO NOT TAKE OFF UNTIL CHARGING CURRENT FALLS BELOW 20 AMPS. NEVER USE A 12 OR 24 VOLT BATTERY IN PLACE OF A SIX VOLT BATTERY SINCE ELECTRICAL DAMAGE MAY RESULT.

NOTE: Should the hydrometer reading indicate less than 1190, the battery should be removed and recharged or replaced.

a. When using a 12 volt battery for external power starting and the airplane's battery is nearly depleted, the following procedure should be used.

1. Disconnect the airplane's battery at the negative terminal to prevent excessive loading of the external starting battery.
2. Check that all of the airplane's electrical equipment and master switch are turned OFF.
3. Connect the external battery to the external power receptacle and start RIGHT ENGINE ONLY using normal starting procedures.
4. Remove external battery and then reconnect airplane's battery at the negative terminal.
5. Turn master switch on and check ammeter for battery charging current.

b. When starting with a power cart and the airplane's battery is nearly depleted, the procedure in step (a) need not be followed. The capacity of a power cart is sufficient to start an aircraft with a low battery. If a six volt battery is available, it can be connected in series with the 12 volt external battery to supply 18 volts for starting. In this case, use the same starting procedure as used with a power cart.

44b. EXTERIOR LIGHTS. See Table IX, below, for replacement lamps.

45. 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 Figure 1.) 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.

46. REMOVAL. (Refer to Figure 25.)

a. Ascertain the master switch is off prior to doing any work on the landing lights.

CAUTION: WHEN REMOVING THE ATTACHMENT PLATE, USE CAUTION NOT TO DROP THE LAMPS.

b. Removal of either lamp from the landing light mounting fixture is accomplished by removing the screws securing the front lamp attachment plate and removing the attachment plate.

c. Disconnect the electrical leads from the lamp being removed.

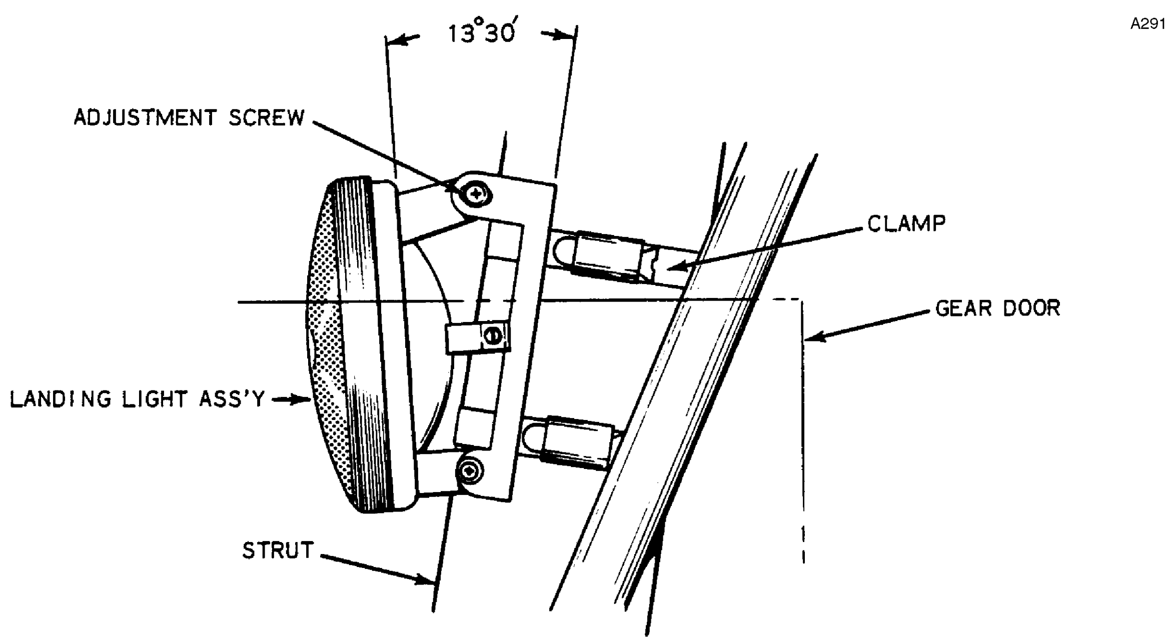
d. To remove the complete assembly from the gear strut, disconnect the electrical leads from both lamps and release the clamps that secure the assembly to the strut housing.

47. INSTALLATION. (Refer to Figure 25.)

a. To install the landing lamps, attach the electrical leads to the lamp or lamps.

CAUTION: TIGHTEN THE SCREWS JUST ENOUGH TO ALLOW THE LAMPS TO FIT SNUG IN THE MOUNTING FIXTURE.

b. Place the lamp or lamps against the mounting pad and position the attachment plate on the mounting fixture and secure with appropriate screws.



Landing Light Adjustment
Figure 25

TABLE IX
LAMP REPLACEMENT GUIDE

Location	Piper Part No.	Lamp No.
Exterior		
Wing Tips	751-381	# 1512
Tail Light	753-431	# 1073
Anti-Collision	757-635	# A406
Landing Light	472-661	# 4509
Interior		
Reading Light		# 93
Instrument—Glar-Ban	472-054	# 330
Compass Light	472-054	# 330
Forward Baggage	472-036	# 89
Stall Warning	572-054	# 330
Overvoltage Trip Indicator	472-054	# 330
Instrument Cluster		# 53
Gear—Down	472-054	# 330
Gear—Up	472-054	# 330

c. To install the landing light assembly to the strut, position the assembly against the strut housing with the bottom of the mounting fixture 2.9 in. up from the bottom of the strut housing. (See Figure 25.)

d. Align the bracket longitudinally and secure in place with clamps.

e. The light beam angle may be adjusted by the adjustment screws at the sides of the bracket and tilting the mounting fixture as desired.

48-50. See Paragraphs 67-70, below.

51. NAVIGATION LIGHTS.

51a. WING.

52. REMOVAL.

a. Remove screw securing the lens retainer.

b. Remove lens and bulb.

NOTE: To remove the complete lamp assembly, the wing tip must be removed.

53. INSTALLATION.

a. Install bulb, lens and lens retainer.

b. Secure with appropriate screws.

53a. TAIL.

54. REMOVAL.

a. To remove bulb, remove the screws securing the light assembly to the rudder tip and remove the lens.

b. Remove the bulb.

NOTE: To remove the complete light assembly, unsolder the electrical lead from the base of the light assembly and disconnect the remaining electrical lead at the connector.

55. INSTALLATION.

a. Install bulb and lens in light assembly.

b. Place light assembly in position on rudder tip and secure with appropriate screw.

55a. ANTI-COLLISION STROBE LIGHTS.

55b. TROUBLESHOOTING. The strobe light assembly functions as a condenser discharge system. A condenser in the power supply is charged to approximately 450 volts D.C., then discharged across the Xenon flash tube at intervals approximately 45 flashes per minute. The condenser is parallel across the Xenon flash tube which is designed to hold off the 450 volts D.C. 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 the appropriate schematic at the back of this section.

a. Ascertain the input voltage at the power supply is 14 volts.

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.

b. Check for malfunction in interconnecting cables.

1. Ascertain pins 1 and 3 of interconnecting cable are not reversed.
2. Using an ohmmeter check continuity between pin 1 and 3 of interconnecting cable. If you obtain a reading on the meter the cable is shorted and should be replaced.

NOTE: A short of the type described in steps 1 and 2 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. Check interconnecting cables for shorts.

CAUTION: WHEN DISCONNECTING THE POWER SUPPLY ALLOW FIVE MINUTES OF BLEED DOWN TIME PRIOR TO HANDLING THE UNIT.

1. Disconnect the output cables from the power supply outlets.
2. The following continuity checks can be made with an ohmmeter.
3. 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. When making these checks if no continuity exists the cable is broken and should be replaced.
4. Check continuity between pins 1 and 2, 1 and 3, and 2 and 3 of the interconnecting cable. If continuity exists between any of these connections the cable is shorted and should be replaced.
5. Check for continuity from pins 1, 2 and 3 to airplane ground. If continuity exists the cable is shorted and should be replaced.

d. Check the tube socket assembly for shorts.

1. Disconnect the tube socket assembly of the anti-collision light from the interconnecting cable.
2. The following continuity checks can be made with an ohmmeter.
3. 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. When making these tests if no continuity exists, the tube socket assembly is broken and should be replaced.

55c. WING TIP STROBE LIGHT LAMP.

56. REMOVAL. The lights are located in both wing tips next to the navigational lights.

a. Remove the screw securing the navigational light cover and remove cover.

b. Remove the three screws securing navigational light bracket assembly and remove light assembly.

c. Remove the strobe lamp by cutting the wires on the lamp beneath the mounting bracket.

d. Remove the defective lamp.

e. Remove and discard the plug with the cut wires from the electrical socket.

57. INSTALLATION.

a. Route the wires from the new lamp down through the hole in the navigational light bracket.

b. Insert the wire terminals in the plastic plug supplied with the new lamp. Wire according to the schematic diagram located at the back of this section.

c. Position strobe lamp on navigational light bracket.

d. Secure navigational light assembly and bracket with appropriate screws.

e. Install navigational light cover and secure with appropriate screws.

57a. TAIL-MOUNTED ANTI-COLLISION LIGHT LAMP.

58. REMOVAL. The light is located on the upper section of the vertical fin.

a. Loosen the screw in the clamp securing the light cover.

b. Remove the light cover.

c. Remove the defective lamp from the socket.

59. See Paragraph 55b, above.

60. INSTALLATION.

a. Plug in new lamp using correct number.

b. Replace light cover.

c. Tighten screw in clamp to secure light cover.

60a. INTERIOR LIGHTS. See Table IX, above, for replacement lamps.

60b. OVERHEAD READING LIGHT LAMP.

61. REMOVAL. The lights are located in the center and rear overhead panels.

   a. Grasp the protruding section of the light assembly and turn to remove from its socket.

   b. Remove the lamp from the light assembly mounting fixture.

62. INSTALLATION.

   a. Insert the new lamp using the proper number in the light assembly mounting fixture.

   b. Install the mounting fixture in the light assembly and turn to secure.

63. INSTRUMENT AND PANEL LIGHTS. The instrument and panel lights are broken up into six groups; Main Panel Lights, Co-Pilot Panel Lights, Lower Panel Lights, Overhead Panel Flood Lights, Middle Panel Lights and the Engine Instrument Cluster Lights. The instrument lights are controlled by a five (5) amp circuit breaker through a transistorized dimmer. The dimmer control is located in the middle of the instrument panel just above the pedestal. In earlier model airplanes there is one control knob connected to a variable resistor that controls the intensity of the instrument lights. In serial numbers 34-7450001 thru 34-7450220 (i.e. - 1974 models), there is a second control knob connected to a variable resistor which controls the light intensity for all the avionic equipment. It may be necessary to gain access to the Dimmer Control Assembly; if so follow the instructions given below.

63a. DIMMER CONTROL ASSEMBLY.

64. REMOVAL.

   a. Access to the Dimmer Control Assembly is from beneath the instrument panel.

   b. Disconnect the electrical connection from the assembly.

   c. Remove the two screws securing the assembly to the instrument panel.

   d. Remove assembly from the airplane.

65. INSTALLATION.

   a. Position the assembly in the instrument panel with the control knobs inserted into their appropriate slots.

   b. Secure the assembly to the instrument panel with the two screws previously removed.

   c. Connect the electrical connection to the assembly.

   d. Check operation of Dimmer Control Assembly.

66. ALUMINUM WIRING. For airplanes which have not complied with Piper Service Bulletin No. 836A:

a. Locate and identify the following cables:
   (1) Battery to ground.
   (2) Battery to master relay.
   (3) Master relay to starter solenoid.
   (4) Starter solenoid to starter.
   (5) Engine return ground cable (engine to airframe).

b. Inspect the cables listed above for the presence of aluminum wire.

c. If aluminum wire is found, replace the affected cable(s) with copper cable(s), as follows:

   Replacement cables for AL-1 wire shall be fabricated from AN-4 copper wire; for AL-00 wire, fabricate from AN-2 copper wire; using copper wire listed below. All wire recommended is of 150°C rating.

   (1) Copper Wire:

Mil-W-22759/4	Mil-W-22759/41
Mil-W-22759/8	Mil-W-81044/5
Mil-W-22759/13	Mil-W-81044/6
Mil-W-22759/16	Mil-W-81044/8
Mil-W-22759/34	Mil-W-81044/9

   (2) Use appropriate terminals listed below, or equivalent:

   CAUTION: USE OF PROPER CRIMPING TOOL FOR COPPER CABLE/TERMINAL COMBINATION UTILIZED IS REQUIRED.

AN-2	AMP	AMP	Mil. Spec.
1/4	51982	320383	MS20659-113
1/4	51982-1	322870	MS20659-147
5/16	51982-2	321600	MS20659-114
1/4	324034		MS20659-113 - Requires 90° bend
3/8	35249		MS20659-114 - Requires 90° bend
3/8	321600		MS20659-114
1/2	51982-3	321602	MS20659-133

AN-4	AMP	AMP	Mil. Spec.
1/4	321671		MS25036-123
5/16	322010		MS25036-124
3/8	322898		MS25036-125 - Requires 90° bend
3/8	322011		MS25036-125
1/4	33469		MS20659-111
5/16	33470		MS20659-132
3/8	33471		MS20659-112
3/8	324102		MS25036-125 - Requires 90° bend
3/8	321121		MS25189-115

d. Upon completion of inspection/cable replacement, make a logbook entry of compliance with Service Bulletin No. 836A.

67. STALL WARNING INDICATOR, HORN AND LIFT DETECTORS.

This system consists of an inboard and outboard lift detector, both of which are electrically connected to a stall warning light located in the instrument panel in front of the pilot and a stall warning horn located behind the instrument panel. As stalling conditions are approached with the wing flaps up, the outboard lift detector will activate the warning light and horn. As the flaps are lowered to the 25° and 40° position a micro switch deactivates the outboard lift detector and activates the inboard lift detector, which will now control the warning system should stall conditions exist. The electrical circuit for this system is protected by a five (5) amp circuit protector located in the circuit protector panel. The following ground check can be performed to determine that each lift detector is functioning properly.

a. Put the flaps in the full up position and turn on the master switch. Using finger pressure gently raise the sensor blade of the outboard lift detector. The warning light and horn should activate.

b. With the flaps in the 25° and 40° down position and the master switch on, raise the sensor blade of the inboard lift detector. The warning light and horn should activate.

c. With the flaps in the 25° and 40° down position and the master switch on, raise the sensor blade of the outboard lift detector. The warning light and horn should NOT activate. In the event the warning light and horn do activate, the micro switch is in need of adjustment as follows:

NOTE: The master switch must be off prior to performing any work on the lift detector, warning light and horn, or micro switch.

1. Refer to Section V, paragraph 36, and proceed to the extent necessary to gain access to the micro switch mounted on a bracket adjacent to the left end of the wing flap torque tube. (Refer to Figure 26.)
2. Put the flaps in the full up position and determine that the wheel of the micro switch actuator is in contact with the torque tube fitting. Loosen, but do not remove the screws securing the micro switch in position. Move the flaps towards the full down position while moving the micro switch in the direction necessary to hear it actuate as the flaps assume the 25° down position. Tighten the micro switch mounting screws and repeat steps a thru c.

68. LIFT DETECTORS.

69. REMOVAL.

a. Remove four screws holding the unit in place and remove the unit from the wing.

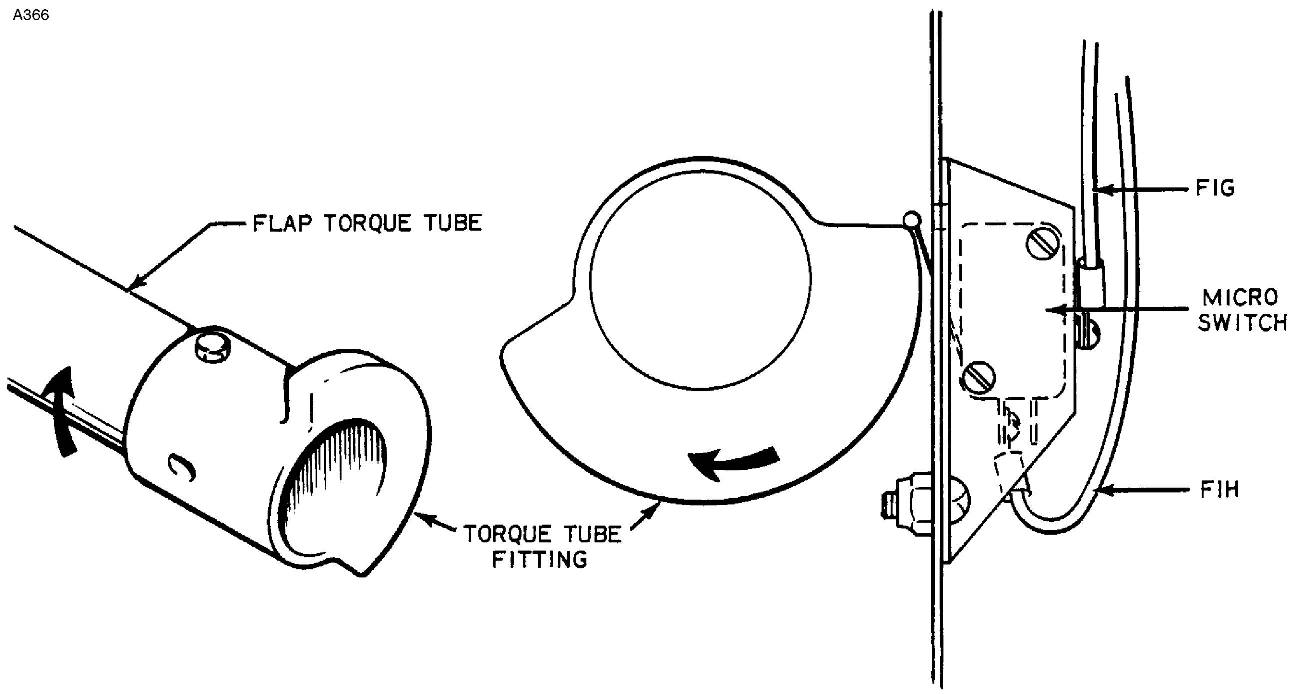
b. Identify the electrical leads to facilitate reinstallation and disconnect the electrical leads.

70. INSTALLATION.

a. Attach electrical leads to the appropriate terminals of the lift detector.

b. Position the unit on the wing, determining that the sensor blade of the unit drops down freely, and secure in position with four screws previously removed.

A366



Adjusting Lift Detector Microswitch
Figure 26

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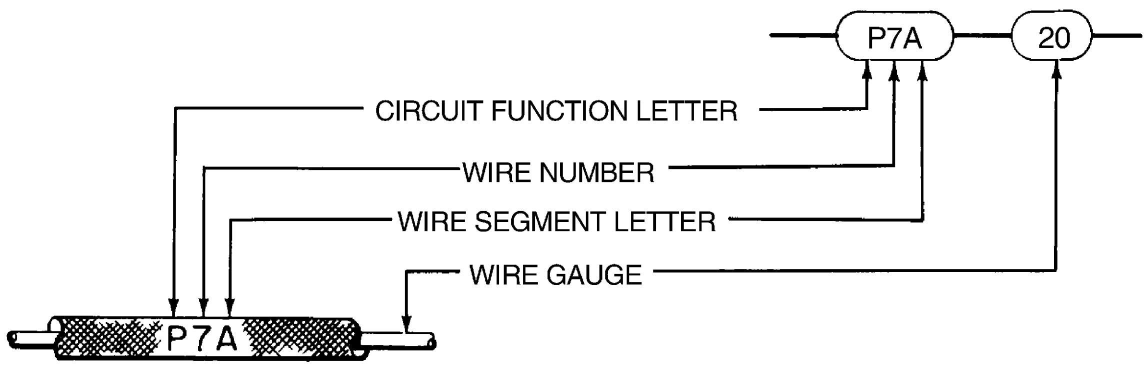
71. ELECTRICAL SCHEMATICS (I.E. - WIRING DIAGRAMS) INDEX.

72. ELECTRICAL WIRE CODING. See Table X, below.

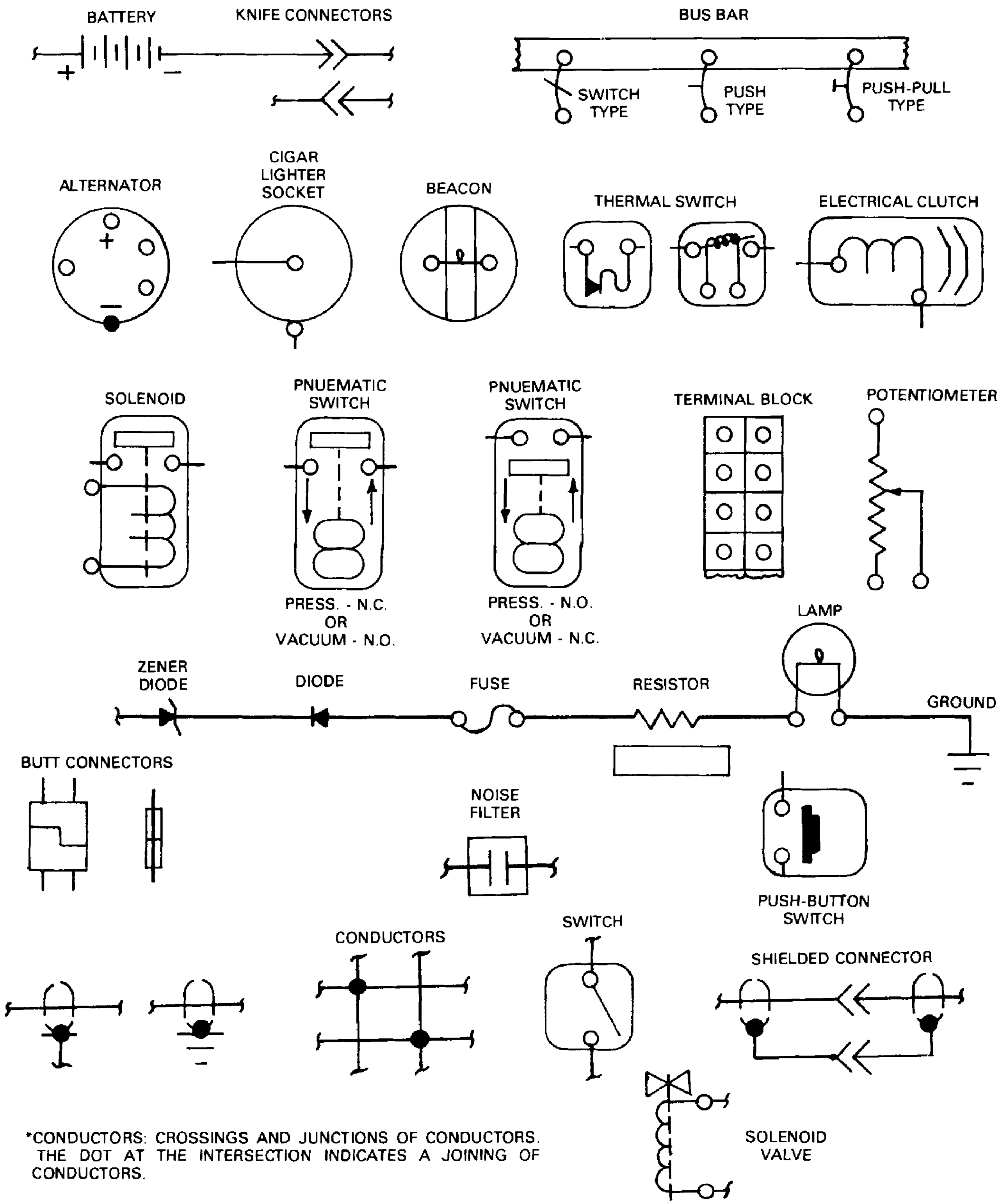
73. ELECTRICAL SYMBOLS. See Table XI, below.

TABLE X
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

TABLE XI (Sheet 1 of 3)
ELECTRICAL SYMBOLS (Old Style)



*CONDUCTORS: CROSSINGS AND JUNCTIONS OF CONDUCTORS. THE DOT AT THE INTERSECTION INDICATES A JOINING OF CONDUCTORS.

TABLE XI (Sheet 2 of 3
ELECTRICAL SYMBOLS (New Style)

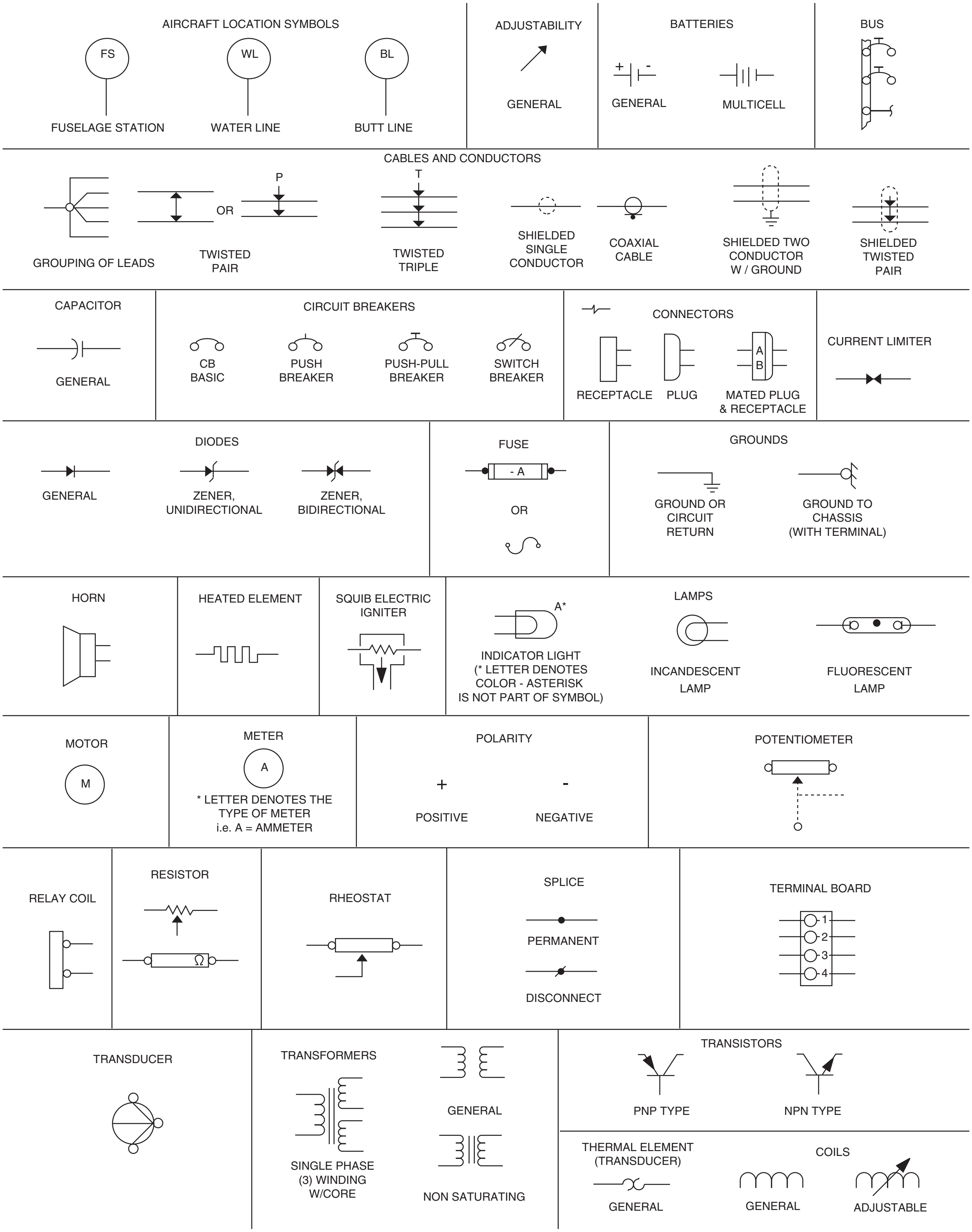
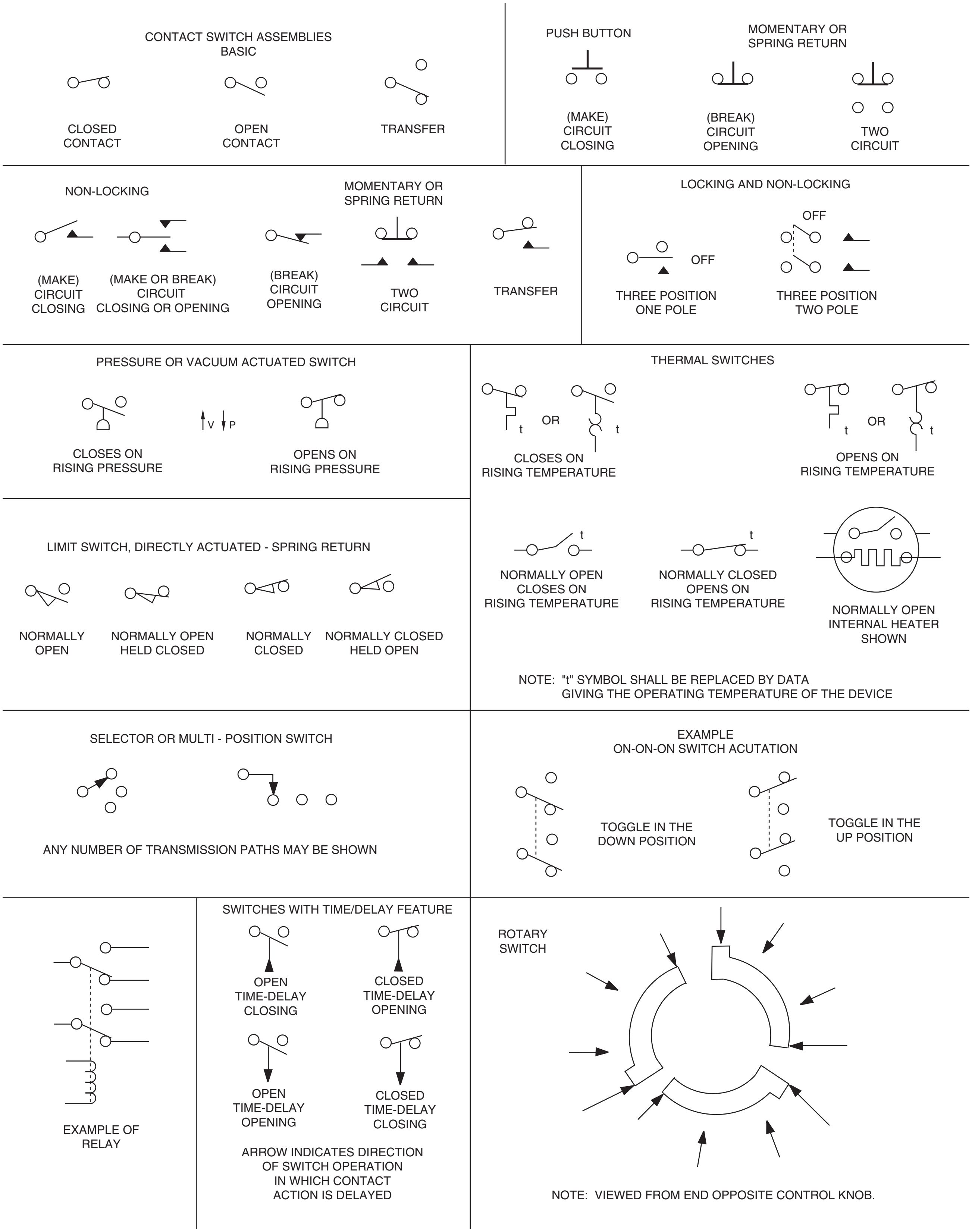


TABLE XI (Sheet 3 of 3
ELECTRICAL SYMBOLS (New Style)



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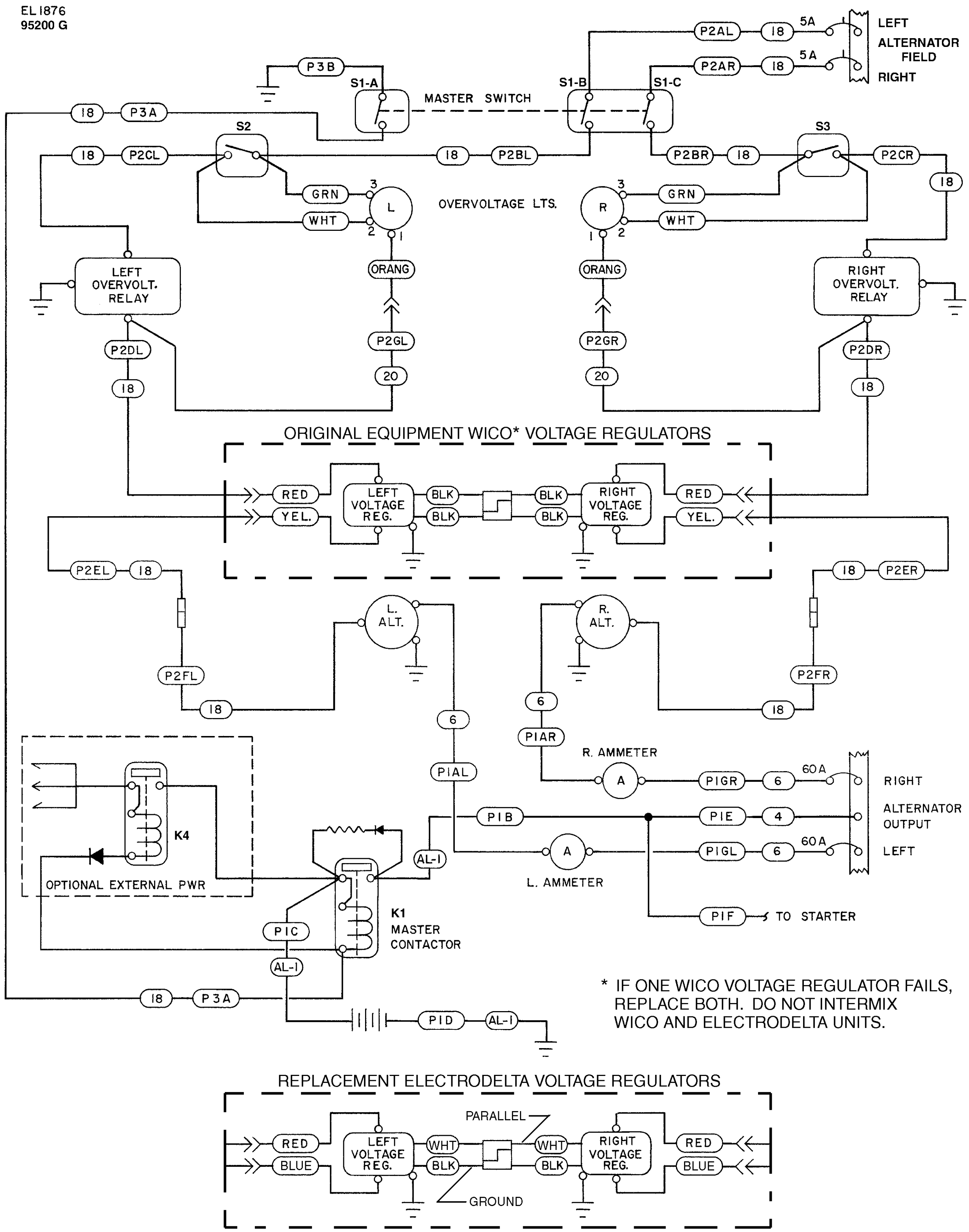
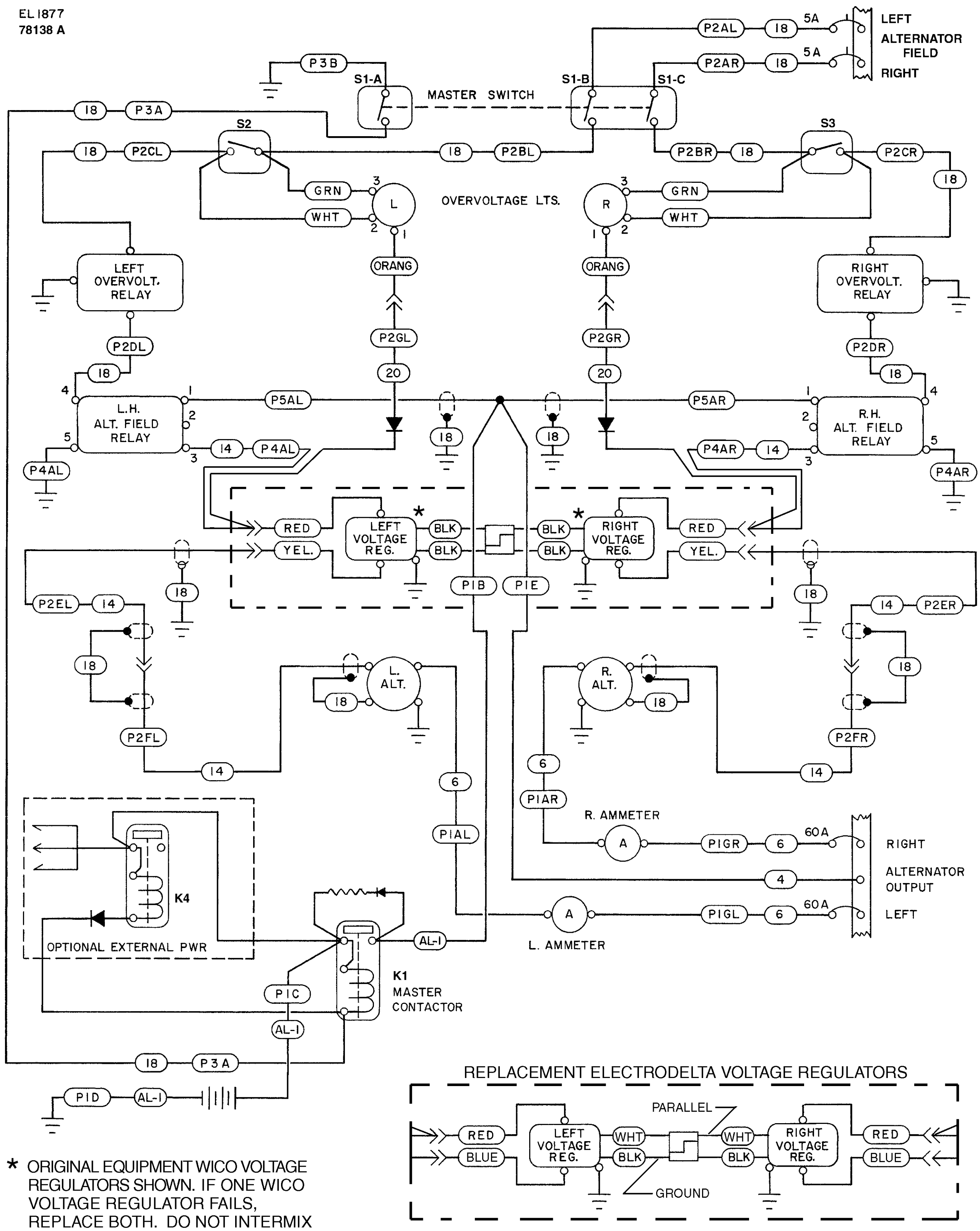


Alternators
Figure 27

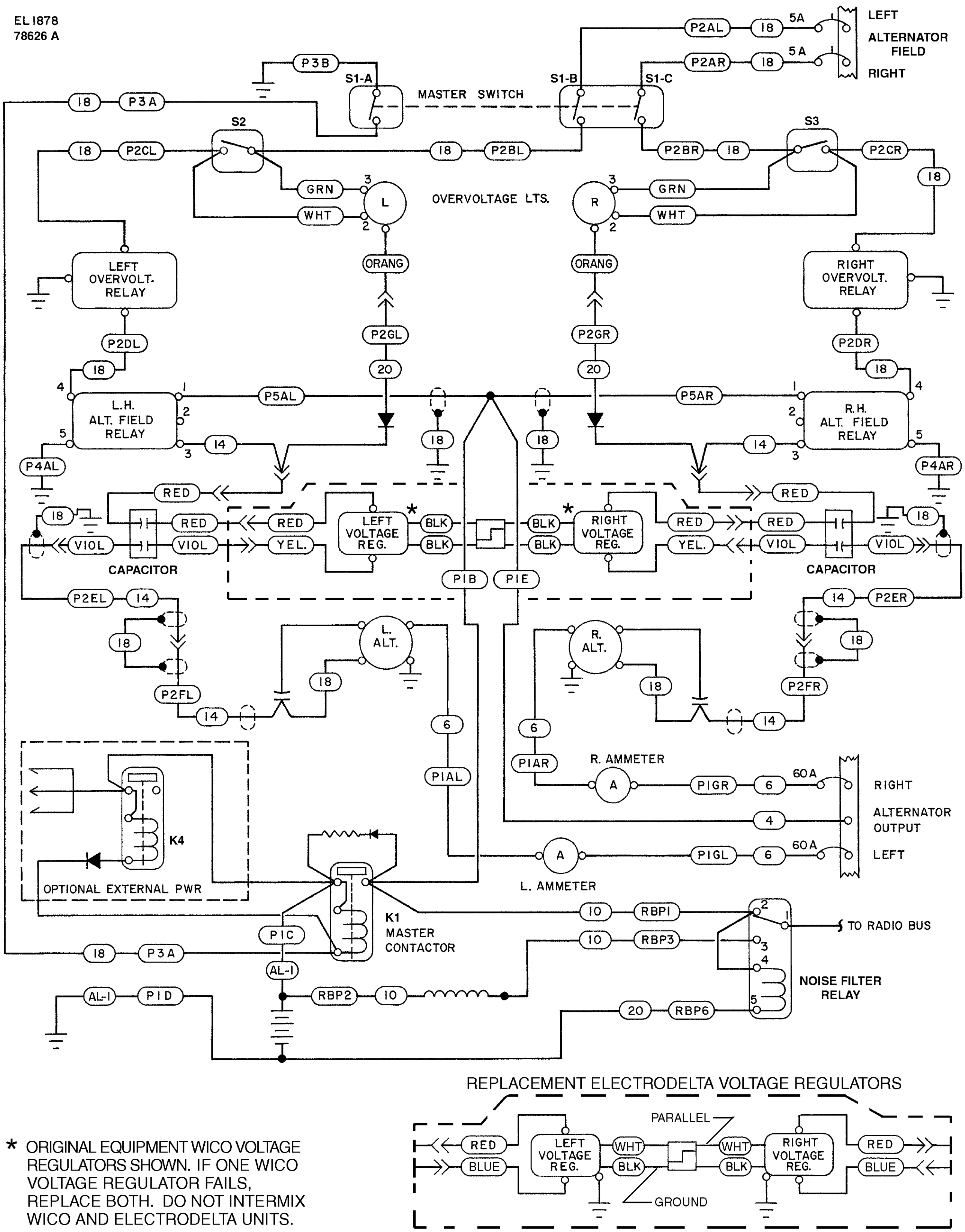
Effectivity
34-7250001 thru 34-7350135



* ORIGINAL EQUIPMENT WICO VOLTAGE REGULATORS SHOWN. IF ONE WICO VOLTAGE REGULATOR FAILS, REPLACE BOTH. DO NOT INTERMIX WICO AND ELECTRODELTA UNITS.

Effectivity
34-7350136 thru 34-7350363

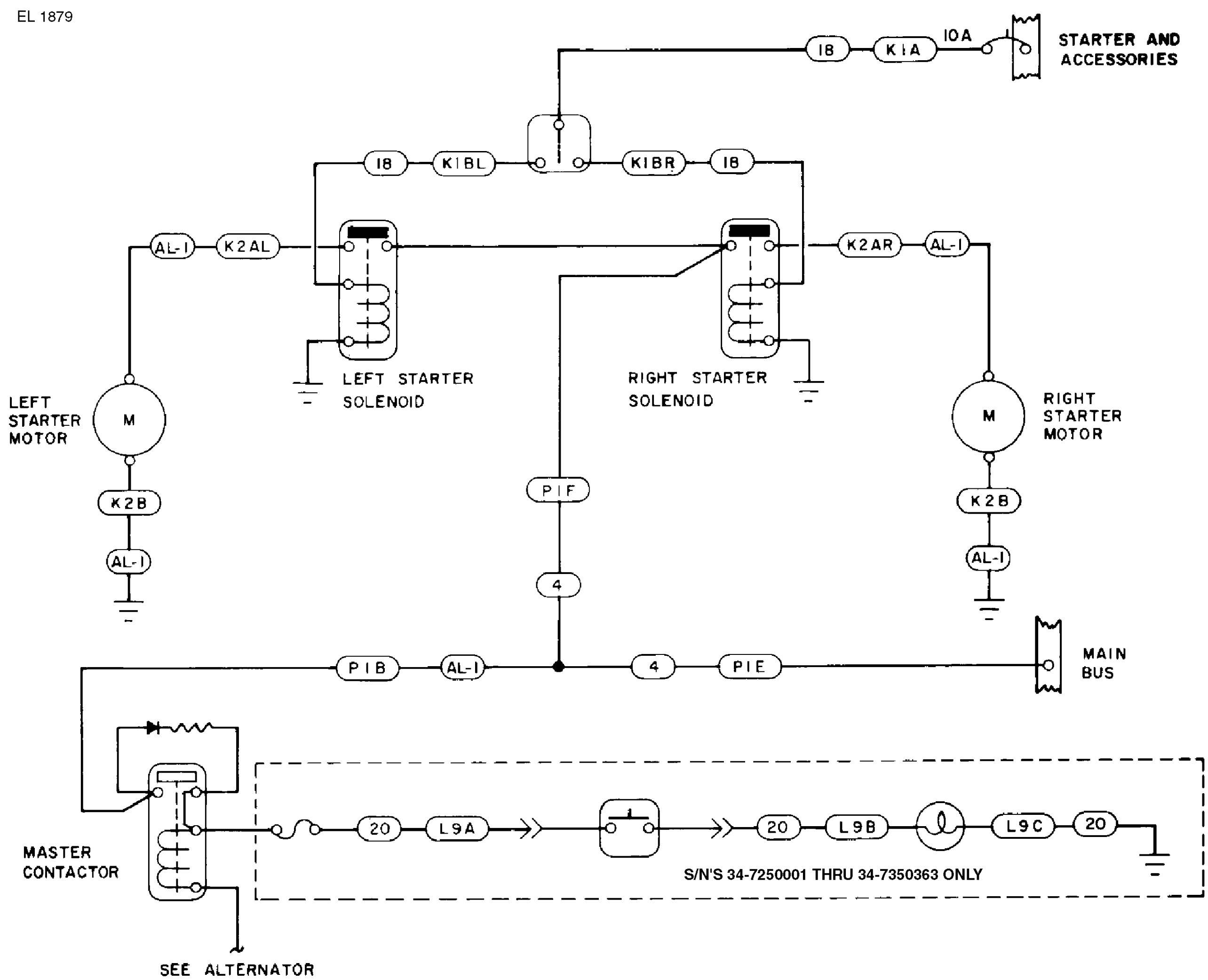
Alternators
Figure 28



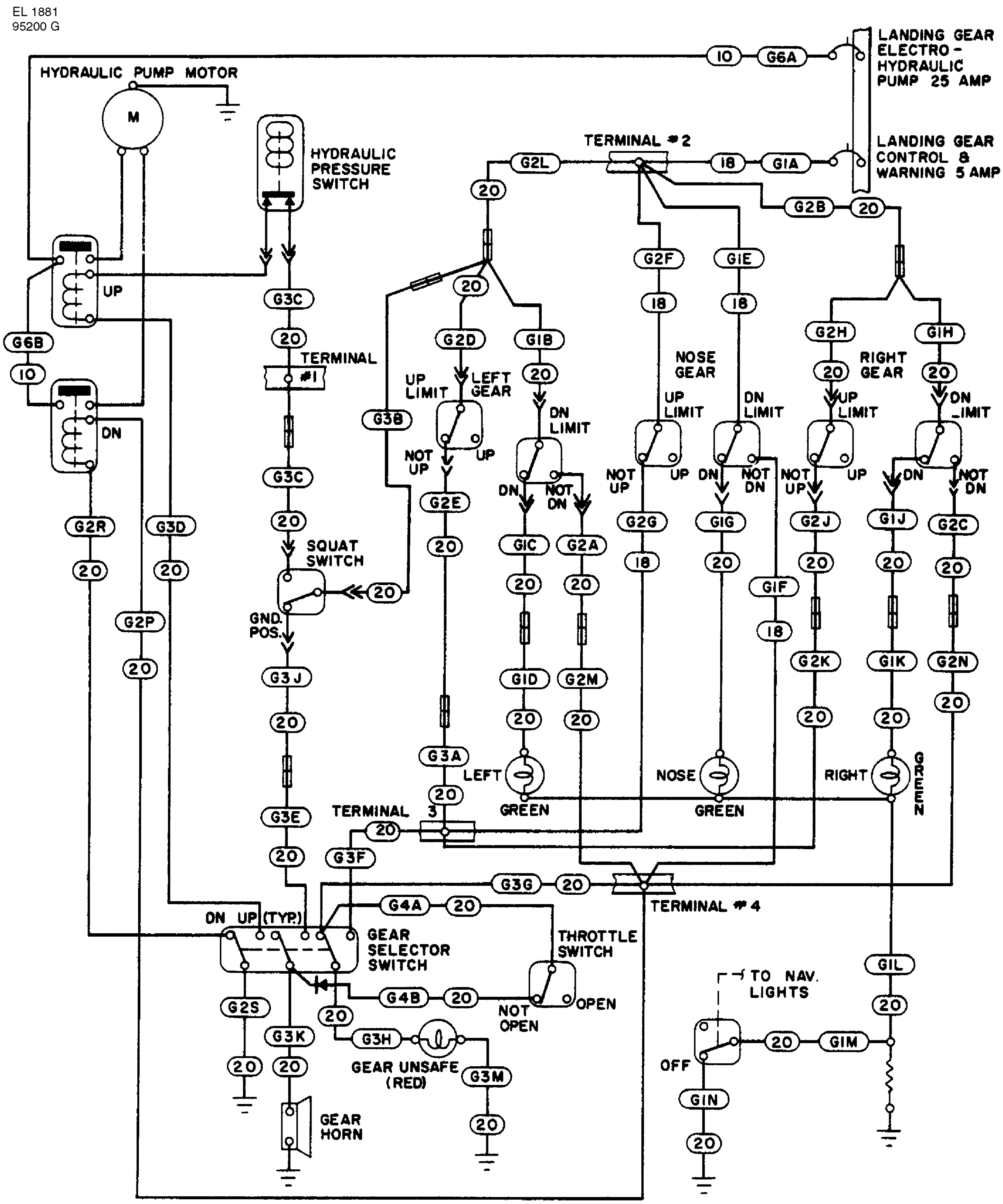
* ORIGINAL EQUIPMENT WICO VOLTAGE REGULATORS SHOWN. IF ONE WICO VOLTAGE REGULATOR FAILS, REPLACE BOTH. DO NOT INTERMIX WICO AND ELECTRODELTA UNITS.

Alternators
Figure 29

Effectivity
34-7450001 thru 34-7450220

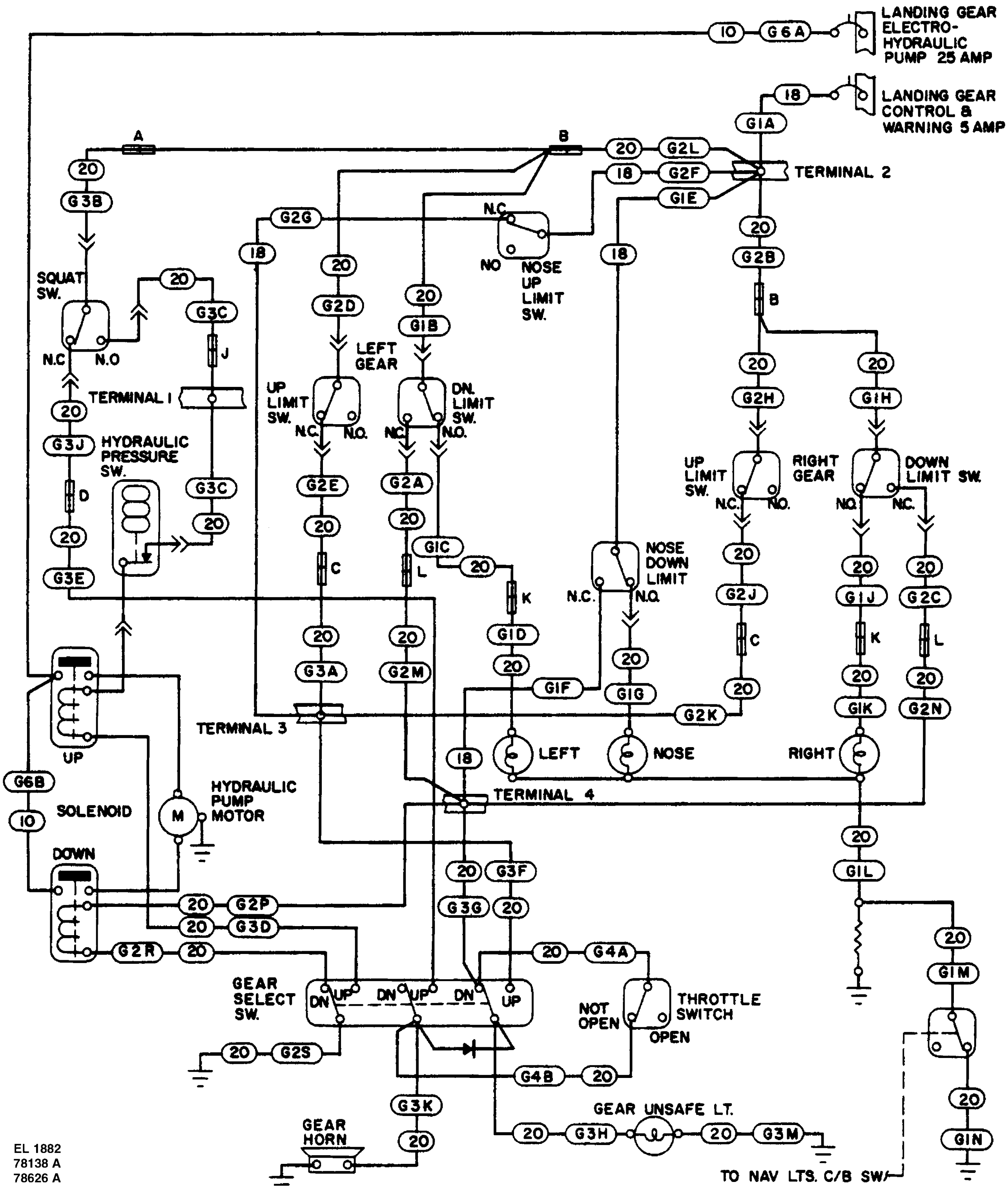


Starters
Figure 30

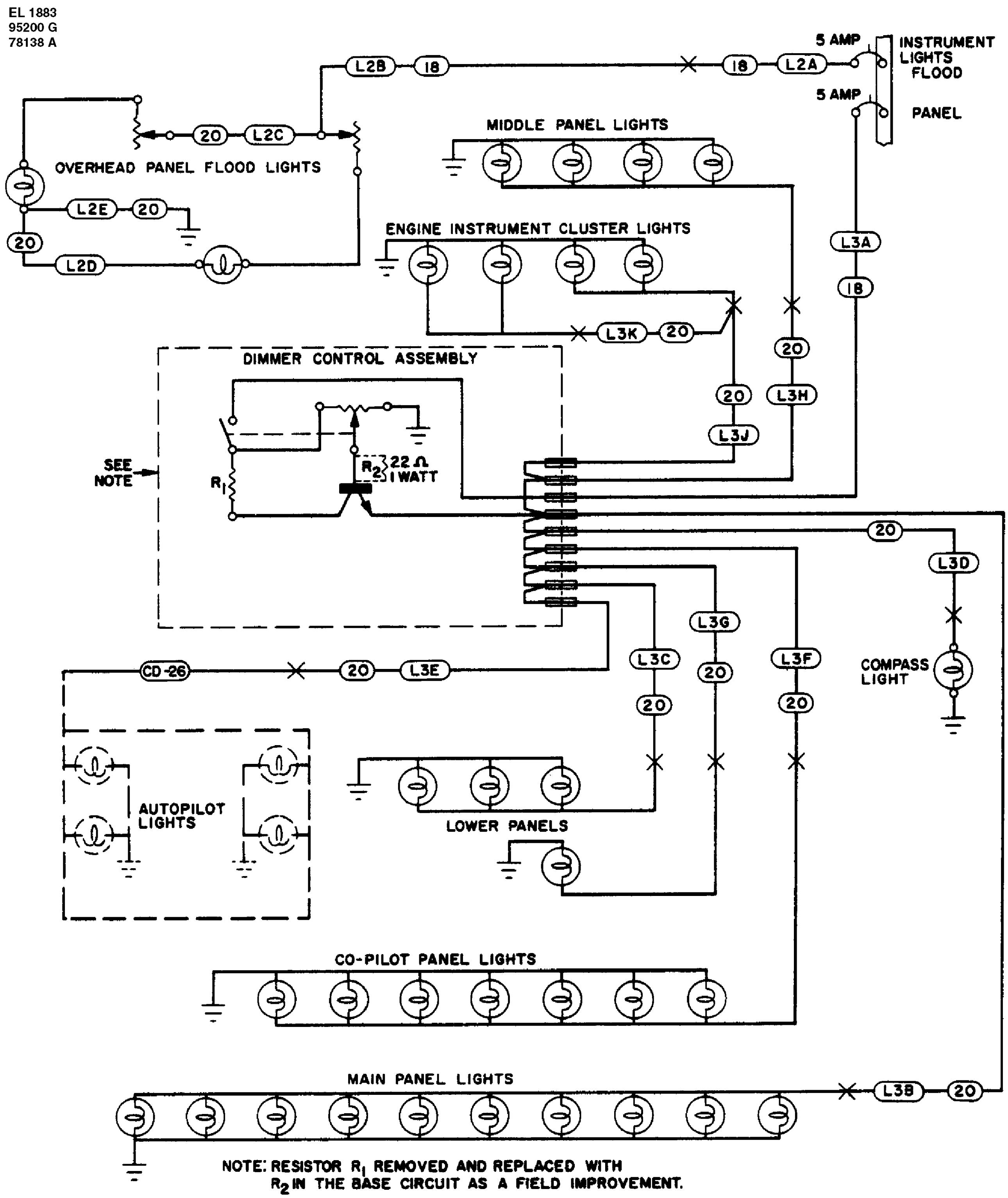


Landing Gear
Figure 31

Effectivity
34-7250001 thru 34-7350135

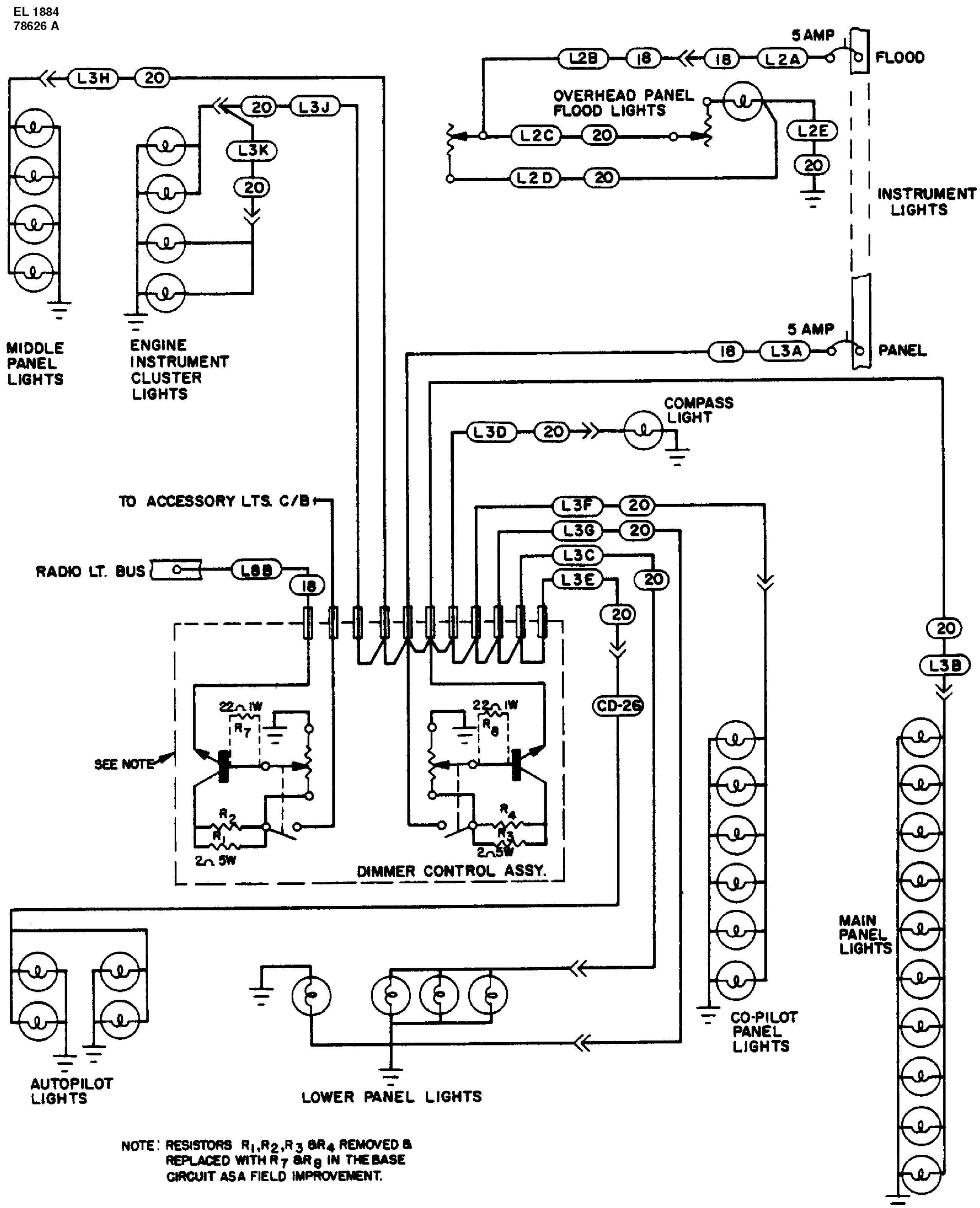


Landing Gear
Figure 32



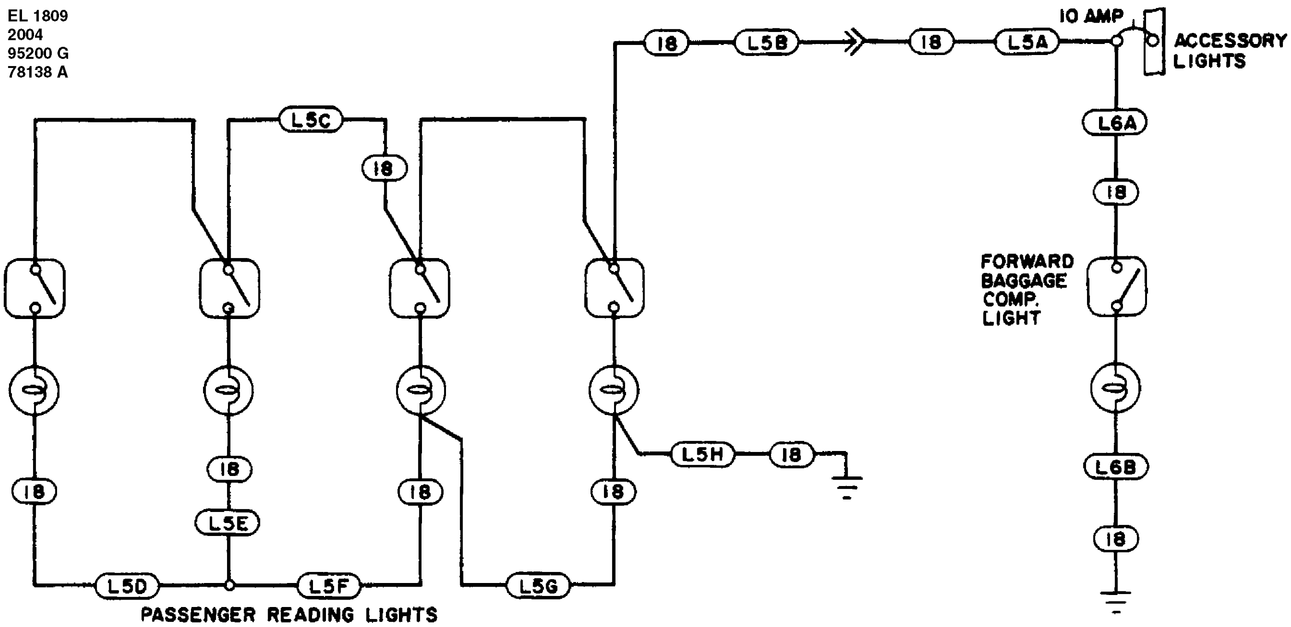
Panel Lights
Figure 33

Effectivity
34-7250001 thru 34-7350363



Panel Lights
Figure 34

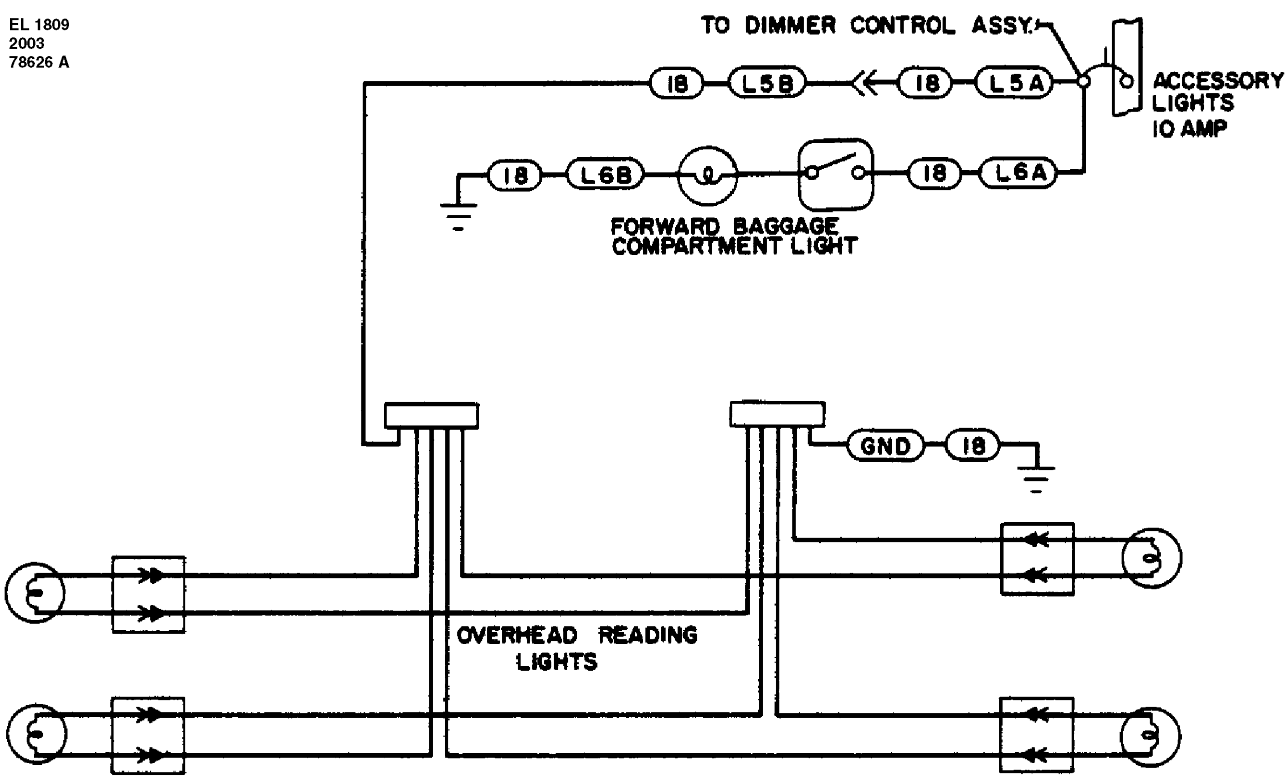
EL 1809
2004
95200 G
78138 A



Reading and Baggage Lights
Figure 35

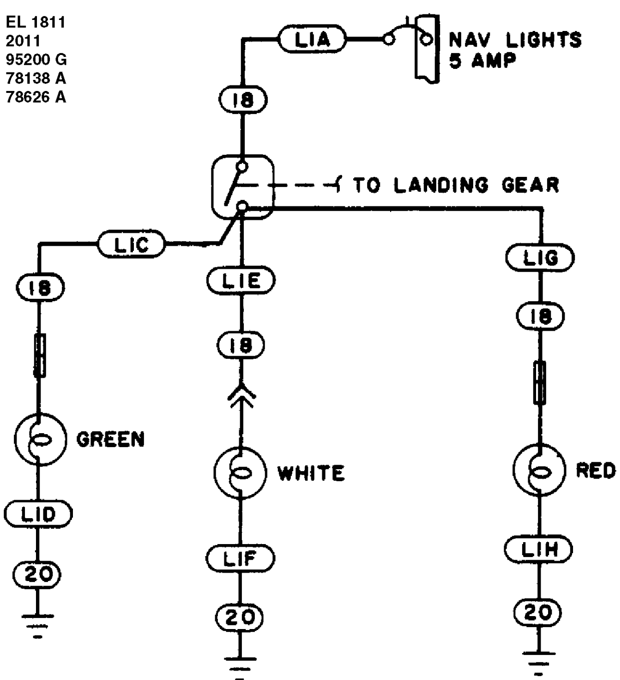
Effectivity
34-7250001 thru 34-7350363

EL 1809
2003
78626 A

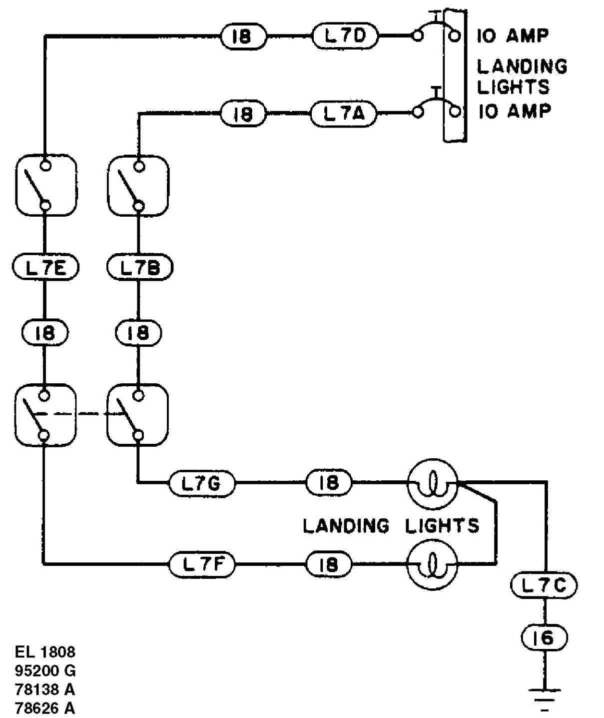


Reading and Baggage Lights
Figure 36

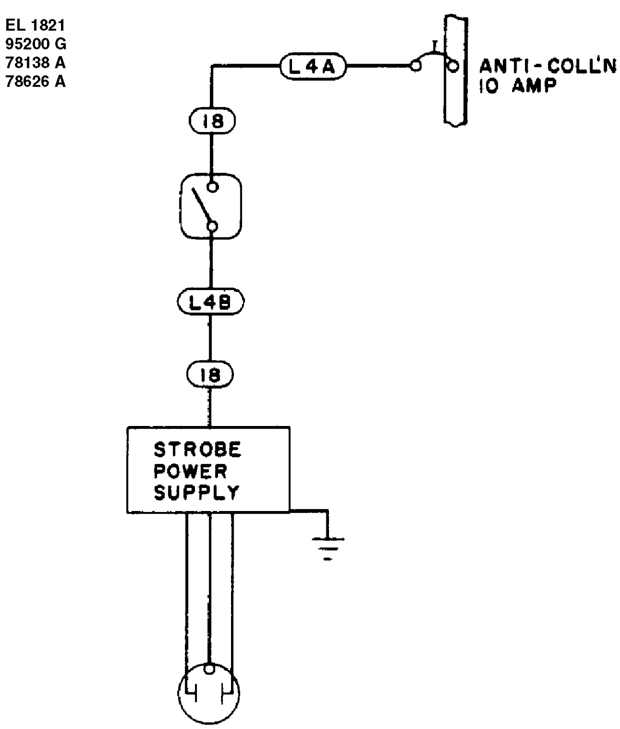
Effectivity
34-7450001 thru 34-7450220



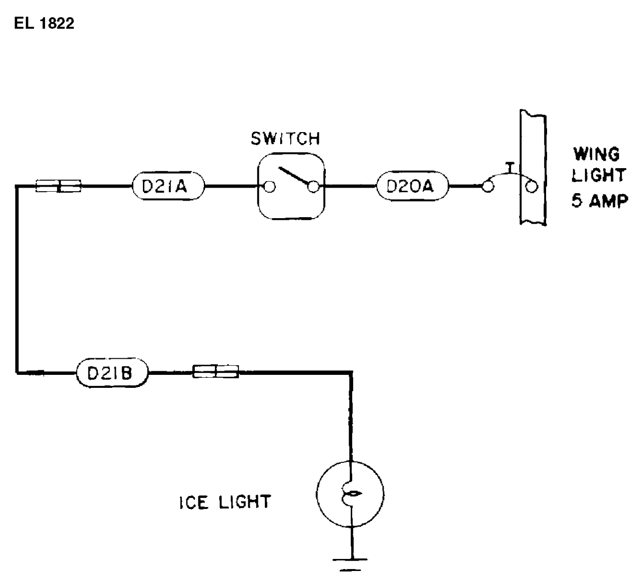
Position Lights
Figure 37



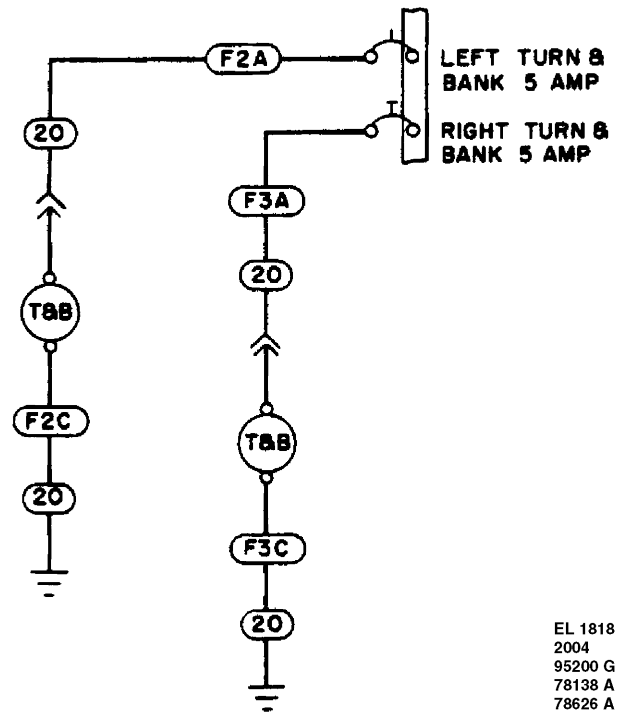
Landing/Taxi Lights
Figure 38



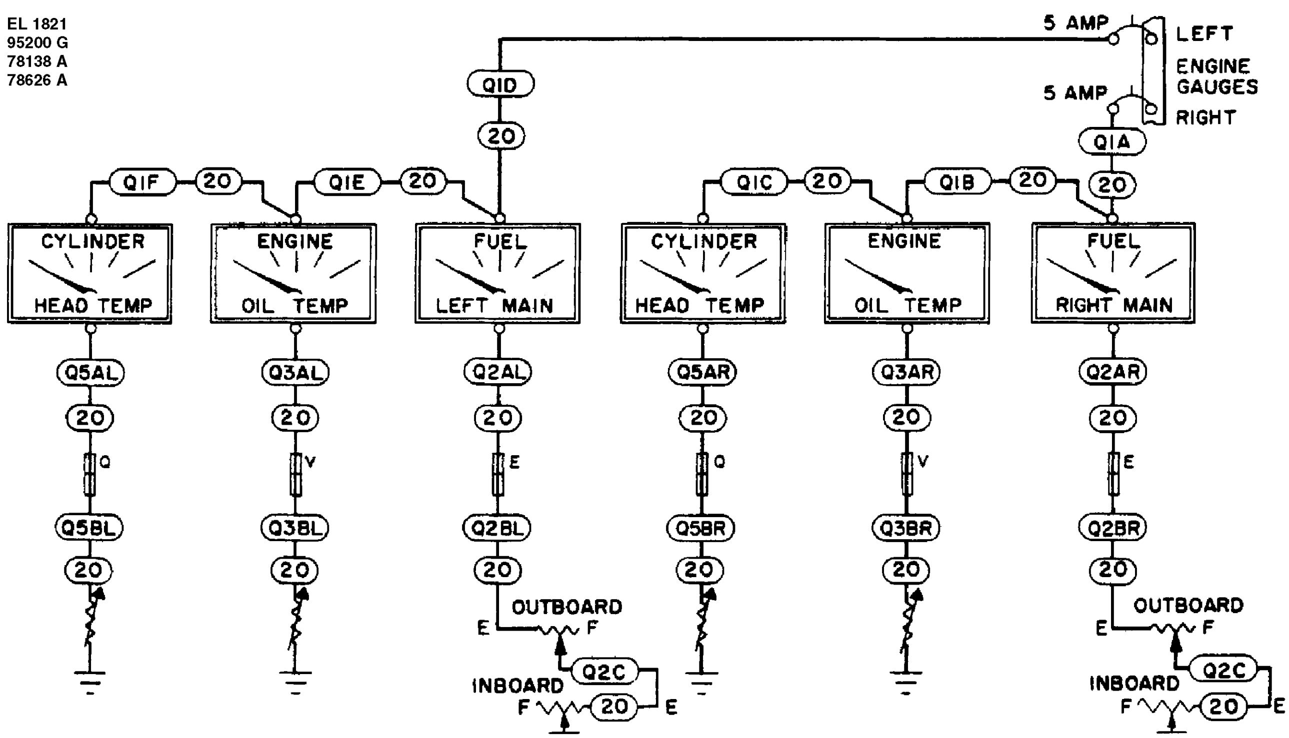
Anti-Collision Fin-Tip Strobe Light
Figure 39



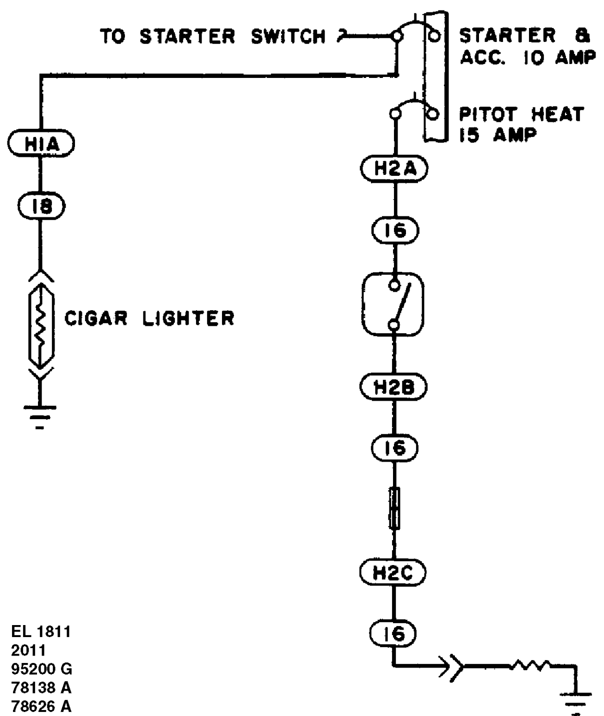
Wing Ice Inspection Light
Figure 40



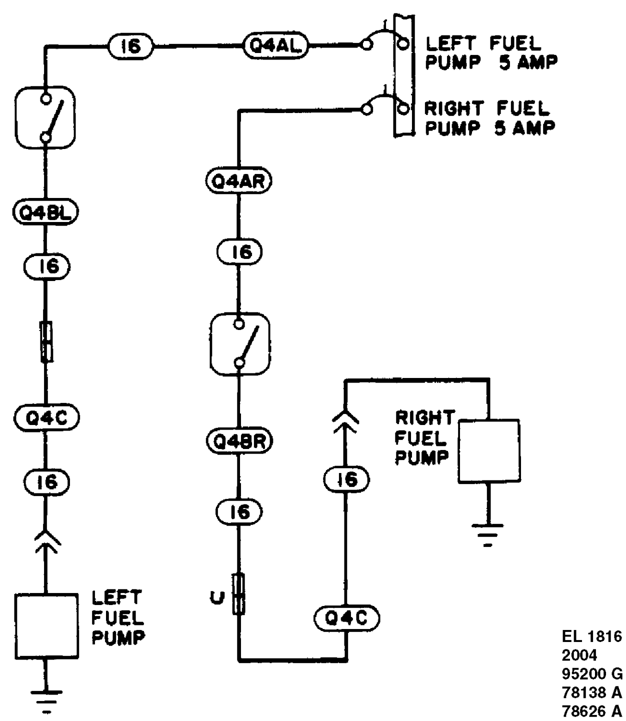
Turn and Bank
Figure 41



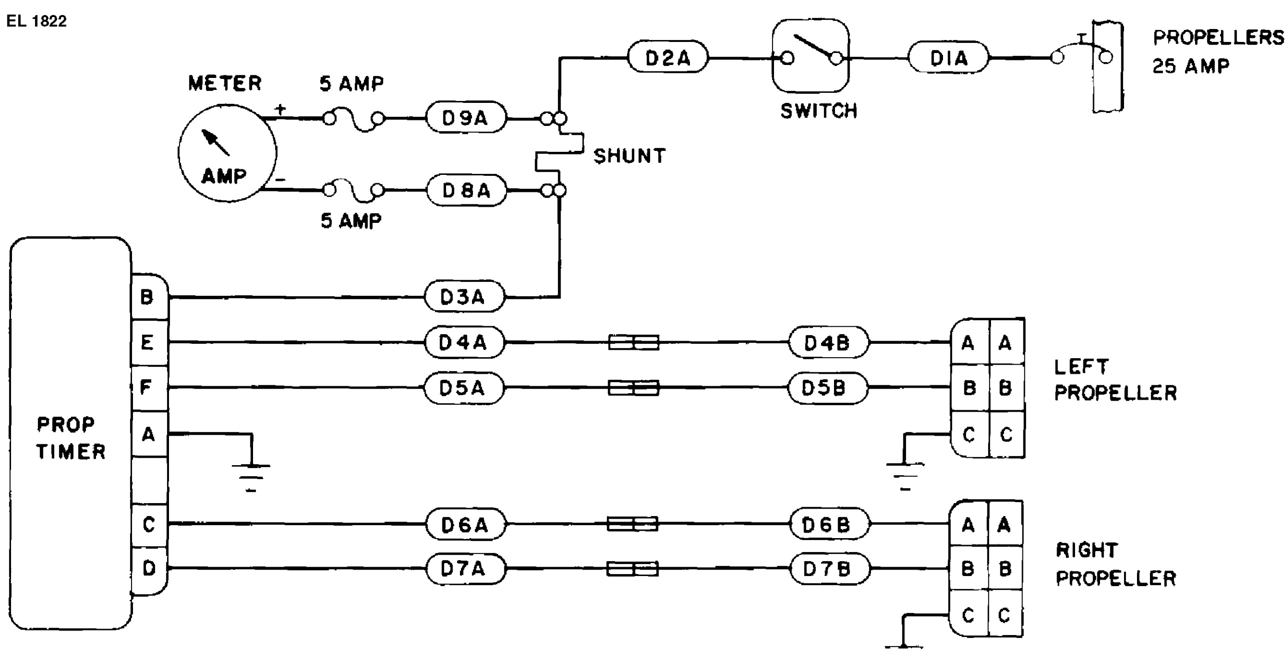
Engine Gauges
Figure 42



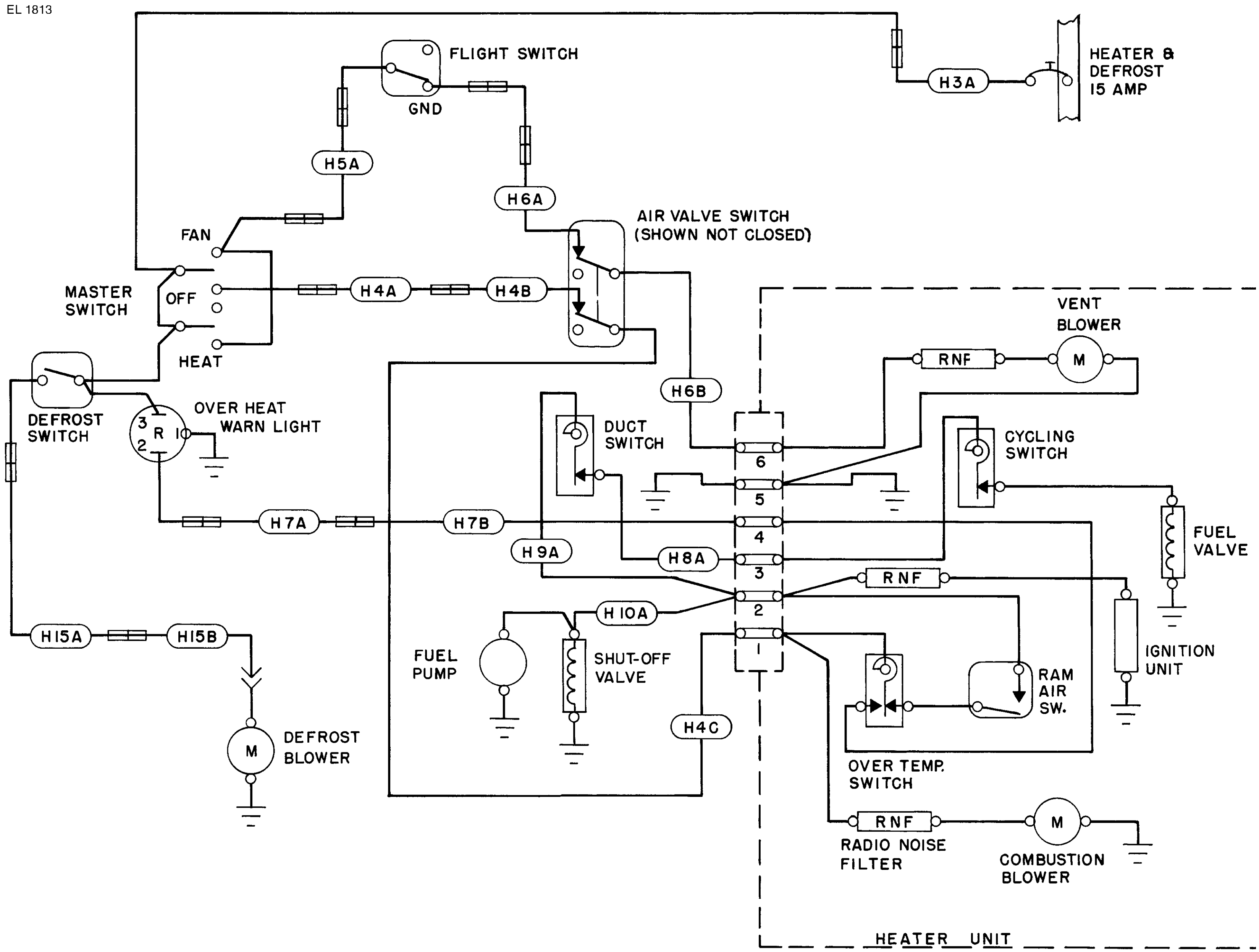
Pitot Heat and Cigar Lighter
Figure 43



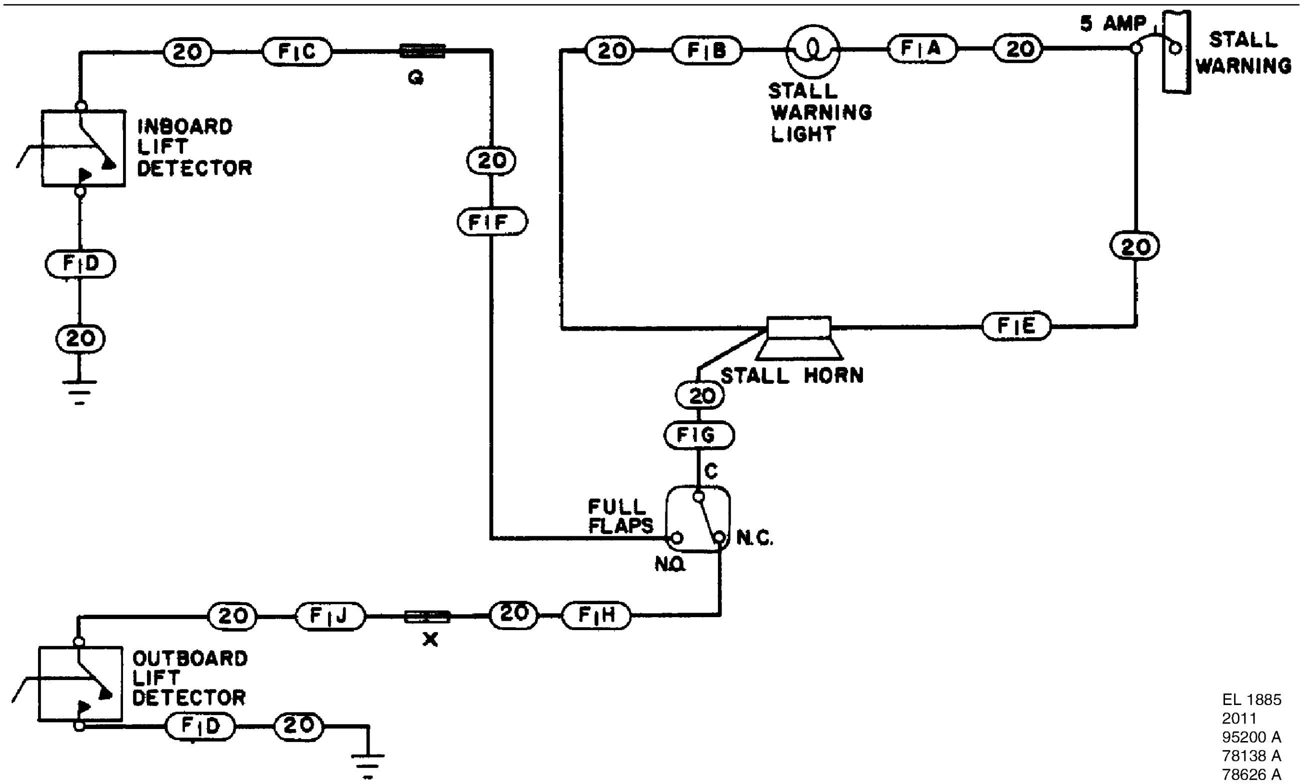
Fuel Pumps
Figure 44



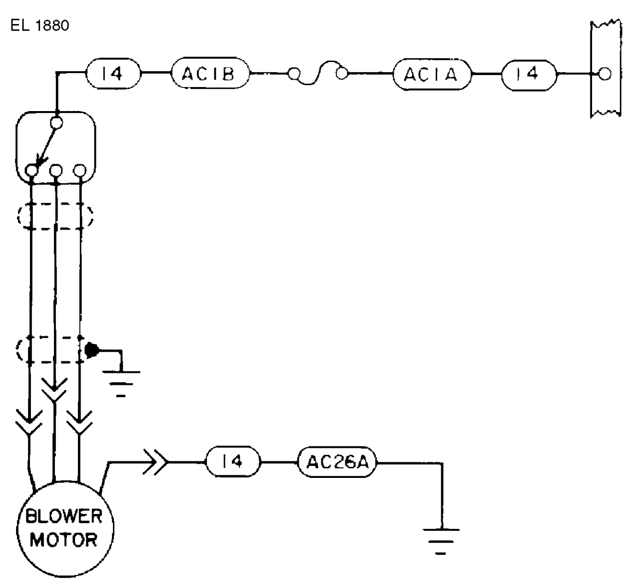
Propeller Deice
Figure 45



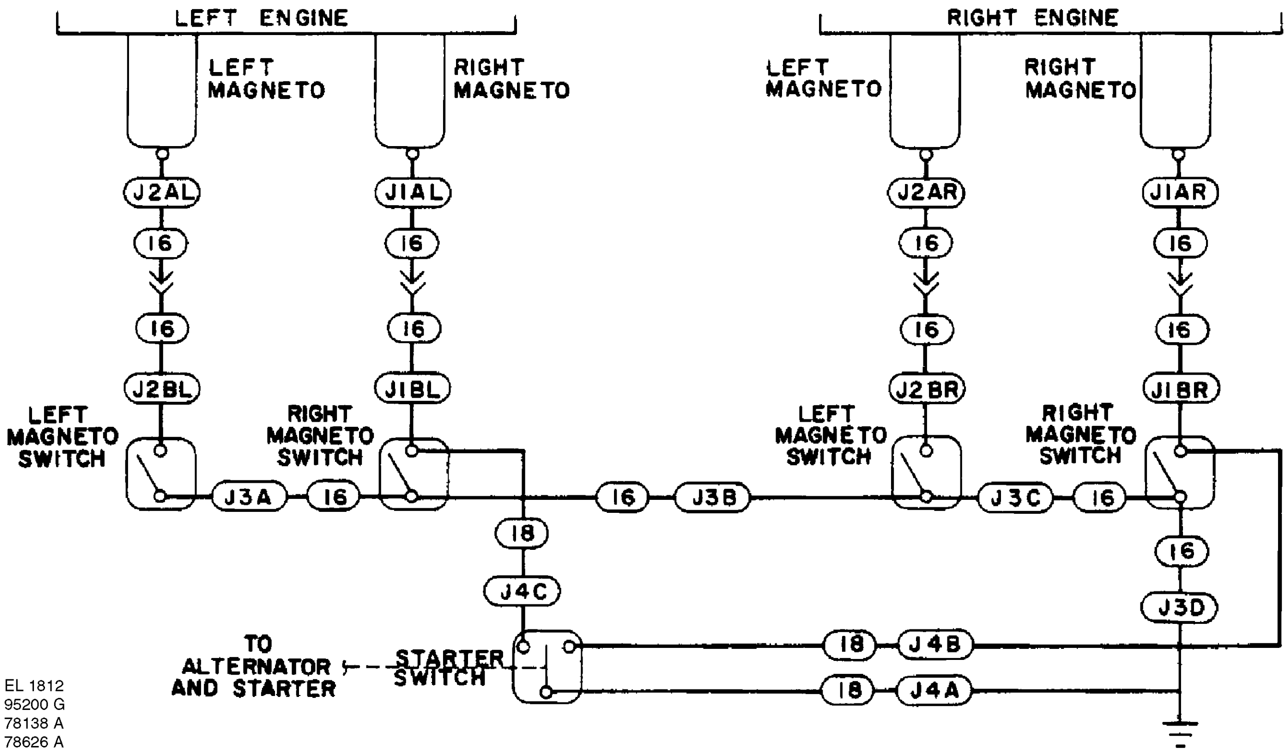
Heater and Defroster
Figure 46



Stall Warning
Figure 47



Vent Blower
Figure 48



EL 1812
95200 G
78138 A
78626 A

Magnetos
Figure 49

GRIDS 3K22 THRU 3L24
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AIRPLANE SERVICE MANUAL

CARD 4 OF 4

PA-34-200

(S/N's 34-7250001 THRU 34-7450220)

PIPER AIRCRAFT CORPORATION

PART NUMBER 753-817 October 30, 2003

Published by
Technical Publications

2926 Piper Drive
Vero Beach, Florida 32960
U.S.A.

Member
General Aviation
Manufacturers Association

AEROFICHE REVISION STATUS

Revisions to this Service Manual 753-817 originally issued April 5, 1971 are as follows:

Revision	Publication Date	Aerofiche Card Effectivity
ORG710405	April 5, 1971	N/A
CR720613	June 13, 1972	N/A
CR031030 *	October 30, 2003	1, 2, 3, & 4

*** COMPLETE REISSUE OF SERVICE MANUAL 753-817**

This is a complete reissue of this publication. Accordingly, replace your existing Aerofiche Card Set (i.e. - Cards 1 and 2) with this set (i.e. - Cards 1, 2, 3, and 4) dated 10/30/03.

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

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INTRODUCTION

LIST OF EFFECTIVE PAGES

SECTION	PAGE	DATE	SECTION	PAGE	DATE
Intro-List of	1	Oct 30/03			
Effective Pages	2	Oct 30/03			
Intro-Table of Contents	1	Oct 30/03			
	2	Oct 30/03			
Introduction	1	Oct 30/03			
	2	Oct 30/03			
	3	Oct 30/03			
	4	Oct 30/03			
	5	Oct 30/03			
	6	Oct 30/03			
	7	Oct 30/03			
	8	Oct 30/03			
	9	Oct 30/03			
	10	Oct 30/03			
Index	1	Oct 30/03			
	2	Oct 30/03			
	3	Oct 30/03			
	4	Oct 30/03			
	5	Oct 30/03			
	6	Oct 30/03			

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TABLE OF CONTENTS

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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-34-200 Seneca Service Manual constitutes the Instructions for Continued Airworthiness. Section I contains the Airworthiness Limitations and the Inspection Program is in Section III.

2. GENERAL.

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

Genuine PIPER parts are produced and inspected under rigorous procedures to insure airworthiness and suitability for use in PIPER airplane applications. Parts purchased from sources other than PIPER, even though identical in appearance, may not have had the required tests and inspections performed, may be different in fabrication techniques and materials, and may be dangerous when installed in an airplane.

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

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

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

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

3. EFFECTIVITY.

This maintenance manual is effective for PA-34-200 Seneca airplane serial numbers 34-7250001 thru 34-7450220.

This encompasses the following model years:

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

Model Year	Serial Numbers
1972	34-7250001 thru 34-7250360
1973	34-7350001 thru 34-7350353
1974	34-7450001 thru 34-7450220

4. SERIAL NUMBER EXPLANATION.

Example: 34 72 50 001

TYPE CERTIFICATE DESIGNATION — 34

MODEL YEAR — 72

MODEL CODE — 50
50 = PA-34-200 SENECA

SEQUENCE NUMBER — 001

5. ASSIGNMENT OF SUBJECT MATERIAL.

This publication is divided into logical subject groupings based on aircraft system or task function. Refer to paragraph 14, Section Index Guide, for a complete breakdown and list. The material is arranged in ascending numerical sequence.

6. PAGINATION.

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

7. AEROFICHE EFFECTIVITY.

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

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

First number is the Aerofiche card number.
Letter is the horizontal row reference per card
Second number is the vertical column reference per card.

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

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

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

8. IDENTIFYING REVISED MATERIAL.

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

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

Example.

9. INDEXING.

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

10. LIST OF EFFECTIVE PAGES.

Each Section has a List of Effective Pages preceding the Table of Contents to identify the effective revision date for each page in that section.

11. WARNINGS, CAUTIONS AND NOTES.

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

12. ACCIDENT/INCIDENT REPORTING.

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

13. SUPPLEMENTARY PUBLICATIONS.

The following publications/sources provide servicing, overhaul and parts information for the PA-34-200 airplanes and their various components. Use them to supplement this manual.

A. PIPER PUBLICATIONS:

(1)	Parts Catalog:	P/N 753-816
(2)	Periodic Inspection Report:	P/N 230-208
(3)	Progressive Inspection Manual (50 Hour):	P/N 230-208
(4)	Autopilot Service Manuals	See Section XII

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) ALTERNATOR:

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

(2) AUTOPILOT:

See Section XII, Autoflight.

(3) BATTERY:

Vendor Address: GILL Batteries
(A Division of
Teledyne Continental Motors,
see listing under Magnetos, below)
http://www.gillbatteries.com
PH: - (800) 456-0070

(4) BRAKES AND WHEELS:

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

(5) ENGINE:

Vendor Address:	Textron Lycoming 652 Oliver Street Williamsport, PA 17701 http://www.lycoming.textron.com/main.html	PH - (717) 323-6181 FAX - (717) 327-7101
Overhaul Manual:	DIRECT DRIVE MODELS - P/N 60294-7	
Parts Catalog:	IO-540- ..... - K1G5, ... ENGINES - P/N PC-615 TIO-540-AH1A ENGINES - P/N PC-615-12	
Operators Handbook:	O-540, IO-540 SERIES - P/N 60297-10 TIO-540 Series - P/N 60297-23	

NOTE: The above Lycoming publications can be ordered as a set on CD-ROM from Avantext. See www.avantext.com or PH - (800) 998-8857.

(6) FIRE EXTINGUISHER (PORTABLE):

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

(7) FUEL PUMP:

Vendor Address:	Weldon Pumps P.O. Box 46579 640 Golden Oak Parkway Oakwood Village, Ohio 44146 http://www.weldonpumps.com/index.html	PH: - (440) 232-2282 FAX - (440) 232-0606

(8) COMBUSTION HEATER:

Vendor Address:	Electro Systems, Inc. (See listing under Alternator, above.)	PH: - (334)-227-0152

(9) HI-LOK FASTENERS AND TOOLS:

Vendor Address:	Hi-Shear Corporation 2600 Skypark Drive Torrance, California 90509	PH: - (213) 326-8110

(10) LANDING GEAR ACTUATOR, EXTENSION AND RETRACTION:

Vendor Address:	Parker Hannifin Corp Aircraft Wheel and Brake Division 1160 Center Road Avon, Ohio 44011 http://www.parker.com/cleveland/	PH: - (800) 272-5464
Component Maintenance Manual:	(Effective for P/N's 96860-002 and 96860-003 only.) CMSFA232-5 (011-00504)	

(11) LIGHTS - NAVIGATION, STROBE, AND STANDBY/MAP LIGHTS:

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

(12) MAGNETOS:

Vendor Address:	Teledyne Continental Motors P.O. Box 90 Mobile, AL 36601 http://www.tcmlink.com	PH: - (334-438-3411, ext. 8392) FAX - (334-433-2325
Service Support Manual:	S1200 Series Magnetos, P/N X42001-1	
or, if installed:		
Vendor Address:	Slick Aircraft Products Unison Industries Attn: Subscription Dept. 530 Blackhawk Park Ave. Rockford, IL 61104 http://www.unisonindustries.com/index4.html	PH - (815) 965-4700 FAX - (815) 965-2457
Installation, Operation and Maintenance Instructions:	F1100 MASTER SERVICE MANUAL, 4300/6300 SERIES MAGNETO MAINTENANCE AND OVERHAUL MANUAL - L-1363	

(13) PNEUMATIC DEICE SYSTEM:

Vendor Address:	De-Icing and Specialty Systems Goodrich Corporation 1555 Corporate Woods Parkway Uniontown, Ohio 44685-8799	PH - (330) 374-3040 FAX - (330) 374-2290
Technical Assistance:	Email: dssd.support@goodrich.com http://www.deicingsystems.goodrich.com/	PH - (800) 334-2377 (330) 374-3743 FAX - (330) 374-2290
Black Standard Pneumatic De-Icer Installation, Maintenance and Repair Manual:	ATA 30-10-31	

(14) PROPELLER:

Vendor Address:	Hartzell Propeller Inc. One Propellor Place Piqua, OH 45356-2634 http://www.hartzellprop.com/index2.htm	PH - (937) 778-4379 FAX - (937) 778-4321
Standard Practices:	Manual No. 202A	
Overhaul and Maintenance:	Manual No. 117D	
Aluminum Blade Overhaul:	Manual No. 133C	
Propeller Owner's Manual and Logbook:	Manual No. 115N	

(15) PROPELLER DEICE SYSTEM:

Vendor Address:	See Pneumatic Deice System, above.
Installation and Maintenance Manual for Prop De-Icing Systems:	ATA 30-60-02
Removal and Installation Manual, Standard and FASTprop™ Electrothermal Propeller De-Icers:	ATA 30-60-07

(16) PROPELLER GOVERNOR:

Vendor Address:	Hartzell Propeller Inc. One Propellor Place Piqua, OH 45356-2634 http://www.hartzellprop.com/index2.htm	PH - (937) 778-4379 FAX - (937) 778-4321
Governor Maintenance:	Manual No. 130B	

(17) VACUUM PUMPS: (For service replacement, Tempest Dry Air Pumps, only.)

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

(18) VACUUM REGULATORS:

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

(19) VOLTAGE REGULATOR:

Vendor Address: See listing under Alternator, above.

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14 SECTION INDEX GUIDE.

GRIDS 4A18 THRU 4A24
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GRIDS 4B6 THRU 4B24
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SECTION

XII

ELECTRONICS

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SECTION XII

LIST OF EFFECTIVE PAGES

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SECTION XII - ELECTRONICS

TABLE OF CONTENTS

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ELECTRONICS

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.)

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1. INTRODUCTION. This section provides information necessary to perform operational checks of the Emergency Locator Transmitter (ELT), with and without a pilot's remote switch. Also included are the appropriate removal and installation instructions to facilitate battery replacement.

2. EMERGENCY LOCATOR TRANSMITTER (ELT).

3. DESCRIPTION. Electrical power for each ELT installation is totally supplied by its own self-contained battery. Three different ELT installations are used in the PA-34-200. The Garrett "Rescu 88" which uses magnesium batteries; and the Communication Components Corporation "CIR-11-2" and Narco "ELT-10", both of which use alkaline batteries. In accordance with FAR 91-207, the battery used in an ELT must be replaced when the transmitter has been in use for more than one cumulative hour or when 50 percent of the useful life of the battery has expired. The battery is marked at the factory with the date indicating when the battery is to be replaced. When replacing a battery, transfer this date to the ELT data plate for easy reference.

4. BATTERY REMOVAL AND INSTALLATION.

NOTE: One or more of the following batteries may no longer be available. See parts catalog and consult your local Piper Service Center for available replacement options, if any. As of the 2003 revision, Artex Aircraft Supplies, 14405 Keil Rd NE, Aurora, OR 97022 (www.artex.net) offered a line of replacement batteries.

Alternatively, installation of a new aftermarket ELT by an FAA-approved repair station under a field approval (i.e. - FAA Form 337) from the local FAA Flight Standards District Office (FSDO) is also an option. If such an ELT is installed, the Instructions for Continued Airworthiness (ICA) provided in the field approval or from the aftermarket ELT manufacturer will supercede those provided herein.

4a. GARRETT MFG. LTD. MAGNESIUM BATTERY. (Refer to Figure 1.)

The ELT is located on the right side of the airplane tail section, ahead of the stabilator.

a. Remove the access plate on the right side of fuselage aft of sta. 257.678.

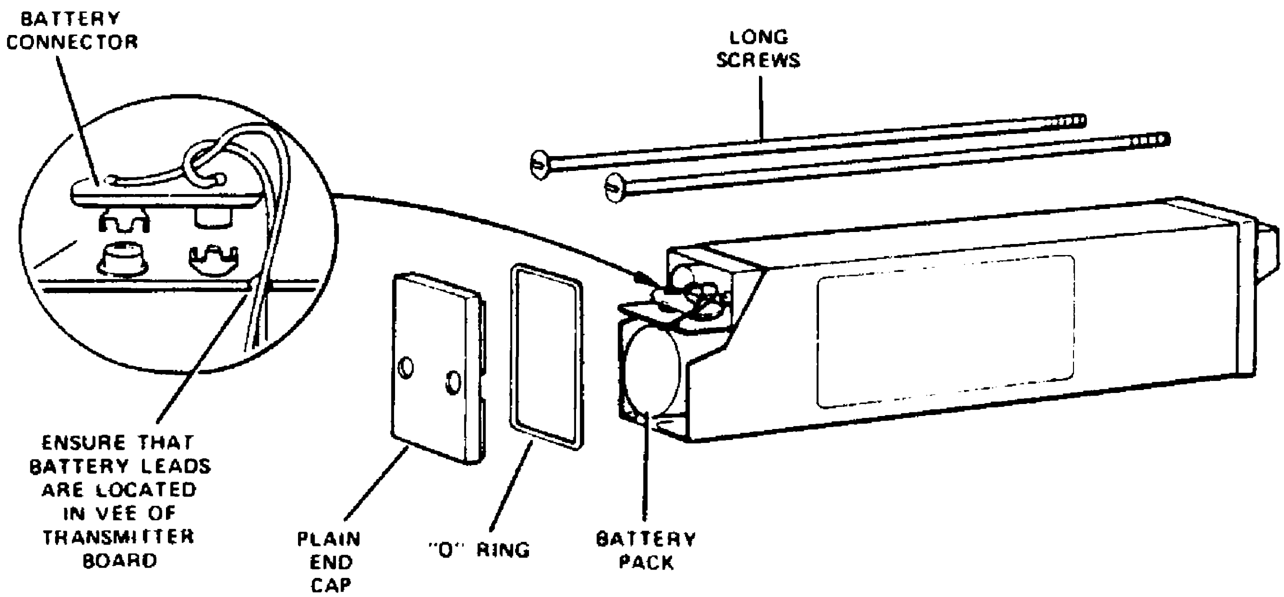
b. Set the ON/ARM/OFF switch on the transmitter to the OFF position.

c. Disconnect the antenna coax from the transmitter.

d. Disconnect the harness to the pilot's remote switch.

e. Remove rear mounting bracket by pulling plastic knob out. Remove transmitter from airplane.

f. Remove two long or four short screws securing transmitter plain end cap. Remove plain end cap.



Garrett Magnesium Battery Connections
Figure 1

g. Disconnect the battery connector from the board terminals.

h. Withdraw the battery pack from the transmitter case.

i. Before installing the new battery pack, check the replacement date printed on the battery. Transfer this date onto the ELT label.

j. Slide the new battery pack, plain end first, into transmitter. It may be necessary to rotate the battery slightly to get it seated properly in the transmitter case and to achieve correct orientation of the battery connector.

k. Connect the battery connector to board terminals.

l. Insure O-ring is fitted in plain end cap and correctly seated.

m. Refit end cap and secure with the screws previously removed.

NOTE: Do not overtighten the end cap screws.

n. Place transmitter into its mounting bracket; replace rear mounting bracket by pushing plastic knob into place.

o. Connect the pilot's remote switch harness to the transmitter.

p. Connect the antenna coax to the transmitter.

CAUTION: ANTENNA DAMAGE MAY CAUSE STRUCTURAL FAILURE OF WHIP IN FLIGHT.

q. Inspect the external whip antenna for any damage. Avoid bending the whip. Any sharply bent or kinked whip should be replaced.

NOTE: Before installing access plate ascertain that transmitter switch is in the ARM position. It may also be advisable to test the unit operation before installing the access panel.

r. Install the access plate on the right side of the fuselage aft of sta. 257.678. Make an entry in the aircraft logbook, including the new battery run out date.

5. COMMUNICATIONS COMPONENTS CORP. ALKALINE BATTERY.

The ELT is located on the right side of the airplane tail section, ahead of the stabilator.

a. Remove the access plate on the right side of fuselage aft of sta. 257.678.

b. Rotate the ON/ARM/OFF switch to the OFF position.

c. Disconnect the antenna coax cable (twist left, then pull outward).

d. Disconnect the harness to the pilot’s remote switch.

e. Remove the forward mounting bracket by pulling the black plastic knob out. Remove the transmitter from the airplane.

f. Remove the six Phillips-head screws securing the transmitter cover. Remove the cover.

g. Lift out the old battery pack.

h. Copy the expiration date on the battery into the space provided on the external ELT name and date plate.

i. Disconnect and replace with a new battery pack.

j. Insert transmitter into airplane and fit into place. Replace mounting bracket by pushing the black plastic knob into place.

k. Reconnect the pilot’s remote switch harness and the antenna coax cable to the transmitter.

CAUTION: ANTENNA DAMAGE MAY CAUSE STRUCTURAL FAILURE OF WHIP IN FLIGHT.

l. Inspect the external whip antenna for any damage. Avoid bending the whip. Any sharply bent or kinked whip should be replaced.

m. Set the ON/ARM/OFF switch to the ARM position.

NOTE: Before installing access plate ascertain that transmitter switch is in the ARM position. It may also be advisable to test the unit operation before installing the access panel.

n. Install the access plate on the right side of the fuselage aft of sta. 257.678. Make an entry in the aircraft logbook, including the new battery run out date.

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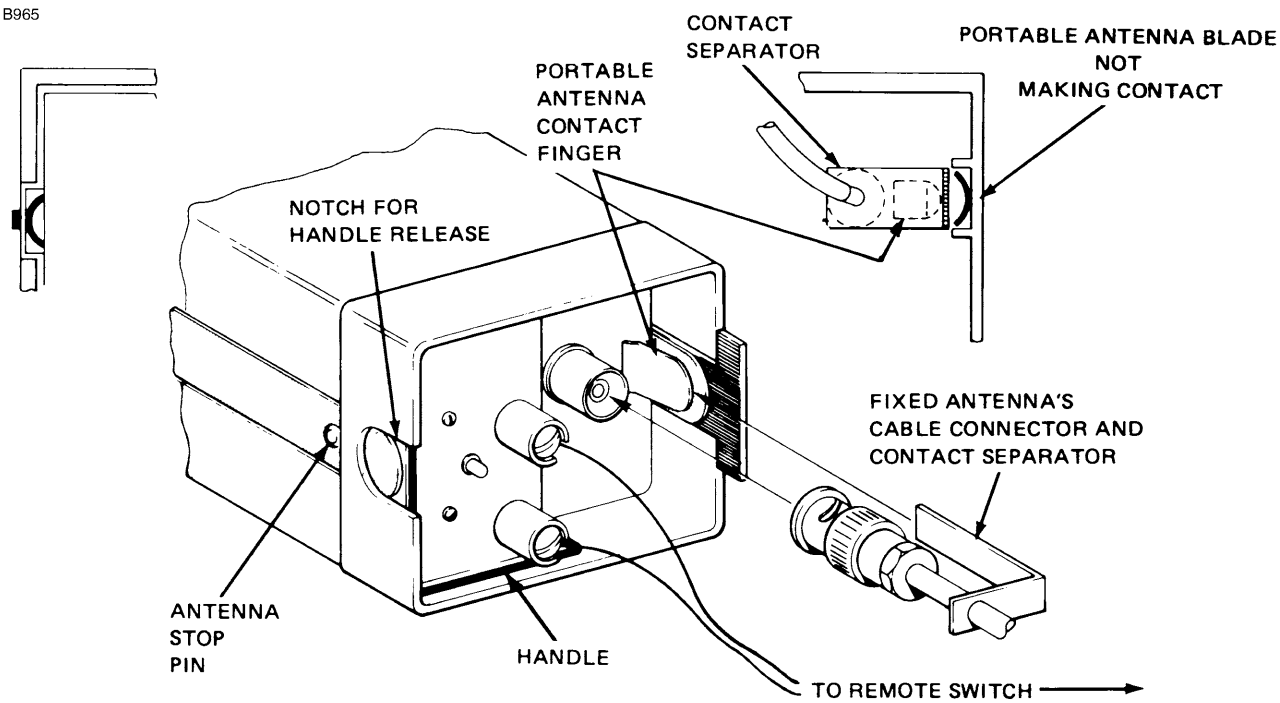
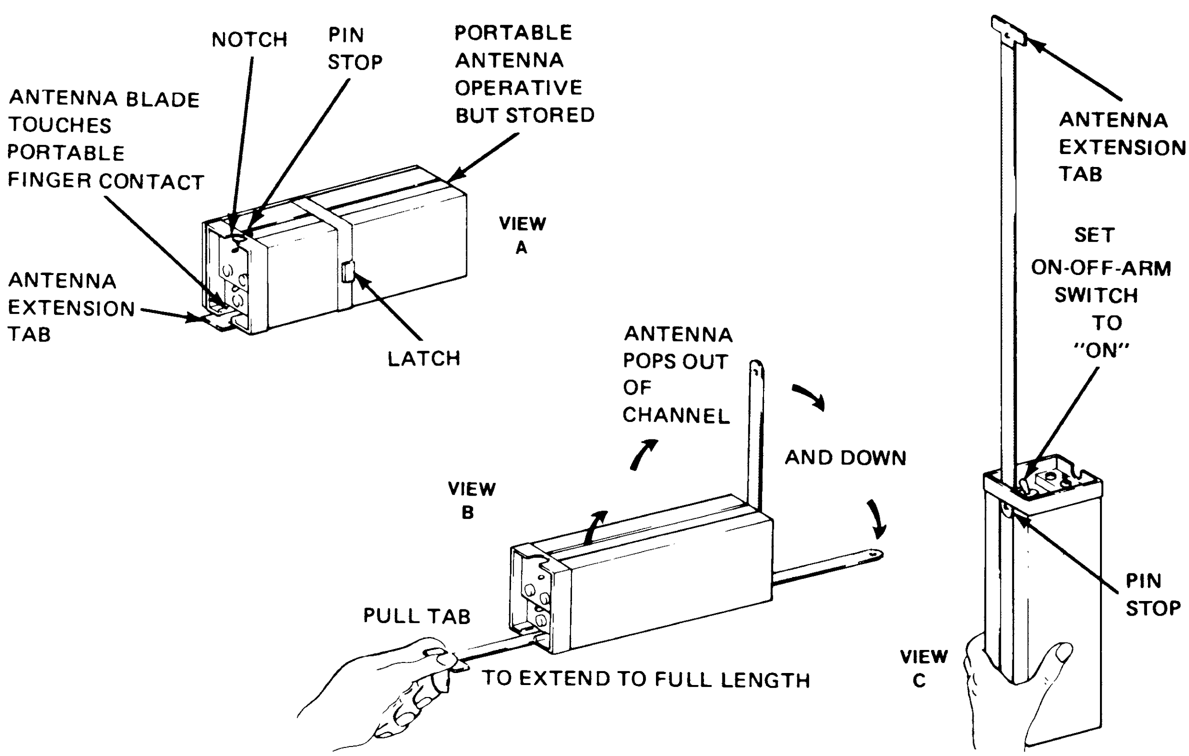


USING FIXED ANTENNA



USING FOLDING ANTENNA

Narco ELT 10
Figure 2

6. NARCO ALKALINE BATTERY. (Refer to Figure 2.)

The ELT is located on the right side of the airplane tail section, ahead of the stabilator.

a. Remove the access plate on the right side of fuselage aft of sta. 257.678.

b. Set the ON/OFF/ARM switch on the transmitter to OFF.

c. Disconnect antenna coaxial cable from E.L.T.

d. Remove ELT from its mounting bracket by releasing the latch on the strap and sliding the ELT off the bracket.

e. Extend the portable antenna.

f. Unscrew the four screws that hold the control head to the battery casing and slide apart.

g. Disconnect the battery by unsnapping the snap-off battery pigtail terminals from the bottom of the transmitter printed circuit board.

h. 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.

i. Connect new battery pack terminals to the bottom of the circuit board.

j. 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.

k. Slide the portable antenna back into the stowed position.

l. Place transmitter into its mounting bracket and fasten the strap latch.

m. 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 2.)

CAUTION: ANTENNA DAMAGE MAY CAUSE STRUCTURAL FAILURE OF WHIP IN FLIGHT.

n. Inspect the external whip antenna for any damage. Avoid bending the whip. Any sharply bent or kinked whip should be replaced.

o. Press RESET button and set ON/OFF/ARM switch to ARM.

NOTE: Before installing access plate ascertain that transmitter switch is in the ARM position. It may also be advisable to test the unit operation before installing the access panel.

p. Install the access plate on the right side of the fuselage aft of sta. 257.678. Make an entry in the aircraft logbook, including the new battery run out date.

7. PILOT'S REMOTE SWITCH - DESCRIPTION, OPERATION, AND TESTING.

Refer to Airplane Flight Manual/Pilot's Operating Manual and see also Figure 3.

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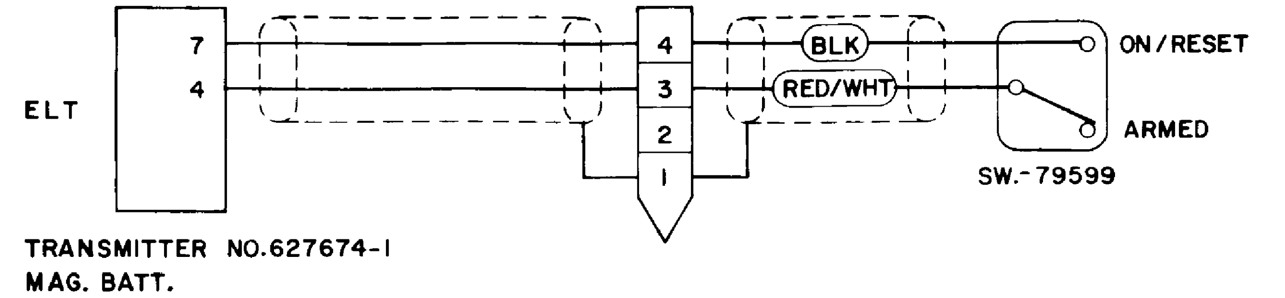
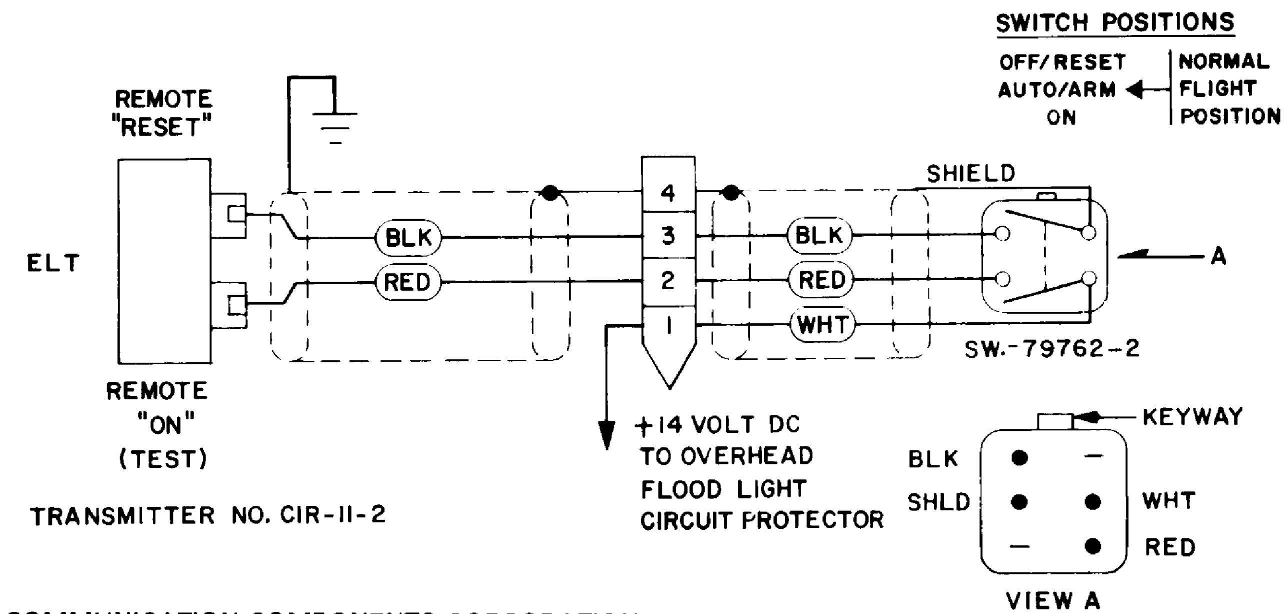


GARRETT MFG. LTD.



COMMUNICATION COMPONENTS CORPORATION

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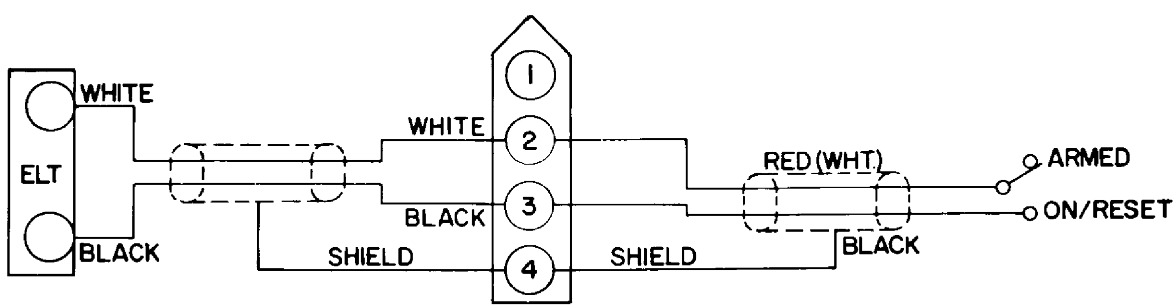

NARCO

Pilot's Remote Switch
Figure 3

8. Testing. 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 operational test of the ELT, the following precautions should be observed:

CAUTION: TESTING OF AN ELT SHOULD BE CONDUCTED IN A SCREEN ROOM OR METAL ENCLOSURE TO ENSURE THAT ELECTROMAGNETIC ENERGY IS NOT RADIATED DURING TESTING. IF A SHIELDED ENCLOSURE IS NOT AVAILABLE, TESTING MAY BE PERFORMED IN ACCORDANCE WITH THE FOLLOWING PROCEDURES:

1. Test should be no longer than three audio sweeps.
2. 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 coordinated with the closest FAA Tower or Flight Service Station.

CAUTION: CONSULT FAA ADVISORY CIRCULAR (AC) 20-81 FOR DETAILED INFORMATION CONCERNING UNSHIELDED TESTING.

a. Remove the access plate on the right side of the fuselage aft of sta. 257.678.

b. Tune the aircraft communications receiver to 121.5 MHz and switch the receiver ON; deactivate the squelch, and turn the receiver volume up until a slight background noise is heard.

NOTE: If the aircraft is not fitted with a communications receiver, request that the tower listen for your test.

c. On the transmitter, set the ON/ARM/OFF switch to the ON position. Keep the switch in this position for only a few seconds; then set to the OFF position. Return to the ARM position.

NOTE: A successful test transmission will be picked up by the aircraft communications receiver and/or control tower. During cold weather, there may be a slight delay before transmission occurs.

d. A transmitter which is functioning properly should emit a characteristic downward swept tone.

CAUTION: 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 BEFORE REVERTING TO THE ARM POSITION AGAIN.

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

e. When test is completed, ascertain the transmitter ON/ARM/OFF switch is in the ARM position.

f. Place the access panel on the right side of the fuselage aft of sta. 257.678.

9. AUTOFLIGHT. Due to the wide variety of A.F.C.S. (Automated Flight Control System) 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 & installation, servo clutch adjustments, etc.

10. PIPER A.F.C.S. EQUIPMENT: In early models, Piper AutoPilot equipment bears the Piper name, and the appropriate Piper AutoPilot/Flight Director Service Manual shall be used.

    NOTE: If a Roll Axis-only AutoPilot is installed, or if no AutoPilot is installed, consult the Piper Pitch Trim Service Manual - 753 771 for manual electric pitch trim service information.

    The following is a complete list of Piper A.F.C.S. equipment service manuals. Correctly identifying the AutoPilot system by “faceplate” model name is imperative in order to consult the appropriate service manual. Consult the airplane parts catalog for replacement parts.

Service Manual	Part No.
AutoControl I/II & AltiMatic I/II	753-798
AutoControl III and AltiMatic III and IIIB	753-723
AutoControl IIIB and AltiMatic IIIB-1	761-502
AltiMatic IIIC	761-602
AltiMatic V and V-1	761-525
AltiMatic V F/D and V F/D-1	761-526
AltiMatic X F.D./A.P./& X A.P.	761-668
AutoFlite	753-720
AutoFlite II	761-481
Piper Pitch Trim (Manual-Electric)	753-771

    Refer to the Customer Service Information Aerofiche, P/N 1755-332, to ensure you have the latest revision.

11. NON-PIPER A.F.C.S. EQUIPMENT CONTACTS: Refer the following list of AutoPilot/Flight Director manufacturers to obtain service direction, parts support, and service literature.

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Bendix-King Aerospace Honeywell One Technology Center 23500 W. 105th Street, M/D #19 Olathe, KS 66061-1950 USA http://www.bendixking.com/	PH: - (800) 247-0230
Edo Corporation - Avionics Divsion	Became Sigma-Tek in 1983, see below.
Global Navigation, Inc. 24701 Crenshaw Boulevard Torrance, CA 90505	Last known address. Reportedly acquired by Hamilton-Sundstrand, see below.
Hamilton-Sundstrand P.O. Box 7002 4747 Harrison Avenue Rockford, Illinois 61125-7002 http://www.hamiltonsundstrand.com/	PH: - (815)-226-6000
Rockwell/Collins 400 Collins Road NE Cedar Rapids, IA 52498 http://www.rockwellcollins.com/	PH: - (888) 265-5467
S-TEC Corporation One S-TEC Way Mineral Wells, Texas 76067-9236 http://www.s-tec.com	PH: - (940) 325-9406
Sigma-Tek 1001 Industrial Rd. Augusta, Ks. 67010 http://www.sigmatek.com/	PH: - (316) 775-6373
Sperry Flight Systems/Avionics Div.	Purchased by Honeywell in 1986. See Bendix-King, above.

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SECTION

XIII

HEATING AND VENTILATION SYSTEM

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SECTION XIII

LIST OF EFFECTIVE PAGES

SECTION	PAGE	DATE	SECTION	PAGE	DATE
XIII-List of	1	Oct 30/03		40	Oct 30/03
Effective Pages	2	Oct 30/03		41	Oct 30/03
				42	Oct 30/03
XIII-Table of Contents	1	Oct 30/03		43	Oct 30/03
	2	Oct 30/03		44	Oct 30/03
				45	Oct 30/03
XIII	1	Oct 30/03		46	Oct 30/03
	2	Oct 30/03		47	Oct 30/03
	3	Oct 30/03		48	Oct 30/03
	4	Oct 30/03		49	Oct 30/03
	5	Oct 30/03		50	Oct 30/03
	6	Oct 30/03		51	Oct 30/03
	7	Oct 30/03		52	Oct 30/03
	8	Oct 30/03			
	9	Oct 30/03			
	10	Oct 30/03			
	11	Oct 30/03			
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	37	Oct 30/03			
	38	Oct 30/03			
	39	Oct 30/03			

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SECTION XIII - HEATING AND VENTILATION SYSTEM

TABLE OF CONTENTS

SECTION XIII - HEATING AND VENTILATION SYSTEM

TABLE OF CONTENTS (cont.)

HEATING AND VENTILATION SYSTEM

1. INTRODUCTION. This section contains instructions for operating, servicing, and inspecting the heating, defrosting and ventilating systems installed in the PA-34-200.

2. DESCRIPTION AND OPERATION. Cabin and defrost heat is provided by means of a heat exchanger mounted on the exhaust manifold of each engine (outboard side). Air is taken in through a scoop on the engine cowling, passes through the heat exchanger and is heated by the exhaust manifold. A heat and defrost valve located on the forward side of the firewall directs heated air for the cabin interior to a fresh air and temperature control valve assembly which regulates the temperature of the air to be introduced into the cabin interior. The cabin heat and defroster controls are located on the right side of the instrument panel.

   Heated air for the defroster does not go through the fresh air and temperature control valve assembly, but is passed directly from the heat and defrost valve to the defroster outlets located at the base of the windshield. The defroster, through its own control lever, can be turned off when its operation is not required.

   When cabin heat and defrost heat controls are in the off position, heated air from the heat exchanger is dumped overboard.

   Fresh air for the cabin interior is taken in through inlets located in the leading edge of each wing. The fresh air is forced into the fresh air and temperature control valve where it passes directly into the cabin interior or is mixed with heated air depending upon the setting of the control lever.

   Fresh air for the overhead ventilating system is taken in through air scoops located on each side of the dorsal fin and is funneled forward to individual outlets located directly above each seat.

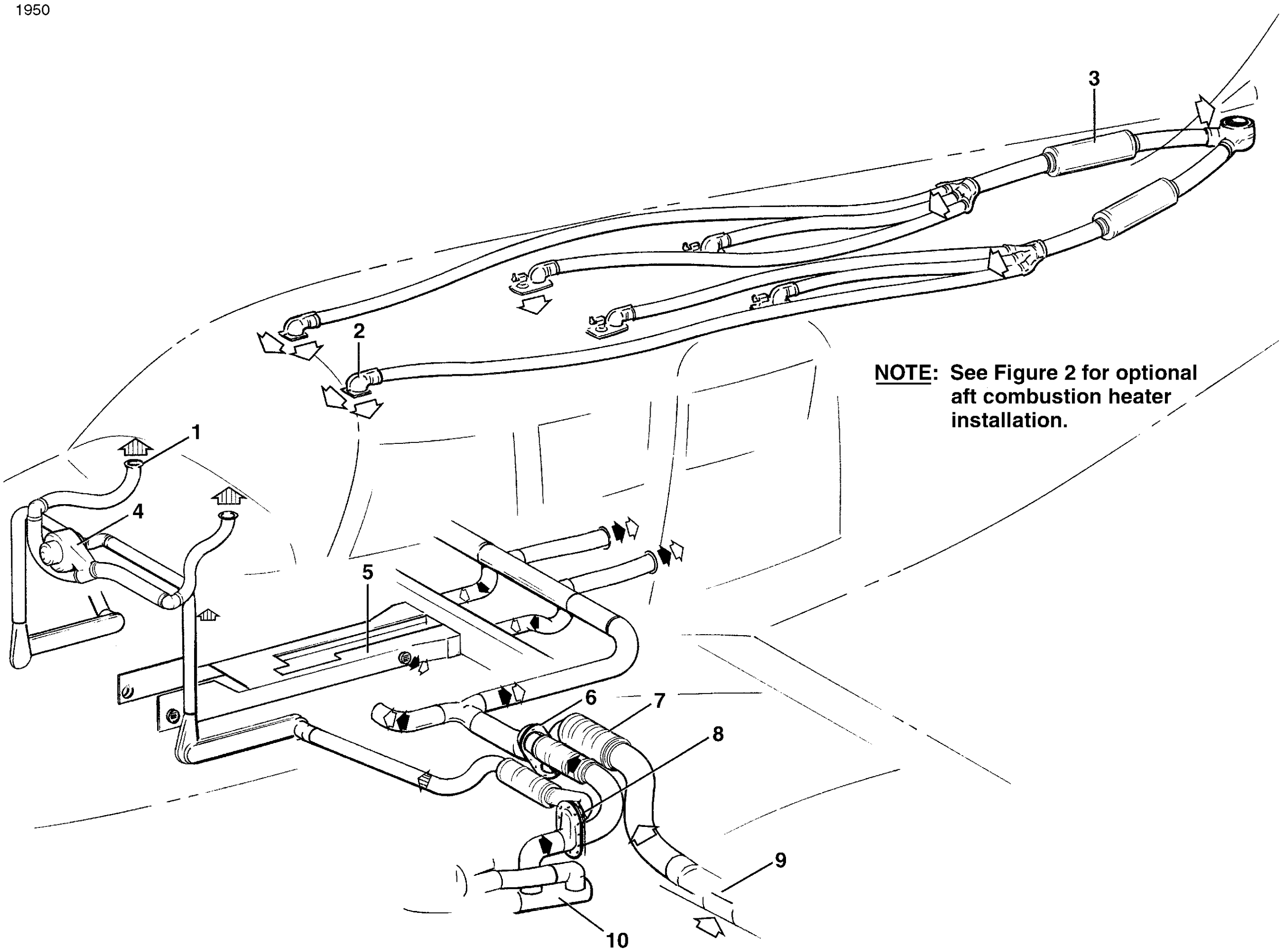
   Air flow through these outlets is regulated by turning the knurled knob in the direction necessary to obtain the desired flow.

   NOTE: An optional combustion air heater is also available to supplement cabin heating and windshield defrosting. See Optional Combustion Heater (Janitrol), below.

   NOTE: See also Optional Overhead Vent Blower, below.

3. INSPECTION. If the exhaust manifold should become defective, carbon monoxide could be discharged into the cabin interior, therefore it is imperative the exhaust manifold be inspected on a regular basis (every 100 hours). The heat exchanger must be removed to properly inspect the exhaust manifold. Inspect the manifold for cracks and holes. If defects are found, the exhaust manifold should be replaced.

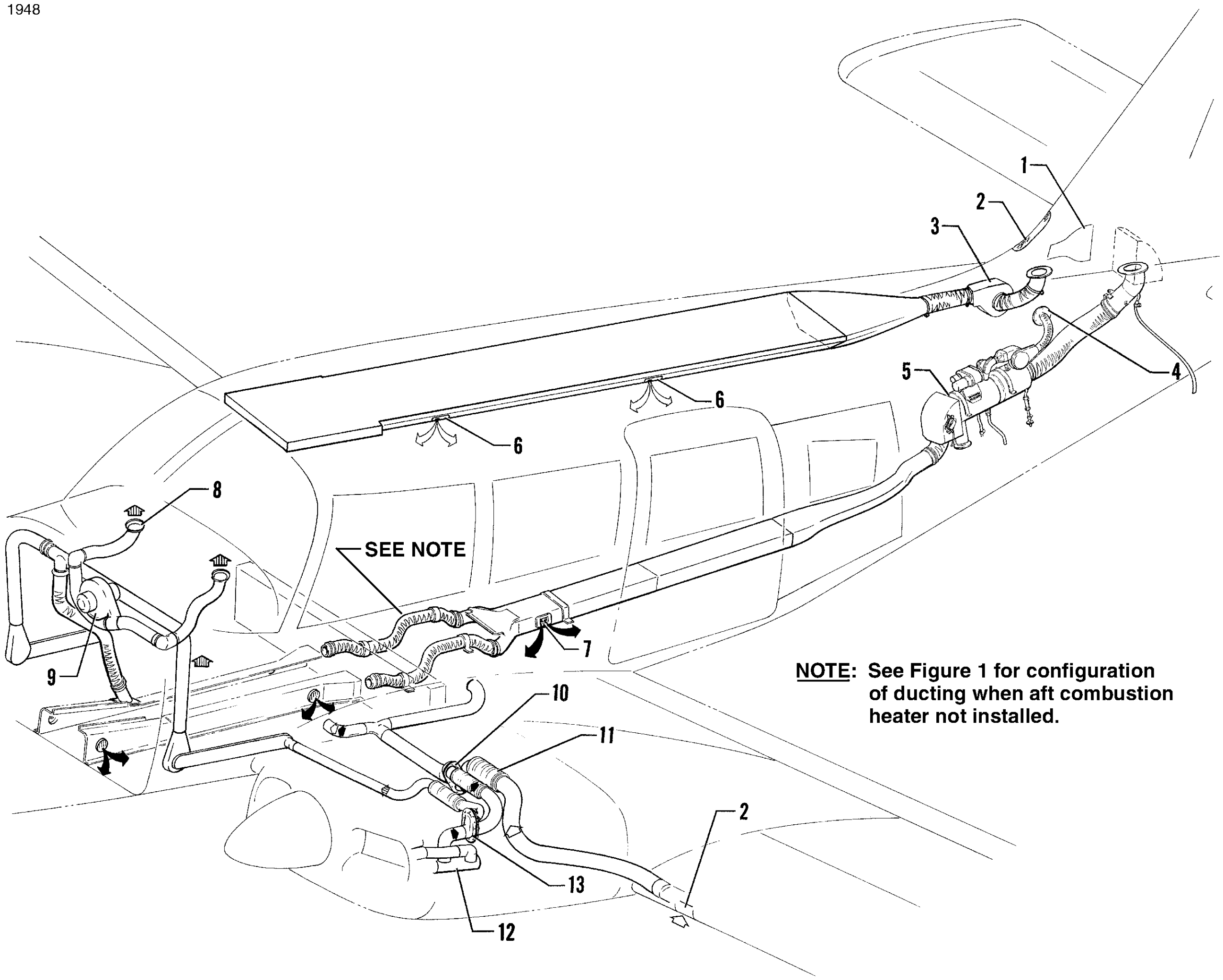
   Check operation of the control levers for freedom of movement and to determine the valves operate freely and properly. Inspect swivel fittings to be sure cables are held securely in position. In the event it is necessary to replace a cable, refer to Figure 3 for routing of cables.



1. DEFROSTER OUTLET
2. FRESH AIR OUTLET
3. SILENCER ASSEMBLY
4. DEFROSTER BLOWER
   (S/N'S 34-7250246 THRU 34-7350363 - STANDARD;
   S/N'S 34-7250001 THRU 34-7250245 - ONLY IF
   KIT NO. 760-692 OR 760-693 INSTALLED PER
   PIPER SERVICE LETTER NO. 622.)
5. DUCT ASSEMBLY
6. FRESH AIR AND TEMPERATURE CONTROL ASSEMBLY
7. SILENCER ASSEMBLY
8. HEAT AND DEFROST VALVE
9. FRESH-AIR INLET
10. HEAT EXCHANGER

Effectivity
34-7250001 thru 34-7350363

Cabin Heating, Defrost, and Ventilation
(1972 - 1973 Models)
Figure 1



1. HEATER INLET
2. FRESH AIR INLET
3. OVERHEAD VENT BLOWER (OPTIONAL)
4. COMBUSTION AIR BLOWER INLET
5. AFT COMBUSTION HEATER (OPTIONAL)
6. FRESH AIR OUTLET
7. HEATER OUTLET
8. DEFROSTER OUTLET
9. DEFROSTER BLOWER
10. FRESH AIR AND TEMPERATURE CONTROL ASSEMBLY
11. SILENCER ASSEMBLY
12. HEAT EXCHANGER
13. HEAT AND DEFROST VALVE

FRESH AIR
DEFROSTER AIR
HEATED AIR

Cabin Heating, Defrost, and Ventilation
(1974 Models)
Figure 2

Effectivity
34-7450001 thru 34-7450220

4. RIGGING CABIN HEAT AND DEFROST CONTROLS. (The following paragraphs keyed to Figure 3.)

5. CONTROL INTERCONNECT TO FIREWALL HEAT VALVE.

   a. Position the control arm actuating end (2) so that its centerline is perpendicular to the centerline of the sliding link (3), and install the cable (10) in the fitting on the control arm (1).

   b. Install cable end in cabin heat valve control arm (3) with the valve in the fully closed position and bend inner member at fittings as shown in View B.

6. HEAT AND FRESH AIR CONTROL CABLE.

   a. Bottom out thread in rod end bearings and do not secure jam nuts.

   b. Install cable in cabin heat control lever (5) of control assembly (6).

   c. Connect rod end bearings (4) to end of control arms (3) and (5), then connect cable housing clamps (7) and (11) loosely.

   d. Put control arm (9) in maximum heat HI position and adjust end of cable housing to within .062 of an inch of the rod end and tighten cable housing clamp (7).

   e. Position control arm (9) in OFF position, measure between end of cable housing and rod end for minimum of 2.35 inches of control travel.

   f. Position control handle (5) and control arm (9) of valve assembly (8) in the maximum heat position and install rod end bearing (4) to end of control arm (3).

   g. Adjust rod end so bolt will fit hole in control arm (3) with slight preload between connecting parts; then tighten rod end jam nut.

   h. Place the control handle (5) in the OFF position; the valve should fully cover the fresh air opening. If not, repeat steps g and h after connecting the rod end bolt in the hole of the control arm (3).

7. DEFROST CONTROL CABLE.

   a. Install cables in defrost control lever (12) of control assembly (6) and move arm to the OFF position.

   b. Place cable in the fitting (13) in the control arm (14) of the defrost control valve (15) with the valve in the fully closed position and bend inner member at fittings as shown in View B.

   c. If installed, adjust the micro switch to activate the blower when the control lever is at the full on HI position.

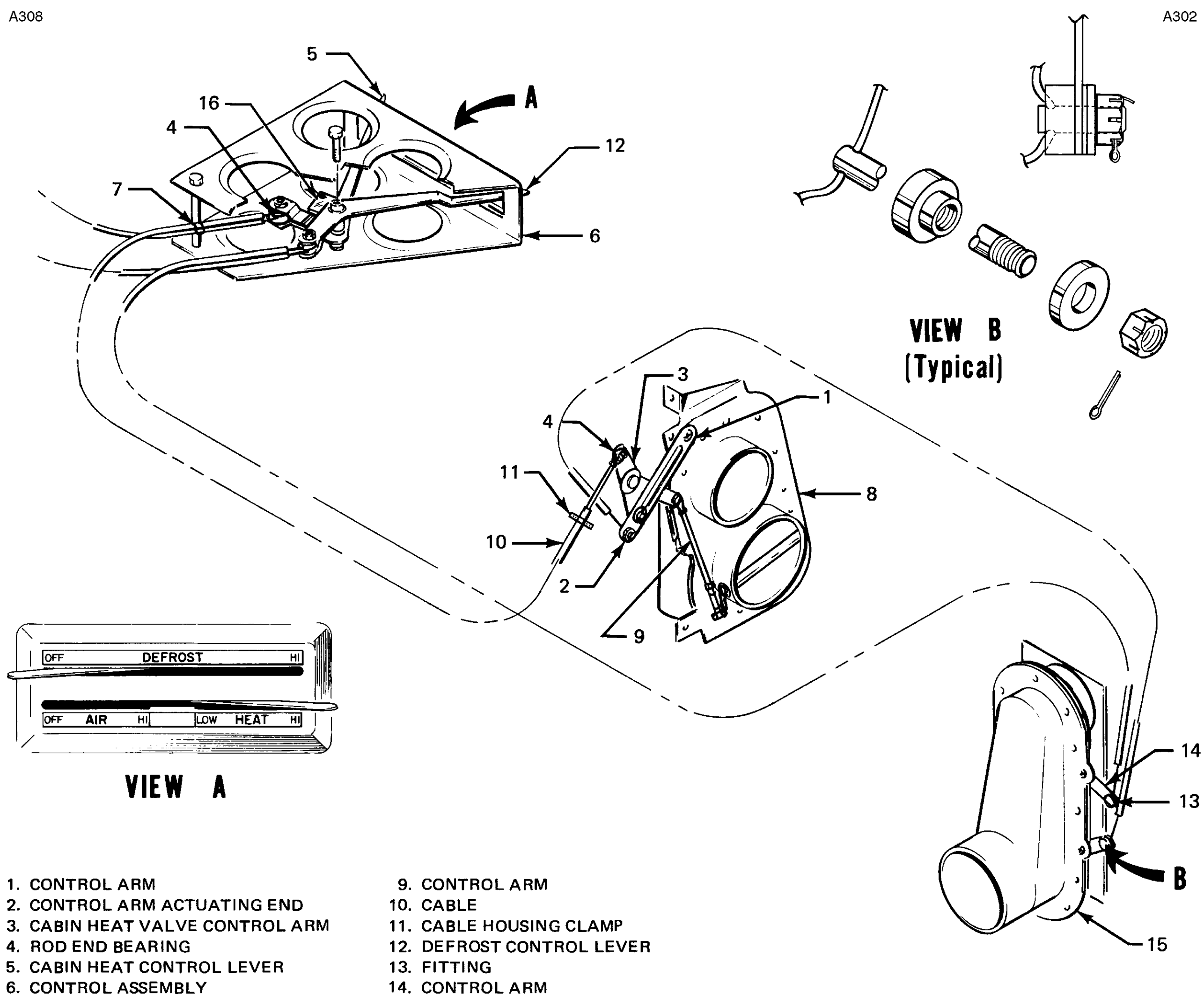
   NOTE: Ensure that the blower switch allows the defroster lever to hit the stop after the switch has been activated. Do not allow the lever to contact the switch with enough force to dislocate it.

8. CHECK OPERATION OF HEAT AND FRESH AIR CONTROLS.

   a. With the cabin heat and fresh-air control OFF, the fresh air valve should be closed, the heat valve closed, and hot air dump valve open.

   b. With the cabin heat and fresh air control in the fresh AIR ON position, the fresh air valve should be open, heat valve closed and hot air dump valve open.

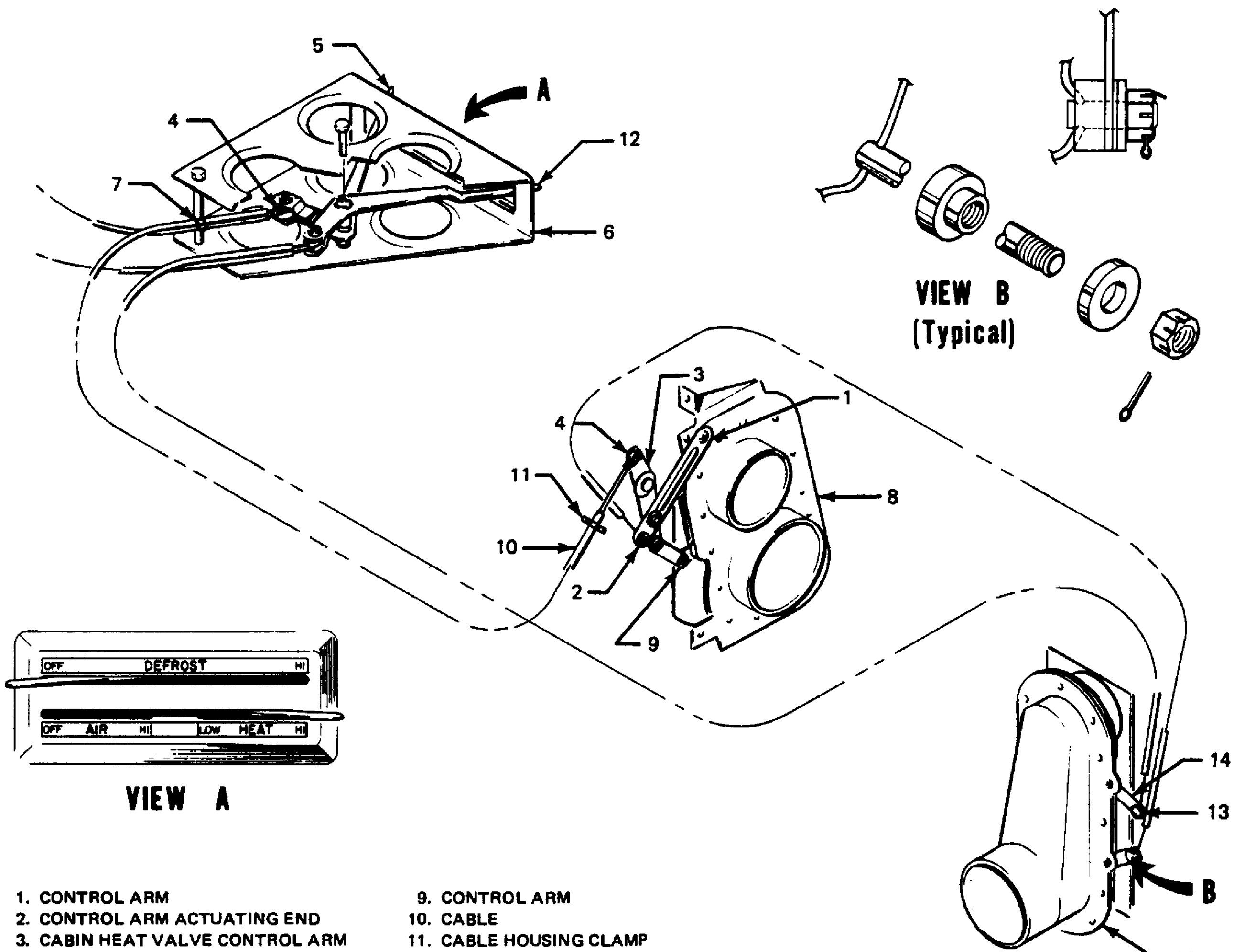
   c. With the cabin heat and fresh-air control in full HEAT HI position, the fresh-air valve should be closed, the heat valve open, and the hot air dump valve closed.



1. CONTROL ARM
2. CONTROL ARM ACTUATING END
3. CABIN HEAT VALVE CONTROL ARM
4. ROD END BEARING
5. CABIN HEAT CONTROL LEVER
6. CONTROL ASSEMBLY
7. CABLE HOUSING CLAMP
8. CONTROL VALVE ASSEMBLY
9. CONTROL ARM
10. CABLE
11. CABLE HOUSING CLAMP
12. DEFROST CONTROL LEVER
13. FITTING
14. CONTROL ARM
15. CONTROL VALVE
16. BLOWER SWITCH

Rigging Cabin Heat / Defrost Controls
Figure 3 (Sheet 1 of 2)

Effectivity
34-7250246 thru 34-7450220
and
34-7250001 thru 34-7250245
with Kit No. 760-692 or
760-693 installed



1. CONTROL ARM
2. CONTROL ARM ACTUATING END
3. CABIN HEAT VALVE CONTROL ARM
4. ROD END BEARING
5. CABIN HEAT CONTROL LEVER
6. CONTROL ASSEMBLY
7. CABLE HOUSING CLAMP
8. CONTROL VALVE ASSEMBLY
9. CONTROL ARM
10. CABLE
11. CABLE HOUSING CLAMP
12. DEFROST CONTROL LEVER
13. FITTING
14. CONTROL ARM
15. CONTROL VALVE

Effectivity
34-7250001 thru 34-7250245
as originally delivered

Rigging Cabin Heat / Defrost Controls
Figure 3 (Sheet 2 of 2)

9. CHECK OPERATION OF DEFROST CONTROLS.

   a. With the cabin defrost control in the full on HI position, the defrost control valve is closed and the hot air dump valve is closed.

   b. With the cabin defrost control in the full OFF position, the defrost control valve is open, and the hot air dump valve closed.

   NOTE: If operation is not as stated, adjust cable rigging as required to comply with paragraphs 8 and 9.

10. OPTIONAL COMBUSTION HEATER (JANITROL). (See Figures 2 and 4.)

    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.)

11. DESCRIPTION AND OPERATION. An optional combustion heater may be installed in the aft fuselage, which will provide added air for cabin heating and windshield defrosting. This combustion heater supplements the heated air obtained from the standard heater-muff system.

    The controlled atomized spray from a specially designed spray nozzle, coupled with high voltage spark plug ignition, insures 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 (Figure 5) 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.

    Operation of the combustion heater is controlled by a three position switch located on a 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 only and may be used for cabin ventilation or windshield defogging on the ground when heat is not desired.

    The defroster control lever for the standard heater-muff system must be in the full "ON" position in order to energize the defroster blower any time defrosting or defogging is desired with or without heat.

    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, insuring that the right engine mixture control is in the idle cutoff position, turning on the right auxiliary fuel pump, 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 light located on the heater control console. To prevent activation of the overheat limit switch upon normal heater shutdown during ground operation, turn the switch to “FAN” for two minutes, while leaving the air intake lever in the open position, before turning the switch to the “OFF” position.

12. TROUBLESHOOTING.

See Table I.

13. HEATER SYSTEM - OPERATIONAL TEST.

a. Check all fittings and connections for condition and security of mounting.

b. Disconnect wire (H8A) from the heater terminal No. 3, this will remove electrical power to the fuel valve.

c. Turn the master switch and “HEATER” switch on. Both blowers should operate. Check at heater exhaust and ventilating air outlets to insure airflow.

d. Turn off heater switch.

e. Turn on right fuel boost pump briefly to pressurize the fuel line; then turn it off along with the master switch.

f. To insure that the heater fuel line is free of airlock, cautiously loosen the fuel connection at the heater. This will bleed the line between the heater and fuel source. Then tighten the fuel line connection.

g. Reconnect the wire (H8A) to the heater terminal No. 3.

h. Place the air intake lever in the “OPEN” position and the temperature control lever in the center of its travel.

i. Turn on the master switch; then press the press-to-test overheat indicator light. The lamp should illuminate indicating the lamp filament is intact.

j. Turn on the right-hand boost pump and 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.

k. 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 two minutes; then place the air intake lever in the closed position. The blower should turn off.

l. 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.

TABLE I (Sheet 1 of 5)
TROUBLESHOOTING COMBUSTION HEATER (JANITROL)

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. (Refer to Operating Controls, below.)
	Fuel cut off from tank.	Turn on heater switch.
	Regulator not operating properly.	Check for low pressure or replace regulator. (Refer to Fuel Regulator and Shutoff Valve, below.)
	NOTE: When making the fuel pressure check, be sure fuel is flowing through the nozzle. Turn the adjusting screw clockwise to increase fuel pressure and counterclockwise to decrease it.	
	Restriction in fuel nozzle orifice.	Remove the nozzle and clean or replace it. (Refer Fuel Nozzle Orifice Inspection, below.)
	Fuel heater solenoid not operating.	Remove and check solenoid. Replace if faulty. (Refer to Overhaul: Disassembly; Inspection; and, Reassembly; below.)
	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. Check for defective radio noise filter. (Refer to Vibrator: Removal and Installation, below; and, Overhaul: Inspection; below.)
	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.

TABLE I (Sheet 2 of 5)
TROUBLESHOOTING COMBUSTION HEATER (JANITROL)

Trouble	Cause	Remedy
Heater fails to light. (cont.)	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. (Refer to 100 Hour Inspection, below; and, Combustion Air Pressure Switch; below.)
	Cycling switch open.	Replace if defective. (Refer to Cycling Switch and Limit (Overheat) Switch, below.)
	Duct switch open.	Operate control to see if switch will come on. Replace switch if defective. (Refer to Duct Switch, below.)
Ventilating air blower fails to run.	Heater switch “OFF.”	Energize the heater switch.
	Broken or loose wiring to motor.	Check and repair wiring.
	Circuit breaker open.	Close circuit breaker.
	Worn motor brushes.	Replace motor brushes. (Refer to Combustion Air Blower: Replacing Motor Brushes; below.)
	Blower wheel jammed.	Remove and check the ventilating air blower wheel and realign if necessary. (Refer to Overhaul: Reassembly; below.)
	Motor burned out.	Remove blower assembly and replace motor. (Refer to Overhaul: Disassembly; and, Reassembly; below.)
	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. (Refer to Combustion Air Blower: Replacing Motor Brushes, below.)

TABLE I (Sheet 3 of 5)
TROUBLESHOOTING COMBUSTION HEATER (JANITROL)

Trouble	Cause	Remedy
Combustion air blower fails to run. (Cont.)	Blower wheel jammed. (Usually indicated by hot motor housing.)	Overhaul the combustion air blower. (Refer to Ventilating Air Blower, below; and, Overhaul: Reassembly, below.
	Defective radio-noise filter.	Replace filter.
	Faulty or burned-out motor.	Remove combustion air motor for overhaul or replacement of motor. (Refer to Combustion Air Blower, below; and, Overhaul: Disassembly; Combustion Air Blower Assy, below; and, Heater: Installation, below.
Heater fires but burns unsteadily.	Insufficient fuel supply.	Inspect fuel supply to heater, including shutoff valve, solenoid valve and fuel lines. Make necessary repairs.
	WARNING: 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.	
	Spark plug partially fouled.	Replace spark plug. (Refer to Spark Plug, below.)
	Loose primary connection at ignition assembly.	Tighten the connection.
	Faulty vibrator.	Replace the vibrator. (Refer to Vibrator: Removal and Installation, below.)
	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. (Refer to Combustion Air Blower, below; and, Overhaul: Disassembly; Combustion Air Blower Assembly, below; and, Overhaul: Testing, below; and, Overhaul: Reassembly; Combustion Air Blower Assembly, below.)

TABLE I (Sheet 4 of 5)
TROUBLESHOOTING COMBUSTION HEATER (JANITROL)

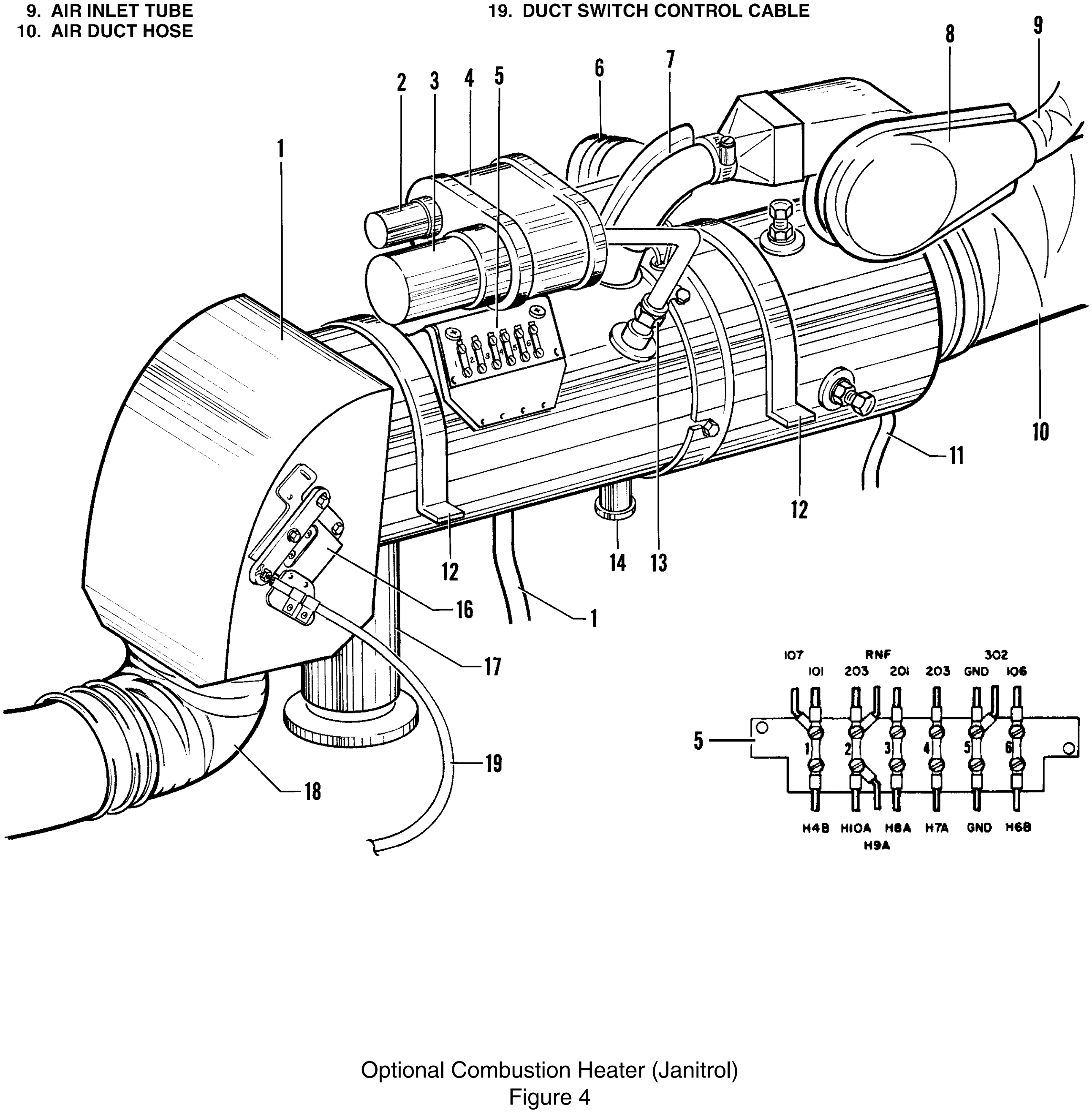
Trouble	Cause	Remedy
Heater fires but burns unsteadily (cont).	High voltage leak in lead between ignition assembly and spark plug.	Replace ignition assembly. (Refer to Ignition Unit: Removal and Installation, below.)
	Inoperative ignition assembly.	If vibrator is in good condition, replace ignition assembly only. (Refer to Ignition Unit: Removal and Installation, below.)
	Restriction in fuel nozzle orifice.	Remove nozzle for cleaning or replacement. (Refer to Fuel Nozzle Orifice Inspection, below.)
	Nozzle loose in retainer or improper spray angle.	Tighten or replace the nozzle as required. (Refer to Overhaul: Inspection of Remaining Components, below; and Overhaul: Reassembly, below.)
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. (Refer to Combustion Air Pressure Switch, below.)
	Inoperative overheat switch.	Replace switch. (Refer to Cycling Switch and Limit (Overheat) Switch, below; and, Test Procedure: Operation Test (on Bench), below.)
	Inoperative cycling switch.	Adjust or replace the switch. switch. (Refer to Cycling Switch and Limit (Overheat) Switch, below; and, Test Procedure: Operation Test (on Bench), below.)
	Low voltage.	Attach external power.

TABLE I (Sheet 5 of 5)
TROUBLESHOOTING COMBUSTION HEATER (JANITROL)

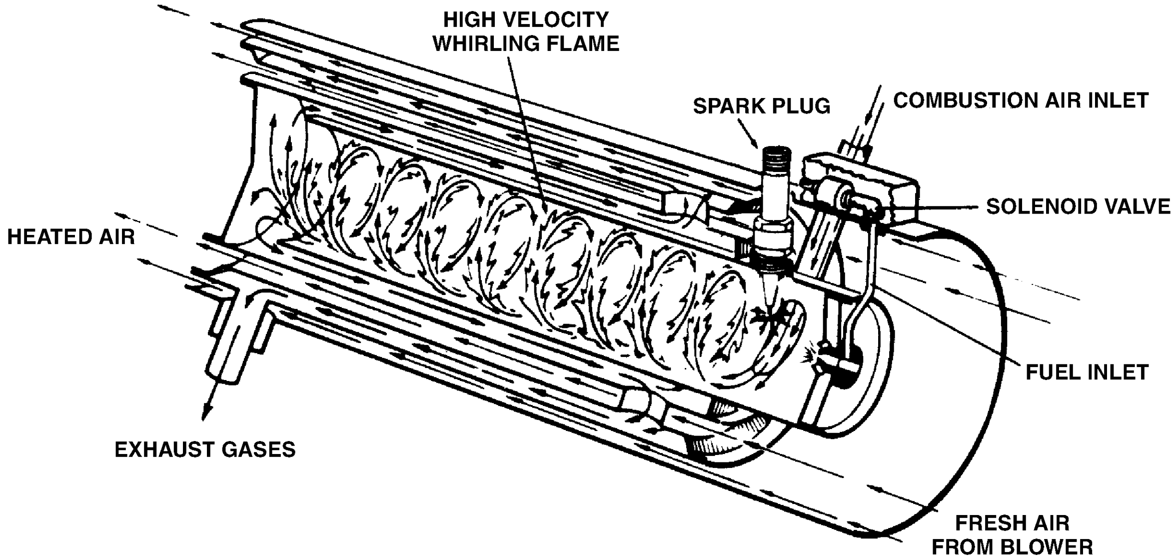
Trouble	Cause	Remedy
Heater fails to shut off.	Fuel solenoid valve in heater stuck open.	Remove and replace solenoid assembly. (Refer to Overhaul: Disassembly, below; and, Overhaul: Inspection of Remaining Components, below; and, Overahaul: Reassembly, below.
	Inoperative duct and cycling switch.	Check and repair. (Refer to Cycling Switch and Limit (Overheat) Switch, below; and, Duct Switch, below.)
	Defective heater switch.	Replace the heater switch.

1957

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



Optional Combustion Heater (Janitrol)
Figure 4



Heater Cutaway Showing Whirling Flame Action
Figure 5

14. OPERATING CONTROLS. (Refer to Figure 6.)

NOTE: The schematic diagram (Figure 6) shows the heater circuit, including the electrical wiring in the airplane.

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

15. PROCEDURE.

a. Place the master and right fuel boost pump switches in their “ON” position, and place the air intake lever in the “OPEN” position. The ventilating air and combustion air blowers will operate.

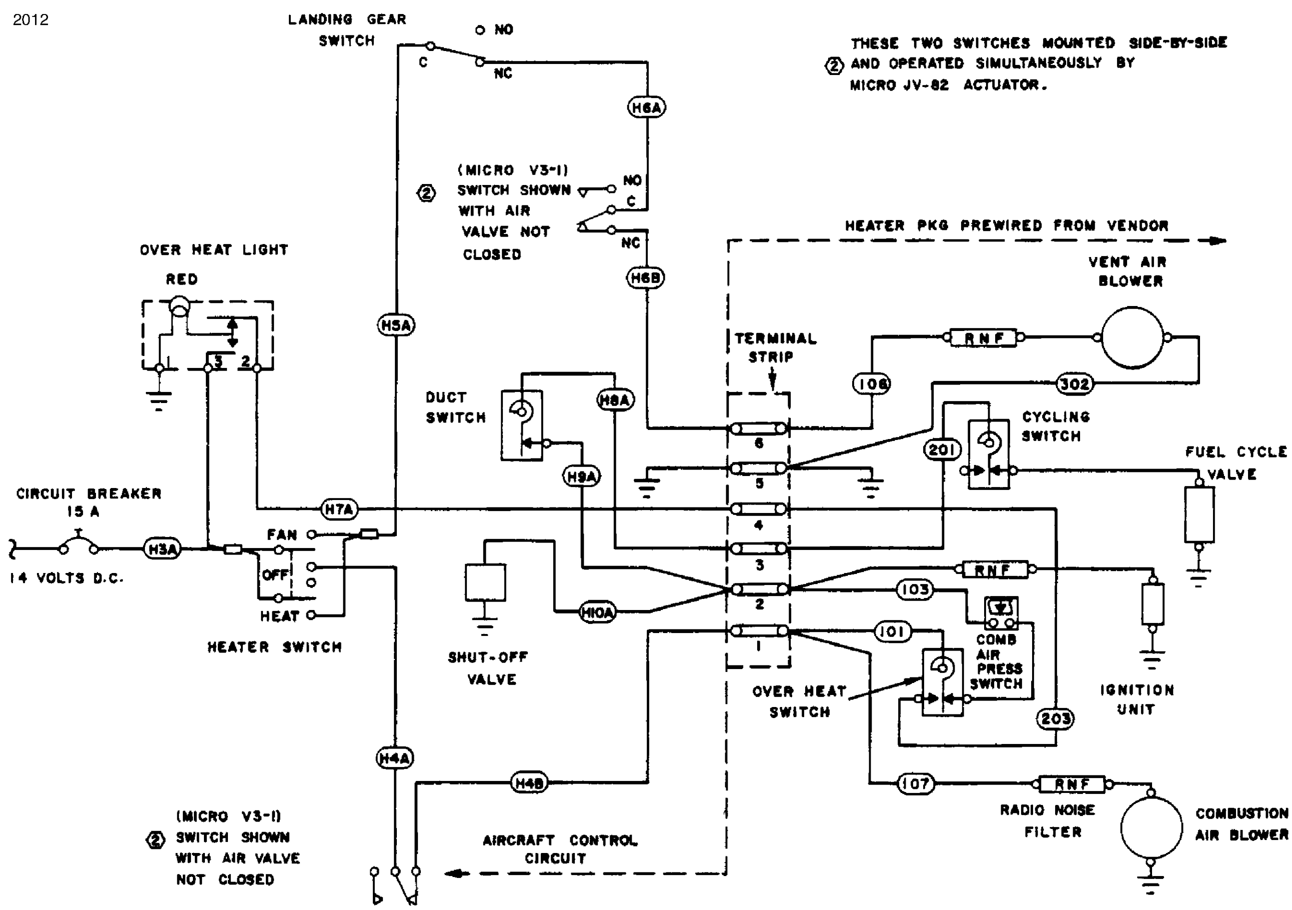
NOTE: The blowers will not operate with the air intake lever in the “CLOSED” position.

b. Turn on the heater switch. The heater will ignite and continue to operate.

c. 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.

d. To stop the heater operation, turn the heater switch to the “FAN” position . Turn off boost pump. 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. Refer to Heater System - Operational Test, above, for complete operational test of the system. Turn off master switch.



Heater Wiring Diagram
Figure 6

16. INSPECTIONS.

17. 50-HOUR INSPECTION.

    a. Inspect the ventilating air inlet scoop, combustion air inlet scoop, 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.

    b. Perform an operational check as follows:

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

       NOTE: To proceed with the operational check, follow Heater System - Operational Test, above.

18. 100-HOUR INSPECTION.

    a. Perform 50-Hour Inspection as described, above.

    b. Inspect ventilating air and combustion air inlets and exhaust outlet for restrictions and security at the airplane skin line.

    c. Inspect the drain lines to make sure they are free of obstructions. Run a wire through them if necessary to clear any obstructions.

    d. 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.

    e. Perform Fuel Regulator and Shutoff Valve 100 Hour Inspection as described under Maintenance, below.

    f. Inspect electrical wiring at the heater terminal block and components for loose connections, possible chafing of insulation, and security of attachment points.

    g. 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.

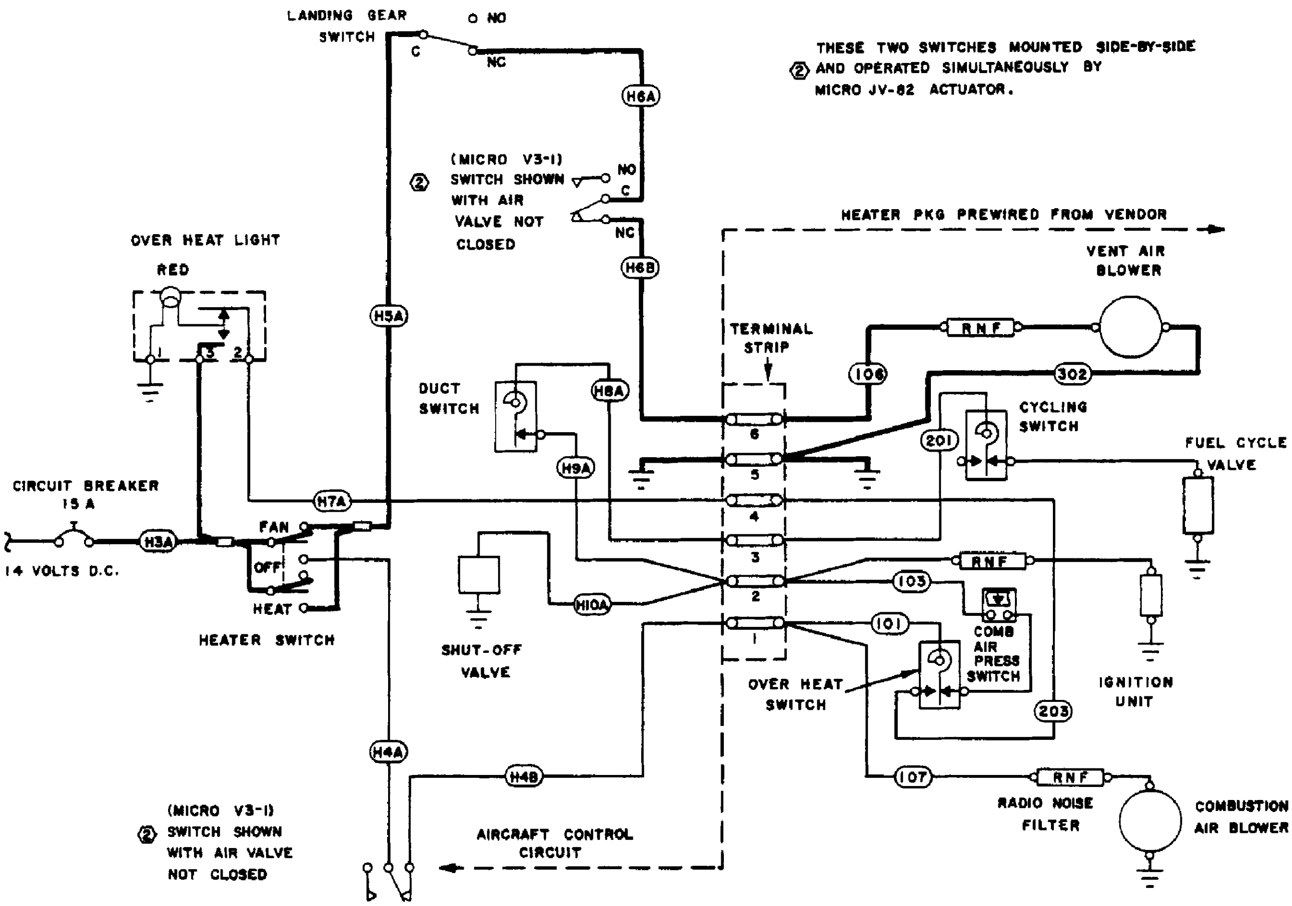
    h. Inspect the combustion air blower assembly for security of mounting and security of connecting tubing and wiring. Tighten any loose electrical terminals and air tube connections.

19. HEATER ELECTRICAL SYSTEM CHECKS.

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

    NOTE: The wiring diagrams (Figures 6, 7 and 8) show, in addition to the heater circuitry, the aircraft control circuit. For the purposes of this manual, the circuitry shown in these illustrations will be utilized to describe voltage checks.

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



Heater Primary Power Circuit
Figure 7

21. VENT BLOWER POWER CIRCUIT CHECK.

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 ventilating air intake scoop is used during flight.

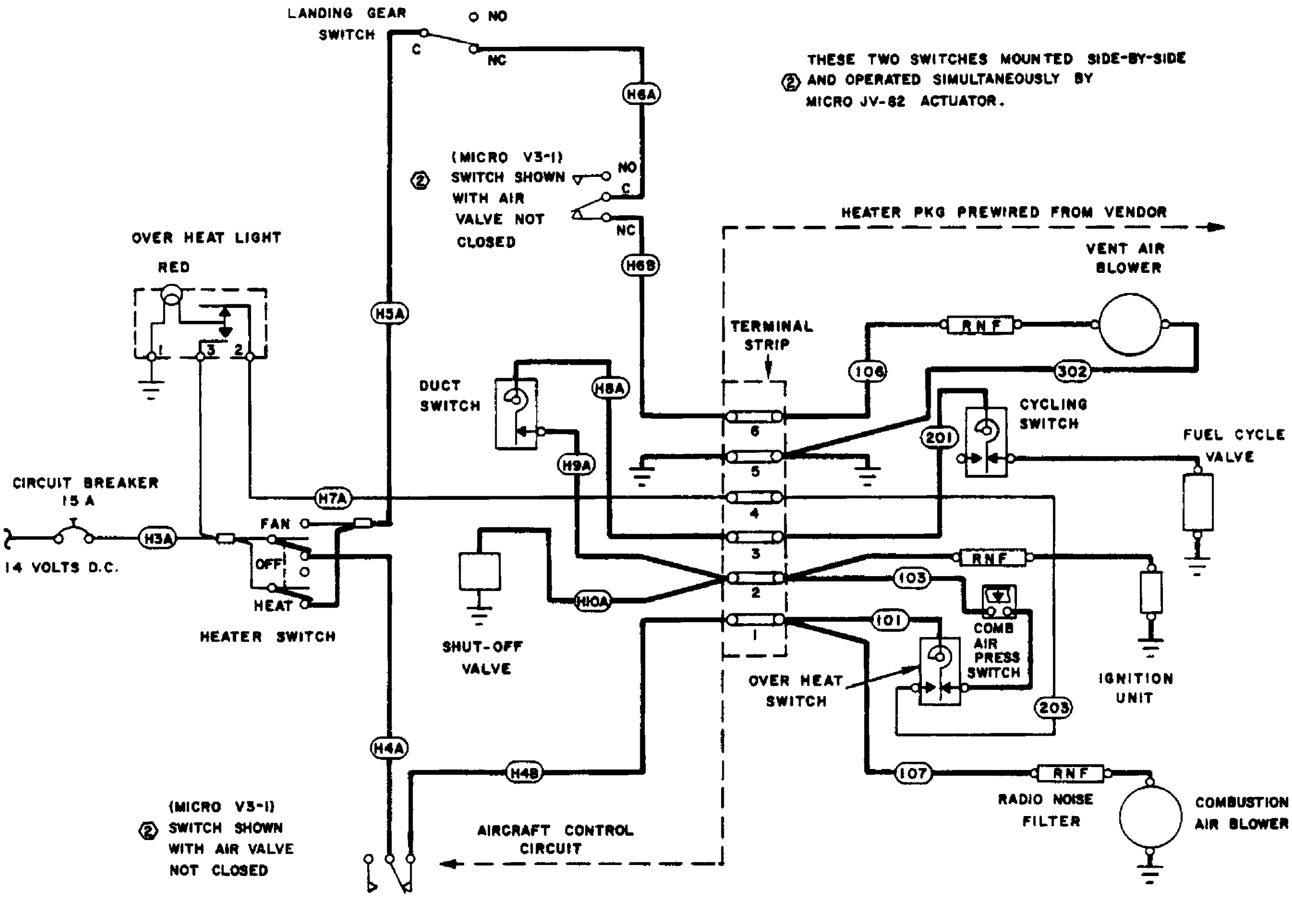
With the HEATER SWITCH in the FAN position, voltage (14-volts nominal) should be present at the following locations: (Refer to Figure 7.)

1. Terminal No. 6 on the heater terminal strip, if the air valve is not closed.
2. From terminal No. 6 of the heater terminal strip through the radio noise filter to the ventilating air motor.
3. Electrical ground circuit for the ventilating air motor is provided from terminal No. 5 of the heater terminal strip. Ventilating air motor is inoperative when the landing gear is up.

22. HEATER POWER CIRCUIT CHECK.

a. With the HEATER SWITCH in the HEAT position, voltage should be present at the following locations: (Refer to Figure 8.)

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.



Heater Starting Power Circuit
Figure 8

1. Terminal No. 1 of the heater terminal strip, if the air valve is not closed.
2. From terminal No. 1 of the heater terminal strip through the radio noise filter to the combustion air motor, and to terminal No. 1 of the overheat switch.
3. From terminal No. 3 of the overheat switch through the combustion air pressure switch to terminal No. 2 of the heater terminal strip.
4. From terminal No. 2 of the heater terminal strip through the radio noise filter to the ignition unit; to the shutoff valve and through the adjustable duct switch to terminal No. 3 of the heater terminal strip.
5. From terminal No. 3 of the heater terminal strip through the cycling switch to the fuel solenoid valve.

b. 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.

23. MAINTENANCE. Instructions below 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.

24. HEATER.

25. REMOVAL. (Refer to Figures 2 and 4.)

a. Ascertain that all heater controls are off.

b. Remove the access panel to the aft section of the fuselage.

c. Disconnect the heater outlet hose from the heater air distribution box by releasing the hose attachment clamp.

d. Disconnect the duct switch control cable from the left side of the air distribution box.

e. Note the hookup of the electrical leads to facilitate reinstallation. Disconnect the leads from the heater terminal block.

f. 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.

g. Disconnect the fuel and water drains from the bottom of the heater and allow them to slide down.

h. Disconnect the air inlet hose from the inlet end of the heater by releasing the hose attachment clamp.

i. Disconnect the combustion air blower inlet hose from the blower assembly by removing the cotter key and clevis pin at the blower.

j. Loosen the clamps from around the heater and remove the heater from the airplane. The exhaust shroud should remain in the airplane.

k. With the heater removed the necessary maintenance may be performed as required.

26. INSTALLATION. (Refer to Figures 2 and 4.)

a. Ascertain that all the heater components are on the heater. Position the exhaust tube shroud on the tube mounting flange located in the fuselage.

b. 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.

c. 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.

d. 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.

e. Connect the air inlet hose to the inlet end of the heater and secure with clamp.

f. Connect the fuel and water drain lines to the bottom of the heater.

g. Connect the fuel supply line to the heater and cover over the fuel shroud and secure with four screws.

h. Attach the duct switch control cable to the switch, refer to Duct Switch, below, for rigging information.

i. Connect the electrical leads to the heater terminal block on the heater as shown in Figure 4.

j. Check the operation of the heater per Heater System - Operational Test, above.

k. Install the access panel to the aft section of the fuselage.

27. COMBUSTION AIR BLOWER.

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

a. Removal:

1. Disconnect wire at quick-disconnect terminal.
2. Disconnect the inlet tubing from the inlet air adapter.
3. Loosen the clamps that hold the combustion air blower assembly in the support bracket and slide the motor out of the bracket.

b. Installation:

1. 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 spill plate. Blower performance is based upon this close-tolerance clearance. It is recommended that correct voltage be applied for this clearance check.
2. Install the blower inlet adapter in the same orientation as before removal.
3. 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.
4. Tighten the blower motor mounting strap securely, making certain the air tubing is in proper alignment.
5. Secure the air tubing by tightening the clamp or installing the sheet metal attaching screws.
6. Connect the wire lead at the quick-disconnect terminal. Be sure to slide an insulating sleeve over the connection (or tape it) in order to prevent any possible short circuits. Tie the sleeve in place.
7. Connect the ground lead securely to the mounting bracket.
8. 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.

c. Replacing Motor Brushes: (Refer to Figure 19.)

1. 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.
2. Inspect the brush for wear. If brushes are worn to a length of .187 of an inch, they must be replaced.
3. 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.
4. After installing new brushes, it is advisable to run in the brushes as follows: Connect the motor to a controlled voltage supply (rheostat in a 14-volt line). 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.

28. SPARK PLUG.

a. Removal: (Refer to Figure 18.)

1. Remove the necessary access panels to expose the spark plug area of the heater assembly.

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

2. Unscrew and remove the high-voltage lead connector at the spark plug. Exercise care to avoid fouling or damaging the connector.
3. Remove the grommet (39).
4. Using a 7/8 inch deep hex socket, unscrew and remove the spark plug (32). 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.

b. Inspection and Servicing.

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 paragraph c, below.

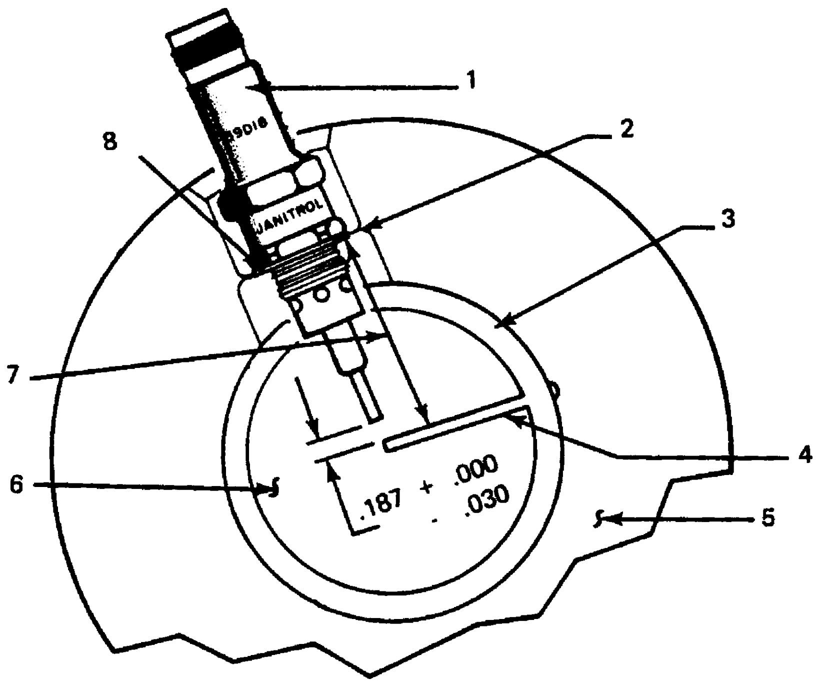
c. Spark Gap Adjustment: (See Figure 9.)

1. Measure the distance between the seating surface of the spark plug with a new gasket installed to the end of the plug electrode; then add .157 to .187 of an inch.
2. Using a depth gauge, measure the distance between the ground electrode in the heater to the spark plug seating surface in the heating jacket and check against the measurement obtained in Step "1."
3. The ground electrode in the heater can be bent to obtain the distance found in Step "1."

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

d. Installation: (Refer to Figure 9.)

1. If a new spark plug is being installed, be sure to adjust the spark gap as outlined in Step c of this paragraph. Do not bend the electrode on the spark plug.
2. 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.
3. Screw the spark plug into the heater with a deep socket wrench. Tighten to a torque of 28 foot-pounds.
4. Install the grommet (39, Figure 18) in the heater jacket opening.
5. 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.
6. Reconnect the wire to the No. 3 terminal on terminal strip, if disconnected for above tests.
7. Operate the heater to check dependability and close all access openings.



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

Spark Plug Gap Adjustment
Figure 9

29. 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.

30. OPERATIONAL TEST.

    a. Close the momentary switch and read the voltmeter and ammeter. Release the momentary switch immediately.

    b. The amperage reading at 14-volts DC must be 1.50 + 0.25 amperes.

31. REMOVAL AND INSTALLATION.

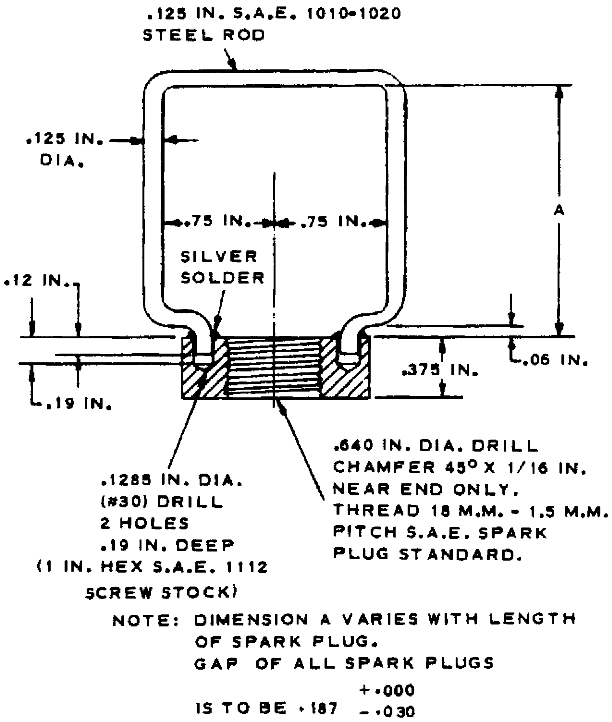
    a. Removal: (Refer to Figure 18.)

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

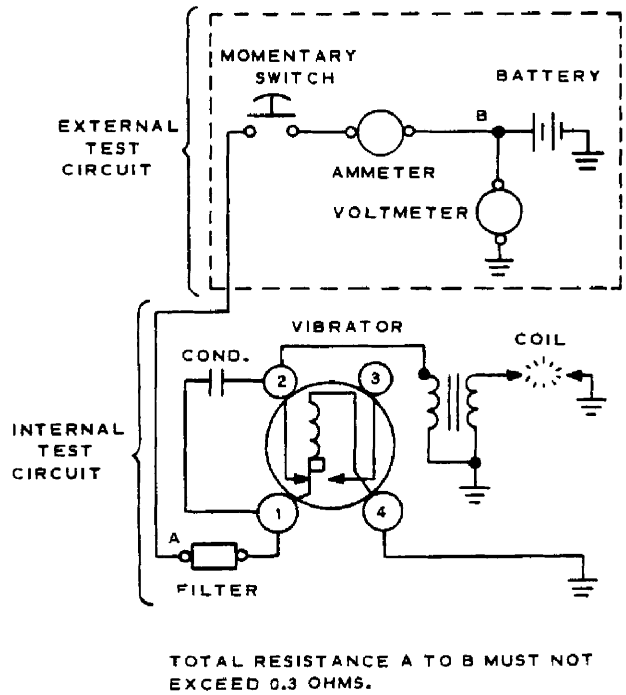
    1. Disconnect the primary wire from the primary terminal of the ignition assembly (2).
    2. Carefully unscrew and disconnect the high-voltage ignition cable at the spark plug. Exercise care to avoid fouling or damaging the connector.
    3. Remove the four attaching screws and lock washers and lift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

    b. Installation: (Refer to Figure 18.)

    1. Place the ignition assembly in position on the brackets attached to the heater jacket, with the high-voltage cable facing the spark plug end of the heater.
    2. Install the four screws and lock washers. Tighten the screws securely.
    3. Carefully connect the high-voltage lead to the spark plug. (Refer to Spark Plug - Installation, above.)



Spark Plug Fixture
Figure 10



Test Setup Wiring
Figure 11

4. Connect the primary lead to the primary terminal on the ignition unit (2) and tighten the nut securely.
5. Check for proper heater operation.

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

a. A battery that will supply power at approximately 14-volts DC.

b. A voltmeter with a range of 0-15-volts.

c. A lead from the battery to the test fixture in which is included an ammeter with a range of 0-3 amperes and a normally open, momentary-closed switch. The total resistance of the lead, including the ammeter and switch must not exceed 0.3 ohms.

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

d. A spark gap of 0.187 inch (plus 0, minus .030). A convenient means of arranging the correct spark gap is to install a spark plug, P/N 39D18, in a test fixture arranged to provide a ground electrode and a .187 inch spark gap. (Refer to Figure 10 for information on fabricating this fixture.)

NOTE: Any one of several spark plugs may be used with the spark plug fixture detailed in Figure 10. However, the "A" dimension in that sketch must be varied with the length of spark plug electrode to provide a gap of .187 inch for all spark plugs.

e. The high tension shielded ignition lead between the ignition unit and the spark plug is a part of the cover assembly.

f. Arrange the test equipment as shown in Figure 11.

33. DISASSEMBLY. (Refer to Figure 12.)

    a. Remove cover assembly (1) by carefully drilling out the “pop” rivets (2).

    b. Remove ignition cable terminal from ignition coil (8).

    c. All replaceable items are accessible for checking without further disassembly from the ignition box (12).

34. INSPECTION. Inspect components as directed in Table II and Figure 12.

35. ASSEMBLY. Replace any component that fails to meet tests listed in Table II.

    CAUTION: WHEN INSTALLING COVER ASSEMBLY (1), THE IGNITION CABLE TERMINAL MUST SEAT INTO THE OPENING OF THE IGNITION COIL (8).

    Replace cover assembly (1) to ignition box (12) and secure with pop rivets (2).

36. VIBRATOR. Replace each vibrator after it accumulates 250 hours of heater operation.

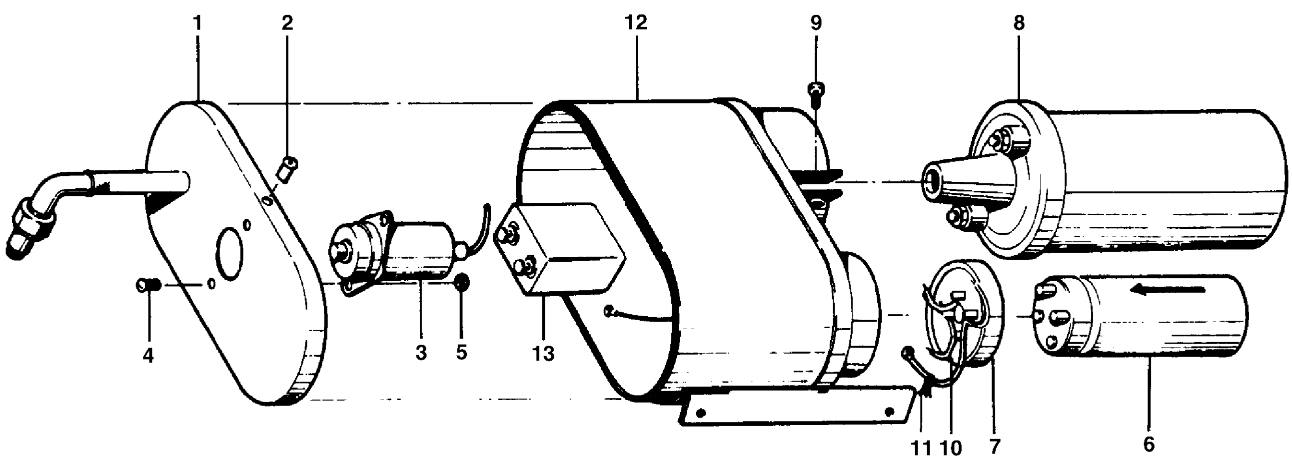
37. REMOVAL AND INSTALLATION. (Refer to Figure 12.)

    a. Remove the screw (9) and nut.

    b. Remove the vibrator (6) from the ignition unit, it may require a slight back-and-forth movement to remove it from the unit. A piece of masking or friction tape around the exposed portion of the vibrator will help to grip the vibrator for removal.

    c. Install the new vibrator with the index marks 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 screw (9) and nut.

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



1. COVER ASSEMBLY
2. POP RIVET
3. FILTER
4. SCREW
5. NUT
6. VIBRATOR
7. SOCKET ASSEMBLY
8. IGNITION COIL
9. SCREW
10. INSULATING SLEEVE
11. CABLE TIE
12. IGNITION BOX
13. CONDENSER

Ignition Unit Assembly
Figure 12

TABLE II
IGNITION UNIT INSPECTION

Index No.	Nomenclature	Inspection
1	Cover Assembly	Inspect 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.
3	Filter	Inspect terminal for thread damage, and lead for breakage. Check filter for open or short circuit conditions. Capacity of filter should be 2.0 MFD + 10%. Replace filter, if it fails to meet any one of the above conditions.
8	Ignition Coil	Inspect for broken bakelite, carbon tracks, oil leaks, and dents in coil cover. Replace for any of the above conditions.
13	Condenser	Inspect for oil leakage or broken terminals. Check condenser for open or shorted condition. Capacity of condenser should be 0.5 MFD. Replace if condenser fails to meet above conditions.

38. CYCLING SWITCH AND LIMIT (OVERHEAT) SWITCH. (Refer to Figure 18.)

a. Removal:

1. If the limit switch (25) 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.”)
2. Remove the two attaching screws, lock washers and plain washers, and lift the limit switch (25) and spacers (gaskets) (27) from the jacket opening.
3. If the cycling switch (24) is damaged or defective, disconnect the electrical leads, being sure to mark them for proper reassembly.
4. Remove the two screws, lock washers and plain washers, and lift the cycling switch (24) 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. (Refer to Bench Test - Procedure, (m) and (n), below, for test instructions.)

b. Installation: (Refer to Figure 18.)

1. Install the limit switch (25) and spacers (gaskets) (27) by placing them in position in the heater jacket opening and installing two screws, lock washers and plain washers.
2. Tighten screws securely; then reconnect the electrical leads in accordance with markings made during disassembly. (Refer to wiring diagram, Figure 6.)
3. Install the cycling switch (24, Figure 18) by placing it in position in the heater jacket opening and securing it with the two screws, lock washers and plain washers. Tighten screws securely; then reconnect the electrical leads to their respective terminals as marked during disassembly. (Refer to wiring diagram, Figure 6.)

39. COMBUSTION AIR PRESSURE SWITCH. (Refer to Figure 18.)

a. Removal:

CAUTION: DO NOT BEND THE TUBE. (IT IS “TACKED” TO THE COMBUSTION CHAMBER INSIDE THE JACKET.)

1. Disconnect electrical leads from the terminals of the combustion air pressure switch (26), being sure to mark them for proper reassembly. Disconnect the tube from the switch cap.
2. Unscrew and remove the combustion air pressure switch from the fitting on the combustion air inlet tube.

b. Installation:

1. Install the combustion air pressure switch (26) 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.
2. 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 6. Connect the tube to the switch cap.
3. Check for proper heater operation.

40. FUEL REGULATOR AND SHUTOFF VALVE. (Refer to Figure 13 and 19.)

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 7.0 psi. The shutoff valve is operated by a solenoid.

a. Removal.

1. Disconnect the electrical lead from the valve.
2. Disconnect the fuel lines from the inlet and outlet openings. Take note of these connections for correct installation.
3. Remove the two attaching screws to free the unit from its mounting.

b. Installation.

1. Attach the fuel regulator and shutoff valve to its mounting with the two attaching screws.
2. Place the fuel regulator and shutoff valve into position between the fuel line connections and install and tighten connections securely.
3. Connect the electrical lead. Be sure to slide an insulating sleeve (or tape) over the connection to avoid a short circuit and tie the sleeve in place.
4. Operate the heater to make sure the unit is functioning properly.

c. Adjustment.

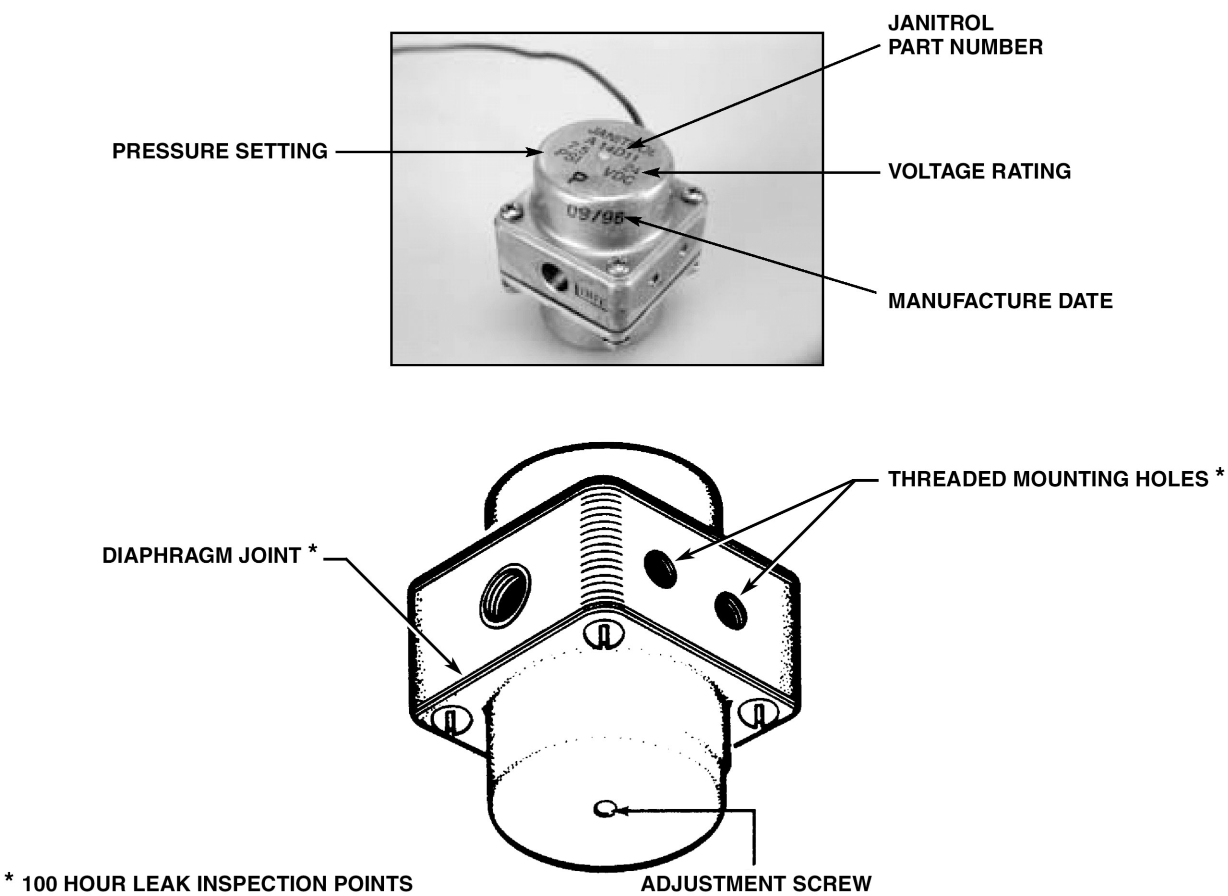
The fuel regulator and shutoff valve used in this system are adjustable but not repairable. The following steps cover the proper adjustment of this unit:

1. Install the regulator in a test stand similar to that shown in Figure 14.
2. Install a 2.5 gph nozzle (Janitrol Part No. D08D09). Gasoline or Stoddard solvent can be used for testing.
3. Apply a fluid pressure of 20 to 50 psi and energize the solenoid.
4. Using a screwdriver, break the adjustment seal and adjust the regulated outlet pressure as close to 7.5 psi as possible. (Turn clockwise to increase pressure; counterclockwise to decrease pressure.)
5. Slowly vary the inlet pressure from 10 to 50 psi. The outlet pressure should remain between 7.0 and 8.0 psi.
6. With the inlet pressure of 50 ± 3 psi, de-energize and energize the solenoid at least twice. The outlet pressure should be 7.0 to 8.0 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.
7. With the solenoid energized, slowly reduce the inlet pressure from 50 to 10 psi. Outlet pressure should remain between 7.0 and 8.0 psi.
8. During the above tests, 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.

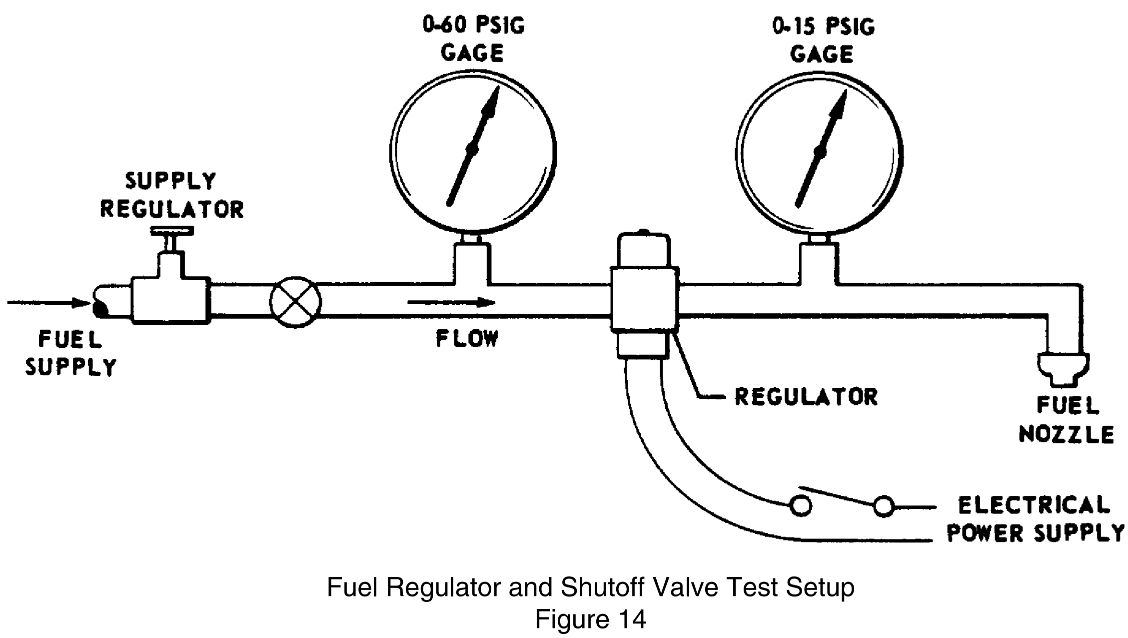
41. FUEL REGULATOR AND SHUTOFF VALVE 100 HOUR INSPECTION.

Each 100 hours or two (2) years, whichever comes first:

Visually inspect the valve body for signs of fuel stains, paying careful attention to the diaphragm joint and the threaded mounting holes located in sides of the valve body (see Figure 13). Fuel leakage may appear as a greenish blue stain or residue in the area of the diaphragm joint or threaded mount hole. Use supplemental lighting if needed to facilitate visual inspection. Visual inspection must include all four sides of the regulator valve body. If signs of fuel leakage are found replace the valve using a new valve of appropriate part number with a manufacture date code of 02/02 or later. Record valve replacement in the logbook.



Fuel Regulator and Shutoff Valve
Figure 13



Fuel Regulator and Shutoff Valve Test Setup
Figure 14

42. FUEL FILTER.

At the end of each 500 hours of operation, the fuel filter should be removed from the aircraft and overhauled according to the following procedure:

a. Remove the tube from the “IN” side of the filter assembly.

b. Unscrew the hex shoulder nipple from the “OUT” side of the filter assembly.

c. The complete assembly is removed by removing the two bolts which secure it to the mount on the fire wall.

d. To disassemble the filter assembly, proceed as follows:

(1) Remove the safety wire.

(2) Unscrew the bowl from the head.

(3) Remove the element assembly, retaining spring and O-ring packing.

NOTE: Do not disassemble the element assembly as it is replaceable only as a complete assembly. The retaining spring is an unattached part of the element assembly and should be replaced as part of the element assembly.

(4) Cleaning of the filter assembly may be accomplished by the following instructions:

(a) Wash the bowl and head in clean gasoline. After washing, blow into the fuel inlet and outlet ports of the head with compressed air or by mouth. Finally, wipe out the interior of the bowl and head with a clean cloth.

(b) Cleaning of the element assembly is not recommended. A new element assembly should be installed at each overhaul. However, if a new element assembly is not available, the old element assembly may be cleaned and used until a new one is obtained. Apply compressed air to the open end of the element assembly or, if compressed air is not available, rinse the element assembly in clean gasoline. Wipe off the outside with a clean cloth.

(5) Inspect the filter assembly as follows:

(a) Inspect the bowl and head for cracks, warpage and damaged threads. Discard and replace the bowl or head for any of these conditions.

(b) In case the old element assembly was cleaned for use until a new one is obtained, press lips firmly against the open end of the element assembly and give several strong blows. If air does not pass readily through the old element assembly, it must not be reinstalled in the filter.

(6) Repairs shall consist of replacing worn or damaged parts. The element assembly, including the retaining spring, should be replaced at each overhaul. The O-ring packing should also be replaced at each overhaul in order to maintain rubber age control.

e. Reassembly of the filter assembly may be accomplished by the following procedure:

(1) Install the O-ring packing on the bowl.

(2) Position the element assembly on the head. Make sure the rubber washer on the open end of the element assembly is against the flat surface in the head.

(3) Press the retaining spring into the recess in the closed end of the element assembly.

(4) Carefully place the bowl over the element and spring; then screw the bowl into the head.

f. After reassembly, the fuel filter should be subjected to a leakage test. Plug the fuel outlet port and connect the fuel inlet port to a source of compressed air. Turn on 75 psi of air pressure and submerge the fuel filter in water. If no leakage occurs, dry off the assembly and safety wire the bowl to the head.

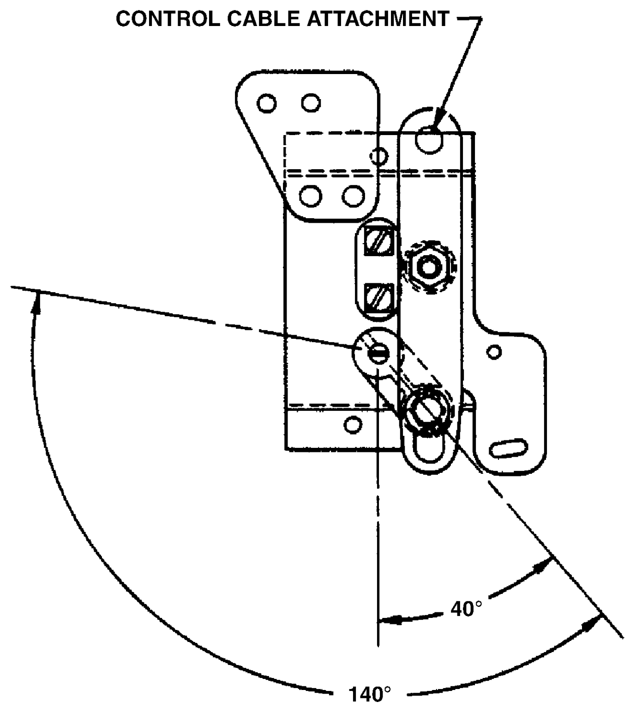
g. Position the filter assembly on the mount and secure with the two bolts.

h. Screw the hex shoulder nipple in the “OUT” side of the filter assembly.

i. Install the tube on the “IN” side of the filter assembly.

43. DUCT SWITCH. (Refer to Figure 15 and 19.)

This switch is installed in the ventilating air duct downstream 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.



Duct Switch - Top View
Figure 15

a. Removal:

1. Disconnect the electrical leads from the terminals on the exposed face of the switch and mark to facilitate installation.
2. Remove the two attaching screws and washers from the duct switch bracket.
3. Carefully lift out the switch and gasket (if gasket is used).

b. Cleaning and Inspection:

Brush off any dust or lint from the switch operating mechanism (exposed inside the duct) and wipe the external surfaces with a clean cloth.

c. Installation:

1. Insert the switch carefully with gasket (if used) into the ventilating duct opening and secure with the two attaching screws and washers.
2. Connect the two electrical leads to their respective terminals on the face of the switch as marked during removal.
3. Operate the heater with the duct switch set above ambient temperature to check operation. Refer to Bench Test - Procedure, Step I, below, for additional switch tests and setting instructions.

44. HEATER OVERHAUL. Each 500 hours time-in-service, or after each heating season, whichever comes first, the heater should be removed from the airplane (see Heater - Removal, above), disassembled, all parts thoroughly inspected and necessary repairs and replacements made prior to reassembly. Detailed step-by-step instructions are included for a complete heater overhaul. In some instances, however, inspections may reveal that it is unnecessary to remove certain parts, and, if so, those portions of the overhaul procedures may be eliminated.

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.)

45. DISASSEMBLY. (Refer to Figure 18.)

a. Remove the screw and slide the elbow adapter (23) off the combustion air inlet tube.

b. 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. The ventilating air blower housing must be removed so that the two motor wires quick disconnect may be released.

NOTE: Label all wires, prior to removal, to insure correct connections during reassembly. Cable straps and clips must be replaced if removed, as they cannot be reused.

c. 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.

d. Remove the four screws, lock washers, and cable straps to free the ignition assembly (2) from the heater jacket and remove the ignition assembly. The vibrator may be removed by exerting a firm pull straight away from the ignition assembly case after releasing the nut and screw.

e. Remove the grommet (39) from the jacket (5) and remove the spark plug (32) with a 7/8 inch deep socket. Make sure the spark plug gasket is removed.

f. Remove the two screws, lock washers and plain washers, and lift out the overheat (limit) switch (25) and spacer gaskets (27).

g. Remove the two screws, lock washers and plain washers, and lift out the cycling switch (24).

h. Remove the four screws and lock washers to release the terminal strip (35) and insulator (36) from the jacket (5).

CAUTION: DO NOT BEND THE TUBE. (IT IS “TACKED” TO THE COMBUSTION CHAMBER INSIDE THE JACKET.)

i. Disconnect the tube fitting (33) at the cover of the combustion air pressure switch (26). Unscrew and remove the combustion air pressure switch (26) from the combustion air inlet tube.

j. Remove vent air inlet adapter (16) from the blower housing by removing the three screws and lock washers.

k. Loosen the four screws (20) and rotate the blower and motor housing (11) to disengage the notched end from the four screws in the end of the heater jacket. Disconnect the motor wiring quick-disconnect.

l. Remove the upper fuel shroud box assembly (10) by removing the screws.

m. Reach inside the inlet end of the jacket assembly (5) with a 3/4 inch open-end wrench and, while holding the fuel-tube fitting at the jacket, use a 3/4 inch deep socket to remove the nut (38), washer and gasket (29).

n. Remove the combustion head assembly (6) and the gasket (30) from the combustion tube assembly (7) by removing the screws and washers.

o. Remove the two screws and lock washers; then carefully withdraw the nozzle holder and valve assembly from the combustion head assembly (6).

p. Remove the screws, lock washers and remaining cable straps, if not previously removed, from the seam of the jacket assembly (5). Note positions of cable straps as they are removed. Spread the jacket (5) at the seam and remove it from the combustion tube assembly (7). This will free the rope gasket (31), which can be removed from the particular part to which it remains attached.

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.

q. Carefully unscrew and remove the spray nozzle (21) from the nozzle holder (8). Remove the gasket (28).

r. Remove the fuel solenoid assembly (22) by removing the nipple (37) and elbow (34).

s. Loosen the nut and remove the screw, flat washer, and rubber grommet from blower housing (12).

t. Remove the two screws, flat washers, and rubber grommets at the other two locations around the blower motor housing (12).

u. Slide the ventilating air blower motor out of the blower housing (12) with the motor bracket assembly (19) and blower wheel (17) attached. Loosen the set screw in the blower wheel (17) and slide it off the end of the motor shaft. The flat washers and rubber washers will fall out when the bracket is removed. Then remove the motor bracket assembly (19). If these parts are in good condition, they need not be disassembled further.

v. Remove the screw and lock washer to free the capacitor assembly (18) with attached leads.

46. DISASSEMBLY OF COMBUSTION AIR BLOWER ASSEMBLY. (Refer to Figure 19.)

a. Remove the combustion air blower inlet adapter (2) by removing three screws, lock washers, cover plate and gasket.

b. Remove the outlet adapter (5) by removing the two screws (6) and lock washers (7).

c. Remove the inlet flange (8) by removing the three screws (9) and lock washers (10).

d. Remove screws (12 and 16) and lock washers (13 and 17); then separate the back plate (20), with motor (25) attached, from the blower housing (15) and free the motor leads and capacitor (11) from the back plate (20).

e. Loosen the set screw in the blower wheel (19) and slide it off the motor shaft.

f. Remove the two hex nuts (21), lock washers (23) and flat washers (22), and slide the back plate (20) off the motor through bolts. The spacer (24) will drop out.

g. Install new motor brushes as described in Maintenance - Combustion Air Blower - Replacing Motor Brushes, above. If the motor commutator is badly worn, or if the motor is defective in any respect, it must be replaced.

47. CLEANING. (Refer to Figure 18.)

a. 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.

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.

b. Use compressed air or lintless cloth to dry the parts, unless sufficient time is available for them to air dry.

c. 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.

48. CLEANING AND INSPECTING THE COMBUSTION TUBE ASSEMBLY. (Refer to Figure 18.)

a. Slight scaling and discoloration of the combustion tube assembly (7) is a normal condition for units that have been in service up to 1000 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.

b. 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.

c. The combustion tube assembly may be cleaned by either of two methods:

1. 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.

2. 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.

49. INSPECTION OF REMAINING COMPONENTS. (Refer to Figure 18.)

a. Discard all rubber parts such as grommets, gaskets, etc. These items should always be replaced at overhaul. Also discard the rope gasket (31).

b. Inspect all wires and wiring harnesses for damage to insulation, damaged terminals, chafed or cracked insulation and broken plastic 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.

c. Inspect all hard parts, consisting of bolts, screws, nuts, washers and lock washers. Replace damaged parts.

d. The combustion air pressure switch (26) must respond to delicate pressure changes and should always be checked and/or replaced at overhaul. (Refer to Testing - Combustion Air Pressure Switch, below, and Figure 17.)

e. Replace the vibrator in the ignition unit at each overhaul.

f. Inspect the ignition assembly (2, Figure 18) 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.

g. Inspect the terminal strip (35) for distortion and cracks, and replace it if either condition exists.

h. Inspect radio-noise filters for short circuits by checking from either terminal to ground with an ohmmeter. An open-circuit reading should be obtained.

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.

i. Inspect the spray nozzle (21) 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 re-examine 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 is advisable to store the nozzle in a polyethylene bag until ready for reassembly.

j. Replace the nozzle at overhaul.

NOTE: The nozzle (21) can be spray tested as described in Testing - Spray test the nozzle, below.

k. Inspect the nozzle holder and solenoid valve assembly for damaged threads at the fuel-tube fitting and for crimped or cracked fuel line or distorted housing. The only part in this assembly that can be replaced is the solenoid winding. Check the solenoid for continuity by connecting across each wire lead with an ohmmeter. A reading of between 18 and 22 ohms should be obtained at room temperature. If not within these limits, or if the solenoid winding shows any form of physical damage or overheating, it should be replaced.

l. Remove the brushes, one at a time, from the ventilating air blower motor (13) 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 (refer to Maintenance - Combustion Air Blower - Replacing Motor Brushes, above). 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.

m. Inspect the combustion air blower motor as described in the preceding step.

n. Inspect the blower wheel for broken or bent vanes and replace it for either condition.

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

a. Check ventilating air and combustion air motors for correct RPM and current draw:

1. Connect motor to 12-volt DC power supply. Rotation should be counterclockwise when viewed from the shaft end.
2. Both motors should rotate at approximately 7500 RPM at rated voltage. Current draw is approximately five amperes.
3. 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. (Refer to Maintenance - Combustion Air Blower - Replacing Motor Brushes, above.)
4. If after replacing brushes, operation is still unsatisfactory, replace the motor.

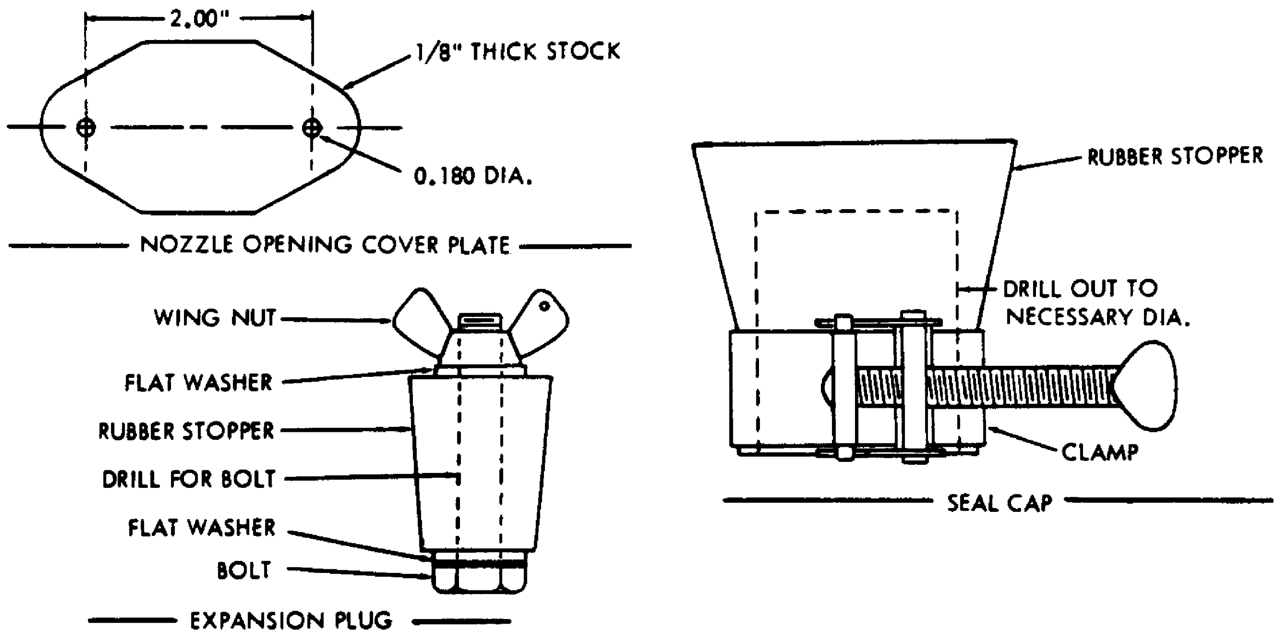
NOTE: The motor checks described above should be made without the blower housing attached, for both the ventilating air and combustion air motors.

b. Test the combustion tube assembly (7) for leaks as follows:

1. Fashion a sealing plate from approximately 1/8 inch thick flat stock to seal the nozzle holder opening in the combustion tube assembly. (Refer to Figure 16.) Use a rubber gasket under the plate and attach the plate with two screws.
2. Make up seals for all remaining openings, except the one used to connect the air pressure source. (Refer to Figure 16.) 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.
3. 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.)
4. 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.
5. 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.

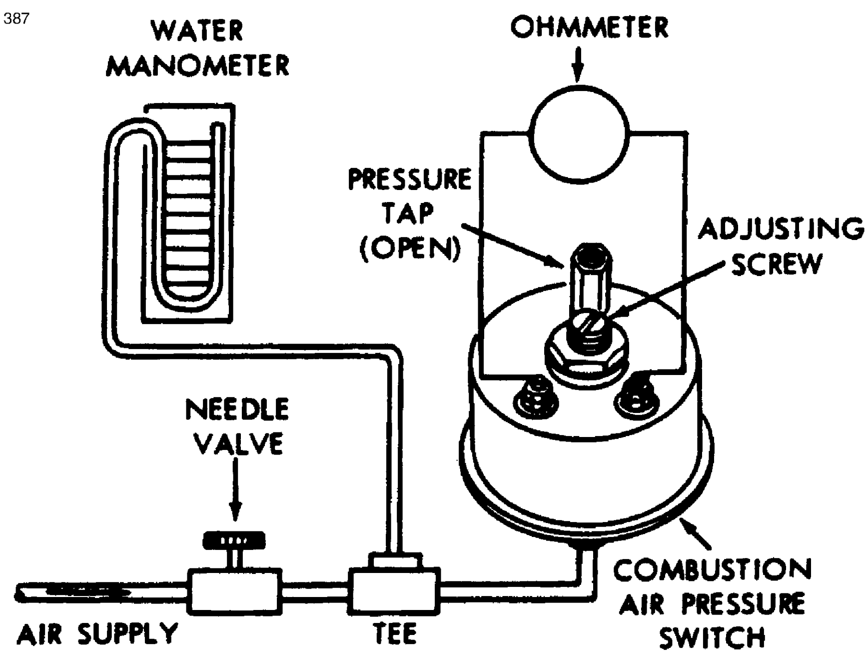
c. Combustion air pressure switch.

1. Connect an adjustable air pressure line that can be controlled in a range of zero to 5.0 psi (maximum) of water 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 16.
2. Connect an ohmmeter across the switch terminals to determine the exact instant of switch closing.



Seal Plate, Plugs, and Caps for Combustion Tube Leak Test
Figure 16

387



Combustion Air Pressure Switch Test Setup
Figure 17

3. 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.

4. Make several trials to insure switch reliability. Be sure to increase and decrease the air pressure slowly in order to produce accurate indications.
5. If an adjustment is required, rotate the adjusting screw clockwise to increase settings and counterclockwise to decrease settings.

d. Test the fuel line and fuel line shroud tube for leaks as follows:

1. Using filtered compressed air, apply 20 psi to the shroud drain port, located on the surface near the threaded nozzle cavity.
2. Immerse the fuel feed and nozzle holder assembly in clean water with the fuel inlet and nozzle cavity left open.
3. 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.
4. In either of the above cases, the complete fuel feed and nozzle holder assembly must be replaced.

e. Spray test the nozzle (21, Figure 18) as follows:

WARNING: BE SURE TO KEEP THE ATOMIZED SPRAY AWAY FROM FIRE.

1. Install the nozzle in the fuel feed and nozzle holder assembly and connect the fuel tube to a seven (7) psi fuel pressure source.
2. Connect the solenoid leads to a 12-volt battery. Connect a switch in the line to open and close the solenoid when desired.
3. 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.
4. 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.
5. If the spray pattern is distorted, check for an obstruction and clean the nozzle as described in Inspection of Remaining Components, (i), above. If this fails to provide a normal spray pattern, replace the nozzle.
6. If the nozzle continues to dribble, the solenoid valve is not closing properly and the fuel feed and nozzle holder assembly must be replaced.

51. REPAIR OF COMBUSTION TUBE ASSEMBLY. No weld or braze repairs of the combustion tube assembly are authorized.

52. REASSEMBLY. (Refer to Figure 18.)

a. If removed during disassembly, secure the nipple (37) and elbow (34) to the fuel solenoid (22).

b. Insert the ventilating air motor (13) into the motor bracket assembly (19); slide the blower wheel (17) on the end of 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.

c. Attach the capacitor and leads assembly (18) to the motor bracket (19) with the screw and lock washer. Make sure a good electrical ground connection is made at this point.

d. Insert this assembly into the blower housing (12) and position it so the long screw is in alignment with the gap on the inner ring of the motor bracket assembly (19). This is the screw used to secure and align the motor in the bracket.

e. Slide the flat washer and rubber washer into position between the legs of the motor bracket (19) and blower housing (12).

f. Make sure all wires are routed and grommeted as they were prior to disassembly and install the two screws, flat washers, and new grommets at the two lower edges securing the motor bracket assembly (19). Then install the grommet, flat washer, nut, and screw in the remaining (upper) corner of the motor bracket assembly (19).

g. Center the motor bracket (19) in the housing and tighten the screw to secure it. The motor (13) should be positioned in the bracket (19) to locate the blower wheel (17) properly in the blower housing (12). 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 screws and spin the blower wheel by hand for a clearance check. Then apply appropriate voltage to run the motor as a final clearance check.

h. Attach the inlet adapter (16) to the end of blower housing (12) with three screws and lock washers.

i. Place a new rope gasket (31) in position on the exhaust outlet; spring the jacket assembly (5) open at the seam and insert the combustion tube assembly (7) carefully into the jacket. Exercise care to clear the pressure switch tube in the exhaust outlet and see that the rope gasket (31) is properly located. Close the gap on the jacket assembly and install screws and lock washers to secure it at the seam. (Two leads ground under these screws. See notations made during disassembly.) Make sure the tongue and channel at the seam are in good condition and a tight fit is effected.

j. 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.

k. Remove the spray nozzle (21) from the polyethylene bag. Screw the nozzle into 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 “drool.”

l. Install the gasket (30) and combustion head (6) in the combustion tube (7) and secure with the screws and washers.

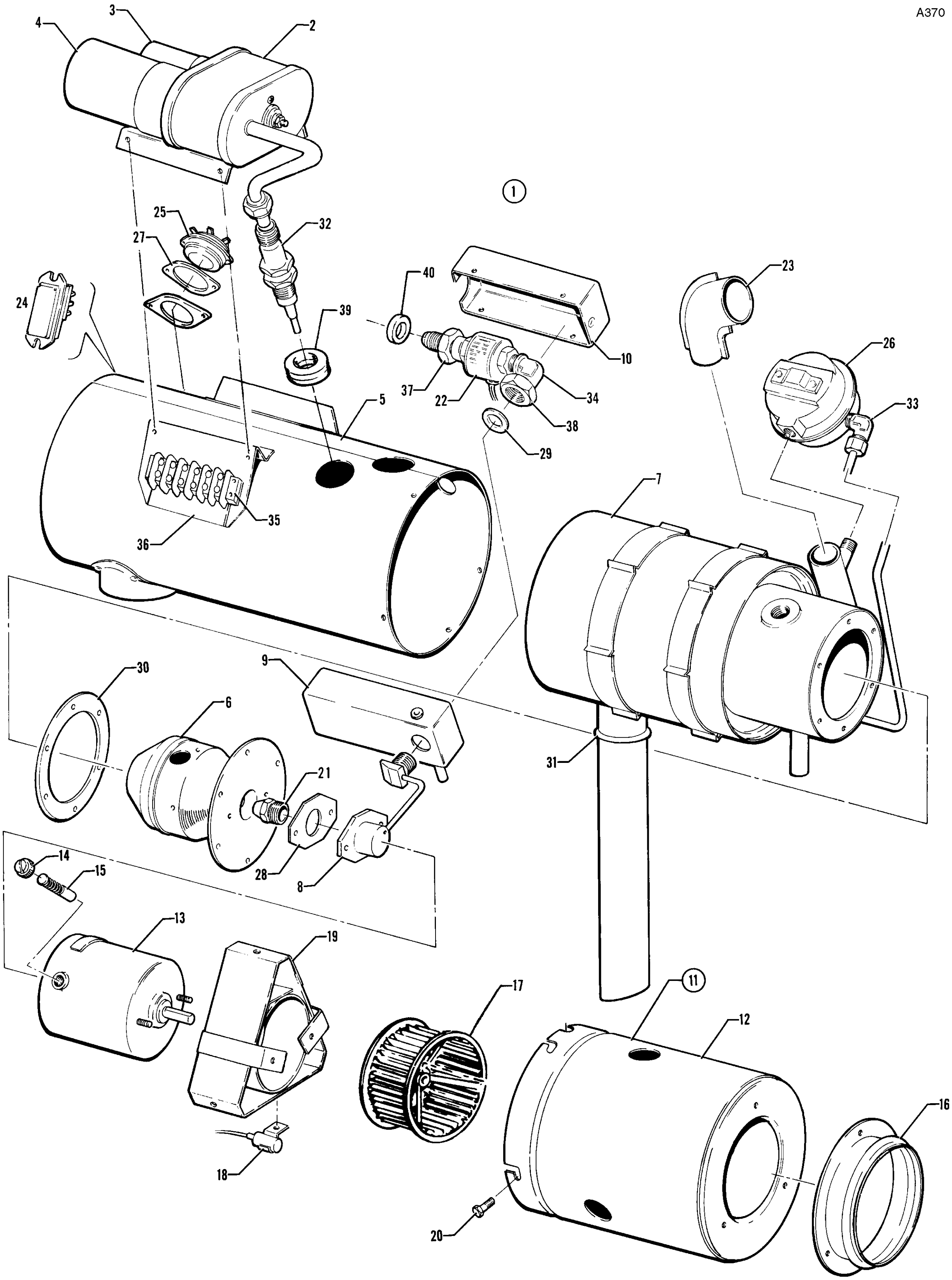
m. Insert the fitting on end of nozzle fuel tube through the opening in jacket (5) and attach the nozzle holder to the combustion head assembly (6) with the two screws and lock washers. It may be necessary to place a slight bend in the shrouded fuel tube to permit alignment of screw holes. Be sure to use a new gasket (28).

n. Using a new spark plug gasket, install the spark plug (32) and tighten to a torque of 28 foot-pounds. Install the grommet (39) in the jacket around the spark plug.

o. Install the ignition assembly (2) on the jacket assembly (5) with the four screws and lock washers. Connect the high-voltage lead to the spark plug and tighten it to 20 foot-pounds.

p. Attach the overheat limit switch (25) and spacer gaskets (27) to the jacket assembly (5) with the two screws, lock washers and flat washers. Tighten the screws securely.

q. Attach the cycling switch (24) to the jacket assembly (5) with the two screws, lock washers and flat washers.



Heater (Janitrol) Assembly - Exploded View
Figure 18 (Sheet 1 of 2)

LEGEND

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 AI R
12. HOUSING- BLOWER
13. MOTOR ASSEMBLY - VENT AIR BLOWER
14. CAP - BRUSH ASSEMBLY
15. BRUSH ASSEMBLY -MOTOR
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

26\. GASKET

29\. GASKET

30\. GASKET

31\. GASKET - ASBESTOS

32\. PLUG -SPARK

33\. ELBOW

34\. ELBOW

35\. STRIP -TERMINAL

36\. INSULATOR -TERMINAL STRIP

37\. NIPPLE

33\. NUT

39\. GROMMET

40\. GROMMET

Heater (Janitrol) Assembly - Exploded View
Figure 18 (Sheet 2 of 2)

r. Place the terminal strip insulation (36) in position on the jacket (5), followed by the terminal strip (35). Secure both parts by installing the two screws and lock washers. The two screws are located at two diagonal corners of the terminal strip.

s. Center the fuel fitting in jacket opening. Position the fuel fitting shroud gasket (29) and washer; then install the nut (38) finger tight. Insert a 3/4 inch open-end wrench inside the jacket and hold the fuel-tube fitting while tightening the nut (38) with a 3/4 inch deep socket. Install the fuel solenoid elbow (34).

t. Rotate the combustion air switch (26) onto the threaded fitting on the combustion air tube and tighten it firmly.

u. Connect the tube to the elbow fitting (33) on the combustion air pressure switch (26).

v. Install the wiring harness and connect all wire leads to their respective terminals. (Refer to the wiring diagram, Figure 6) Place the grommet (39, Figure 18) in position in the jacket (5); locate the ventilating air blower (11) at the end of the jacket. Thread the quick-disconnect on the wiring harness through the grommet and connect it to the mating connector on the motor lead.

w. Place the blower housing in position on the jacket assembly (5) and secure it by installing the four screws (20), if removed at disassembly. This operation is easier if the screws (20) 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.

x. Install the elbow adapter (23) with the screw.

y. Install the upper fuel shroud box (10) with the screws. Ascertain that the grommet (40) is installed.

53. REASSEMBLY OF COMBUSTION AIR BLOWER ASSEMBLY. (Refer to Figure 19.)

a. Place the spacer (24) over the end of the motor shaft and attach the motor assembly (25) to the back plate (20) with the two self-locking nuts (21), flat washers (22) and lock washers (23).

b. Slide the blower wheel (19) on the motor shaft and tighten the set screw lightly against the flat portion of the motor shaft.

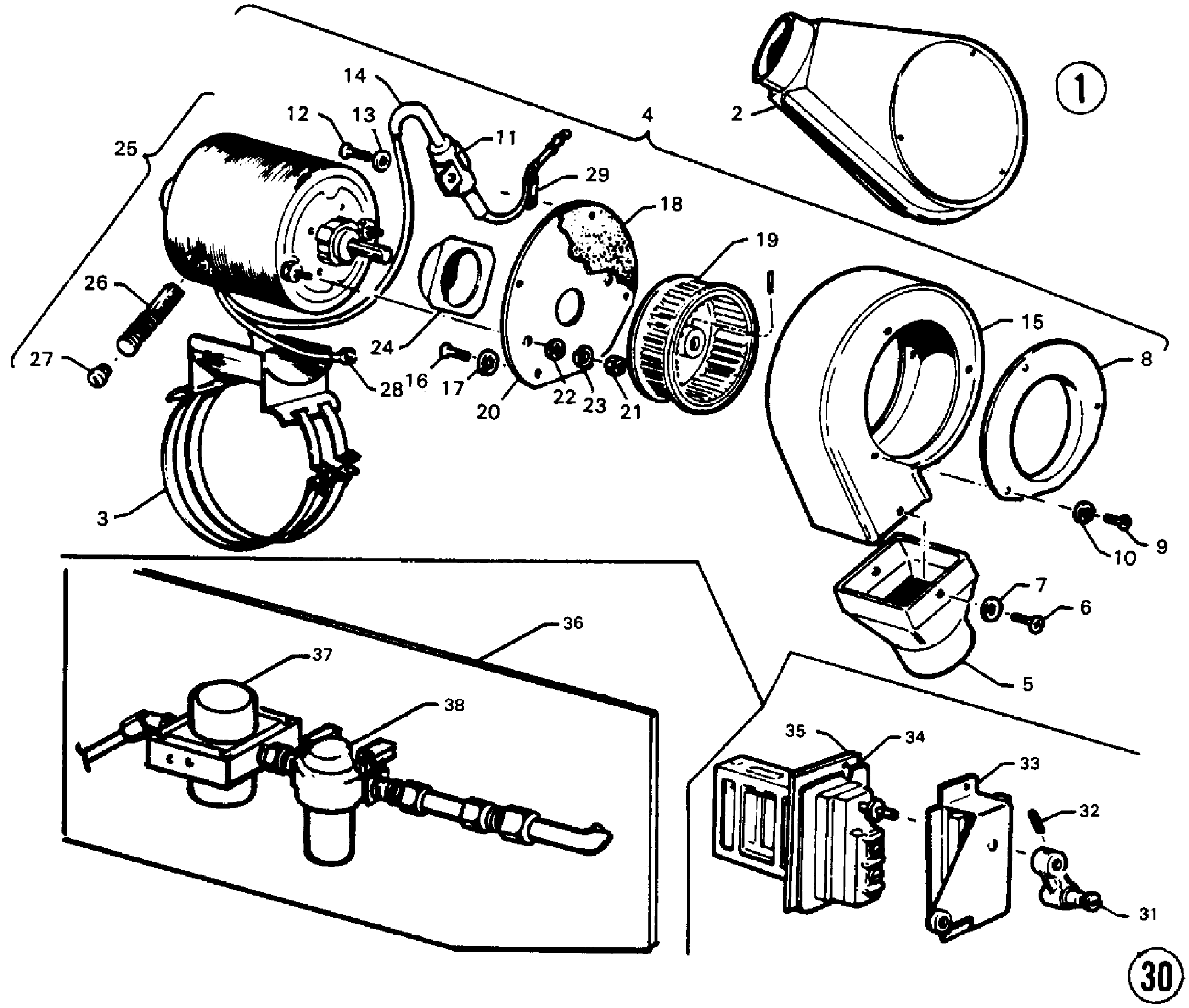
c. Place the blower housing (15) in position on the back plate (20) and install screws (16) and lock washers (17).

d. Attach the radio-noise filter (11) at the point shown with the screw (12) and lock washer (13). The motor ground lead terminal (28) can be grounded to the motor support bracket (3).

e. Attach the inlet flange (8) and blower inlet adapter (2) to blower housing (15) with three screws (9) and lock washers (10).

f. Loosen the Allen-set screw in the blower wheel (19) 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.

g. Slide the blower outlet adapter (5) on the blower housing outlet (15) and install the two screws (6) and lock washers (7).



1. COMBUSTION AIR BLOWER AND MOTOR ASSEMBLY
2. ADAPTER ASSEMBLY - BLOWER INLET
3. MOUNT - COMBUSTION AIR BLOWER SUPPORT
4. COMBUSTION AIR BLOWER AND MOTOR
5. ADAPTER
6. SCREW - ANS 30-6R6
7. WASHER - AN936A6
8. FLANGE - INLET
9. SCREW - AN530-6R6
10. WASHER - AN936A6
11. CAPACITOR
12. SCREW - AN530-6R6
13. WASHER - AN936A6
14. SLEEVE - HIGH TEMPERATURE
15. HOUSING - BLOWER
16. SCREW - AN530-6R6
17. WASHER - AN936A6
18. GASKET - BACK PLATE
19. FAN - COMBUSTION AIR BLOWER
20. PLATE - BACK
21. NUT - AN345-10
22. WASHER - AN960-10L
23. WASHER - AN936-310
24. SPACER
25. MOTOR ASSEMBLY - COMBUSTION AIR BLOWER
26. BRUSH ASSEMBLY
27. CAP - BRUSH ASSEMBLY
28. TERMINAL - PREINSULATED
29. STRAP - CABLE
30. SWITCH ASSEMBLY - ADJUSTABLE DUCT
31. LEVER ASSEMBLY - SWITCH
32. SCREW - AN565D8H3
33. COVER - SWITCH
34. SWITCH - ADJUSTABLE DUCT
35. SPACER
36. FIREWALL - RIGHT ENGINE
37. FUEL REGULATOR AND SHUTOFF VALVE
38. FUEL FILTER

Combustion Air Blower and Motor Assembly - Exploded View
Figure 19

54. BENCH TEST.

A test of all components should have been made after overhaul to insure 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.

55. EQUIPMENT REQUIRED. (Refer to Figure 20.)

a. 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.

b. A source of fuel capable of being regulated at seven psi.

c. The combustion air blower to be used with the heater should be used for the test.

d. 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.

e. 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.

f. 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 20.

g. A thermometer with 500° F scale.

h. A fuel-pressure gauge.

i. A controlled source of compressed air for final leakage test.

56. PROCEDURE. (Refer to Figures 20 and 21.)

a. Connect the heater to the test setup as shown in Figure 20. Make sure the combustion air blower is mounted securely and that the heater is clamped to its supporting stand.

b. Insert the duct switch in the sheet-metal extension tube at the location shown in Figure 20.

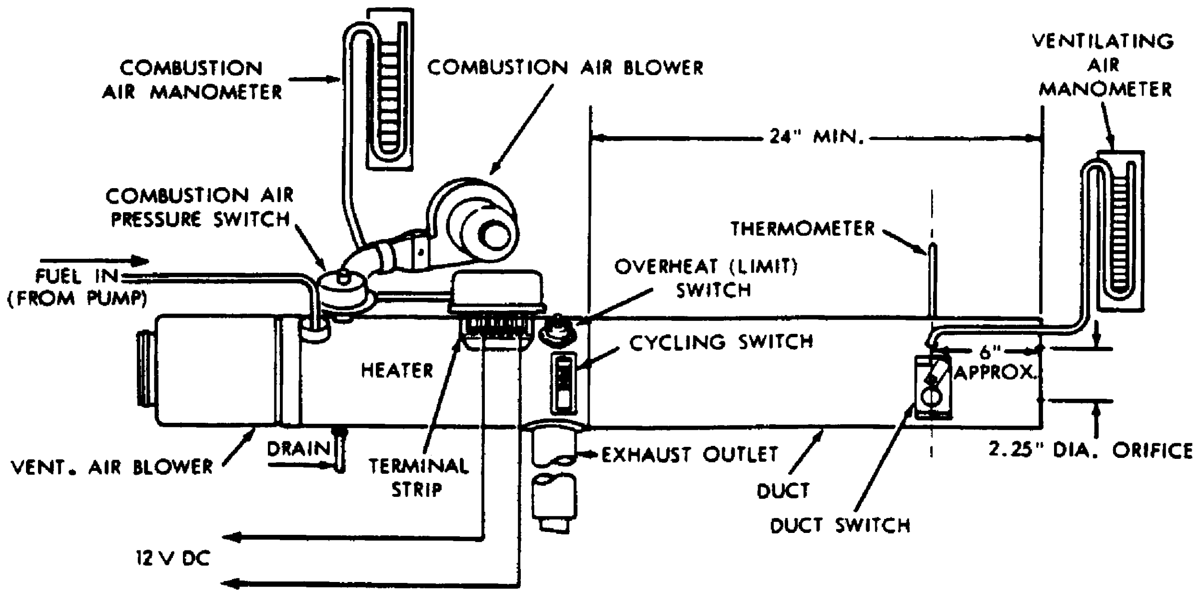
c. Connect components and heater as outlined in the wiring connection diagram, Figure 21. The power supply switch should be open.

d. Connect the power source to the heater.

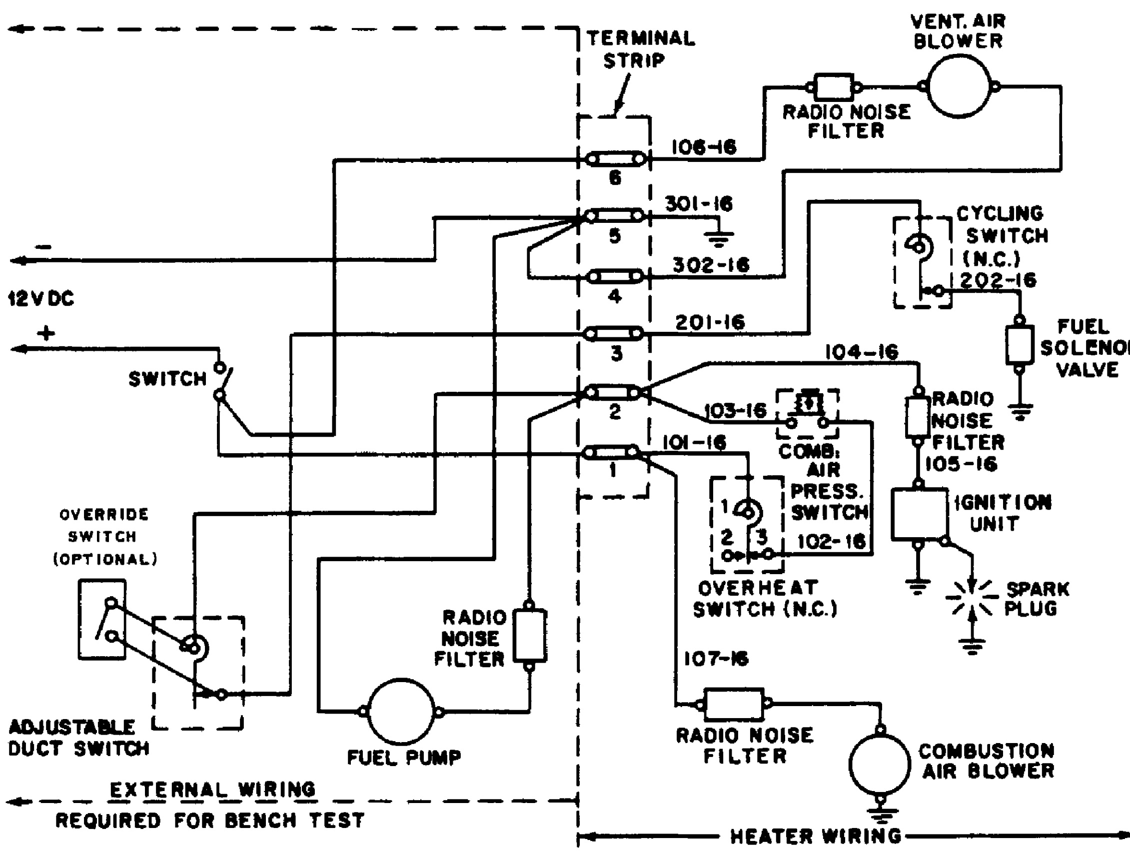
e. Disconnect wire lead from terminal "3" on the heater side of heater terminal strip to prevent the heater from lighting and close the power source switch to check operation of blowers. The combustion air blower and ventilating air blower should operate at full speed with no blower wheel interference. If either blower fails to run, locate and correct the trouble before proceeding with the test.

f. 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.

g. 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.



Heater Operation Bench Test - Setup
Figure 20



Heater Operation Bench Test - Wiring
Figure 21

h. 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.

i. Open the power supply switch and reconnect the terminal lead disconnected in preceding Step e.

j. 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).

k. Observe operation of duct switch, which should control heater operation according to the switch setting.

l. 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).

m. 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.

n. With duct switch still jumped, place a jumper across the cycling switch terminals to check operation of the overheat switch. Block the ventilating air outlet and notice if the overheat switch shuts off the heater. It should open at between 300°F and 400°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.

o. Shut down the heater and check all components visually to make sure no damage has occurred to any of them.

p. Remove heater and other components from the test setup and install it in the airplane.

57. FUEL NOZZLE ORIFICE INSPECTION. (Refer to Figure 18.)

a. Loosen the four screws (20) and rotate the blower and motor housing (12) 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 (21).

b. Remove the upper fuel shroud box (10) by removing the screws.

c. Reach inside the inlet end of the jacket assembly with a 3/4 inch open end wrench and, while holding the fuel tube fitting of the jacket, use a 3/4 inch deep socket to remove the nut (38), washer and gasket (29).

d. Remove the two screws and lock washers and carefully withdraw the nozzle holder and valve assembly (21) from the combustion head assembly (6).

e. Carefully unscrew and remove the spray nozzle (21) from the nozzle holder. Remove the gasket (28).

f. After cleaning the nozzle, reinstall the parts removed in essentially the reverse order from removal. Be sure to hold the fuel tube fitting when tightening the nut (38) to avoid damage to the fuel tube.

58. OPTIONAL OVERHEAD VENT BLOWER. (See Figure 2.)

59. DESCRIPTION. If installed, 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 four position blower switch is mounted in the overhead panel and controls the three speed blower.

60. REMOVAL.

a. Remove the access door from the aft wall of the baggage area.

b. With the master switch off, disconnect the plug assemblies at the blower assembly.

c. Remove the inlet and outlet hoses from the blower assembly by removing the clamps.

d. Remove the screws, washers and nuts that secure the blower assembly to the hanger braces.

e. Remove the screws and washers which secure the blower assembly to the retainer and hangers.

f. Remove the blower assembly from the aircraft.

61. DISASSEMBLY.

a. Remove the hose duct from the forward edge of the blower assembly be removing the nuts, washers and screws.

b. Remove the cover from the blower assembly by removing the nuts, washers and screws.

c. Remove the blower fan from the motor shaft by removing the set screw.

d. For removal of the motor, proceed as follows:

1 Separate the plate from the motor cover by carefully drilling out the connecting rivets.

2. Cut the motor wires at the edge of the receptacle and plug and remove the wire ends from the blocks.

3. Remove the motor from the mounting plate by removing the nuts, washers and bolts.

62. REASSEMBLY.

a. 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.

b. Position the cover over the motor plate with the motor wires protruding through the cover grommet.

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

d. Apply PRC-5000 sealant to fill any opening left after the wires are brought through the grommet.

e. Install the wires in the plug and receptacle according to Table III.

f. Position the blower fan on the motor shaft and secure with set screw.

g. Secure the cover to the blower assembly with screws, washers and nuts.

h. 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.

i. After cleaning the surfaces of all old sealant, use white rubber caulk PRC-5000 sealant to seal where the duct attaches to the blower assembly.

63. INSTALLATION.

a. Position the blower assembly in the hangers and retainer and install the washers and screws.

b. Install the nuts, washers and screws securing the blower assembly to the hanger braces.

c. Seal all hose joints with Arno No. C-520 gray tape, then install the inlet and outlet hoses securing them with the clamps.

d. With the master switch off, connect the plug and receptacles at the blower.

e. Check the blower for the proper operation.

f. Install the access door to the aft wall of the baggage area and secure with the attaching hardware.

TABLE III
VENT BLOWER WIRE CODES

	MOTOR WIRES				**AIRCRAFT WIRES**	
	Pin. Nos.	**15920-01 General Industries**	**E362Q Singer Controls**	**F0018075FA Leece-Neville**	**Aircraft Harness**	**Pin Nos.**
Ground	**Plug** 2	Brown	Brown	Black	AC26A	**Receptacle** 2
Low Speed	1	Red	Yellow	Yellow	Black	1
Medium Speed	**Receptacle** 2	Black	Red	Red	White	**Plug** 2
High Speed	1	Yellow	Orange	Orange	Red	1
Note: Pin number 1 is on the pointed side of the plug or receptacle.						

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SECTION

XIV

ACCESSORIES AND UTILITIES

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SECTION XIV

LIST OF EFFECTIVE PAGES

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SECTION XIV - ACCESSORIES AND UTILITES

TABLE OF CONTENTS

SECTION XIV - ACCESSORIES AND UTILITIES

TABLE OF CONTENTS (cont.)

ACCESSORIES AND UTILITIES

1. INTRODUCTION. This section covers accessories which are available for this airplane and not covered in other sections of this Service Manual.

2. TROUBLESHOOTING. A troubleshooting table is provided for each accessory covered in this section to assist in locating and correcting malfunctions in the particular system. Common troubles, their causes and suggested remedies are listed in these tables.

3. PROPELLER DEICING SYSTEM. (See also Goodrich ATA Report No. 30-60-02, dtd 3/20/02.)

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.)

4. DESCRIPTION AND OPERATION. (Refer to Figure 1.) The Propeller Deicing System consists of an electrically-heated deicer (1) bonded to each propeller blade, a slip ring assembly (2) with a brush block assembly (3) to transfer electrical power to the rotating deicers, a timer (4), an ammeter (5), a control switch-circuit breaker (7), shunt (6), together with wiring harnesses (8) to complete the circuit. Power is drawn from the aircraft electrical system (10).

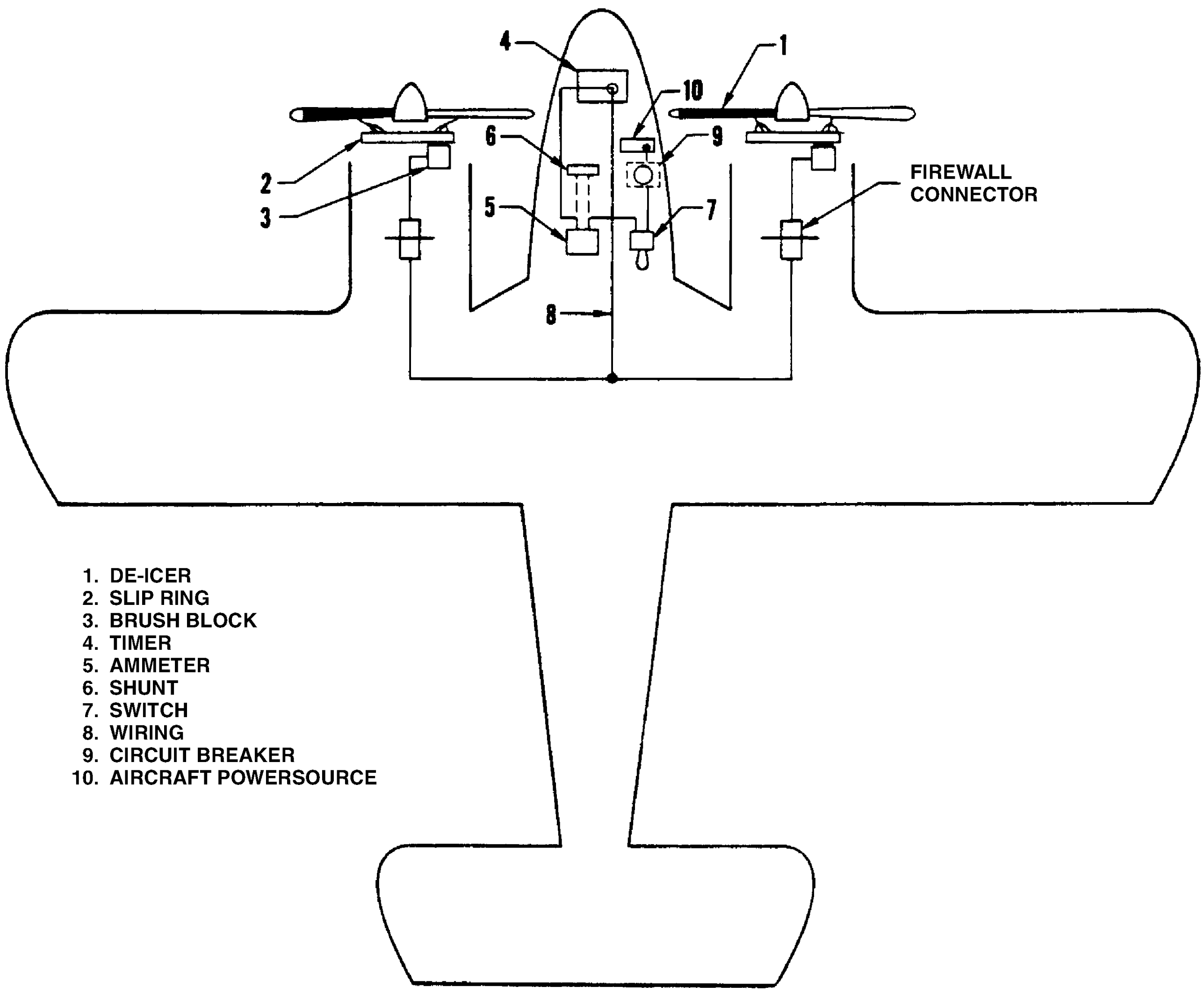
To conserve electrical power, current is cycled to the deicer heaters at timed intervals rather than continuously. Each deicer has two separate heaters: one for the outer half and one for the inner half. By heating all outer or inner heaters on only one propeller at a time, rotational balance is held during deicing. Current is drawn from the airplane electrical system through the switch, ammeter and timer. The timer successively delivers current via the slip ring and brush block arrangement to (phase 1) the outer heaters on the right propeller, (phase 2) the inner heaters on the same propeller, (phase 3) the outer heaters of the left propeller and (phase 4) the inner heaters on the left propeller. The timer energizes each of these four phases in turn for about 34 seconds and then repeats the cycle as long as the control switch is on. The cycling sequence given is vital so that outboard heaters on each propeller operate before the inboard heaters. See cycle sequence. (Refer to Figures 2 thru 5.) The system may be used continuously in flight if needed.

NOTE: Heating may begin at any phase in the cycle depending on the timer position when the switch was turned off from previous use.

a. Deicers: The deicers contain special heater wires protected by fabric plies and by oil and abrasion-resistant rubber. The side of the deicer cemented to the propeller has a dull finish whereas the air side finish is “glossy.” Each deicer has 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. All deicers used on this airplane must be of the new design, which includes a grey plastic patch where deicer and strap join.

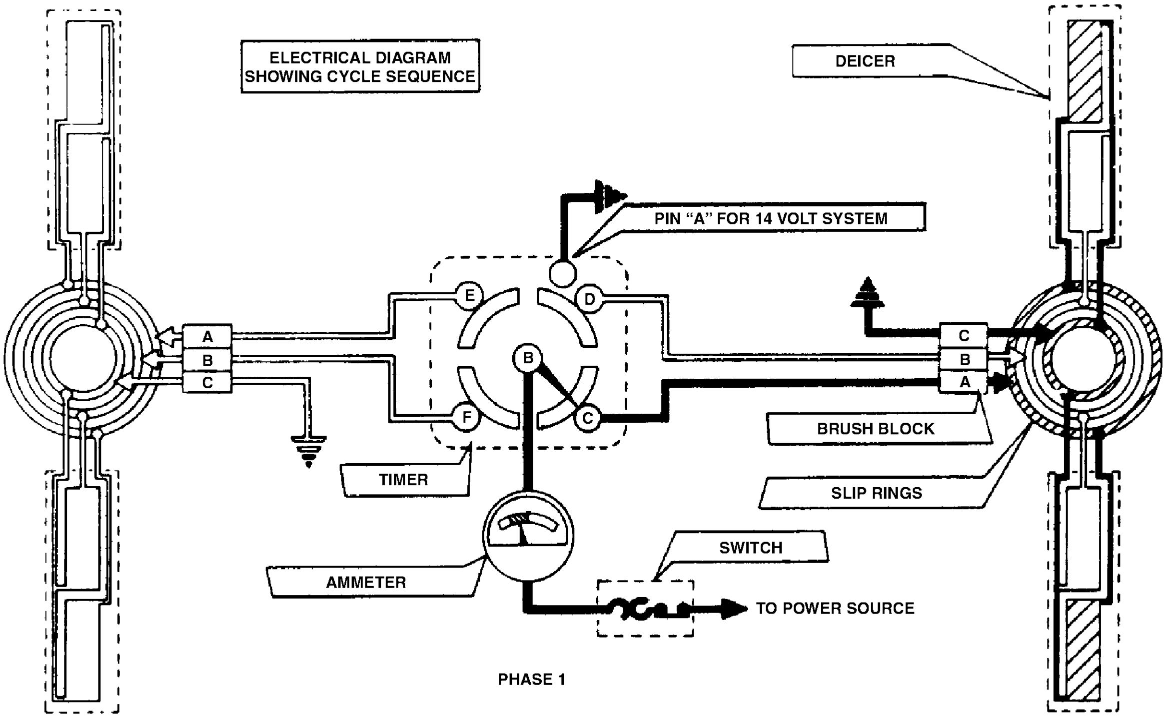
b. Slip Rings, Brushes and Brush Blocks: To transfer electrical power to the rotating deicers, a brush block assembly is mounted to the engine or by means of a bracket and has brushes which are spring loaded to press against the revolving slip rings. The slip Ring assembly is provided as a slip Ring gear assembly which replaces the original starter ring gear of the engine.

c. Timer: The timer is a sealed unit. If found inoperative, it must be replaced as an assembly - no field repairs are authorized. For timer function, refer to Timer Test, below.

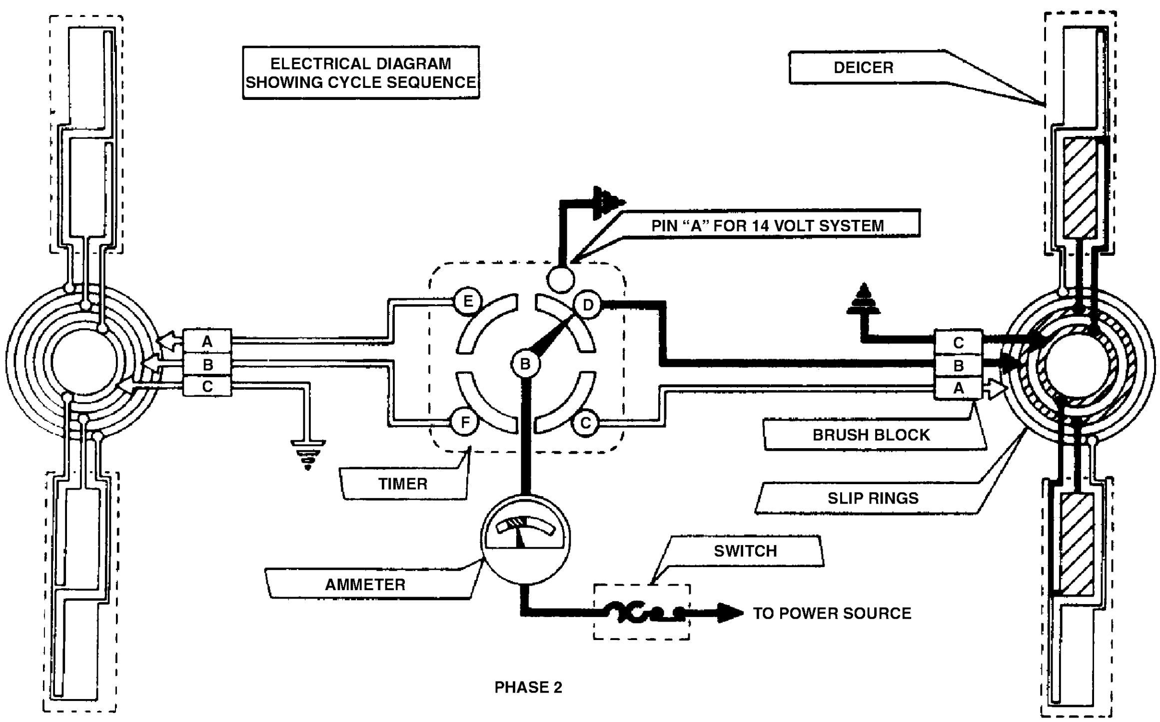


1. DE-ICER
2. SLIP RING
3. BRUSH BLOCK
4. TIMER
5. AMMETER
6. SHUNT
7. SWITCH
8. WIRING
9. CIRCUIT BREAKER
10. AIRCRAFT POWERSOURCE

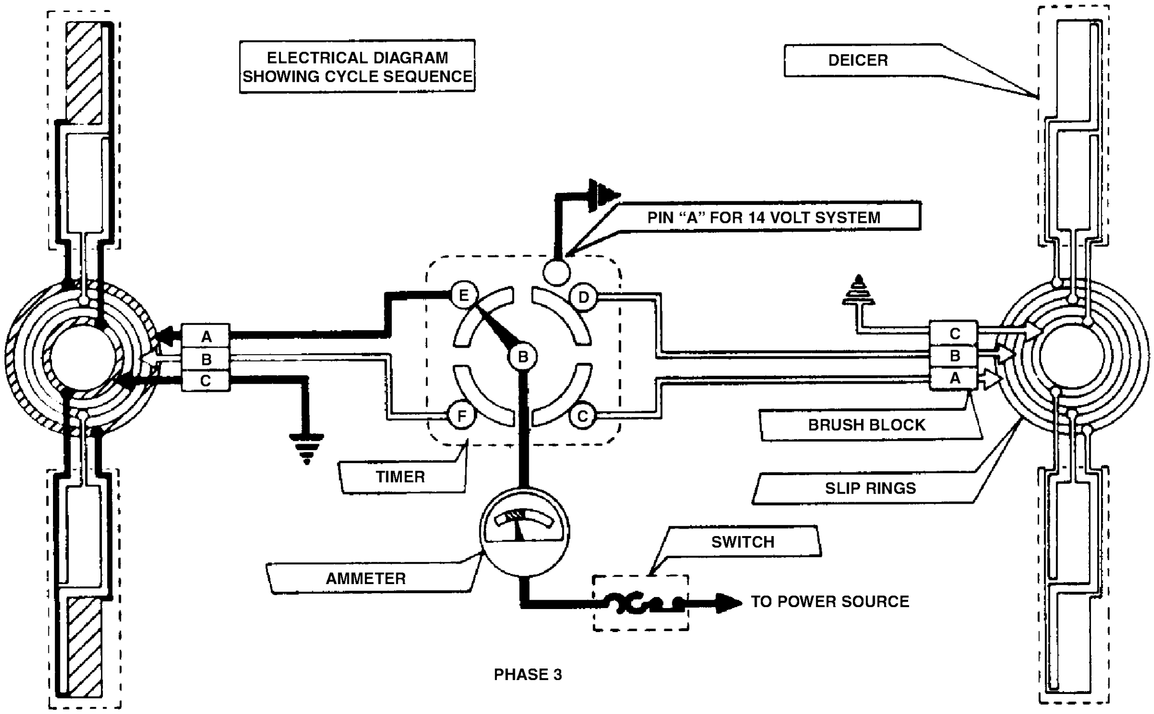
Propeller Deice Installation
Figure 1



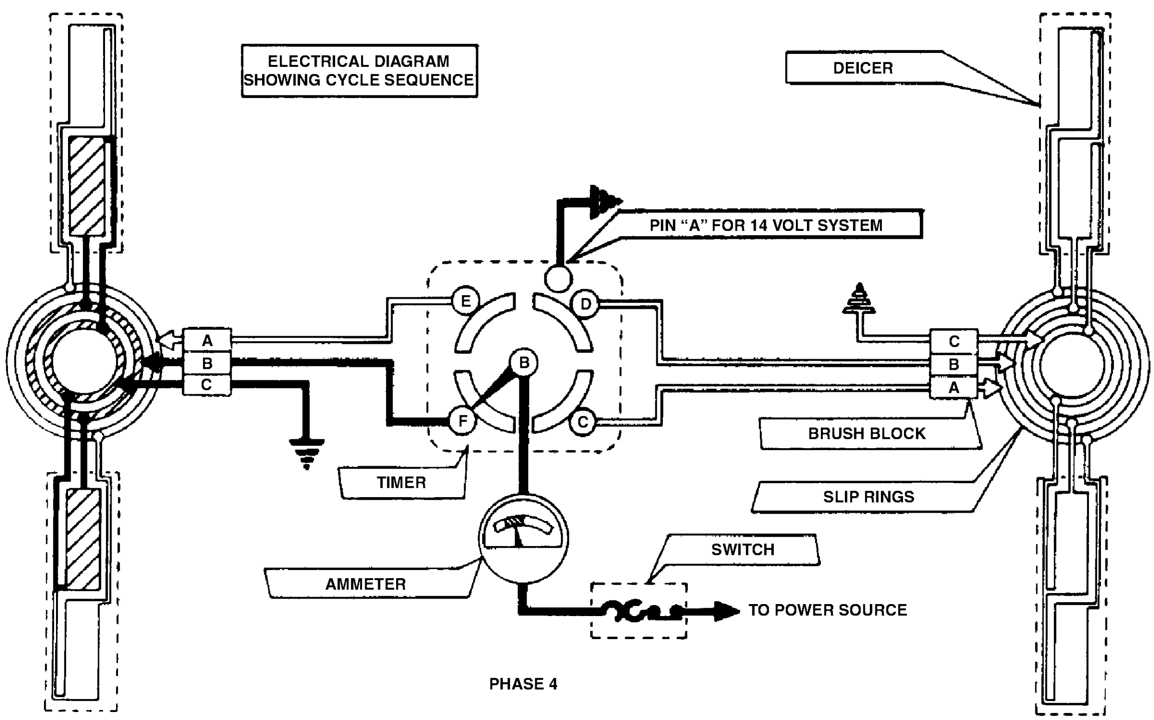
Cycle Sequence - Phase 1
Figure 2



Cycle Sequence - Phase 2
Figure 3



Cycle Sequence - Phase 3
Figure 4



Cycle Sequence - Phase 4
Figure 5

d. Ammeter: The ammeter is designed for each particular system and it is therefore important that the correct replacement part number be used if replacement should be required. In the event of low aircraft battery voltage (very possible in ground checks), the ammeter readings will be lower than at full voltage. Provided the ammeter needle reads in the shaded range on the scale, (full aircraft voltage) current flow is considered as normal.

e. Switch: The switch-circuit breaker is mounted in the switch and circuit breaker control panel.

5. OPERATIONAL CHECK.

a. Chock the wheels and operate the engine at near takeoff power.

b. Turn deicer system switch ON and observe deicer ammeter for at least two minutes.

c. The ammeter needle must “flicker” approximately every 34 seconds as the step switch of the timer operates.

d. With engines stopped, turn deicer switch ON and feel deicers on propellers for proper sequence of heater operation.

e. The starting point is not important but the sequence is vital and must be: Right Outboard, Right Inboard, Left Outboard, Left Inboard Heaters, in that order.

f. Temperature rise should be noticeable, and each heater should warm for about 34 seconds.

g. Local hot spots indicate surface damage of deicer heaters and should be repaired.

6. TROUBLESHOOTING. See Table I, below.

7. 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 this use of the ammeter and assumes that the user does understand all normal operating modes of the system as given in, Description and Operation, above.

NOTE: When troubleshooting, first use the “ammeter test” and “heat test” to determine which circuits are involved. Use circuit diagram, Figure 9, for assistance to check voltages or continuity.

8. HELPFUL TIPS.

a. If the ammeter reading drops to one third normal current, this indicates that one heater circuit is open or possibly improper connections are allowing both inboard and outboard units to heat at the same time.

b. 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.

c. 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, below, before concluding that the timer is defective.

TABLE I (Sheet 1 of 4)
TROUBLESHOOTING PROPELLER DEICE SYSTEM

Trouble	Cause	Remedy
Ammeter shows zero current. (All 4 phases of the 2 minute cycle.)	Tripped circuit breaker switch.	Locate and correct short before setting circuit breaker.
	No power from airplane.	If no voltage into switch, locate and correct open.
	Circuit breaker switch faulty.	If no voltage at switch output with voltage at switch input, replace the switch. If voltage is satisfactory at switch output, go to next step.
	Ammeter faulty. (If some or all deicers heat with ammeter at zero, replace the ammeter.)	Test for voltage up to and out of ammeter. If low or zero output and input satisfactory, replace ammeter. If no voltage to ammeter, locate and fix open between switch and ammeter.
	Open ammeter to timer.	Disconnect harness at timer and check voltage at Pin B (of harness) to ground. If none, locate and correct open.
Ammeter shows normal current part of cycle, zero current rest of cycle.	Open in wiring between timer and brush block assembly.	Use heat test to find deicers not heating and test for voltage on that contact of wire harness plug. (At brush block assembly.) If zero over 2 minutes, 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.

TABLE I (Sheet 2 of 4)
TROUBLESHOOTING PROPELLER DEICE SYSTEM

Trouble	Cause	Remedy
Ammeter shows normal current part of cycle, low current rest of cycle.	Inner and outer deicers heating same phase.	Locate and repair incorrect connections.
	Open in deicer or slip ring leads.	Disconnect deicer straps to check heater resistance as in Deicers: Electrical Check, below. If satisfactory, locate and fix open in slip ring leads.
	High resistance in circuit with low current.	If no contact, 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.

TABLE I (Sheet 3 of 4)
TROUBLESHOOTING PROPELLER DEICE SYSTEM

Trouble	Cause	Remedy
Ammeter shows normal current part of cycle, excess current rest of cycle.	Ground between timer and brush block.	Disconnect leads at brush block and, with ohmmeter, check from power leads to ground. If ground indicated, locate and correct.
	Ground between brush block and deicers. (Excluding ground brush circuit.)	If no short exists at brush slip ring contact, check for ground from slip ring lead to propeller assembly while flexing slip ring and deicer leads. If ground indicated, locate and correct.
	Short between two adjacent circuits.	Check for cuts or low resistance between circuits If any, locate and correct.
	Timer faulty.	Perform Timer Test, below.
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).	Perform Timer Test, below. If timer does not cycle with voltage at Pin B, replace timer but be sure short causing original failure has been located & corrected.
Ammeter flicks between 34 second phase periods.	Loose connection between aircraft power supply and timer input.	If trouble occurs over entire cycle, trace wiring from power source to timer input to locate and tighten loose connection.
	Loose or poor connection timer to deicers.	If trouble occurs in part of 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.

TABLE I (Sheet 4 of 4)
TROUBLESHOOTING PROPELLER DEICE SYSTEM

Trouble	Cause	Remedy
Ammeter flicks between 34 second phase periods. (cont.)	Timer cycles erratically.	Perform Timer Test, below.
Radio noise or interference with deicers ON.	Brushes “arcing”.	Check brush alignment per Figures 7 & 8. 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. (See Slip Rings, below.)
	Loose connection.	Refer to “Ammeter flicks between 34 second phase period,” above.
	Switch faulty.	Try jumper wire across switch - if radio noise disappears, replace the switch.
	Wiring located within 8 inches or radio equipment wiring.	Relocate at least 8 inches away from input wiring to radio equipment.
Cycling sequence not correct.	Crossed connections.	Check system wiring circuit diagram for improper connections. (Refer to Figures 2 thru 5.)
Rapid brush wear or frequent breakage.	Brush block out of alignment.	Check brush alignment. (Alignment of new brushes, below.)
	Slip ring wobbles.	Check slip ring alignment with dial indicator per Figure 6.

9. INSPECTION (PROPELLER DEICE SYSTEM).

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.)

10. 50-HOUR INSPECTION.

a. 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, Table I, above.

b. 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 (i.e. - resistance check) and repair or replace per Deicers, below.

c. 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 fire wall 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.

11. 100-HOUR INSPECTION.

a. Remove cowling in accordance with Engine Cowling, Removal, Section VIII.

b. Conduct 50-hour inspection.

c. Check for radio noise or radio compass interference by operating the engine at near takeoff power and 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.

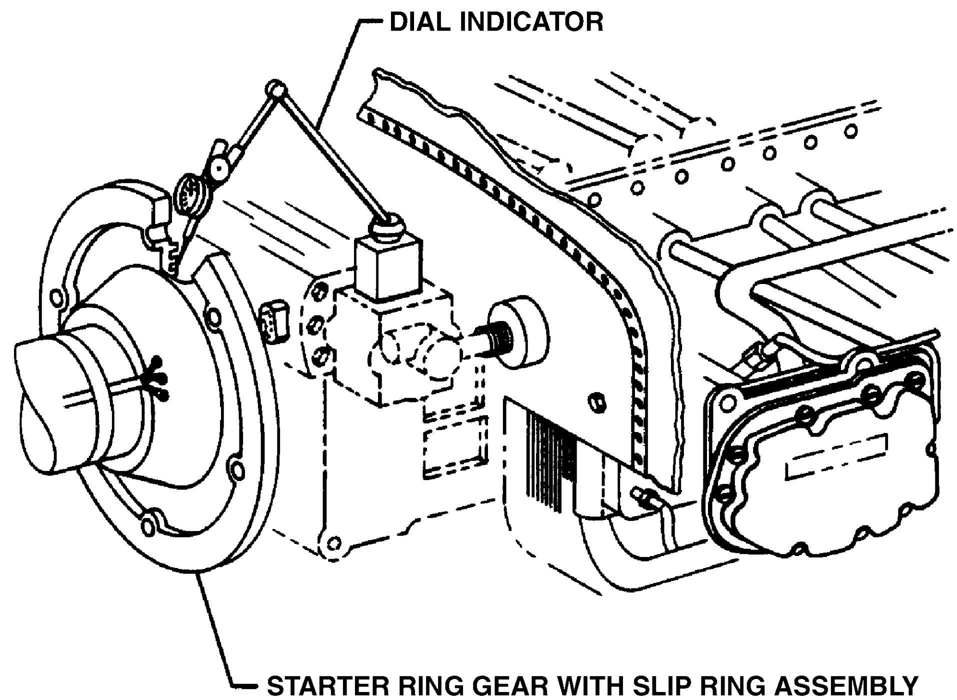
d. Ascertain that all clamps, clips, mountings and electrical connections are tight. Check for loose, broken or missing safety wire.

e. 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 as described in Deicers, below.

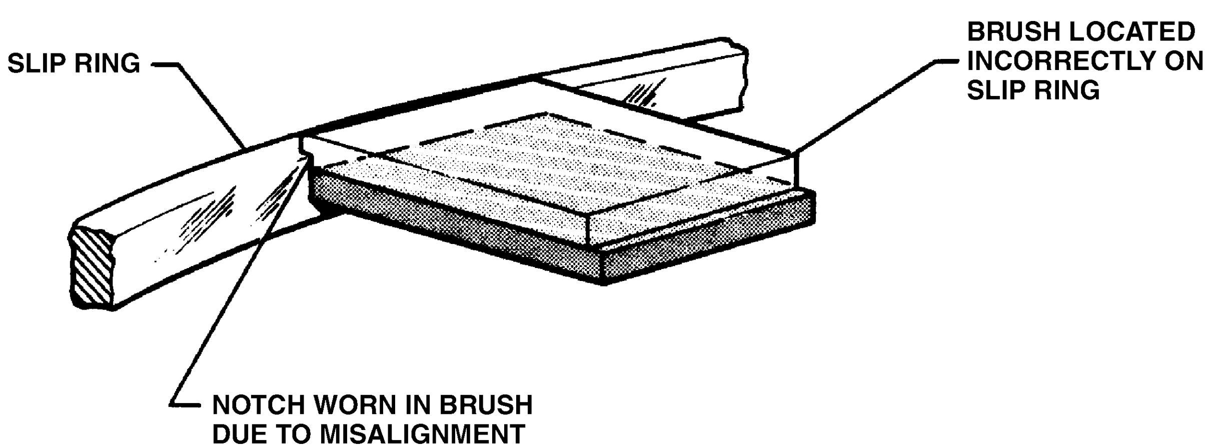
NOTE: Check the strap restrainers are correctly located and secure. Look for cracks or other damage. Operate propeller from “full pitch” to “feathering” and check that deicer lead straps do not come under tension, or are pinched by propeller blade. (Refer to Figures 16 and 17.)

f. Slip Rings: Check slip rings for gouges, roughened surface, cracks, burned or discolored areas and for deposits of oil, grease or dirt.

1. Clean greasy or contaminated slip rings with CRC 2-26 solvent.
2. If uneven wear is found or if wobble is noticed, set up dial indicator as shown in Figure 6 to check alignment of slip rings to propeller shaft.



Using a Dial Indicator (Typical)
Figure 6

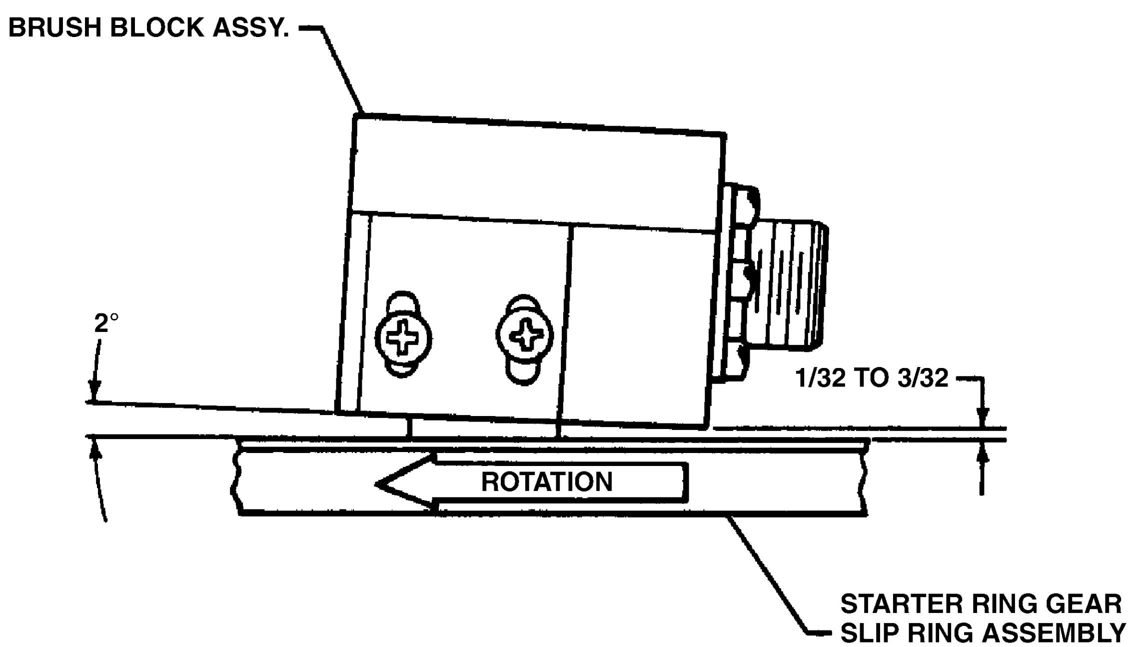


Centering Brushes on Slip Rings
Figure 7

g. Brush Block - Brushes: Examine mounting brackets and housing for cracks, deformation or other physical damage.

1. Test that each brush rides fully on its slip ring over 360°. Figure 7 shows wear pattern if this condition is not corrected. If alignment is off, shim where brush block bracket attached to engine back bone or pivot at support arm which is attached to generator idler pulley bracket.
2. Check for proper clearance of brush block to slip rings as shown in Figure 8. If not correct, loosen mounting screws and move in elongated holes to correct block position before tightening securely
3. Visually check brush block for approximately 2° angle of attack. (Refer to Figure 8.) If not, loosen mounting screws and twist block, but be sure to hold clearance limits shown when tightening.

h. System Wiring: With deicer system operating, have assistant observe ammeter while visually inspecting and physically flexing wiring from brush blocks through fire wall, 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 9 to trace circuitry.



Setting Brush / Slip Ring Contact Angle
Figure 8

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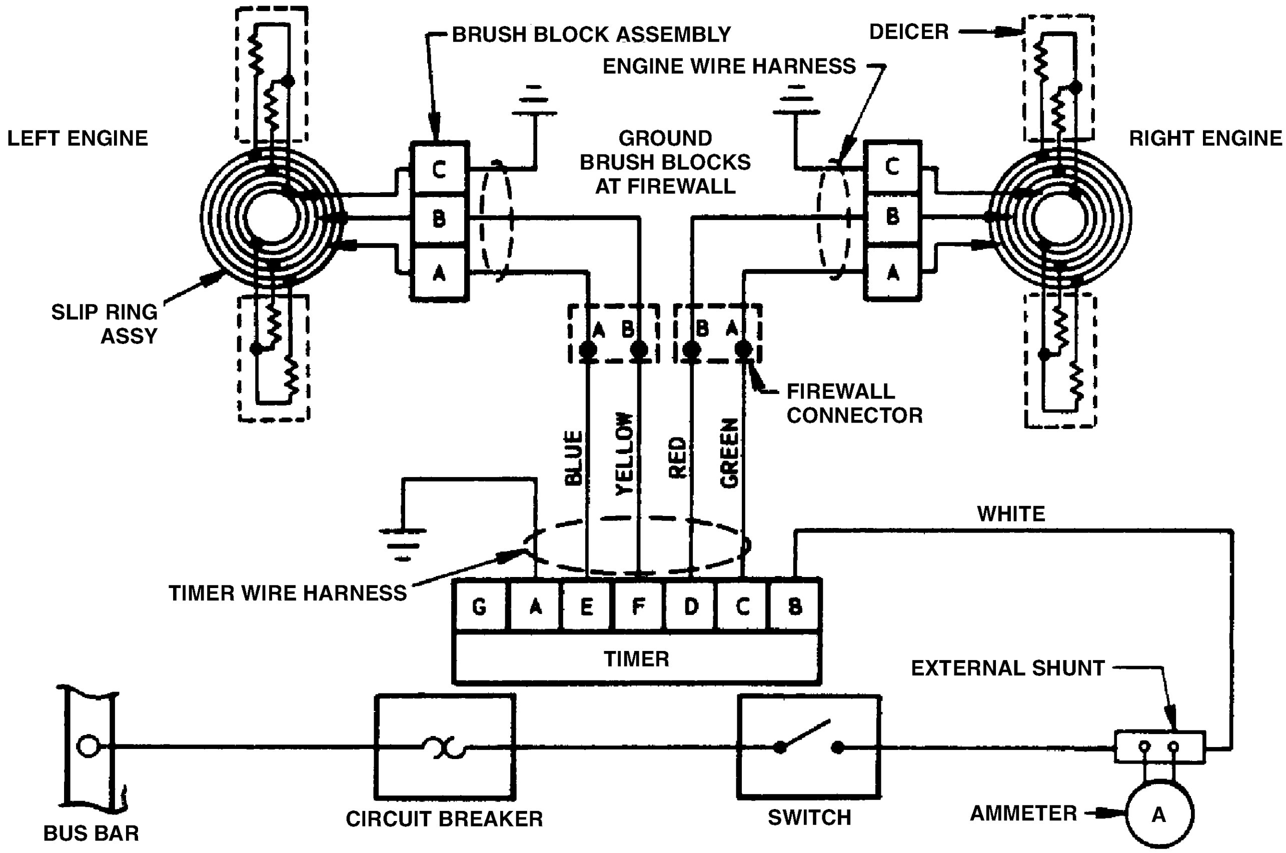


Propeller DeiceSystem - Electrical Schematic
Figure 9

12. INDIVIDUAL COMPONENTS.

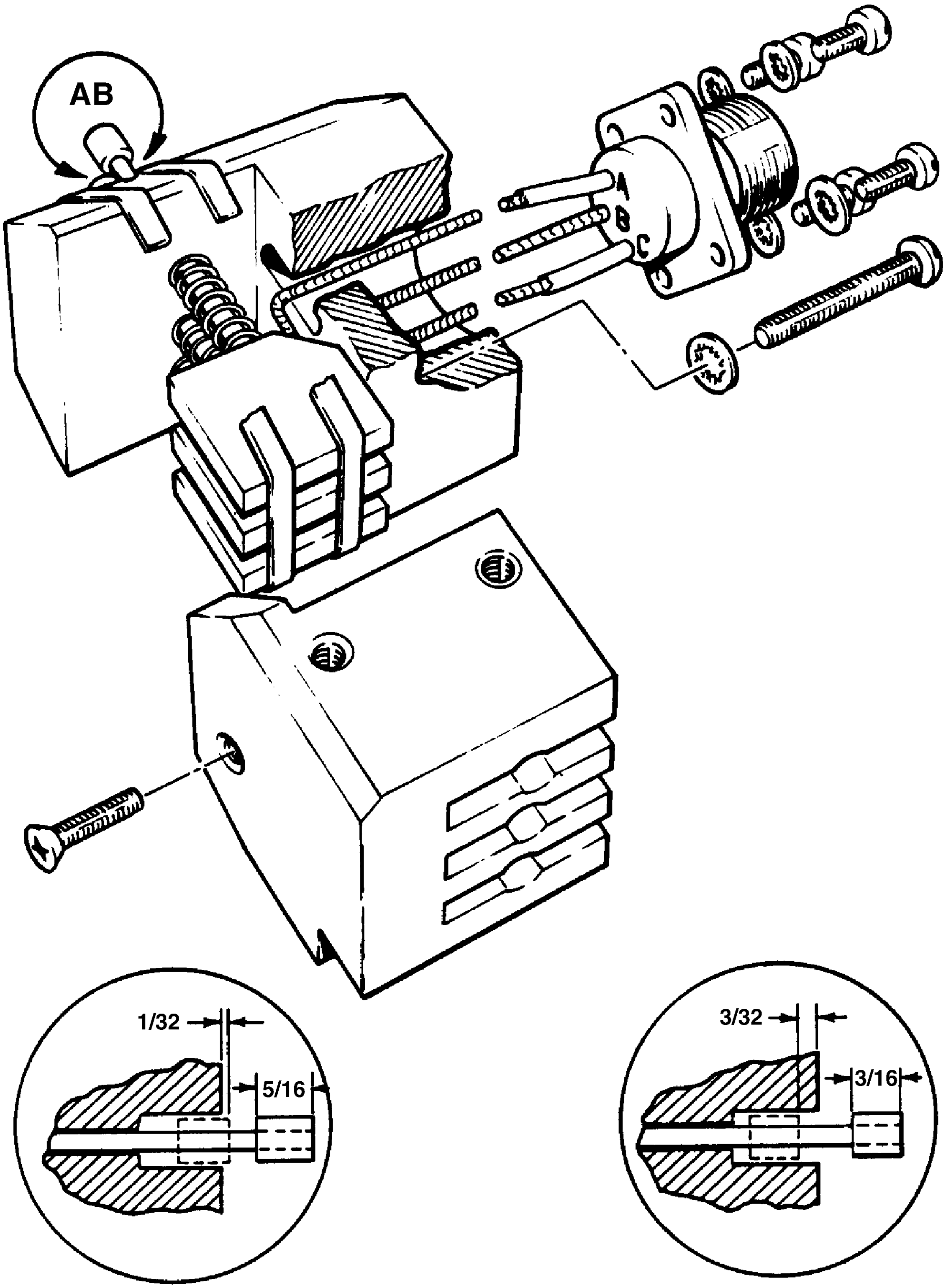
13. BRUSHES.

14. REPLACEMENT. Brushes are replaceable when the “B” barrel rests entirely within the block; for example, when the aft end of the .187 inch barrel is flush with the aft surface of the block. The brushes must be replaced when the aft end of the “B” barrel is .093 inch inside the recess. (Refer to Detail A, Figure 10.) If .312 inch barrels are used, refer to Detail B, Figure 10.

CAUTION: SIDE LOADS ON BRUSHES SHOULD BE AVOIDED TO PREVENT BRUSH DAMAGE.

a. Remove the screws which hold the brush block assembly to the mounting brackets and remove the brush block assembly.

b. Remove the two assembly screws which hold the block together. These screws are located one on the same side at the connector plug and one on the side directly opposite.



DETAIL A
SHOWING MAX. PERMISSIBLE WEAR ON BRUSHES WITH 5/16 "B" BARRELS

DETAIL B
SHOWING MAX. PERMISSIBLE WEAR ON BRUSHES WITH 3/16 "B" BARRELS

Brush Block Assembly
Figure 10

15. REPAIRING BRUSH BLOCK ASSEMBLY.

a. Discard the old brush retainer assembly.

b. Assemble the new brush retainer assembly to the other block by slipping the block from the front of the retainer assembly over the brushes and then over the springs. Replace the two screws removed in Brushes, Replacement, step b, above. This installation can be made only in this manner since the springs are of slightly larger diameter than the brush slots in the block and must be fed into the cylindrical grooves provided.

c. Reassemble the brush block to the mounting brackets using hardware removed in Brushes, Replacement, step a, above.

16. ATTACHING INDIVIDUAL BRUSHES TO BRUSH RETAINER.

a. Remove the brush retainer assembly per Brushes, Replacement, step b, above.

b. Compress the springs by pushing the brushes back into the brush retainer assembly and hold them there by wrapping with rubber bands.

c. Mark the connector plug with respect to its orientation relative to the brush retainer assembly block so that is may be removed and replaced in the exact same position.

d. Remove the four screws which hold the connector plug to the block.

e. Pull the connector plug from the block far enough so that the leads from the brushes to be replaced may be unsoldered at the plug.

f. Unsolder the brush lead at the connector plug and unsolder the “B” barrel from the brush rod of the brush to be replaced.

g. Now, remove and discard the old brush and spring.

h. Place new springs over the rods on the new brushes and insert through the holes in the block of the brush retainer assembly. Compress the spring and hold in position with rubber bands.

NOTE: New springs and “B” barrels should always be used when replacing brushes.

i. Place the “B” barrel over the brush rod and soft solder. The end of the “B” barrel should be flush with the aft end of the rod. The barrel must be concentric with the rod and no solder is permitted on the exterior of the barrel or rod.

NOTE: If concentricity is not obtained or if residual solder is allowed to flow on the exterior of the barrel, the barrel may catch on the brush block causing the brush to “hang-up” and consequently, the system will malfunction.

j. Place tubing over the brush lead. (Refer to Figure 10.) Soft solder the brush leads to the appropriate pin in the connector plug. Wicking on the leads should be held to .125 maximum.

k. Wipe flux from leads and connector pins.

l. Pull tubing up over connector pins to insure that no electrical shorts exist and, if necessary, bend the leads away from each other.

m. Reinstall the connector plug to brush block, using the four (4) screws removed in paragraph d, above.

n. Carefully remove the rubber bands from the brushes.

o. Assemble the brush block per Repairing Brush Block Assembly, step b, above.

p. Check for free movement of brushes by pushing the brushes back into the block and allowing the spring pressure to return them. DO NOT SNAP. If free movement is impaired, correct the restriction and recheck. In particular, check the concentricity requirement in paragraph i, above.

q. Reinstall the brush block to the mounting bracket utilizing the hardware removed in Brushes, Replacement, step a, above.

17. ALIGNMENT. Any time the brush block assembly is dismounted, the alignment at reinstallation must be checked as described under Brush Block - Brushes, in the 100 Hour Inspection, and in Figures 7 and 8, above.

18. SLIP RINGS.

19. MACHINING. Slip rings with roughened or damaged surfaces can be machined to restore to serviceability. Remove the starter ring gear assembly from the aircraft to mount it in a lathe, located concentrically in the lathe and with not over 0.002 wobble or run out over 360° rotation with respect to mounting surface of starter gear/slip ring assembly. Take light cut for smooth finish and cut no deeper than required to remove surface damage. Contact surfaces of the three slip rings must be parallel within 0.005 inch and flat within 0.005 inch overall - deviation from flat not to exceed 0.002 inch over a four (4) inch arc. If necessary, undercut insulation between slip rings to a depth of .030 inch below the contact surface of the slip rings. In this operation, width of slip ring must not be reduced more than .005 inch. Contact surface of slip rings must have a finish of 29-35 micro inches. De-burr slip ring edges and reinstall on airplane.

NOTE: If in machining, the solder or braze connection on the underside of the slip ring is exposed, replacement of the ring gear assembly will be necessary.

20. REPLACEMENT. Starter 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 with a new starter ring assembly.

21. DEICERS (PROPELLER DEICE SYSTEM). (See also Goodrich ATA Report No. 30-60-07, dtd 4/18/03.)

See Table II, below, for required materials.

WARNING: CEMENTS AND SOLVENTS USED TO REMOVE AND INSTALL DEICERS ARE EXTREMELY FLAMMABLE AND TOXIC. EXTINGUISH OPEN FLAMES. AVOID SPARKS. USE IN WELL-VENTILATED AREA. AVOID SKIN CONTACT AND/OR PROLONGED BREATHING OF VAPORS. CONSULT MSDS FOR ADDITIONAL SAFETY INFO.

CAUTION: PROPELLER DEICER REPAIR IS LIMITED TO REFURBISHMENT OF EDGE SEALER. SEE PREPARATION AND APPLICATION OF SEALER, BELOW.

CAUTION: DISPOSE OF UNUSED MEK AND OTHER CHEMICALS AND SOLVENTS IN A MANNER CONSISTENT WITH LOCAL LAWS AND/OR ENVIRONMENTAL PROTECTION AGENCY REGULATIONS.

22. RESISTANCE CHECK. 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 .58 to .67. If this reading is not obtained, disconnect the deicer lead straps to measure heater resistances individually. Individual heater should be 1.15 to 1.33. 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.

23. REPLACEMENT. If tests show the deicer to have an open circuit, to be the wrong resistance or if it's visibly damaged beyond repair as outlined in 100 Hour Inspection, above, remove the deicer and install a new deicer as directed below.

NOTE: Replacement deicers may be ordered from the Goodrich Corporation.

24. REMOVAL.

a. Disconnect terminals of propeller deicer from studs on the spinner bulkhead.

b. Use MEK or Toluene to soften the adhesion line between the deicer and the propeller blade.

c. Starting at one corner of the deicer, loosen enough of the deicer to grasp in the jaws of a vise grip pliers or similar tool.

d. Apply a steady pull on the deicer to pull it off the propeller surface. Continue using MEK or Toluene 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.

e. Remove residual cement from blade. See Table II for solvents.

25. INSTALLATION. See Table II, below.

26. BLADE PREPARATION.

a. Mark and cut from masking tape a pattern the size of the propeller deicer including the first inch of the lead strap. (Refer to Figure 11.)

b. 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 lead strap where it crosses the hub.

NOTE: All deicers on a single propeller must be located the same distance from the hub for rotational balance.

CAUTION: CLEANLINESS OF METAL AND RUBBER PARTS CANNOT BE TOO HIGHLY STRESSED. ONLY PERFECTLY CLEAN SURFACES WILL ASSURE MAXIMUM ADHESION.

c. Remove the pattern and remove any paint in the marked off area. Clean down to bare metal. Next, clean the area thoroughly with Methyl Ethyl Ketone (MEK) or acetone. For final cleaning, wipe the solvent off quickly with a clean dry lint-free cloth to avoid leaving a film.

d. 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.

NOTE: MEK can be used instead of Toluene to tackify cement; however, tests show that MEK causes rapid drying and provides only 10 seconds working time for deicer application compared with 40 seconds for Toluene.

27. CEMENT APPLICATION.

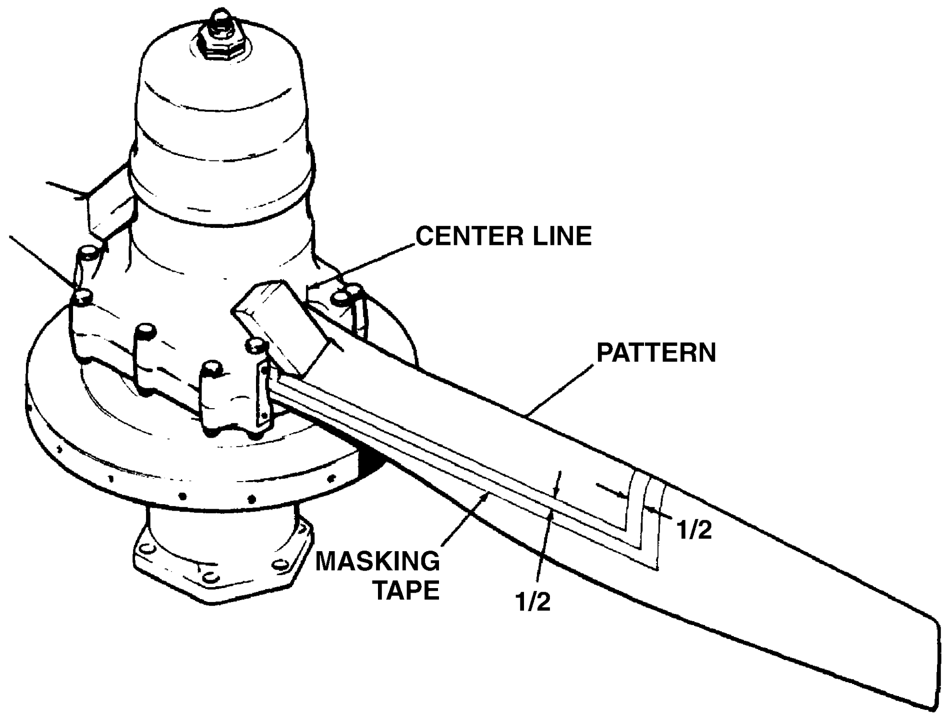
NOTE: The following describes the use of 3M's 1300L cement. If other cements are used, follow the instructions provided with the cement, if different from below. See Table II for other cement options.

a. Using a silver pencil, mark a centerline on the glossy side of the deicer.

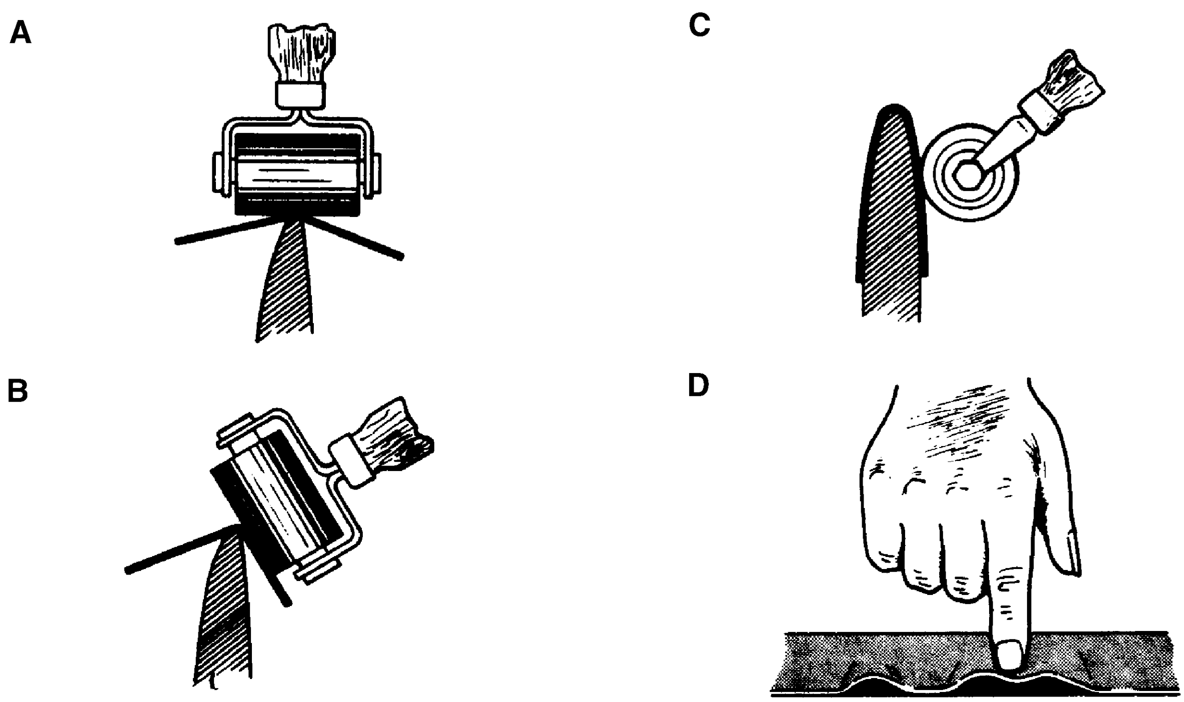
b. Moisten a clean cloth with MEK or acetone and clean the unglazed surface of the deicer, changing cloth frequently to avoid contamination of the clean area.

TABLE II
REQUIRED MATERIALS - PROPELLER DEICER - INSTALLATION / REMOVAL / REPAIR

Adhesive - Choose One System	
Bostik 1096M System EC776 (if required) and 1007 or 1007M Bostik Primer and 1096M Bostik Cement and #9R Boscodur Accelerator	
or	
3M 1300L System 1300L Cement	
or	
British Bostick 2402 System 2402 British Bostick and 9252 British Bostick Primer	
Filler - Choose One Product	
Goodrich 74-451-100 or 3M EC800 or 3M EC801 or PRC1422	
Sealer - Choose One Product	
Goodrich 82-076	
or	
Sherwin Williams F63B12 sealer and V66V29 accelerator (8 parts sealer to 1 part accelerator)	
Solvents	
Item	**Where Used**
Toluene	Propeller blade cleaning solvent
Shell Rubber Solvent #332, or Peerco #321 stripper, or Methyl Ethyl Ketone (MEK)	Propeller blade stripping solvent
MEK or Toluene or Acetone	Prop deicer removal and tackifying solvent
Tools (Goodrich Part Number)	
2” Rubber roller (74-451-74)	1/4” Metal stitcher roller (74-451-89)
1” Paint brush	Lint-free cloths
Scissors	1” masking tape



Propeller Deicer Installation
Figure 11



Propeller Deicer Installation Procedure
Figure 12

c. Thoroughly mix the 1300L cement. Apply one even brush coat of cement on 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 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.

d. 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.

28. MOUNTING. It is imperative that the following instructions be followed exactly to insure maximum adhesion to the propeller blades. When the cement coats are tacky dry on both propeller surface and deicer surface, proceed as follows:

a. Position the deicer on the propeller leading edge, using centerlines starting from the hub. (Refer to Figure 11.) Make sure that the strap will fall in the position previously marked. Working towards the tip, tack the deicer centerline to the leading edge of the propeller blade. Use tackifying solvent as necessary. If the deicer is allowed to get off course, pull up with a quick motion and remove deicer. Recement per Cement Application, c and d, above, if necessary, before proceeding. Roll firmly along the centerline with a rubber roller, as shown in Figure 12A.

CAUTION: TO AVOID DAMAGE TO RESISTANCE WIRES, DO NOT USE METAL STITCHER ON BODY OF DEICER.

b. Roll the tapered edges, especially the inboard edge, of the deicer with a narrow steel stitcher roller (Refer to Figures 12B and C.)

c. Apply one even brush coat of sealer around the edges of the installed deicer.

d. Remove the masking tape from the blade immediately after applying the sealer.

e. Allow 24 hours cement curing time before turning up propeller. Allow 72 hours curing time before operating the deicers. Handle the propeller carefully to prevent damage to the deicers.

29. PREPARATION AND APPLICATION OF SEALER. See Table II.

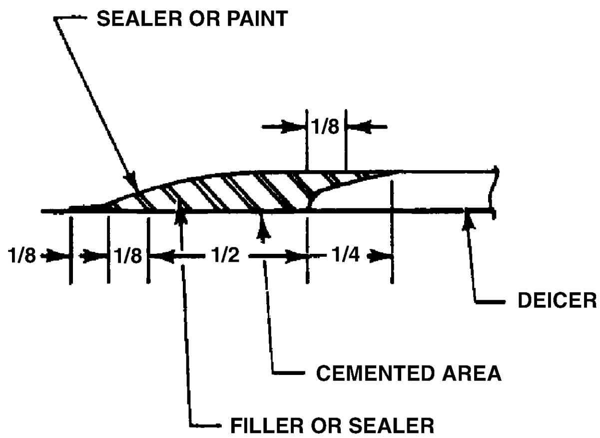
a. Clean an area .500 inch wide around the circumference of the deicer down to the bare metal. Use MEK or Acetone and clean thoroughly.

b. Clean outer .500 inch of all deicer edges and back under deicer about .250 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.

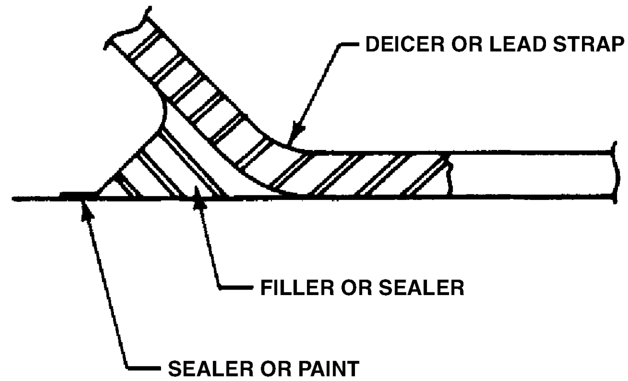
c. Recement loosened areas of deicers in accordance with Cement Application, above.

Note: Deicers loosened due to destruction of adhesive bond by lubricants do not respond well to recementing. Therefore, removal, cleaning and reinstallation of the deicers is recommended. See Removal and Installation, above.

d. Mix filler, sealer, and/or paint thoroughly as required and in the proper proportions by weight, as given in their manufacturer's instructions.



Sealer Application - Deicer
Figure 13



Sealer Application - Lead Strap
Figure 14

e. Locate masking tape approximately .125 inch beyond cemented area around deicer to allow application of filler directly to metal. Apply one even brush coat of filler (or sealer) over .125 inch of bare metal, cemented area and about .125 of an inch of deicer. (See Figure 13.)

f. Insure that a fillet of filler completely covers the area between deicer strap-and blade. (See Figure 14.) Immediately remove masking tape and allow filler to dry for six hours.

g. Apply new masking tape approximately .125 of an inch beyond filler to allow application of sealer directly to metal. Apply one even brush coat of sealer (or paint) over .125 of an inch of bare metal, filled area and .250 of an inch of deicer. (See Figure 13.)

h. Insure that sealer completely covers area between deicer strap and blade. (See Figure 14.) Immediately remove masking tape and allow sealer to dry for 24 hours before starting engine.

30. WRINKLED DEICERS. (Refer to Figure 12D.) If edge of deicer is found wrinkled or loose, try recementing. Use MEK or Toluene 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.

31. ELECTRICAL CHECK.

a. Check the electrical resistance of each of the two elements within the deicer. Refer to Schematic, Figure 8, and Resistance Readings. Refer to Table III.

b. 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 strap retainer. Resistance must not vary.

c. Identification of the circuits within the element may be confirmed by referring to the resistance values and schematic diagram, Figure 8. 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 1.15 to 1.33.

NOTE: These resistances apply only to deicers that are not connected to terminal studs.

32. DEICER STRAPS AND WIRE HARNESS INSTALLATION.

a. The deicer lead strap is fastened to the bulkhead in the same positions from which they were removed.

b. The deicer strap is to be attached to the studs on the spinner bulkhead.

CAUTION: NEVER USE TYPE “B” STAR WASHER (TEETH ON OUTER DIAMETER) ADJACENT TO TORQUE OF DEICER TERMINALS.

c. Make certain that there is no slack in the deicer lead strap between the terminals and the clip. This is important because it assures enough slack between the clip and the strap restrainer to allow for proper feathering. A test should be conducted on each propeller deicing system to insure that deicer lead straps are installed in such a manner that the propeller can be moved from full low pitch through the feathering position without placing the straps in tension.

NOTE: Deicers should have a piece of gray plastic bonded to the air side (shiny side) of the deicer strap as shown in Figure 15. The strap restrainers should be positioned as shown in Figure 16 when the propeller blades are in the full feather position.

d. If damage occurs to slip ring wire harness, rubber spacers or hose clamps, replace damaged parts.

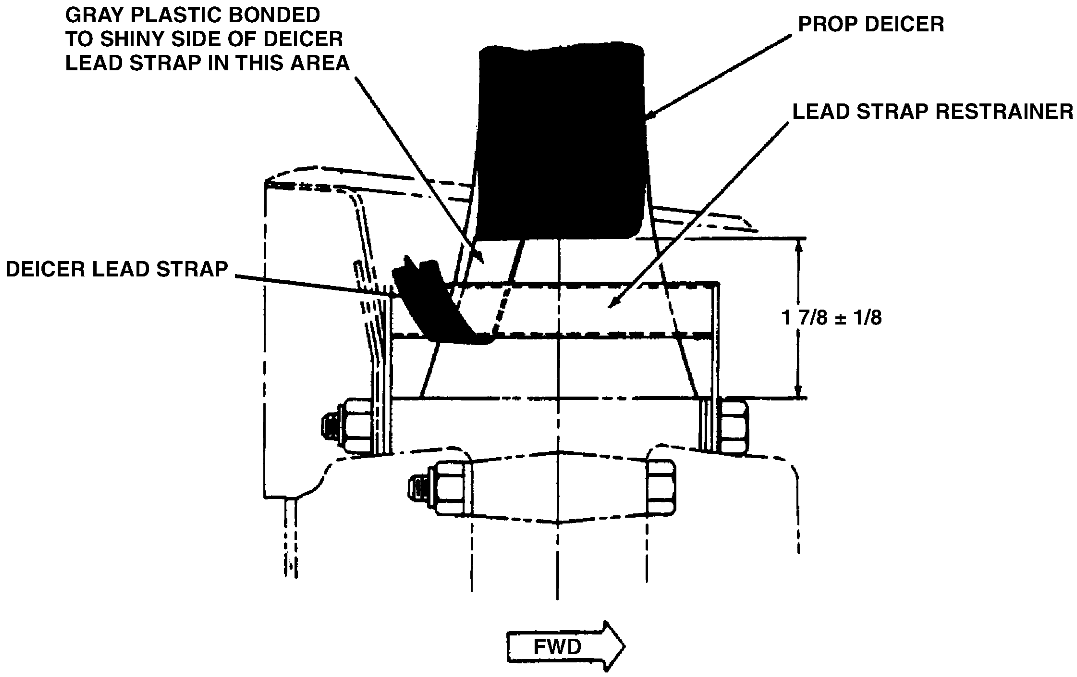
33. OTHER COMPONENTS. Do not attempt internal repairs of the timer, ammeter or switch. If inoperative, these components must be replaced with one of the same part number. For any other repair or maintenance problems not covered in this manual, contact Goodrich Corporation.

34. 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:

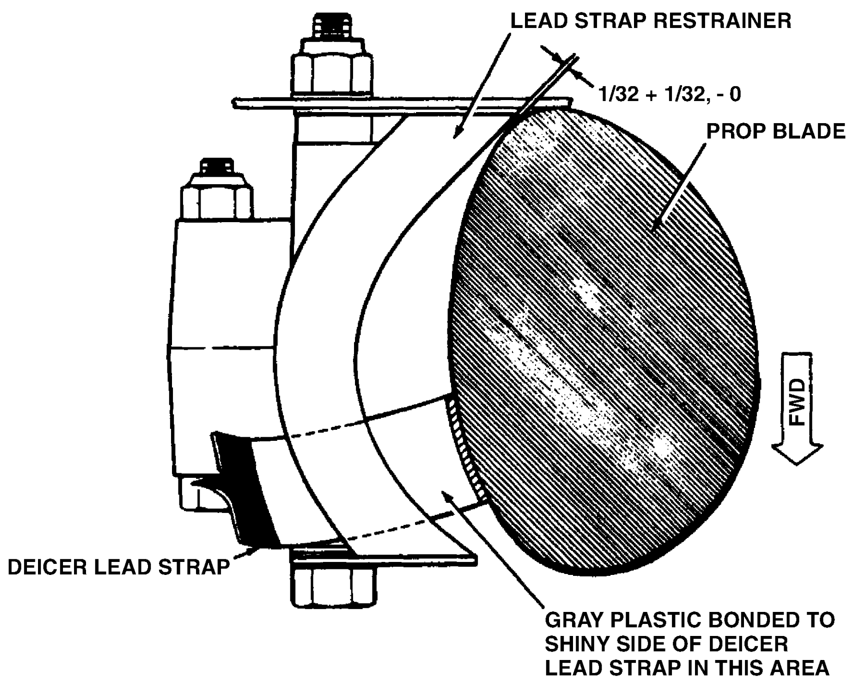
a. Disconnect wire harness at timer and with deicer switch ON, check voltage from Pin B of harness plug to ground. If system voltage is not present, the fault is not in the timer. If system voltage is present at Pin B, check ground circuit using ohmmeter from Pin G to ground. If no circuit is shown, the fault is in ground lead, not in timer. If ground connection is open, the timer step switch will not change position.

b. 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.

c. If the timer meets these requirements, it is not the cause of the trouble. If it fails to perform as indicated, the trouble does lie in the timer and it should be replaced.



Propeller Blade in Low Pitch
Figure 15



Propeller Blade in Full Feather
Figure 16

35. BALANCING. To assure balance of the propeller assembly, the original balancing weights or their equivalents must be reinstalled. The weights must be left in their 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.

36. FINAL ELECTRICAL CHECK.

   a. Make certain that all terminals are tight. Do not over torque.

   b. Check the electrical resistance between the deicer terminals or between the slip rings. The reading should be as shown in Table III.

   c. If the propeller is installed on an airplane, the deicer circuits on the propeller must be electrically isolated from the rest of the airplane wiring when making the above resistance check. The isolating can be done by any one of the following methods:

      1. Remove the brush block.
      2. Retract the brushes and slip a sheet of paper between the brushes and the slip rings. If this method is used, make certain that the brushes are not misaligned or damaged by insertion of the paper shim.
      3. Disconnect the timer and engine wire harness at any convenient place.

   d. Reconnect any circuits that may have been disconnected, or remove paper shims that might have been used for making the final electrical check.

TABLE III
ELECTRICAL RESISTANCE

Resistance Check	Max.	Min.
1 Blade each Element	1.33	1.15
2 Blades in Parallel	.67	.58

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37. PNEUMATIC DEICE SYSTEM.

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.)

38. INTRODUCTION. The following provides service and maintenance procedures for the pneumatic deicing system.

39. DESCRIPTION AND OPERATION. The deicer is essentially a fabric reinforced rubber sheet containing built-in inflation tubes. The type used in this installation have spanwise inflation tubes. Deicers are attached by means of a cement to the leading edges of the surfaces being protected. There are either aluminum or flexible rubber air connections on the backside of the deicer boots called “air connection stems.” Each stem projects from the underside of the boot into the leading edge, through a round hole provided in the metal skin, for connection to the airplane’s pneumatic air supply system.

Through the engine driven vacuum pumps, the system will normally apply vacuum to the deicer boots at all times, except when the boots are being inflated. Deicer inflation is effected by the deicer system control switch. This is a momentary ON type switch which returns to the OFF position when released. Through actuation of the momentary ON type switch the timer energizes the pneumatic pressure control valves for six seconds. The boot solenoid valves are energized and air pressure from the engine driven pumps is supplied to the inflatable tubes in the boots. Inflation sequence is controlled by the timer and solenoid operated valves located near the deicer air inlets. The deicer pressure, normally 18 psig, is regulated by the high stage of the pneumatic pressure control valves. Upon automatic de-energization of the control valves by the timer, the deicer solenoid valves permit the deicer pressurizing air to return to the solenoid valves and be exhausted overboard. System vacuum is then reapplied to the boots to hold them close to the surface skin. Should reactivation of the boots be required, the momentary ON type switch is moved to the ON position again and released. The boots inflation cycle will again take place, with all boots inflating simultaneously.

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, causing static interference with the radio equipment and possible punctures in the rubber. Also, such static charges would constitute a temporary fire hazard after each flight.

40. TROUBLESHOOTING. See Table IV, below.

The troubleshooting procedure in Table IV was written with the following assumptions:

a. The engine driven vacuum pumps, vacuum regulators, and the airplane electrical system are operational and properly adjusted; and,

b. The deicer system installation was made in an approved manner.

41. OPERATIONAL CHECK. 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 operational check of the system.

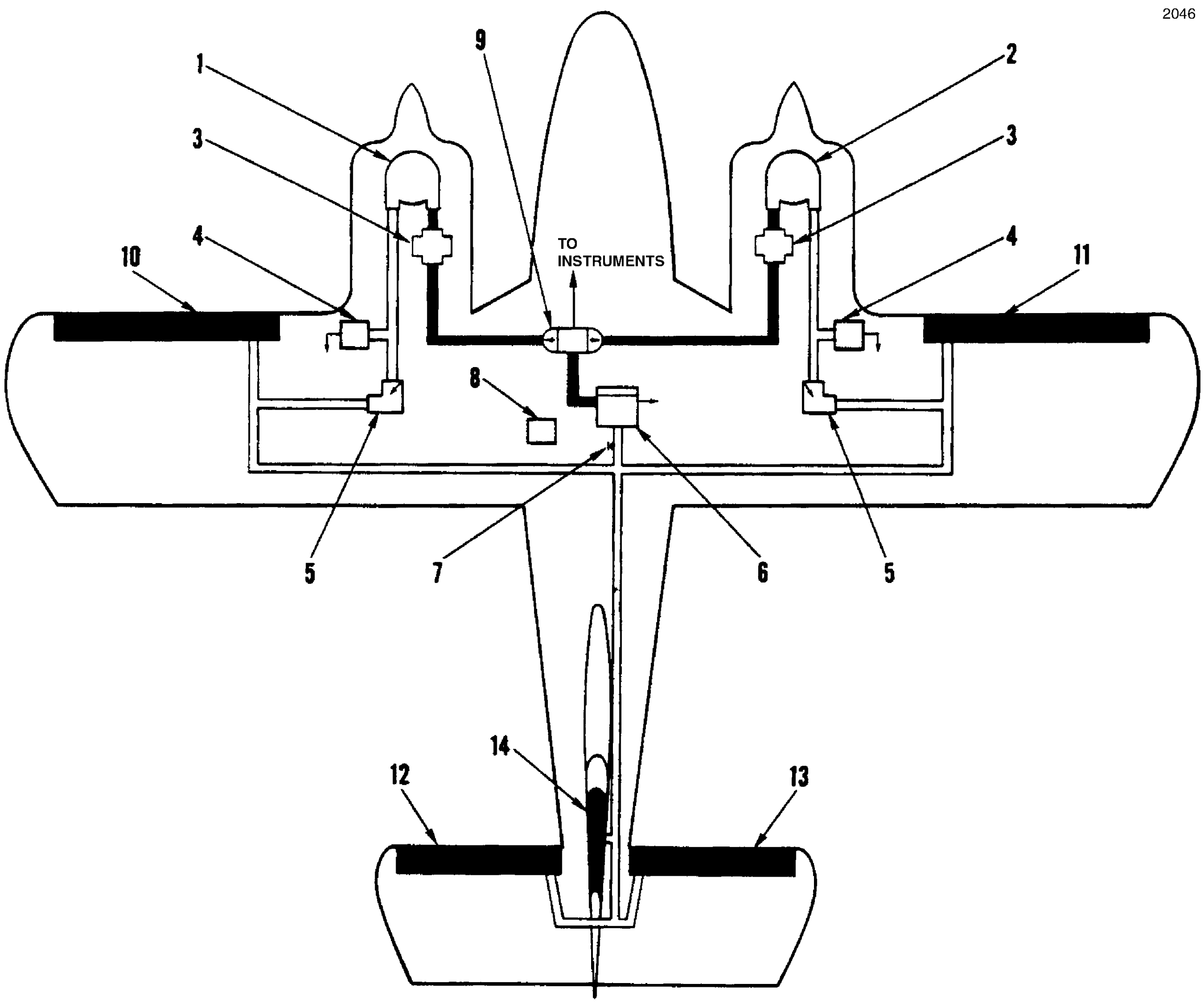
With one engine operating, activate the deicing system switch. Observe the operation of the deicers carefully for evidence of malfunctioning. Look for tubes which leak or fail to inflate and deflate properly.

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 if off the specified time, determine and correct the difficulty. Inflation must be rapid to provide efficient deicing. Deflation should be completed before the next inflation cycle of the boots.

Repeat the procedure for the other engine.

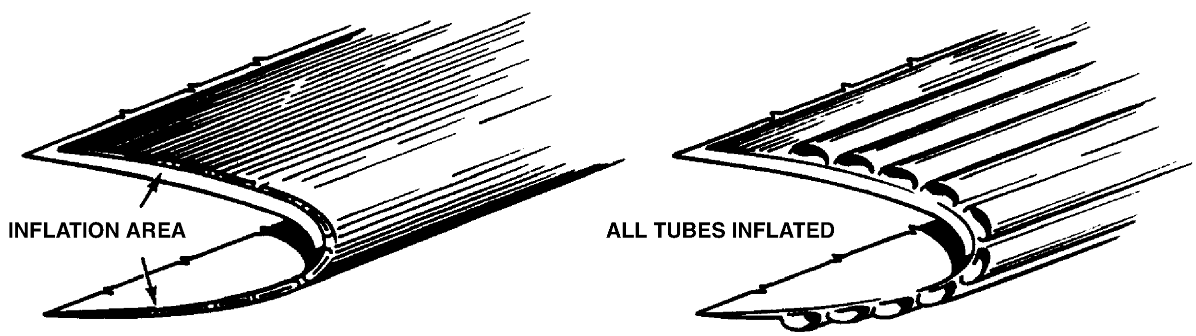
TABLE IV
TROUBLESHOOTING PNEUMATIC DEICE SYSTEM

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 reset.
	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.
	Lines blocked or not connected.	Blow out lines and 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.
		Make air leakage test.
	Deicer valve not functioning.	Check fitting in deicer port for proper installation.
	System pressure not being reached.	Check performance to manufacturers specifications.
	Deicer puncture.	Repair per specification or replace.
Deicers deflate slowly.	Pressure regulator set to low.	Readjust pressure regulator.
	Lines partially blocked.	Inspect and blow out lines.
	Overboard line from control valve partially blocked.	Inspect and blow out lines.
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 replace broken wires. Check for proper ground.

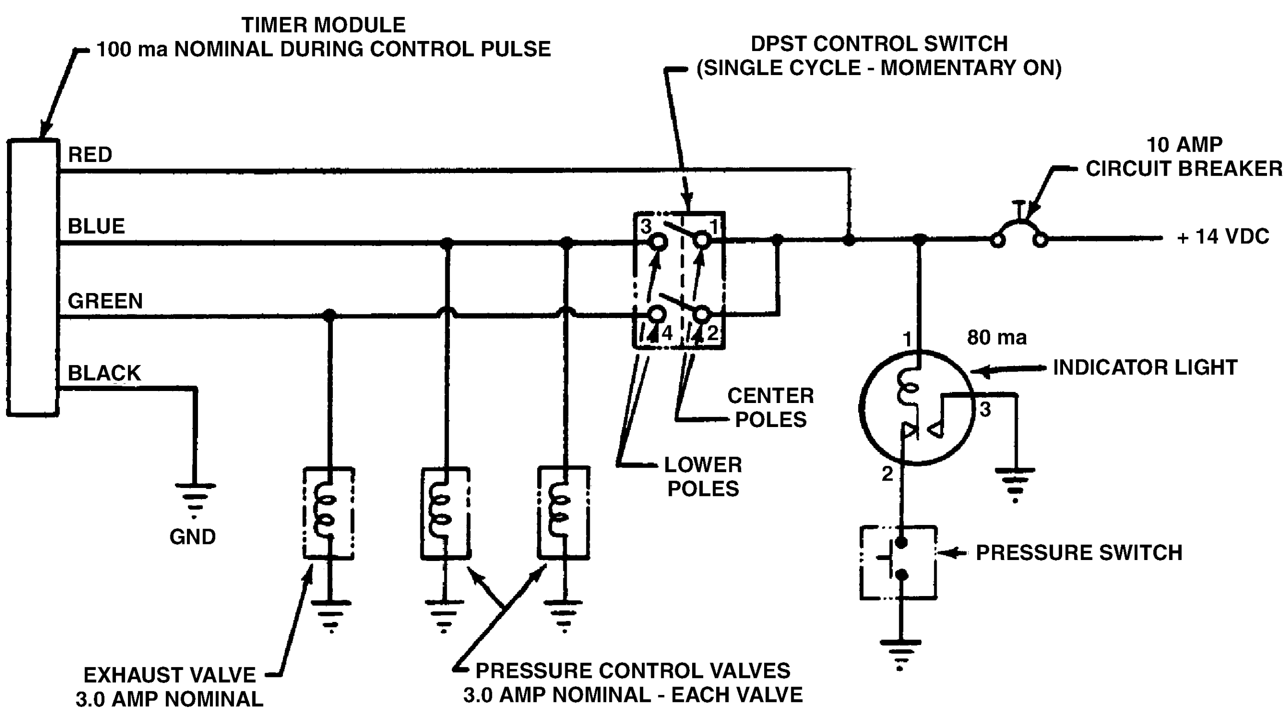


1. VACUUM PUMP, LEFT ENGINE
2. VACUUM PUMP. RIGHT ENGINE
3. VACUUM REGULATOR VALVE
4. PRESSURE CONTROL VALVE
5. FLOW CHECK VALVE
6. EXHAUST VALVE
7. PRESSURE SWITCH
8. TIME MODULE
9. VACUUM MANIFOLD
10. DEICER BOOT, LEFT WING
11. DEICER BOOT, RIGHT WING
12. DEICER BOOT, LEFT STABILATOR
13. DEICER BOOT, RIGHT STABILATOR
14. VERTICAL STABILIZER

Pneumatic Deice System Installation
Figure 17



Pneumatic Deicer (Boot) Operation
Figure 18



Pneumatic Deice System Schematic
Figure 19

42. ELECTRICAL TEST. With engines off, turn airplane battery switch to ON position.

    a. Timer: Activate the deicer system switch. The timer should begin to operate immediately and complete one full cycle of the system. If the timer does not function:

        1. Reset circuit breaker and recheck.
        2. Check circuit from power source, through circuit breaker, to switch, to timer, to ground.
        3. Replace timer.

    b. Solenoid Valves: Check both solenoid valves, one in each nacelle. Activate system switch to ON position. Solenoid valve should be actuated immediately for 6 seconds, as evidenced by an audible “click” that can be felt if hand is placed on a solenoid. If solenoid valve does not function:

        1. Unplug electrical connector at solenoid. Attach test light or other suitable test equipment to connector and re-actuate system switch. If test equipment does not indicate complete circuit:
            (a) Check circuit from timer, to solenoid connector, to ground.
            (b) Replace timer.
        2. Use ohmmeter to check solenoid for open circuit. If solenoid circuit is open, replace solenoid valve.
        3. Remove solenoid safety wire and unscrew solenoid.

            CAUTION: DO NOT LOSE STEEL HEX ACTUATOR PIN OR VALVE POPPET.

        4. Reattach connector to solenoid, insert hex actuator pin into solenoid, and reactuate system switch. If pin is not ejected from solenoid, replace control valve.

43. PRESSURE LEAKAGE TEST.

    a. This test can be performed in either the left or right nacelles.
    b. Cap the overboard ports of the control valve.
    c. Connect a source of clean air to the inlet port of the control valve. It is necessary that the inlet pressure be a minimum of 18-20 psig to perform this test. Observe the system pressures on the airplane’s vacuum pressure gauge.
    d. Apply 18 psig pressure to the system by means of a hand operated valve, trip 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.
    e. Remove test equipment, lubricate all threads, and replace all system components.

44. VACUUM REGULATORS. Whenever testing or troubleshooting the pneumatic deice system; first, verify that the vacuum regulators are properly adjusted. See Section X, Non-Electrical Instruments, Vacuum Regulators, Adjusting.

45. INSPECTIONS (PNEUMATIC DEICE SYSTEM). A ground check of the entire deicer system should be made at least every 100 hours or whenever damage is suspected or repairs have been completed. To permit ground checking the system without engine operation, a test plug is designed into all systems, usually between the pressure check valve and the combination unit.

Before checking the system, all deicers should be inspected for damaged areas and repaired according to the Repair Procedure, below. See Table V and Ground Procedures, below, for operating pressures and inspection procedure.

46. GROUND PROCEDURE.

Connect an external source of air providing test pressure (Table V) to the test plug. When the air supply is turned on, the check valves in the lines from the vacuum pumps close automatically. The deicer system should be within one psig of the recommended operating pressure with each inflation cycle.

If deicers do not reach the operating pressure, check the inflation time to ascertain that the solenoid valves are open the specified length of time, (six seconds). If this is not the cause of trouble or if the boots deflate slowly, the lines or valves may be plugged. Then the lines should be disconnected and blown clear.

47. 100-HOUR INSPECTION. At each 100-hour inspection of the airplane, inspect and operate the deicer boots. Make checks as follows:

a. Carefully inspect the deicers for evidence of damage or deterioration and repair or replace damaged boots.

b. Resurface boots which show signs of considerable wear or deterioration.

c. Inspect all hose connections which form a part of the pneumatic deicing system. Replace deteriorated sections on non-kink hose.

d. Check the operation of the boots and the operating pressure of the system as outlined in Operational Check and Table V, below.

e. If new or replacement boots have been installed, check the tube inflation to make sure that the air connection stems have been properly connected.

f. Disconnect all drain lines in the system and check for proper drainage.

g. Check the on-off control switch for freedom of action. Check associated electric wiring.

h. Clean or replace the vacuum system air filters. See Section X, Vacuum System, Air Filter.

CAUTION: OIL WHICH REACHES THE DEICERS WILL CAUSE RAPID DETERIORATION OF THE RUBBER. 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 VALVE AND DISTRIBUTOR VALVE. IF STICKING OF THESE PARTS IS ENCOUNTERED, REMOVE FROM AIRPLANE, CLEAN OUT, AND REPLACE.

NOTE: This operation may be omitted if the boots were installed on the airplane subsequent to the last previous 100 hour check. On the other hand, if operations are being conducted under cold weather conditions below 10° F (-12° C), the air filters should be cleaned out at each 100 hour check, or more often if difficulties are encountered with valves sticking due to congealed oil.

TABLE V
OPERATING PRESSURES

Recommended Operating Pressure PSIG	Test Pressure in PSIG	
18	16	20

48. COMPONENT MAINTENANCE AND REPLACEMENT.

49. AIR FILTER(S). The air filter(s) in the vacuum system can affect pneumatic deice system performance if they are clogged. See Section X, Non-Electrical Instruments, Vacuum Filter(s) for inspection and replacement instructions.

50. CONTROL VALVES. After 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. To determine if valve poppet is sticking, perform electrical test. If solenoid checks satisfactory, remove valve poppet and clean control valve bore and poppet. To clean:

    a. Remove safety wire and electrical connector. Unscrew solenoid.

    CAUTION: DO NOT LOSE STEEL HEX ACTUATOR PIN.

    b. Remove valve poppet. It may be necessary to apply slim nose pliers to pin projection to pull poppet from valve.

    c. Thoroughly clean valve bore and poppet with commercial hydrocarbon type solvent.

    d. Reassembly valve and re-safety wire solenoid.

51. TIMER. No field maintenance is recommended. For repair or replacement, contact your Goodrich dealer or distributor.

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52. DEICERS (BOOTS) (PNEUMATIC DEICE SYSTEM). (See also Goodrich ATA Report No. 30-10-31, dtd 7/21/03.)

See Table VI, below, for required materials.

WARNING: CEMENTS AND SOLVENTS USED TO REMOVE AND INSTALL DEICERS ARE EXTREMELY FLAMMABLE AND TOXIC. EXTINGUISH OPEN FLAMES. AVOID SPARKS. USE IN WELL-VENTILATED AREA. AVOID SKIN CONTACT AND/OR PROLONGED BREATHING OF VAPORS. CONSULT MSDS FOR ADDITIONAL SAFETY INFO.

CAUTION: DEICER REPAIR IS LIMITED TO REFURBISHMENT OF EDGE SEALER. SEE PREPARATION AND APPLICATION OF SEALER, BELOW.

CAUTION: DISPOSE OF UNUSED MEK AND OTHER CHEMICALS AND SOLVENTS IN A MANNER CONSISTENT WITH LOCAL LAWS AND/OR ENVIRONMENTAL PROTECTION AGENCY REGULATIONS.

NOTE: These instructions address the installation, maintenance, and repair of the Goodrich standard Neoprene deicers installed as original equipment in these airplanes. If the newer Estane® deicers have subsequently been installed, consult the appropriate vendor publication.

53. REMOVAL.

NOTE: Disconnect line fittings from boot fittings.

a. Starting at one comer of the upper trailing edge of the deicer, apply a minimum amount of solvent to the seam line while tension is applied to peel back the corner of the deicer.

b. Using a pressure handle squirt can filled with solvent, separate the deicer boot from the surface for a distance of 4 inches all the way along the upper trailing edge.

c. The area between the deicer and the wing which has now been separated will act as a reservoir for the solvent, therefore, the deicer can be pulled down towards the leading edge with a uniform tension.

d. From the centerline of the leading edge to the lower trailing edge of the deicer, use the pressure handle squirt can to soften the bond between the deicer and the wing skin.

e. Use Toluene or Peerco #321 to clean the dry cement off the exposed wing area, and clean the area thoroughly with MEK (methylethylketone.)

54. INSTALLATION.

55. PREPARATION OF LEADING EDGES.

a. Dry fit deicer on leading edge. Make sure deicer air connection fits in air connection hole in leading edge and cut-outs are properly aligned. Use deicer as template to mask installation area with one (1) inch masking tape. For non-recessed deicers, add at least one-half (1/2) inch extra around perimeter of deicer. Mark deicer centerline on masking tape at each end.

NOTE: Mask accurately, thus eliminating the need for cleaning off excess cement later.

b. Remove paint and primer in masked area with stripper or sand painted/primed area to roughen. Use clean pressurized air or dry cloth to remove sanding particles before proceeding with deicer installation.

NOTE: Deicers can be installed on alodined or anodized surfaces, and over zinc chromate primer that cannot be removed by scrubbing with solvent.

c. Clean the metal surfaces thoroughly, at least twice, with MEK or Toluene. For final cleaning, wipe the solvent film off quickly with a clean dry cloth before it has time to dry.

d. Fill gaps of skin splices that lead under deicers with sealing compound EC-801.

TABLE VI (Sheet 1 of 2)
REQUIRED MATERIALS - PNEUMATIC DEICER - INSTALLATION / REMOVAL / REPAIR

Adhesive * - Choose One System (Goodrich Part Number)

3M 1300L System (preferred adhesive) 1300L Cement [Piper P/N 179-929 = 1 qt.]	and, A-851-B Fuel Barrier Adhesive (74-451-99) = 1 qt.
or	
Bostik 1096M System 1007 or 1007M Bostik Primer 1096M Bostik Cement Boscodur 9R Accelerator	or, British Bostick 2402 System 9252 British Bostick Primer 2402 British Bostick Cement Bostikure D Accelerator

* use Boar's Bristle brush

Filler - Choose One Product (If Required)

PRC1422 or PRC1425 or equivalent

Sealer * - Choose One Product (Goodrich Part Number)

A-56-B (74-451-11) = 1/2 pt **; (74-451-11-1) = 1 qt. or, Edge Sealer Kit (74-451-P)

* use Pure Bristle brush ** Piper P/N 912-018

Solvents

Item	**Where Used**
Toluene	Leading edge and deicer cleaning solvent
Toluene, or Peerco #321 stripper, or Methyl Ethyl Ketone (MEK)	Leading edge stripping solvent
MEK or Toluene or Acetone	Prop deicer removal and tackifying solvent *

* Toluene is the preferred tackifying solvent. Methylethylketone (MEK) can be used, but causes very rapid drying and provides only 10 seconds working time compared with 40 seconds for Toluene.

Tools and Miscellaneous (Goodrich Part Number)

2 x 2 1/2 in. Rubber roller (74-451-74)	1/4 in. Steel stitcher roller (74-451-89)
1 in. Paint brush	Lint-free cloths
Scissors	1 in. masking tape
Emery Buffing Stick (74-451-75) 6 ea.	Sharp knife
Steel measuring tape (6 ft.)	Fine sharpening stone
Steel wool pads	Hypodermic needles (22 gauge or smaller)
Straight edge	Carpenter's chaulk line
Hook knife (74-451-45)	3M EC 801 filler
FASTpatch^{TM} Primer - 1/2 oz. crush tube (74-451-190)	

TABLE VI (Sheet 2 of 2)
REQUIRED MATERIALS - PNEUMATIC DEICER - INSTALLATION / REMOVAL / REPAIR

Goodrich Kits		
Goodrich Part No.	**Quantity**	**Description**
74-451-AA	**1**	**Universal FASTpatch™ Repair Kit**
74-451-206	1	Primer Pen (2 oz.)
74-451-187	30	Small Oval Patch (1-1/4 x 2-1/2 in.)
74-451-188	30	Medium Oval Patch (2-1/2 x 5 in.)
74-451-189	10	Large Oval Patch (5 x 10 in.)
74-451-75	3	Emery Cloth (9 x 11 in.)
74-451-87	1	Buffing Shield
74-451-AE	**1**	**Pinhole Repair Kit**
74-451-201	8.5 grams	Accelerator
74-451-202	1	Buffing Shield
74-451-205	1	Application Tool
74-451-209	24	Cement
74-451-210	24	Mixing Cup
74-451-211	24	Mixing Tool
74-451-212	50	Application Template
74-451-L	**1**	**Resurfacing Kit ***
74-451-120	4 oz.	Accelerator
74-451-122	1 qt.	Primer
74-451-123	1 qt.	Resurfacing Coat
* after P/N 74-451-L is applied to a neoprene deicer, the deicer should be treated as an Estane® deicer for maintenance purposes.		
74-451-P	**1**	**Edge Sealer Kit**
74-451-20	1 pt.	Cement
74-451-148	50 ft.	Edge sealer strip
74-451-221	1 oz.	Accelerator
74-451-185	1 pt.	Primer
74-451-Z	**1**	**Maintenance Kit**
74-451-127	1 qt.	AgeMaster® No. 1
74-451-178	1 pt.	ShineMaster™
74-451-179	1 qt.	ShineMaster™ Prep Cleaner
ICEX® II	16 oz.	Ice Adhesion Inhibitor

e. Apply fuel barrier cement over fuel tank rivets and edges of fuel tanks which will lie under the installed deicer. Proceed as follows:

(1) Stir cement thoroughly to blend solids.

(2) Apply one even brush coat and let dry one (1) hour.

(3) Apply a second coat and let dry two (2) hours.

f. 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.

56. PREPARATION OF DEICER. Moisten a clean cloth with Toluene (or MEK) and carefully clean the rough, back surface of the boot at least twice. Change cloths often to avoid recontaminating the cleaned area.

56a. CEMENT APPLICATION.

CAUTION: DO NOT INSTALL IF HUMIDITY IS ABOVE 90% OR IF TEMPERATURE IS BELOW 50° F. AT THESE EXTREMES, PROPER ADHESION MAY NOT BE OBTAINED REGARDLESS OF DRYING TIME ALLOWED.

CAUTION: DRY FIT DEICER BEFORE APPLICATION OF CEMENT. SEE PREPARATION OF LEADING EDGES, ABOVE.

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.

a. Thoroughly mix cement before using. Apply one even brush coat to the cleaned back surface of the boot and to the cleaned metal surface of the leading edge.

b. Allow the cement to air dry for a minimum of one hour at humidity of 75% or lower. If humidity is 75-90%, drying time will be longer.

c. Snap a chalk line along the leading edge of the airfoil section. Intensify chalk line on leading edge and the white reference line on the boot with a ball point pen.

d. Stir cement and apply a second coat to both surfaces and allow to air dry per paragraph b, above.

57. MOUNTING DEICER ON LEADING EDGE.

CAUTION: DO NOT TRIM DEICER CLOSER THAN ONE (1) INCH FROM TUBE AREA AT ENDS OR CUT-OUT AREAS, AS AIR LEAKAGE OR SEAM SEPARATION CAN RESULT.

Most boots are made with an excess of material at the inboard and outboard edges for final trimming after installation and some recessed boots trim on the upper and lower edges.

a. 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. Tighten each clamp with a pair of slip joint pliers but do not squeeze the clamp so tight that the hose is damaged.

NOTE: If non-kink hose clamps are not available, wrap each hose connection with several turns of friction tape. Over the tape wrap two separate bindings of safety wire, about one-half (1/2) inch apart. Each of these bindings should consist of several turns of wire. Twist together the ends of each binding to tighten. Press the twisted ends down against the hose. Finally, wrap the wire with several additional turns of friction tape.

b. Push the hose connections into the leading edge grommets or seals, as the case may be. Obtain sufficient personnel to hold boot steady during installation. (Limit handling cemented side of boot with fingers.)

c. Continue installation by reactivating the cement along the centerline leading edge surface and boot in spanwise strips approximately six (6) inches wide. Use a clean lint free cloth dampened with Toulene. Wring and shake cloth to remove excess solvent.

NOTE: Application of vacuum is recommended and makes installation easier.

d. Using a rubber roller, press 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. Position the deicer centerline to coincide with leading edge centerline. Hold boot in this position while reactivating about three (3) inches around connections and around corresponding holes in leading edge, using a clean, lint-free cloth moistened with Toluene. Insert connections in leading edge holes when cement has dried to a tacky state, and press boot to leading edge with roller in tackified area.

e. If the deicer should attach "off course," use MEK to remove and reposition properly. Avoid twisting or sharp bending of the deicer.

f. Using the rubber roller, apply pressure over entire surface of the deicer. All rolling should be done parallel to the inflatable tubes. Roll edges with a one-quarter (1/4) inch stitcher roller.

CAUTION: AVOID EXCESSIVE SOAKING OR RUBBING OF THE CEMENT WHICH COULD REMOVE THE CEMENT FROM THE SURFACE.

Remove all masking tape and clean surfaces carefully with Toluene so that no solvent will run under deicer edges.

g. Mask areas to be edge filled - i.e. - fair full thickness deicer edges to adjacent aircraft structure, around cut-outs, recessed edges, and/or between two deicers installed close together.

Apply two lines of masking tape bordering fill area:

(a) apply one line on deicer surface one-sixteenth (1/16) to one-eighth (1/8) inch from edge; and,

(b) one line on leading edge one-quarter (1/4) to one-half (1/2) inch from deicer edge.

NOTE: Width between masking tape lines may vary depending on area to be filled; use narrowest width possible.

h. Apply edge filler to fair full thickness deicer edges to adjacent aircraft structure, around cut-outs, recessed edges, and/or between two deicers installed close together.

i. Let edge filler dry per manufacturer's instructions.

j. Apply masking tape on deicer surface around deicer and cutouts at least 1/4 inch from edge. If edge filler has been used, make sure masking tape applied on deicer is at least 1/16-1/4 inch in from edge filler.

k. Apply masking tape on leading edge one-eighth (1/8) to one-quarter (1/4) inch outboard of area initially cleaned and cemented (about 3/4 inch out from deicer edge). Form neat, straight lines to border edge sealer application.

l. Mix edge sealer (A-56-B cement) throughly. If desired, dilute with Toluene, not to exceed 20% by volume.

m. Apply an even brush coat of edge sealer to surfaces between tape lines. Ensure that the conductive edge sealer coating is continuous from the deicer surface to the wing painted surface.

n. Remove tape immediately after applying edge sealer - i.e. - before edge sealer dries.

57a. DRYING TIME.

a. Allow a minimum of four (4) hours drying time before flying airplane.

b. Allow a minimum of 48 hours drying time before inflating deicers.

58. 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 (4) hours or more after the installation, attach a spring scale to the un-cemented 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.)

CAUTION: SUCCESSFUL COMPLETION OF THIS TEST INDICATES INSTALLATION IS SUITABLE FOR FLIGHT, NOT INFLATION.

A minimum of five pounds tension (pull) shall be required to remove the test strip. If less than five pounds is required, wait two to three hours and retest. If peel strength is still lower than five pounds, proceed as follows:

a. Carefully lift one comer of deicer in question sufficiently to attach a spring clamp.

b. 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.

c. 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 comer peels back.

d. Re-cement comer following previous procedure.

e. Failure to meet this requirement shall require reinstallation of the deicer.

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.

59. MAINTENANCE.

a. Visually inspect deicers frequently for abrasion, erosion, cracking, tears, pinholes, foreign object damage (FOD), debonding and other damage. Repair damage immediately, see Repairs, below.

b. Clean deicers when the airplane is washed with 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 the boots, direct a blast of warm air along the region being cleaned, using a portable type ground heater.

c. Goodrich Corp. offers a family of decier treatment products which reduce weathering effects, enhance appearance, and enhance performance. Their use is recommended, see below.

59a. AGEMASTER® NO. 1 APPLICATION.

AgeMaster® No. 1 is a rubber preservative for neoprene deicers only that protects against weathering, ozone and ultraviolet rays. Apply AgeMaster® No. 1 initially 6 months after a new deicer is installed. Reapply every 6 months.

WARNING: AGEMASTER® NO. 1 CONTAINS PETROLEUM DISTILLATES. HARMFUL OR FATAL IF SWALLOWED. IF SWALLOWED, DO NOT INDUCE VOMITING; SEE PHYSICIAN IMMEDIATELY. KEEP AWAY FROM OPEN FLAME. VAPORS MAY IGNITE CAUSING FLASH FIRE OR EXPLOSION. DO NOT APPLY BY SPRAYING. USE WITH ADEQUATE VENTILATION. AVOID PROLONGED BREATHING OF VAPOR. IF DIZZINESS OR NAUSEA OCCURS, OBTAIN FRESH AIR. AVOID CONTACT WITH SKIN AND EYES. IF EYE CONTACT OCCURS, FLUSH EYES WITH WATER FOR 15 MINUTES, THEN SEE PHYSICIAN. IF SKIN CONTACT OCCURS, WASH THOROUGHLY WITH SOAP AND WATER. EMPTY CONTAINERS MAY CONTAIN FLAMMABLE OR EXPLOSIVE RESIDUAL VAPORS. SEE MSDS FOR ADDITIONAL SAFETY INFORMATION.

CAUTION: AGEMASTER® NO.1 STAINS SKIN, CLOTHING AND OTHER SURFACES. WEAR PLASTIC OR RUBBER GLOVES WHEN USING. PROTECT SURROUNDING AREAS. USE WATERLESS HAND CLEANER TO REMOVE STAINING.

CAUTION: NOT SUITABLE FOR USE ON ESTANE® DEICERS. IT WILL NOT BE ABSORBED BY DEICER, CAUSING RUN BACK AND STAINING ON AIRCRAFT SURFACE.

NOTE: AgeMaster® No. 1 can be applied to neoprene deicers that have been repaired with Goodrich P/N 74-451-AA patch kit and/or Goodrich P/N 74-451-AE pinhole repair kit; however, excess AgeMaster® No. 1 should be wiped off the surfaces of the repair material, as it will not be absorbed.

NOTE: Store in cool, well-ventilated place. Keep container closed tightly when not in use.

a. One quart covers 90 square feet of deicer, following these directions.

b. Thoroughly clean deicer surface with mild soap and water. Rinse with clean water and let dry.

c. Use isopropyl alcohol to remove substances that cannot be removed with soap and water. Repeat Step b, above.

d. Wipe one even coat of AgeMaster® No. 1 on deicer surface with lint free cloth. Coat deicer surface completely and evenly for best results and appearance. Let dry 5-10 minutes. Dry time may vary due to temperature and humidity conditions.

e. Repeat Step d, above, so that three even coats have been applied with 5-10 minutes dry time between each coat.

f. Let dry 24 hours before flying aircraft or applying Icex® II or ShineMaster® products.

59b. SHINEMASTER® APPLICATION.

ShineMaster® treatment is a cosmetic coating that provides high luster shine. ShineMaster® Prep cleaner is used to clean deicer for ShineMaster® application, and remove residual ShineMaster® before reapplication. Application interval for ShineMaster® depends on operating environment (2 or 3 times per year is typical).

NOTE: ShineMaster® products can be applied to deicers that have been repaired with Goodrich P/N 74-451-AA patch kit and/or Goodrich P/N 74-451-AE pinhole repair kit.

NOTE: ShineMaster® cosmetic treatment should not be heavily applied or allowed to build-up on deicer edges, as it may appear cracked and is very difficult to remove when reapplication is desired.

a. Clean deicer surface with ShineMaster® Prep cleaner to remove dirt, grease, oil, silicone products and other contamination. Previous applications of ShineMaster® treatment must be removed before reapplication to avoid dulling or product build-up.

b. Apply light, even coat of ShineMaster® cosmetic treatment to deicer with clean lint-free cloth wiping in one direction. Let dry to touch - about 5-15 minutes.

c. Repeat Step b, above, once or twice to obtain desired shine.

60. ICEX® II APPLICATION.

Icex® II is an ice adhesion inhibitor that enhances deicer performance by lowering adhesion strength between ice and deicer surface. During icing season, apply Icex® II every 50 flight hours.

NOTE: Icex® II 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.

NOTE: Icex® II can be applied to deicers that have been repaired with Goodrich P/N 74-451-AA patch kit and/or Goodrich P/N 74-451-AE pinhole repair kit.

NOTE: If Icex® II is applied too heavily, result can be sticky surface that collects dust and dirt, reducing efficiency of Icex® II. Residue should be completely removed before reapplication.

a. Clean deicer surface using mild soap and water.

b. Rinse with clean water and let dry.

c. Clean with isopropyl alcohol to remove substances not removed with soap and water.

d. Repeat Steps a & b, above.

e. Apply Icex® II with clean cloth or pad. Apply lightly and wipe in single continuous back and forth motion spanwise on deicer.

60a. APPLICATION IN COMBINATION.

AgeMaster® No. 1, ShineMaster® and Icex® II are specifically designed to use together to provide maximum deicer care, appearance and performance.

a. Clean deicer surface to remove previous coatings, dirt, grease, oil and other contamination. ShineMaster® Prep cleaner should be used to remove ShineMaster® treatment.

b. Apply AgeMaster® No. 1, see above, and let dry at least 24 hours.

c. Apply ShineMaster® cosmetic treatment, see above, and let dry to touch.

d. Apply Icex® II, see above.

e. Icex® II may be removed with alcohol or warm, soapy water, then reapplied without affecting ShineMaster® cosmetic treatment.

f. Icex® II and/or ShineMaster® cosmetic treatment can be removed without affecting AgeMaster® No. 1.

g. Icex® II and/or ShineMaster® cosmetic treatment must be removed before reapplying AgeMaster® No. 1.

61. REPAIR LIMITS.

CAUTION: PNEUMATIC DECIERS MUST BE REPLACED IF: (1) CUTS, TEARS OR RUPTURES CUT THE INFLATABLE TUBE FABRIC AND/OR EXCEED 4 X 9 INCHES; OR, (2) BROKEN STITCHES OR THREADS ARE APPARENT; OR, (3) DAMAGE LEAKS AIR AND EXCEEDS THE PATCH AND PINHOLE REPAIR LIMITS SPECIFIED BELOW.

NOTE: In addition to meeting these repair limits, the deicer must also pass the Inspection (Pneumatic Deicers (Boots)), Procedure, below.

NOTE: If patches and pinhole repairs are mixed within any 12 inch square, a ratio equivalent to the repair limits should be followed. For example, in a 12 inch square it would be permissible to have one (1) small patch (33% of repair limit) and 13 pinhole repairs (67% of repair limit). The net effect is equivalent to 100% of the repair limits.

To maintain optimal functional efficiency of the deicers:

a. The following patch limits are established:

(1) Three (3) small patches per 12 inch square (Small patch is 2-1/2” X 1-1/4"); or,

(2) Two (2) medium patches per 12 inch square (Medium patch is 5" X 2-1/2"); or,

(3) One (1) large patch per 12 inch square (Large patch is 5" X 10"); or,

(4) Two (2) small patches and one (1) medium patch per 12 inch square.

b. No more than 20 pinhole repairs are allowed per 12 inch square.

62. REPAIR PROCEDURE. See Table VI for materials and supplies. Kits and part numbers referenced below are Goodrich Corporation, unless otherwise noted.

NOTE: Repair of damage that does not leak air is not mandatory.

a. Scuff (Surface) Damage. This type of damage will be most commonly encountered and, fortunately, it is not necessary in most cases to make a repair. Surface damage that leaks air, but does not cut inflatable tube fabric, and does not exceed 4" X 9" should be repaired with P/N 74-451-AA patch kit.

b. 74-451-AA Patch Kit Application.

CAUTION: PATCH ADHESION IS TEMPERATURE SENSITIVE. IF TEMPERATURE IS UNDER 50°F (10°C), WARM DEICER SURFACE PRIOR TO APPLYING PRIMER, AND WARM INSTALLED PATCH WHILE DRYING. TO WARM, HOLD PLASTIC BAG FILLED WITH HOT WATER ON DEICER SURFACE, AND ON INSTALLED PATCH. IF SURFACE AND INSTALLED PATCH ARE NOT WARMED, PATCH MAY NOT ADHERE.

CAUTION: PATCHES HAVE A ONE-WAY STRETCH ACROSS WIDTH OF PATCH SO PATCH CAN STRETCH WHEN DEICER INFLATES. PATCH MUST BE INSTALLED WITH LENGTH PARALLEL TO DEICER TUBES. FAILURE TO DO SO MAY RESULT IN PATCH LIFTING WHEN DEICER INFLATES.

CAUTION: PREPARATION OF DEICER SURFACE TO BE PATCHED IS CRUCIAL FOR GOOD PATCH ADHESION. FAILURE TO REMOVE, SHINEMASTER® COSMETIC TREATMENT, WAX, GREASE, OIL, ICEX® II, AND OTHER CONTAMINANTS COMPLETELY CAN RESULT IN POOR PATCH ADHESION.

(1) Trim standard patch sizes to accommodate small areas of damage, leaving at least 1/2 inch beyond damaged area. Mark stretch direction on patch before trimming, so trimmed patch is installed with stretch in same direction as tube inflation.

(2) Clean deicer surface to be patched with detergent and hot water, using lint free cloths to remove dirt, grease and cosmetic coatings. Repeat until oil and silicone contamination is removed.

(3) Use buffing shield or patch as template to outline damaged area. Buff deicer surface with medium grit emery cloth or equivalent.

(4) Wipe deicer surface with cloth dampened with Toluene or alcohol and let dry.

(5) Apply one coat of primer to deicer surface. Let dry to touch (5-10 min.).

(6) Remove paper backing from patch and press patch on primed deicer surface. Roll with rubber roller.

(7) Let dry 30 minutes before inflating deicer.

(8) Patch refurbishment:

(a) To replace loose or damaged patch, remove old patch by peeling off deicer.

(b) Remove adhesive remaining on deicer with Scotch Brite™ soaked in alcohol.

(c) Install new patch.

c. Tube Area Damage. Use Kit No. 74-451-AA (see application instructions, above) to repair cuts, tears or ruptures that leak air but do not cut inflatable tube fabric, and do not exceed 4” X 9”. Use Kit No. 74-451-AE to repair pinholes that leak air, but do not exceed 1/16 inch in diameter.

CAUTION: CUTS, TEARS, OR RUPTURES THAT CUT THE INFLATABLE TUBE FABRIC REQUIRE DEICER REPLACEMENT.

CAUTION: PATCHES HAVE A ONE-WAY STRETCH ACROSS WIDTH OF PATCH SO PATCH CAN STRETCH WHEN DEICER INFLATES. PATCH MUST BE INSTALLED WITH LENGTH PARALLEL TO DEICER TUBES. FAILURE TO DO SO MAY RESULT IN PATCH LIFTING WHEN DEICER INFLATES.

d. 74-451-AE Pinhole Repair Kit Application.

CAUTION: MIXED REPAIR MATERIAL MUST BE USED WITHIN TWO (2) HOURS.

CAUTION: APPLICATION OF 74-451-AE KIT IS NOT RECOMMENDED BELOW 50°F (10°C), AS REPAIR MATERIAL MAY NOT DRY.

(1) Clean deicer surface to be repaired with detergent and hot water using lint-free cloth, to remove dirt, grease and cosmetic coatings. Repeat until oil and silicone contamination is removed.

(2) Isolate repair area with buffing template. Buff isolated area with Scotch Brite^{TM} or equivalent.

(3) Wipe isolated area with lint-free cloth dampened with alcohol or equivalent cleaning solvent and allow to dry.

(4) Secure application template with hole centered over pinhole.

(5) Open foil overpack of 74-451-209 cement. Clip corner of Appli-pak pouch and squeeze cement into mixing cup. Make sure that all material from pouch is squeezed into mixing cup to assure proper mix ratio with accelerator.

CAUTION: RECAP ACCELERATOR TIGHTLY AFTER USE AS ACCELERATOR WILL HARDEN IF NOT SEALED COMPLETELY.

(6) Add seven (7) drops of P/N 74-451-201 accelerator. Mix thoroughly with wooden stir stick for one minute, making sure material on sides of cup is thoroughly mixed.

CAUTION: REMOVE APPLICATION TEMPLATE AS SOON AS REPAIR MATERIAL IS APPLIED AND LEVELED TO ASSURE SMOOTH APPEARANCE.

(7) Apply repair material into hole in application template with wooden stir stick. Push repair material firmly into pinhole. Level repair material with application tool.

NOTE: If repair material is spilled on undamaged deicer surface, remove immediately with Toluene.

(8) Allow two (2) hours dry time prior to flying the aircraft or inflating deicer.

e. Loose Surface Ply in Dead Area (i.e. - non-inflatable area). Use P/N 74-451-AA patch kit to repair cuts, tears or ruptures that do not exceed 4” X 9” per Scuff (Surface) Damage, above. Surface ply peeling less than 4” X 9” can be repaired by trimming away loose surface material, and applying the 74-451-AA patch repair as follows:

(1) Peel and trim the loose surface ply to the point where the adhesion of surface ply to the deicer is good.

(2) Proceed with patch application per 74-451-AA Patch Kit Application, above.

63. RESURFACING. P/N 74-451-L resurfacing kit provides an oil resistant urethane coating. The ”L” Kit can be used to refurbish weathered deicers to extend service life, or to provide oil resistance to newly installed deicers.

CAUTION: AFTER KIT NO. 74-451-L IS APPLIED TO A NEOPRENE DEICER, THE DEICER SHOULD BE TREATED AS AN ESTANE® DEICER FOR MAINTENANCE PURPOSES. SEE APPROPRIATE VENDOR PUBLICATION FOR ADDITIONAL INFORMATION ON ESTANE® DEICERS.

CAUTION: DO NOT USE AGEMASTER® NO. 1 AFTER 74-451-L KIT APPLICATION.

NOTE: Deicers coated with 74-451-L kit may be repaired with 74-451-AA patch kit or 74-451-AE pinhole repair kit.

63a. 74-451-L RESURFACING KIT APPLICATION.

a. 74-451-L kit covers 40-50 square feet of deicer surface.

b. Wash deicer surface with mild soap and warm water to remove contamination.

c. Remove ShineMaster® cosmetic treatment with ShineMaster® Prep cleaner.

d. Lightly sand surface with Scotch Brite™ fine grade abrasive material or equivalent.

e. Clean surface with clear water and dry with lint free cloths to remove soap residue and loose particles raised from sanding.

f. Wipe surface twice with cleaning solvent. Use MEK or Toluene.

g. Apply masking tape to leading edge against edges of deicer.

(1) Mix primer coat with two (2) ounces of accelerator.

(2) Apply one even coat of primer mixture to deicer surface. Brush perpendicular to deicer tubes using short strokes in one direction for smooth finish.

(3) Let dry 30 minutes.

h. Mix protective coat with two (2) ounces accelerator.

i. Apply one even protective coat. If desired, second protective coat may be applied within 15 minutes to one hour of first coat.

j. Remove masking tape as application is made, about every three (3) feet.

k. Aircraft may be flown and deicer inflated after 4 hours dry time.

64. INSPECTION (PNEUMATIC DEICERS (BOOTS)).

Perform the following inspection when:

a. For an uninstalled deicer:

(1) The deicer has been stored for more than 84 months.

(2) There is evidence of damage to original packaging.

(3) The deicer is not in original packaging.

(4) There is evidence that deicer was not stored properly.

b. For an installed deicer if damage or age is suspected of affecting deicer performance.

c. Procedure:

CAUTION: INSTALLATION OR CONTINUED USE OF A DEICER IN CONDITIONS SPECIFIED IN PARAGRAPHS A OR B, ABOVE, IS AT USER'S DISCRETION.

NOTE: Check for damage with deicer inflated using leak detector fluid. Air leaking damage can be located and marked for repair. Deicer should not be inflated at pressures higher than indicated in Table V, above.

(1) Inspect deicer carefully for surface damage: cuts, tears, abrasions, scuffs, cracking and/or crazing. Check backside (if uninstalled) and breeze side of deicer carefully. Pay particular attention to air connection area.

(2) Repair surface damage detected per Repair Procedure, above.

(3) Inflate deicer with regulated air source to correct operating pressure as indicated in Table V, above. Check inflation time. Deicer should inflate to operating pressure within six (6) seconds.

(4) When deicer has reached operating pressure, seal off deicer at air connection. Check deicer pressure after 60 seconds. Pressure drop should not exceed three (3) psi.

(5) Allow deicer to deflate naturally with no vacuum applied. Deflation time should not exceed 22 seconds. When deicer is deflated, check for pockets of trapped air in tubes.

(6) If deicer does not pass these tests, check again for damage, perform appropriate repairs and retest. If deicer still does not meet test criteria, the deicer should be replaced (if installed) or scrapped (if uninstalled).

(7) If deicer passes all tests, its usability is on condition and the decision to install is at user's discretion.

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65. WING ICE INSPECTION LIGHT.

66. INTRODUCTION. This light is installed as part of the pneumatic deicing installation and aids the pilot in detecting ice formation on the left wing leading edge during night flying operations.

67. DESCRIPTION AND OPERATION. 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-volt unit, which is controlled from a rocker type switch mounted on the switch panel. The light is positioned in the nacelle to illuminate the leading edge of the wing when the switch is activated in the cockpit.

68. LAMP REPLACEMENT. Use a new lamp GE1383.

69. REMOVAL.

a. Be sure the switch is in the off position.

b. Remove the top access panel from the left nacelle.

c. Within the nacelle, remove the screws that secure the socket in the retainer.

d. Pull the socket aft-and remove the lamp.

70. INSTALLATION.

a. Position the new lamp in the receptacle of the socket, then secure the socket in the retainer with the screws.

b. Activate the switch in the cockpit to check the lamp operation.

c. Replace the nacelle access panel with the attachment hardware.

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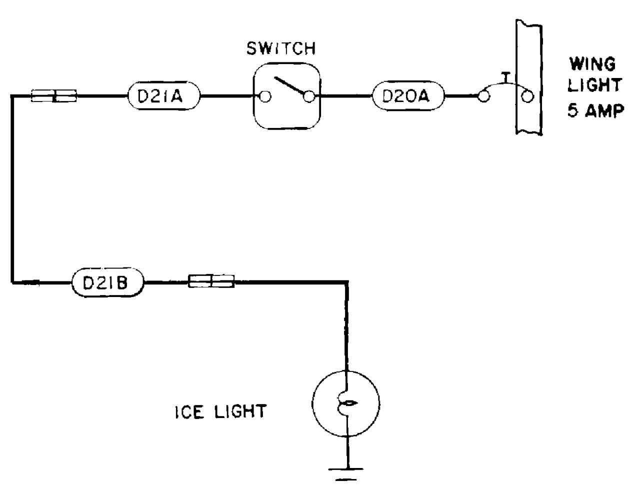

Wing Ice Inspection Light
Figure 20

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71. RESTRAINT SYSTEM.

72. SHOULDER HARNESS INERTIA REEL ADJUSTMENT.

a. Allow the harness to wind up on the reel as much as possible.

b. 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.

c. Unwind the harness completely, then measure and mark the harness 24 inches from the reel center.

d. 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.

e. Aligning slot in shaft with spring tang, wind spring six (6) turns ± 1/2 turn and snap the plastic cover into holes in reel end shaft.

f. Release harness and allowing it to wind up, extend the harness a few times to check reel for smooth operation.

g. With reel fully wound, hold with inertia mechanism end and pry off plastic cap over mechanism and set reel aside.

h. 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.

73. SEAT BELT AND SHOULDER HARNESS INSPECTION.

a. Shoulder Harness Inspection.

(1) Inspect ends and attachment points for condition and security.

(2) Inspect harness web material for condition and wear over its entire length. Particularly look for wear and fraying where harness web passes in and out of inertial reel. If excessively worn, replace.

b. Lap Belt Inspection.

(1) Inspect ends and attachment points for condition and security.

(2) Inspect harness web material for condition and wear over its entire length. Particularly look for wear and fraying where harness web passes in and out of adjustable buckle end. If excessively worn, replace.

(3) Inspect shoulder harness keeper nylon bushing. If excessively worn or missing, replacement of that half of the lap belt is required.

GRIDS 4H18 THRU 4L24
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